

**INTERNATIONAL JOURNAL OF SCIENTIFIC  
RESEARCH IN  
SCIENCE & TECHNOLOGY**

**VOLUME 4, ISSUE 8, MAY-JUNE-2018**

**SCIENTIFIC JOURNAL IMPACT FACTOR VALUE = 5.327**



**PRINT ISSN : 2395-6011  
ONLINE ISSN : 2395-602X**

Web Site : [www.ijsrst.com](http://www.ijsrst.com)

Email : [editor@ijsrst.com](mailto:editor@ijsrst.com)



# **International Journal of Scientific Research in Science and Technology**

Print ISSN: 2395-6011 Online ISSN : 2395-602X

**Volume 4, Issue 8, May-June-2018**

International Peer Reviewed, Open Access Journal  
Bimonthly Publication

**Published By  
Technoscience Academy**



**Email: [info@technoscienceacademy.com](mailto:info@technoscienceacademy.com)**

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# Intelligent Pillbox : Automatic and Programmable Assistive Technology Device

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## ABSTRACT

Assistive Technology (AT) maintains and improves the individual's functioning and independence, thereby promoting their well-being. But today only 1 from each 10 people in need have access to AT due to high costs and a lack of awareness, availability, personal training, policy and functioning. By 2050, more than 2 billion people will need at least 1 assistive product with many elderly needing 2 or more. Elderly make important contributions to the society. Though some people aged well, other become fail, with a high risk of disease. In this paper, we propose a first approach related the design of AT device. This uses open source technologies and gives a new choice in taking medication dosages. "The Intelligent PillBox" allows the organization of several medication schedules that health disorders presented in elderly need basically. Arduino Mega 2560 was taken as the principal controller. This prototype contains; a programmable alarm system with an automatic opening and closing system, an interactive user interface and a notification system through GSM network. The development of this device is focused in the support of elderly people and other vulnerable groups that may need for an assisted care.

**Keywords:** Assistive Technology, Elderly, Intelligent PillBox Design, Internet of Things, Ambient Assisted Living, Medication Schedule

## I. INTRODUCTION

The pill dispensers in the other words electronic pill organizers are developed to alert people about the intermediation. It is an easy way to use tablet dispenser which can assist in the management of medication and allows the correct dose to be available at the correct time of day or night. Their purpose is to help people who may suffer from impaired ability to adhere to their prescribed medication regime. They are commonly used in medicine and some people can use individually as well such as elderly, chronically ill. These devices are evolved to care public health, the cost of medicine industry and waste of drugs. The advanced models of these dispensers can be available

in the medicinal industry. As the people getting busier these days, they tend to forget to take their medicines at prescribed schedule.

According to the national council report, In the United States and around the world, there is compelling evidence that patients are not taking their medicines as prescribed, resulting in significant consequences. A large percentage of patients fail to comply with their prescribed medication schedules. This can result in unnecessary disease progression, complications, lower quality of life, and even mortality. This growing trend of medicine non adherence has many causes. —The most commonly cited reasons for noncompliance include, not being convinced of the need for treatment, fear of adverse

effects, difficulty in managing more than 1 dose a day, or multiple drug regimens. Paper identified that 24% of respondents ascribed non adherence to forgetfulness. 20% did not take medications due to perceived side effects. Additionally, it is projected that the population growth of retirement-age Americans will cause the current healthcare system to become overloaded and inevitably fail in as little as ten years. Although forgetfulness is not the only factor contributing to the medication non adherence issue, it is the biggest factor, and hence, there is a real need to develop an automatic medication self management device. In addition, if the device can provide near real time medication remote monitoring to alert health care providers of non adherence events, it would also help reduce medication non adherence caused by the other factors.

## II. LITERATURE REVIEW

In this section, a combination between electronic and mechanical pill boxes or dispensers is presented. It's been included certain traditional pills organizers, which represents a first step in these developments and allowed us to obtain ideas about design useful patterns in development of this solution. In this box presented a pill dispenser which has different prescribed administration schedules. It includes a plurality of pill storage compartments, each of them capable of holding more than one pill. This device has a pill detector and generates a signal to alert patients to take the prescribed medicine. There are twelve storage compartments, arranged in a ring about a vertically rotating wheel. However, this solution has a limitation due to this pill dispenser can only hold doses for 24hours. A current design presented in Cheyenne, shows a device that allows the storing and dispensing of pills and various supplements (i.e., food, drug, supplements, liquids, powders or pills). This device Works such as an alarm clock and may work with blister packed pills or alternatively uses an encapsulated compartment to hold and dispense loose

pills. Also, it can be connected by wireless to external environments (cell phones, computers). However, this device does not allow the management of several dosages and different kind of pills. Another solution is the e-pill. It has in its stock various alternatives to organize and dispense pills, can be mentioned especially two: i) A device dedicated to dispense pills composed by 2 medication trays, and 3 day-dosage discs. It has a circumference shape and it has turning compartments for each dosage time. The dosages are dispensed when an alarm is activated, this device does not use referential diseases, just use dosages per days, and is also not programmable for any schedule; ii) it is a reminder medication product focused on patients, caregivers or medical health professionals. This device locks automatically and includes 2 keys. For patients trying to get medications before it is time there is tamper resistant. This device considers supply pills in one week, four times per day. Also it has alarm and text message reminders disadvantages perceived are to close device by interaction of keeper and is not independent. As far as we know, more than it has been described before, there are many solutions which offers advantages as dispensing or alerting system however they do not provide an automatic reminder system, different alert forms or a study in lot field, besides devices are economically difficult to access. In this work, it is proposed a solution that solves these problems.

Doan B. Hoang, Lingfeng Chen "Mobile Cloud for Assitive Healthcare (MoCAsH)" 2010 IEEE Asia-Pacific Services Computing Conference.

This paper proposes a Mobile Cloud for Assitive Healthcare infrastructure. The infrastructure addresses the limitations of our earlier Active Grid infrastructure, deploys Cloud computing features such as user easy access, elasticity of resources demands, scalability of infrastructure, and metered usage and accounting of resources. The new infrastructure also addresses a number of issues with current Cloud architecture including some security and privacy

issues, data protection and ownership. P2P paradigm is deployed to federate clouds that may belong to different administrators to address security, data protection and ownership. Part of the infrastructure has been implemented or migrated from the Active Grid. The first version of the mobile platform was implemented with J2ME on Nokia phones; the platform is being migrated to an Android platform. Part of the intelligent Mobile Cloud Middleware was implemented within an active database. In the next version, part of the middleware will reside in the mobile platform to handle local issues efficiently in terms of speedy response and energy minimization. Part of the component will reside in the Cloud Middleware component to provide rich context analysis, recognition and decision support. A collaborative workflow editor has been developed over the existing Grid, it will be deployed in the newly Cloud infrastructure.

Brianna Abbey\*, Anahita Alipour†, Logan Gilmour†, Christopher Camp‡, Crys Hofer‡, Robert Lederer‡, Greig Rasmussen‡, Lili Liu§, Ioanis Nikolaidis†, Eleni Stroulia†, Cheryl Sadowski “A Remotely Programmable Smart Pillbox for Enhancing Medication Adherence” 2012 IEEE.

In this paper we have introduced a new medication adherence device in the form of a dosage-based pillbox with removable and transportable columns. As we are producing the first fully functional unit, we are also considering three extensions: (a) equipping each removable column with wireless capabilities to enable it to autonomously communicate with a mobile phone (or via access points and/or the cellular network directly) to enable the continuous monitoring and update even if the column is detached from the unit, (b) adding Braille numbers beside each chamber to enhance usability by users with sight problems, and (c) enhancing the ability to infer that the medication was consumed by using photo/video evidence triggered when a chamber is opened.

Medication adherence is an important challenge for many patients with chronic conditions, most of them elderly. Technology has an important role to play in this area potentially, with electronic devices equipped with reminder capability and medication intake recording. In this paper, we present a remotely programmable pillbox. This pillbox is equipped with a web application which gives the health professional or caregiver a tool to check and program the pillbox. Also, a mobile application is implemented to establish a connection with the web-application to show pills' daily schedule and pill taking notifications.

Shuai Zhang, Sally I. McClean, Chris D. Nugent, Mark P. Donnelly, Leo Galway, Bryan W. Scotney, and Ian Cleland “A Predictive Model for Assistive Technology Adoption for People with Dementia”

The acceptance of assistive technologies is crucial for healthcare professionals in the provision of such technologies to PwD. In this paper, we characterized PwD features that are relevant to assistive technology adoption. Based on these features, an optimal predictive model was developed through the investigation of a range of classification algorithms, different feature sets, and data resampling to handle class imbalance. The models were evaluated using the multiple criteria of model predictive performance, prediction robustness, bias toward two types of errors, and usability by healthcare professionals. Overall, the model trained using the kNN classification algorithm on data collected from seven features best addressed the four criteria for model evaluation. This predictive model can maximize the opportunity of using assistive technology in order to allow people to stay in their home for longer, thus minimizing the risk of negative impacts on mood and the quality of life for PwD, and financial implications for inappropriate deployment to unsuitable technology adopters. A limitation to our work is the amount of data available. It was both expensive and time-consuming to collect such data from the PwD using the technology. Questionnaires about the PwD and their user experience were

particularly time consuming to administer; caregivers could face additional work checking if the PwD was handling the device well; trials required weeks to complete in order to allow the users to become familiar with the device before deciding whether to adopt it or not. Consequently such trials may be intimidating for the PwD. Nevertheless, a collaborative project is currently underway, which will allow our current approach to be extended to a larger sample size. This collaboration is based around the Cache County Study on Memory in Aging, a large database containing genetic and environmental factors associated with risk for Alzheimer's disease and other forms of dementia. Another interesting future direction is to embed the cost of the two types of error into the classification model in order to minimize the total cost of misclassification.

Huai-Kuei Wu, Chi-Ming Wong<sup>2</sup>, Pang-Hsing Liu<sup>1</sup>, Sheng-Po Peng<sup>1</sup>, Xun-Cong Wang<sup>1</sup>, Chih-Hi Lin<sup>1</sup> and Kuan-Hui Tu<sup>1</sup> "Smart Pill Box with Remind and Consumption" Confirmation Functions" 2015 IEEE 4th Global Conference on Consumer Electronics (GCCE)

To improve medication safety among the elderly, this paper proposed a smart pill box with remind and confirm functions. The proposed pill box can reduce family member's responsibility towards ensuring the correct and timely consumption of medicines. Because the proposed pill box is based on the medicine bag concept and the matrix bar code printed on the medicine bag simplifies the operational procedure. The remind and confirm functions work well even if internet service is not available, thus reducing implementation costs. Population aging is a global issue that affects many developing countries such as Taiwan. The natural decline in physical function with aging leads to an increase in incidences of various chronic diseases in elderly individuals; most patients with chronic diseases need to take medications over a prolonged period of time in order to stabilize their conditions. Ensuring that the patients consume the

right medication at the appropriate time becomes crucial. This paper proposes a smart pill box equipped with a camera and based on the medicine bag concept. The matrix bar code printed on the medicine bags is used to interact with the pill box in order to perform pill remind and confirm functions.

P. Jayashree, S. Shrinidhi, V. Aishwarya, A. Sravanthi "Smart Assistive technologies for aging society: Requirements, Response and Reality" 2016 IEEE Eighth International Conference on Advanced Computing (ICoAC)

Through the use of smart devices and systems, disabled people are well supported to perform routine tasks that are felt difficult otherwise. The feel at home enhanced living style though reduces the burden of care takers and support staff, has some hitches in peoples' adaptability to numerous devices and acceptability to a larger extent. A well connected home is to supplement the lifestyle of the user, delivering an anytime, anywhere, borderless quality lifestyle. In such an environment, all devices work together irrespective of the application (entertainment, home control or energy management). But, this demands security and robustness of the devices and technology. Personal assistive devices are emerging technologies that are indeed developed for the betterment of human life. Through the use of smart devices and systems, disabled people are well supported to perform routine tasks that are felt difficult otherwise. The feel at home enhanced living style though reduces the burden of care takers and support staff, has some hitches in peoples' adaptability to numerous devices and acceptability to a larger extent. A well connected home is to supplement the lifestyle of the user, delivering an anytime, anywhere, borderless quality lifestyle. In such an environment, all devices work together irrespective of the application (entertainment, home control or energy management). But, this demands security and robustness of the devices and technology. Personal



assistive devices are emerging technologies that are indeed developed for the betterment of human life.

### III. PROPOSED WORK

#### Device Contribution

Improving lifestyle not only in elderly sick people also in general sick people is a main goal of this development; our device involves reliability and usability with a friendly technology. In the case of elderly people as in Marceline. It is well known with the years, the gradual degradation of faculties can affect the ability to cope with machine technology that is nowadays common in public spaces, like telephone cards and ticket machines (which requires physical and mental agility) or automatic tellers (where codes are needed to be memorized and alternatives must be selected rapidly). It is important to understand that these devices could become more an obstacle than an aid. This conclusion obtained through a study using two generations of men and women (aged 55-74 and 75+ years, respectively), giving us a way to focus our priorities in development of a pillbox, considering parameters to interact correctly with elderly users mainly. Achieving an appropriate reminder system combined with a new type of programming dosages inside a device may be a possible solution to currently interface that nowadays are everywhere to interact in a better way with a keeper or doctor who are tied most of the time to keep track from their patients, who can use easily technology interfaces. Give them partially release from that responsibility and focus only in load dosage in device. While the interaction between patient and object won't be deep, is necessary to give a solution which doesn't complicate prospective interaction patient pillbox, even though interact between them through technology is an important contribution which this work looks for.

As following fig. shows, a block diagram which summarizes the contribution of this paper. Here, it is

an interaction between keeper and doctor (1) with the pillbox (4) through an interface (3) and a microcontroller. The device (4) sends notifications (5) to patient (6) and keeper (1). When a patient (6) takes the pill, there is an interaction between the pillbox (4) and a sensor (7). Finally, about that interactions are send.

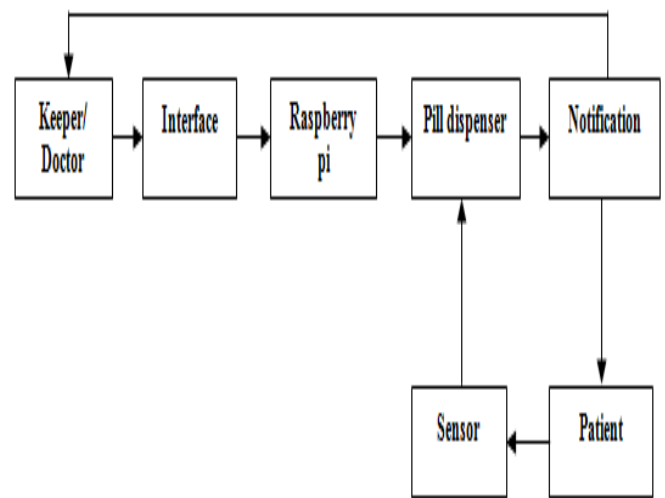


Fig.1: Pillbox Block Diagram

#### Intelligent pillbox composition

The system is composed by different modules that are controlled by Raspberry Pi Mega. Below fig. shows the Pillbox's block diagram. There are different types of communication of each module. It could be one way or two ways. Therefore the Raspberry sends commands to the modules but also receives data from them. Web page contains the connecting information between the Raspberry pi with the help of WiFi. Keypad plays the general role for changing the information of the requirement. Below figure shows the composition of pillbox.

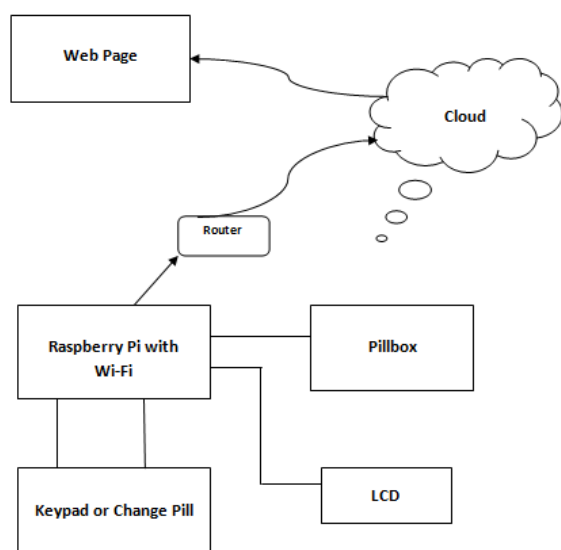


Fig.2: Intelligent Pillbox Composition

### LCD

There is a vast array of LCD displays available. Fortunately, a majority of them comply with the HD44780U standard. This standard refers to the LCD controller chip that accepts data from the Micro Converter and communicates with the LCD screen. HD44780 standard LCD screens are available in numerous formats, the most popular of which are the 16 into 2 and 20 into 2 formats. The various commands to control the basic functions of the LCD are outlined in this application note. INTERFACING AN HD44780 LCD The data bus that connects the HD44780 to the Micro Converter can be eight bits or four bits wide; this document discusses the 8-bit data bus. In addition to the data bus, three control lines are needed, requiring a total of 11 pins to interface the LCD to the Micro Converter. The eight data lines that form the data bus are referred to as DB0 to DB7. The three control lines are referred to as EN, RS, and RW: EN is the enable line. This line is used to indicate the start of a transmission of a data byte to the LCD controller. To indicate the start of transmission, this line is brought high. When transmission is complete, the EN line is brought low.

RS is the register select line. This line indicates to the LCD controller whether the data byte is to be treated as a command or as text data to be displayed on the screen. If the RS line is high, the data byte is treated as text to be displayed. If the RS line is low, the data byte is treated as a command. RW is the read/write line. When this line is low, the information on the data bus is written to the LCD controller. If this line is high, the LCD controller can be read to check the status of the LCD. As shown in Figure 1, the eight data lines are connected to Port 0 of the Micro Converter; external pull-ups are required on Port 0. The three control lines are connected to three Ports. And pill box contain the stock of pills for the providing patient.

### Raspberry Pi

Didn't think the Raspberry Pi could get any better? You're in for a big surprise! The Raspberry Pi 2 Model B is out and it's amazing! With an upgraded ARMv7 multi core processor, and a full Gigabyte of RAM, this pocket computer has moved from being a 'toy computer' to a real desktop PC. The big upgrade is a move from the BCM2835 (single core ARMv6) to BCM2836 (quad core ARMv7). The upgrade in processor types means you will see ~2x performance increase just on processor-upgrade only. For software that can take advantage of multiple-core processors, you can expect 4x performance on average and for really multi-thread-friendly code, up to 7.5x increase in speed!

That's not even taking into account the 1 Gig of RAM, which will greatly improve games and web browser performance! Best of all, the Pi 2 keeps the same shape, connectors and mounting holes as the Raspberry Pi B+. That means that all of your HATs and other plug-in daughter boards will work just fine. 99% of cases and accessories will be fully compatible with both versions.

### IV. IMPLEMENTATION

The user of the web application may be a health professional, an informal caregiver or possibly the patient. Each person with the authority to record the

medication regimen of the patient has his/her own username and password for accessing the application. Associated with each username are metadata that specify the role of the given user and the type of access permitted to the user. For example, if the user is a health professional, he should first select the patient then visit the patient's medicine schedule. If the user is not a health professional, only the information about one specific patient is provided to the user. The user can enter the prescribed medicines and times into a calendar-like interface, and attach special instructions about how each pill looks, how it should be taken, and what are the possible side effects to look out. As can be seen in the calendar of, each day is associated with four medication-taking events (which seems to satisfy the majority of patients who usually take medications in the morning, noon, afternoon and evening). The schedule, once completed, is recorded in the online common data source so that the pillbox and the mobile application can share the same information. Each cell in the medication schedule corresponds to a prescribed medication-taking event and it can be in one of five possible different states:

1. **Empty:** showing that the chamber is empty and the corresponding day time does not have any scheduled medications; The daily view (left), the details view (centre), and the information view (right).
2. **Not Taken:** showing that the chamber has medications inside and the time when they need to be taken is in the future;
3. **Take Now:** representing that it is time to take this chamber's pills;
4. **Taken:** indicating that the medications that used to be inside this chamber have been taken on time, and,
5. **Missed:** indicating that (part of) the medications inside this chamber were not taken.

The mobile application can be used by the patient and also by informal caregivers, i.e., family members, who can communicate with the patient and could motivate the patient to take the medication. This application shows the schedule's daily view, status of each dosage,

and the details about the medication associated with each dosage. When it is time to take a chamber's pills, the mobile application alarms continuously until the patient takes the pills or selects the postpone option. In the case of postponement, the application restarts the alarm after 5 minutes, unless the time window for consuming the corresponding dosage is over. The mobile application full's the need for having a social component in our design, paying attention to the fact that adherence increases when friends and family are involved in the patient's medication regimen. In the pillbox, at the scheduled time, the appropriate pill chamber begins to glow (illuminated by LED) and, at the same time, a notification pops up on the mobile device and a voice alarm is generated. The patient notices the lit chamber, opens the corresponding container, and takes all pills in it. The patient may also choose to look up the associated pill information on the mobile application. The light produced by the LED is also sensed by an embedded light sensor (each chamber has one light sensor). The light sensor is a programmable light-to-frequency IC that outputs a square wave signal with the frequency directly proportional to the incident light intensity. The sensor is very sensitive and supports a wide range of frequencies. A raspberry pi platform analyzes the frequency returned by the sensor and sends a message via Wi-Fi, thus uploading the new state of the pillbox to the online data source.

#### 1. Cloud

Cloud is a network or internet which is present at remote location. It provides services over network on public networks or on private networks. There are different applications running on the cloud such as e-mail, customer relationship management. Cloud computing manipulates, configures and access the application online. Cloud has unlimited storage capacity.

Cloud computing allows simple and easy user access, handles users' dynamic and elastic demands

effectively, and provides convenient metered usage for its resources and hence it is increasingly being adopted by individual users as well as enterprise users. It may just be the right technology for healthcare infrastructure. However, several serious issues concerning security, data protection and ownership, quality of services, and mobility need to be resolved before Cloud computing can be widely adopted. To address these concerns, proposes a new solution that includes a cloud platform designed to deal with those issues that are relevant for an assistive healthcare infrastructure. Within this assistive health infrastructure, the cloud platform offers a high level abstraction and its services can be accessed easily with simple web interface to the users. The new solution includes mechanisms for early detection of networks and network auto-switch function to ensure a ubiquitous computing, which can guarantee a wireless consistent connectivity with back-end processing centre for a high QoS (quality of service). To address the power limitation issue, the new solution includes mechanisms for controlling the energy consumption while maintaining the quality of care. Possible approaches include auto-switch network and algorithm to efficiently control monitoring interval. The new solution will emphasize on data contexts and context-sensitive applications to deal with deviations in physiological state variations. More importantly, MoCAsH adopts a federated Cloud model to address aspects of data ownership, protection and privacy.

## 2. Web Page

“A **web page** (also written as webpage) is a document that is suitable for the world wide web and web browsers. A web browser displays a web page on a monitor or mobile device. The browser uses the Hypertext Transfer Protocol (HTTP) to make such request.”

The web page usually means what is visible, but the term also refer to a computer file, usually return in HTML or a comparable markup language. Web

browser coordinate various web resources elements for the return web page, such as style sheet, scripts and images, to present the web page. Typical web page provide hypertext that include the navigation bar or a side bar menu linking to other web pages via hyperlinks, often referred to as links.

On a network, a web browser can retrieve a web page from a remote web server. The web server may restrict access to a private network such as corporate intranet. The web browser uses the hypertext transfer protocol (HTTP) to make such request.

A static web page is delivered exactly as stored, as web content in the web server's file system. In contrast dynamic web page is generated by a web application, usually driven by server side software. Dynamic web page helps the browser (the client) to enhance the web page through user input to the server.

## 3. Router

A router is a networking device that forwards data packets between computer networks. Router performs the traffic directing functions on the internet. A data packet is typically forwarded from one router to another router through the network that constitute an internetwork until it reaches its destination node.

A router is connected to two or more data lines from different networks. When a data packet comes in on one of the lines, the router reads the network address information in the packet to determine the ultimate destination.

Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey.

The most familiar type of routers are home and small office routers that simply forward IP packets between the home computers and the internet. An example of the router would be the owner's cable or DSL router, which connects to the internet through an internet service provider (ISP). More sophisticated routers, such as interprice routers, connect large business or ISP networks up to powerful core routers that forward

data at high speed along the optical fiber lines of the internet backbone. Through routers are typically dedicated hardware devices, software based routers also exist.

#### 4. WI-FI

Due to the advancement of wireless technology, there are several different of connections are introduced such as WIFI, and each of the connection has their own unique specifications and applications. Among the four popular wireless connections, WIFI is being chosen with its suitable capability. The capabilities of WIFI are more than enough to be implemented in the design. Also, most of the current laptop/notebook or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of this system.

In this project, we propose a system, which is very different than the existing system. We are going to implement it with the help of Wi-Fi (Wireless Federation). The main advantage of this system is that it can be implemented with a wider range. It allows communicating with a brief and small set up without wired connection. This system can be extended for a proper Surveillances of home (Humidity control, security and remote sensing) system.

#### 5. Raspberry Pi With Wifi

Raspberry Pi is a Linux powered computer and definitely is a natural choice for IoT applications. The reason for raspberry pi being a preferred IoT device is because it runs a complete Linux Kernel and has direct interfaces such as Ethernet for wired internet as well as USB ports to connect to wifi. The operating system of raspberry Pi supports modern programming languages like python which makes IoT application development easier. Moreover, raspberry pi also has GPIOs so it can directly connect with devices, sensors and many real world devices. The Raspberry Pi is having a 40-Pin GPIO header, 4 x USB ports, 1x LAN port, 1x CSI and 1x Touch Screen interface, 1xhdmi

port, 1x integrated audio and video output port. The board runs on single +5v power supply for which there is a micro USB female connector provided.

Didn't think the Raspberry Pi could get any better? You're in for a big surprise! The Raspberry Pi 2 Model B is out and it's amazing! With an upgraded ARMv7 multi core processor, and a full Gigabyte of RAM, this pocket computer has moved from being a 'toy computer' to a real desktop PC. The big upgrade is a move from the BCM2835 (single core ARMv6) to BCM2836 (quad core ARMv7). The upgrade in processor types means you will see ~2x performance increase just on processor-upgrade only for or software that can take advantage of multiple-core processors, you can expect 4x performance on average and for really multi-thread-friendly code, up to 7.5x increase in speed! That's not even taking into account the 1 Gig of RAM, which will greatly improve games and web browser performance! Best of all, the Pi 2 keeps the same shape, connectors and mounting holes as the Raspberry Pi B+. That means that all of your HATs and other plug-in daughter boards will work just fine. 99% of cases and accessories will be fully compatible with both versions.

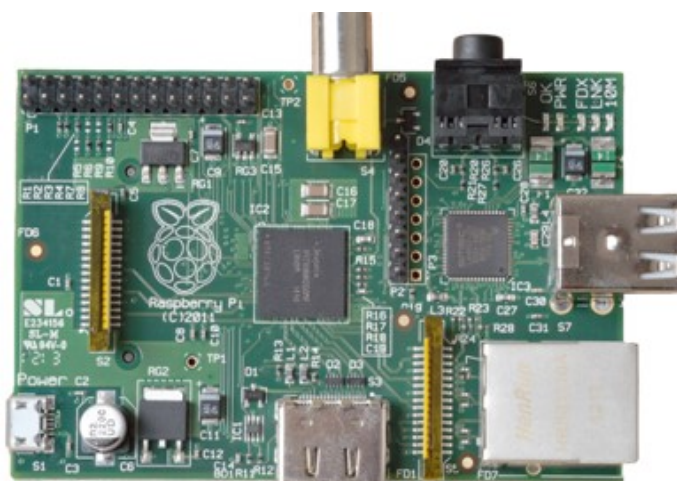


Fig.3 Raspberry pi board

Raspberry Pi is using the Advanced Reduced Instruction Set Computing Machine (ARM) technology. ARM technology is used on the board

which reduces cost, heat and power consumption. It is energy effective multi core CPU implemented as System-On-Chip (SoC) weighing 50gm and operates on 5V, 700mA power rating. This board is available in three models named A, B, B+. The B+ Raspberry Pi board is the latest version among them, and it runs on ARM11 processor with 512MB RAM operating at 700 MHz frequency. It has SD card slot, which is used for booting the operating systems like Raspbian, Pidora, Raspbm. It has four USB2.0 ports to connect to the peripherals like mouse, keyboard and Wi-Fi adapter etc, making it as a full sized portable pocket computer. It also has an Ethernet port to connect to the network. GPIO ports are used to interface and control the LED's, switches, sensors and other devices. With the help of HDMI port, all kinds of monitors like LCD screens, projectors, TVs can be connected. In this board, some additional features like camera connector is available to interface camera and an audio jack. With all these features, Raspberry Pi is not just limited to single use, it can be used in many applications.

## 6. Keypad

Keypad is used for the user or nurse to enter the information of time when the smart box would send "reminder" (displaying numbers and playing synthesized voice). A 3x4 12 button keypad is used for the device. It is also used for the user to enter a number to command a specific pill box to open on a specific day. The keypad is also used for stopping the music and led display when the user has taken the pill. A function for scanning the keypad by corresponding button that is pushed. Firstly, set high 4 bits input port and low-4 bits to output. Calculate the value of the high-4 bits, then inversely do the same task and get the whole value of port. Then using this value we get to look up the button table to find out which button we pushed. The state machine will execute every 25 milliseconds. In state detect, we will judge which kind

of button is pushed and do different things corresponding to the button, such as run flag setting, input string updating and changing to next parameter input. And it also used for the changed the pill depend on the requirement. In computing, a computer keyboard is a typewriter-style device which uses an arrangement of buttons or keys to act as a mechanical lever or electronic switch. interaction via teleprinter-style keyboards became the main input device for computers.

## 7. LCD

There is a vast array of LCD displays available. Fortunately, a majority of them comply with the HD44780U standard. This standard refers to the LCD controller chip that accepts data from the Micro Converter and communicates with the LCD screen. HD44780 standard LCD screens are available in numerous formats, the most popular of which are the 16 into 2 and 20 into 2 formats. The various commands to control the basic functions of the LCD are outlined in this application note.

## V. CONCLUSION

It is impossible for the huge population of elders to follow the traditional health care. This IoT based system not only provides an accurate diagnosis of the users condition, but rather a solution that detects and prevents health episodes by carefully following, capturing, and describing the health trends recorded from physiological and contextual sensors. This system is useful for doctors who are overwhelmed with patient load and also beneficial for rural patients who have less access to health care facilities. The proposed system is suitable for all kinds of patients. It efficiently controls the time of patients to take medicine. It also reduces the ratio that patient misses and delays taking medicine. In addition, the box also has a cold storage for few precise medicine. If the tablets are empty in the box it sends an alert message to refill it.

The goal of the paper was to design automated pill box reminder system using Raspberry pi. So, as to help people to easily Operate the pill box. This project is based on the Raspberry pi, and the language used for communication of kit is Python. These platforms are Free Open Source Software. So the overall implementation cost is low and can be easily configured. We are implementing smart ideas interfacing it with the kit and making easy use or interface with the pill box.

[10] e-pill medication Reminders, "E-pill Medication Reminders." [Online]. Available: [www.epill.com](http://www.epill.com).

## REFERENCES

- [1] W. H. Organization, "Assistive Technology," Assistive Technology, 2016. [Online]. Available: <http://www.who.int/mediacentre/factsheets/assistivetech/en/>.
- [2] E. E. Abdallah and E. Fayyumi, "Assistive Technology for Deaf People Based on Android Platform," *Procedia - Procedia Comput. Sci.*, vol. 94, no. Fnc, pp. 295-301, 2016.
- [3] Ministerio Salud Publica, "MAIS (Manual del Modelo de Atención Integral de Salud)," Ministerio de Salud Publica del Ecuador. p. 210, 2012.
- [4] L. Garyon et al., "Medical and Assistive Health Technology : Meeting the Needs of Aging Populations," vol. 56, pp. 293-302, 2016. C.
- [5] Mollaret, A. A. Mekonnen, F. Lerasle, I. Ferram\ 1. Piquier, and B. Boudet, "A multi-modal perception based assistive robotic system for the elderly," vol. 0, pp. 1-20, 2016. P.
- [6] Casanova-Sotolongo, P. Casanova-Carrillo, and C. Casanova-Carrillo, "Deterioro cognitivo en la tercera edad," *Rev. Cuba. Med. Gen. Integr.*, vol. 20, no. 5-6, pp. 0-0, 2004.
- [7] C. Canet, *La Tercera Edad*, 1st ed. Victoria, Canada, 2005.
- [8] J. H. Brown, P. E. N. Knowles, F. Booth, and H. C. Post, "United States Patent [[ 19 ]," 909628, 1980.
- [9] K. E. Lewis and A. Roberts Jr, "United States Patent [19] [54]," 4,573,606, 1984.

# Neutron Asymmetry and Flavor Decomposition of Up and Down Quarks Using Thermodynamics Bag Model

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## ABSTRACT

Neutron asymmetry  $A_1^n$ , flavor decomposition of up and down quark are evaluated as a function of Bjorken variable in the kinematic region of  $0.2 \geq x \geq 0.573$  at  $Q^2 = 3.67(\text{GeV}/c)^2$  with QCD correction and target mass effect using Thermodynamical Bag Model(TBM). Our results of  $A_1^n$  has zero crossing mere  $x=0.5$ . We observed that the decomposition of up quark is positive distribution and the decomposition of down quark is negative distribution. Theoretical results of  $A_1^n$  and flavor decomposition are good agreement with JLab experimental data.

**Keywords:** DIS, Flavor decomposition, Neutron asymmetry, TBM

## I. INTRODUCTION

Over two decades ago, EMC discovered [1-2] that the fraction of the proton spin is carried by constituent quark and it was insufficient determination. These results caused much excitement to investigate the spin structure of the nucleon as measured by polarized lepton-nucleon deep inelastic scattering[3-5]. But still origin of the nucleon spin has been open puzzle. In relativistic quark model, the quark spin contributes 75% of the proton spin and remaining portion 25% spin is from their orbital angular momentum and gluon spin[6-7]. The nucleon spin sum rule can be written as

$$S_Z^N = S_Z^q + L_Z^q + J_Z^g = \frac{1}{2} \quad (1)$$

Where  $S_Z^N$  is nucleon total spin,  $S_Z^q$  and  $L_Z^q$  are the quark spin and orbital angular momentum respectively and  $J_Z^g$  is the total angular momentum of gluons. According to spin sum rules, only 20-30% of the nucleon spin is carried by quark and remaining portion is carried by quark and gluon orbital angular momentum and gluon spin. The possible contribution of orbital angular momentum is under the investigation.

In the present work, we concentrate the large kinematic region  $x \geq 0.2$ . In this kinematic region, valence quarks more dominated over sea quarks and gluons and ratio of structure functions can be calculated based on our model calculation. An accurate knowledge of polarized Parton Distribution Functions(PDFs) on broad x values is needed to deduce the uncertainty with which the first measurement of polarized distribution and structure function can be determined. Here we fix the four momentum transfer  $Q^2$  corresponding to the experimental data[8] to evaluate the neutron asymmetry and flavor decomposition.

### Thermodynamical Bag Model:

Thermodynamical Bag Model (TBM) first developed by Ganesamurthy et.al[9-13] considering the nucleon to be in the Infinite Momentum Frame (IMF), where the quarks and gluons are treated as fermions and bosons respectively. The invariant mass(W) of the final hadron is given by

$$[\varepsilon(T)V + BV]^2 = W^2 = M^2 + 2Mv - Q^2 \quad (2)$$

Where  $\varepsilon(T)$  is the energy density of the system at a temperature T, V is the volume of bag, B is the bag



constant,  $W$  is the invariant mass of excited nucleon at  $T$ ,  $V$  is the energy transfer,  $Q^2$  is square of four momentum transfer,  $M$  is the mass of the nucleon at ground state.

The total energy density  $\epsilon(T)$  of the bag can be written by the sum of energy densities of quarks and gluon is given by

$$\epsilon(T) = d_q(\epsilon_u + \epsilon_{\bar{u}}) + d_q(\epsilon_d + \epsilon_{\bar{d}}) + d_g \epsilon_g \quad (3)$$

Where  $d_q = 6$  and  $d_g = 16$  denotes the degeneracy of quarks and gluon orderly. The pressure balance condition and energy minimization condition with respect to the nucleon volume taken into consideration. The invariant mass in TBM is obtained by considering the energy transfer to the nucleon results heating up the constituents of the nucleon. The temperature and two chemical potentials are not free parameters rather they are evaluated in accordance with  $x$  and  $Q^2$  either with fixed  $Q^2$  or with fixed  $x$ . At very low  $Q^2$ , i.e. as  $Q^2$  tends to zero, temperature of the bag  $T$  also tends to zero and only the valence quarks are dominated. When  $T \approx 0 \text{ MeV}$ , the invariant mass is equal to the mass of the nucleon at rest. As  $Q^2$  increases, temperature of the bag increases and turn in more and more sea quarks and gluons are produced.

The statistical Parton Distribution Functions are expressed as

$$q_i(x, Q^2) = \left(\frac{6V}{4\pi^2}\right) M^2 T x \ln \left\{ 1 + \exp \left[ \left(\frac{1}{T}\right) \left(\mu_i - \frac{Mx}{T}\right) \right] \right\} \quad (4)$$

$$\bar{q}_i(x, Q^2) = \left(\frac{6V}{4\pi^2}\right) M^2 T x \ln \left\{ 1 + \exp \left[ \left(\frac{1}{T}\right) \left(-\mu_i - \frac{Mx}{T}\right) \right] \right\} \quad (5)$$

$\mu_i$  is the chemical potential of quark with the flavor 'i'.

Here 'i' denotes either u or d quark. In order to relate the PDF's with  $\Lambda_{QCD}$ , which is quark gluon coupling parameter, we introduce the strong quark gluon coupling constant. The experimental fit could be made by considering only with the QCD corrections. The

quark and anti-quark distributions are modified by including QCD parameters as,

$$q'_i(x, Q^2) = q_i(x, Q^2) \left( 1 - \frac{\alpha_s(Q^2)}{2\pi} \right) \quad (6)$$

$$\bar{q}'_i(x, Q^2) = \bar{q}_i(x, Q^2) \left( 1 - \frac{\alpha_s(Q^2)}{2\pi} \right) \quad (7)$$

The strong running coupling constant ( $\alpha_s$ ) for various  $Q^2$  is evaluated using the Next to Leading Order (NLO) solution.

$$\alpha_s(Q^2) = \frac{4\pi}{\beta_0 \ln(Q^2 / \Lambda^2)} \quad (8)$$

In order to account for heavy quark threshold correction and target mass effect together, a substitution of  $x$  is made with  $\xi$ .

$$\xi = \frac{2x((1+m_s^2)/Q^2)}{1 + \sqrt{1 + 4M^2 x^2 / Q^2} (1+m_s^2)/Q^2} \quad (9)$$

$m_s$  is the mass of the strange quark. Here we assume strange quark mass as 100 MeV and

$$\Lambda_{QCD} = 300 \text{ MeV.}$$

**Theoretical evaluation of neutron asymmetry:**

The structure function  $F_1$  and  $F_2$  are related by Callon-Gross relation [14],

$$2xF_1(x) = F_2(x) = \sum_i e_i^2 xq_i(x)$$

$$(10)$$

In this relation, structure functions depend only on  $x$ . This means that the lepton scatters on particles which do not involve any scale i.e. on point-like particles. The fact that the structure function indeed do not depend on  $Q^2$ , the so called scattering discovered at SLAC [15] was the experimental validation of the parton model. The unpolarized structure function of proton and neutron are evaluated with the inclusion

of up and down anti-quarks with quarks. The spin dependent structure function of proton and neutron are given by

$$g_1^p = 0.5 \left[ \frac{4}{9} \Delta u'(x) + \frac{1}{9} \Delta d'(x) \right] \quad (11)$$

$$g_1^n = 0.5 \left[ \frac{1}{9} \Delta u'(x) + \frac{4}{9} \Delta d'(x) \right] \quad (12)$$

Where  $\Delta u'$ ,  $\Delta d'$  are the spin distribution function of up and down quark with anti-quarks given by

$$\Delta u'(x) = \left[ (u'(x) + \bar{u}'(x)) - \frac{2}{3} (d'(x) + \bar{d}'(x)) \right] \cos 2\theta(x) \quad (13)$$

$$\Delta d'(x) = \left[ -\frac{1}{3} (d'(x) + \bar{d}'(x)) \right] \cos 2\theta(x) \quad (14)$$

Where

$$\cos 2\theta(x) = \frac{1}{1 + \left( \frac{H_0}{\sqrt{x}} (1-x)^2 \right)} \quad (15)$$

is known as the spin dilution factor[16]. Since the spin dilution factor is derived from first principles it is adjusted to satisfy the Bjorken sum rule which is considered as the fundamental test of QCD. This enables to determine the valence quark distribution explicitly. Here  $H_0$  is a free parameter chosen as 0.09 to satisfy the Bjorken sum rule.

Neutron asymmetry is expressed by the ratio between spin dependent structure function and unpolarized structure function of neutron. Since  $g_1$  and  $F_1$  are evaluated at same  $Q^2$  in leading order QCD.  $A_1^n$  is expected to vary slowly with  $Q^2$ .

$$A_1^n(x, Q^2) = \frac{g_1^n(x, Q^2)}{F_1^n(x, Q^2)} \quad (16)$$

**Flavor decomposition:**

Quark-parton model assumes that the strange quark distribution is neglected above  $x = 0.3$  and also neglecting any  $Q^2$  dependence in the ratio structure function. The evaluation of up quark polarization  $\frac{\Delta u}{u} \approx 0.979$  which is close agreement with RCQM and pQCD calculations. Our evaluation of  $\frac{\Delta d}{d} = -\frac{1}{3}$  as  $x \rightarrow 1$  while pQCD model predictions give  $\frac{\Delta d}{d} = 1$ .  $\frac{\Delta d}{d}$  evaluation is good agreement with SU(6), RCQM and NNPDF experimental results. The up quark polarization is positive and down quark polarization is negative in the entire evaluated  $x$  region.

Non relativistic quark model predicted the neutron asymmetry  $A_1^n = 0$  as  $x \rightarrow 1$  on the basis of SU(6) symmetry.  $A_1^n$  is more positive at large  $x$  due to positive polarization of up and down quarks. In perturbative QCD,  $A_1^n$  is expected to unity as  $x \rightarrow 1$ . In this kinematic region, the contribution of both sea and gluon are small and we study the contribution of valence quarks and their orbital angular momentum to the nucleon spin. Relativistic constituent quark model also predicted  $A_1^n = 1$  as  $x \rightarrow 1$ . In the present work, the valence quarks are dominated at large  $x$  region and asymmetry of neutron is expected to unity as  $x \rightarrow 1$ .

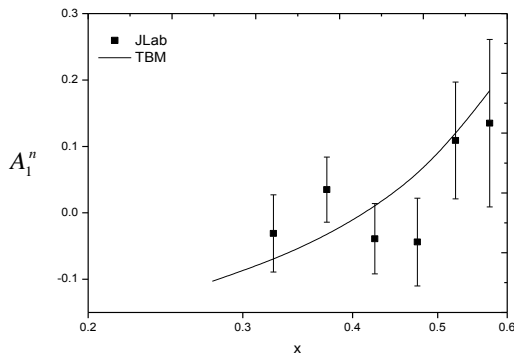
**Table 1.** Theoretical evaluation of  $\Delta u/u$ ,  $\Delta d/d$  and  $A_1^n$  at  $Q^2 = 4\text{GeV}^2$  are compared with several model calculations given in the following table.

	SU(6) symmetry[17]	RCQM[18]	pQCD[20]	NNPDF[21]	TBM
$\Delta u/u$	2/3	1	1	$-0.07 \pm 0.05$	0.979
$\Delta d/d$	-1/3	-1/3	1	$-0.19 \pm 0.34$	-0.304
$A_1^n$	0	1	1	$0.41 \pm 0.31$	1

## II. RESULTS AND DISCUSSION

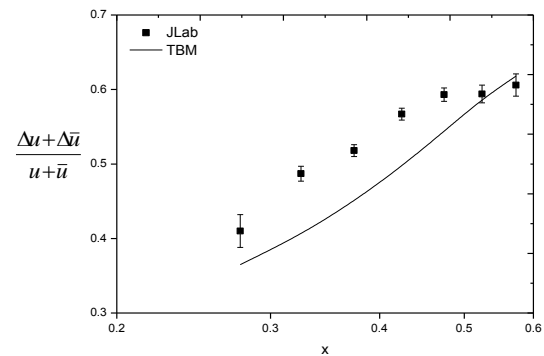
In the present work, the neutron asymmetry  $A_1^n$  and flavor decomposition of up and down quark polarization are calculated using quark distribution.

of  $A_1^n$  is consistent with Relativistic Constituent Quark Model(RCQM) and Perturbative Quantum Chromo Dynamics(pQCD) models prediction which are suggest that  $A_1^n$  becomes increasingly positive at large x.

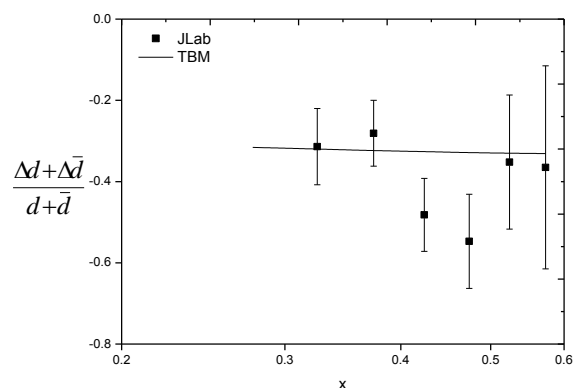


**Figure 1.** Asymmetry of  $A_1^n$  as a function of x at an average  $Q^2 = 3.67(\text{GeV}/c)^2$ . Present results are compared with JLab experimental data [8].

Figure 1 shows that the neutron asymmetry as a function of Bjorken variable x and squared four momentum transfer  $Q^2$ . Neutron asymmetry has negative distribution up to  $x = 0.495$ . This is due to fact that the up quark distribution is very close to the down quark distribution and more and more sea quarks and gluons are produced in that region which is the natural consequence of this model.  $A_1^n$  is zero crossing at  $x = 0.496$  and above this x value, neutron asymmetry becomes positive distribution which is due to fact that momentum carried by the up quark is more than that of down quark. The evaluated results



**Figure 2.** Decomposition of up quark polarization as a function of x at an average  $Q^2 = 3.67(\text{GeV}/c)^2$ . Present results are compared with Jlab experimental data[8].



**Figure 3.** Decomposition of down quark polarization as a function of x at an average  $Q^2 = 3.67(\text{GeV}/c)^2$ .

Present results are compared with Jlab experimental data[8].

The flavor decomposition of up and down quark polarizations as a function of  $x$  have been studied using TBM and are shown in figure 2 and 3 respectively. The up quark decomposition polarization increases with increasing  $x$  in whole evaluated  $x$  region. Up to  $x = 0.523$ , theoretical result of up quark flavor decomposition polarization deviates with experimental data. This is due to the polarized up quark distribution is more than the unpolarized up quark distribution. Above  $x = 0.524$ , polarized up quark and unpolarized quark distribution are merely equal. The down quark decomposition polarization is decreasing with  $x$  and it is negative distribution. In inclusive deep inelastic scattering, only a fraction of the nucleon spin can be attributed to the quark spins and the strange quark sea seems to be negatively polarized. But in the case of semi-inclusive polarized deep inelastic scattering process spin contribution of quark and antiquark flavor to the total spin of the nucleon can be determined as a function of  $x$ . The evaluated results show good agreement with JLab experimental data in the moderate  $x$  region.

### III. REFERENCES

- [1]. J.Ashmann, et al., *Phys.LettB* 206(1988)364.
- [2]. J.Ashmann, et al., *Nucl.PhysB* 328(1989)1.
- [3]. P.L.Anthony, et al., *Phys.Rev.D* 54(1996)6620.
- [4]. K.Abe, et al., *Phys.RevD* 58(1998)112003.
- [5]. Airapetain, et al., *Phys.Rev.D* 71(2005)012003.
- [6]. Z.Dziembowslw, C.J.Martoff and P.Zyla, *Phys.Rev.D* 50(1994)51613.
- [7]. B.Q.Ma, *Phys.Lett.B* 375(1996)320.
- [8]. D.Flav, *Phys.Rev* 94(2016)052003.
- [9]. K.Ganesamurthy, V.Devanathan, M.Rajasekaran, *Z.PhysC* 52(1991)589.
- [10]. K.Ganesamurthy, C.Hariharan, *Mod.Phys.Lett.A* 29(38)(2008)3249.
- [11]. V.Devanathan, S.Karthiyayani, K.Ganesamurthy, *Mod.Phys.LettA*9(1994)3455.
- [12]. V.Devanathan, J.S.MaCarthy, *Mod.Phys.Lett.A* 11(1996)147.
- [13]. F.Takagi, *Z.PhysC* 37(1989)259.
- [14]. C.G.Callon, D.J.Gross, *Phys.Rev.Lett*22(1969)156.
- [15]. M.Breidenbach, et al, *Phys.Rev.Lett* 23(1969)298.
- [16]. R.Carlitz, J.Kaur, *Phys.Rev.Lett.*38(1977)673.
- [17]. F.Close, *Nucl.Phys.B* 80(1974)269.
- [18]. N.Isgur, *Phys.Rev.D* 59(1999)034013.
- [19]. G.R.Farrar, D.R.Jackson, *Phys.Rev.Lett*35(1975)1416.
- [20]. E.RNocera, et al., *Nucl.PhysB* 887(2014)276.

# Load Distribution Scheme to Split the Data on Multiple Paths

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## ABSTRACT

Internet has become need of the hour. In the current scenario of Internet, there has been a tremendous increase in the amount of data being transferred among Internet users. This huge amount of data is termed as big data. Big Data concerns large-volume, complex, growing data sets with multiple, autonomous sources. Big data brings big insights. The most fundamental application for the Big Data is to explore the large volumes of data and extract useful information or knowledge for future business actions. Big data not only includes traditional files but also audio, video and graphics. QoS (Quality of Service) routing mechanism can play an important role for the successful transmission of these data while maintaining its quality. Using multi path strategy, QoS routing can be more valuable. If the source has multiple disjoint paths to transfer the flow, it may use multiple paths altogether by distributing the load. This paper proposes a load distribution scheme for the efficient transmission of data.

**Keywords:** Big Data, QoS, Load Distribution, Multipath Routing, Multiple Paths, Quality of Service, Bandwidth, Delay.

## I. INTRODUCTION

In the present scenario of Internet, the transmission of unstructured data(audio, video, graphics) is a challenging task. QoS routing can be viewed as an attractive approach to tackle this issue.

Multi-path routing scheme can be merged with QoS for the transmission of Internet applications. Multi-path routing establishes multiple routes between source and destination nodes. The function of having multiple paths is either enhancing the trustworthiness of the data transmission, or load balancing.

If the source has multiple disjoint paths to transfer the flow, it may use multiple paths altogether by distributing the load. By using this concept, congestion can be reduced and delays can be decreased a lot.

Thus keeping these all needs into mind, a load distribution scheme for multi-constrained and multi path Routing has been proposed in this paper.

The ultimate goal of this paper is to explore a scheme of optimal disjoint path selection scheme that has been proposed in [2] and propose a load distribution method to distribute the load on multiple paths.

The outline of the paper is as follows: Section 2 explains QoS & Multiple paths. Section 3 discusses the load distribution approach on disjoint paths and Section 4 concludes the paper.

## II. QOS(QUALITY OF SERVICE) & MULTI-PATH

To fulfil the current requirements of Internet, QoS have become essential in the network. Quality of Service(QoS) puts some restrictions in the form of certain constraints on the path. These constraints may

be desired bandwidth, delay, variation in delay experienced by receiver(jitter),packet loss that can be tolerated, number of hops, cost of links etc.

The fundamental problem of routing in a network that provides QoS guarantee is to find a path between specified source and destination node pair that simultaneously satisfies multiple QoS parameters.

These parameters are represented in the form of metrics. One metric for each constraint is to be specified like bandwidth metric, jitter (variation in delay) metric, delay metric, number of hops metric, packet loss ratio etc. from one node to all other nodes in the network. Metric for a complete path with respect to each parameter is determined by the composition rules of metrics. The three basic rules are -

(i) Additive Metric: The value of the constraint over the entire path is the addition of all links constituting path. For Example- delay, hop count, cost or jitter.

ii) Multiplicative Metric: Using this metric, the value for the complete path is multiplication of metric value of all its edges.

Examples are – reliability (1-lossratio) and error free Transmission (probability)

Multiplicative metric can be converted into additive by taking logarithm.

iii) Concave Metric: In this metric, either min edge value or max edge value is taken as constraint value for a path among all the edges of that path. For Example- Bandwidth.

For a complete path, the constraints may be required either as a constrained form or in a optimization form. In constrained form, some condition is put on constraint value e.g. Choose that path only which has delay less than or equal to 60 ms. The path obeying the condition is called feasible. On the other hand optimization refers to path having minimum or maximum value for a constraint e.g. Choose the path

that has minimum delay among all the paths. This path is called optimal path .

The further QoS issues have been discussed in[1] To provide user- or application-level Quality of Service (QoS) guarantee multipath routing strategy can be used for the transmission of QoS sensitive traffic over the network. Multipath routing means using multiple paths instead of using single path to forward the traffic. If multiple paths are being used for the transmission of the traffic then the traffic will be redirected to the backup path if active path fails. In this way robustness can be achieved. On the other hand load balancing for communication network to avoid network congestion & optimize network throughput also requires multi paths to distribute flows . Robustness & load balancing are aspects of QoS routing . So multipath can be proved very valuable for Quality of service.

Multipath approach can be merged into QoS Routing to catch its maximum advantage as in some situation a single path is not able to fulfill all the QoS requirements. The benefits of provisioning multiple QoS paths are reliable QoS support and uniformly balanced network load.

For the load distribution scheme , firstly multiple QoS paths are calculated according to the approach presented in [2]. The routing algorithm ‘M-Bandwidth-Delay constrained algorithm’ presented in [2] is a multipath extension to the algorithm proposed by Wang & Crowcroft[3]. M-Bandwidth-Delay constrained algorithm finds multiple paths which satisfies QoS parameters-residual bandwidth and propagation delay and finds bandwidth-delay constrained paths. The algorithm first eliminates all the links that do not meet the bandwidth requirement. Then it finds the minimum delay path from source to destination using Dijkstra algorithm.

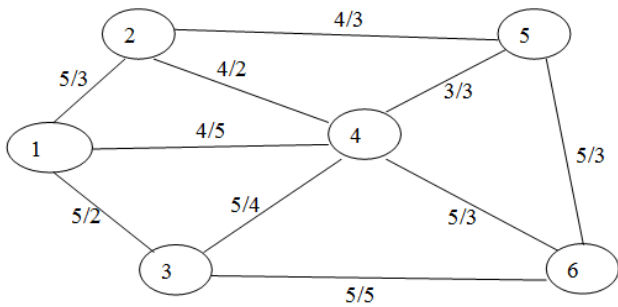
An adjacency matrix is used to define the network in this implementation. After the first minimum delay path is computed by the Dijkstras algorithm, all links in the adjacency matrix that have fallen on the computed path are made 0. The same algorithm is then executed for finding the second best possible path in terms of delay. This path will now be disjoint from the previously computed path. The same process can now be repeated to compute 'n' mutually exclusive paths between a source-destination pair in increasing order of delays.

4	5	2	4	0	3	3
5	0	3	0	3	0	3
6	0	0	5	3	3	0

The following parameters have been assumed-  
 Bandwidth threshold - 4  
 Delay threshold - 10  
 Source - 1  
 Destination - 6

**Example**

Here is a network of 6 nodes. Each edge is represented by its residual bandwidth & delay metric



**Figure 1.** Example Network with edges depicting bandwidth/delay

Thus bandwidth and delay matrix of Network are-

**Table 1.** Bandwidth Matrix

	1	2	3	4	5	6
1	0	5	5	4	0	0
2	5	0	0	4	4	0
3	5	0	0	5	0	5
4	4	4	5	0	3	5
5	0	4	0	3	0	5
6	0	0	5	5	5	0

**Table 2.** Delay Matrix

	1	2	3	4	5	6
1	0	3	2	5	0	0
2	3	0	0	2	3	0
3	2	0	0	4	0	5

The problem can be defined as - find multiple disjoint paths between 1 and 6 in the given network. The paths should follow the following conditions-

- The bandwidth of the paths should be minimum 4.
- The delay of the paths should not exceed 10.

As bandwidth is concave metric, so each of the edges in the path found should have value greater than or equal to 4 and delay is an additive metric, so the sum of the delay of edges constituting the path should be less than or equal to 10.

According to the algorithm, the edges are removed from the graph that does not satisfy the bandwidth requirement by setting their delay value and bandwidth value to 0.

As the bandwidth requirement is 4 so the edges having less than bandwidth 4 should be removed from the graph. Among all the edges of graph, the edge 4-5 is having bandwidth 3 i.e. less than 4. It will not be considered further for path finding.

Now the resultant network will be-

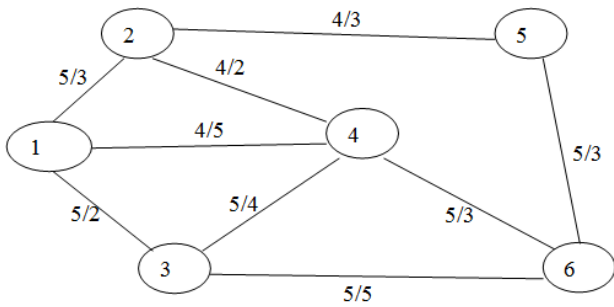


Figure 2. Filtered Network

In this network, Elimination of edges not satisfying bandwidth requirement has been done. Now the bandwidth of all the edges is equal or greater than 4. On this filtered network, the algorithm finds those multiple disjoint paths whose delay are less than 10.

Thus, the multiple disjoint QoS paths found in the given network are as follows-

Table 3. Path Table

Path	Bandwidth of Path	Delay of Path	Hop-Count
1-3-6	5	7	2
1-4-6	4	8	2
1-2-5-6	4	9	3

Thus the algorithm finds multiple disjoint paths satisfying bandwidth and delay requirements in the order of increasing delay.

Now on these disjoint paths, load distribution scheme has also been suggested in next section.

### III. LOAD DISTRIBUTION SCHEME

A load-distribution algorithm divides the traffic among multiple paths for higher network utilization. Data packets are distributed over multiple routes in proportion of the priority level of paths. In this scheme the delay value will be considered as a metric

for traffic distribution. The traffic will be distributed inversely proportionally to the delay value of the paths. That is, paths with lower delay value are assigned more traffic, and paths with higher delay value are assigned less traffic. load distribution can be done according to the following process-

#### Algorithm-

**Step1** Let the value  $R_i = 10 - \text{delay}$  for each path. [As the limit of delay is 10]

**Step 2** Calculate the proportion of traffic by the following equation -

$$P_i = R_i / \sum_{i=1}^n R_i * 100$$

Where n = Total number of paths

**Step 3** Divide the number of packets according to the value  $P_i$  as follows-

Number of packets \*  $P_i / 100$  for each path.

In our example, if the traffic load is 40 packets, then the above described algorithm will yield the following load distribution on the three selected paths. The delay values for three disjoint paths (1-3-6), (1-4-6) and (1-2-5-6) as obtained are-

$D_1 = 7, D_2 = 8$  and  $D_3 = 9$

#### Step 1

$R_1 = 10 - 7 = 3, R_2 = 10 - 8 = 2$  and  $R_3 = 10 - 9 = 1$

#### Step 2

$P_1 = 3 / (3 + 2 + 1) * 100 = 50$

$P_2 = 2 / (3 + 2 + 1) * 100 = 33$

$P_3 = 1 / (3 + 2 + 1) * 100 = 17$

#### Step 3

The load distribution on the two paths may be done proportionally as-

No of packets on path1 =  $40 * 50 / 100 = 20$

No of packets on path2 =  $40 * 33 / 100 = 13$

No of packets on path3 =  $40 * 17 / 100 = 7$

Thus

The load to be sent on path 1-3-6 = 20 packets

The load to be sent on path 1-4-6 = 13 packets

The load to be sent on path 1-2-5-6 = 7 packets



#### **IV. CONCLUSION**

The data created or transmitted on Internet has been growing at increasing rate. The type of data that has been transmitted requires Quality of Service for certain applications So ,there is a need to discover efficient routing schemes along with efficient load distribution for flows in the Internet. Keeping this in mind, this paper ,describes a load distribution scheme to calculate the ratio of traffic among multiple paths.

#### **V. REFERENCES**

- [1]. S.Upadhaya, G.Devi,"Exploring Issues for QoS Based Routing Algorithms" published in International Journal on Computer Science and Engineering (E-ISSN : 0975-3397 ) Vol. 02, No. 05, 1792-1795,2010.
- [2]. S.Upadhaya, G.Devi "Quality of Service Routing: A Multi-Path Approach" published in International journal of Computer Science & Network Solutions January , 2014-Volume 2.No1 ISSN 2345-3397
- [3]. Z. Wang and J. Crowcroft, "Quality-of-service routing for supporting multimedia applications," IEEE J. Select. Areas Commun., vol. 14, pp. 1228–1234, Sept. 1996.

# Fraud Investigation Related to Cryptocurrency - Bitcoin- A Case Study

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## ABSTRACT

**Background:** From the time immemorial there have been several types of crimes. With the advancement in science and technology, digital crimes have become very prominent. One among which is Bit-Coin cryptocurrency frauds which are gaining momentum in the types of frauds encountered by law enforcement agencies. Bit-Coin is a growing form of digital crypto-currency that is created and held electronically that has no centralized control systems, that governs the transactions. It is the most secretive form of money transfer between two anonymous people all over the world. It is on a superficial layer used to purchase or sell goods electronically, similar to the conventional dollars that are traded digitally where individual ledgers are maintained by all the bit coin users to have access to the building block-chain. However, a masked layer consists of a dark-net where enormous amounts of money are concealed in cold storage where illegal websites and illicit commerce like ATM/ Debit/ Credit Card scams subjecting to illegal transactions rule over the deep net by utilizing the innocent public money.

**Case Presentation:** The present study involves a case study where it was noted that innumerable ATM Debit/Credit Cards were skimmed and the illicit money was exchanged with this crypto-currency using an illicit website for bit coin mining and storing huge amounts of anonymous public money that was dictated by a few Nigerian Fraudsters running this racket all over the nation.

**Keywords:** Bit coin, Blockchain, ledger, Websites, ATM/ (Automated Teller Machine) Debit Card Scam

## I. INTRODUCTION

Bitcoin is a worldwide crypto-currency and digital payment system<sup>1</sup> called the first decentralized digital currency, since the system works without a central repository or single administrator<sup>1,2</sup>. It was invented by an unknown programmer, or a group of programmers, under the name Satoshi Nakamoto<sup>3</sup> and released as open-source software in 2009<sup>4</sup>. The system is peer-to-peer, and transactions take place between users directly, without an intermediary.<sup>1</sup> These transactions are verified by network nodes and recorded in a public distributed ledger called a blockchain<sup>5</sup>.

Bit coin is a form of digital currency that is created and marketed electronically with no centralized governing systems to monitor the humongous amounts of transactions<sup>6</sup>. It is the most secretive form of communication and money transfer between two anonymous people worldwide. Digital currency is the most fast growing technological makeover to the world that is the next replacement to the conventional paper currency. Bit Coins, as a cryptocurrency was apparently founded by **Satoshi Nakamoto** in 2009<sup>7</sup>.

In the month of November 2016 the Indian Government has declared sudden demonetization process due to which there was apnea of money felt

between many of the citizens as there was limit of money withdrawal from various ATMs (Automated Teller Machine). The main purpose of the government was to make India Digital and increase the number of digital transactions. Due to the above reasons many people have opted for online money transaction system i.e. Bitcoin as a safe store of value. But there are no laws related to regulation of Bitcoin and thus there are many chances of illegal work or transactions being done through this channel.

Thus with the increase in digital transactions and e-business there are many chances of cases like drug trafficking, human trafficking and money laundering cases to rise and one among them in digital frauds which is catching an eye of law enforcement agencies is frauds related to Bitcoin.

The biggest hack of bit coins is that no single financial institution controls the block chain of bitcoin network, but it is a digital file that is maintained on a ledger that contains names and balances and gain access to the available spendable balance as per the corresponding transactions. It completely works on peer-to-peer network but however these online financial transactions are made amongst impersonal users worldwide. A major feature of this is that the ledger is an open accounts book for all the users who additionally have an account of the bit coins spent or transacted between two users.

The entire understanding relies upon the cryptographic hashes that are assigned to particular bit coin user or account numbers that is attached to a bit coin wallet that has a respective address that dictates the authentic transfer of bit coins whose validation is done using computerized mathematical algorithms using a private key that determines the digital signature value to the message thereby encrypted by the sender whilst, the recipient uses their public key to decrypt the same and validate the transaction using a different algorithm. Transactions remain authentic

and validated as the digital signature is transaction specific and the same bit coin cannot be bought or sold the 2<sup>nd</sup> time. Each bit coin user in the bit coin network has a global access to all the transactions as the loophole of this trade involves anonymity of end users and their transaction time stamps. Adding to this, there can be no trace of the transaction whatsoever, but is recorded on the block-chain that is encoded onto the bit coin itself. Bit coin mining is where bit coins are released to come to circulation that involves solving a computationally difficult equation/ puzzle to discover a new block that is added to the block chain to receive rewards as a few bit coins that gets bagged to the individual's wallets and the release of bit coins is reduced every 4 years to maintain the demand in the stock market.

Very recently, in dark net and other deep websites, the online purchase of the illegal drugs and weapons occur via transactions that are run by bit coins in the illegal market and is currently growing to be a rampant form of cybercrime.

#### **Case Presentation:**

In one of the recent cases, in Bangalore City (India)<sup>9</sup>, it was noted that innumerable ATM Debit/Credit Cards were skimmed and the illicit money was exchanged with this cryptocurrency using an illicit website for bit coin mining and storing huge amounts of anonymous public money that was dictated by a few Nigerian Fraudsters running this racket all over the nation. The technical analysts at our laboratory found the lead through a travel booking agent "via.com" as the source for ATM Fraud and an Indian accomplice who helped the fraudsters to store money in cold storage currency. Around 14 people were found as accused; however we were able to nab the rest eight correspondents.

#### **MO (Method of Operation) of the accused**

Most of the hard core criminals have their own modus operandi, i.e. method of operation. Even in this case

there was a specific signature which was noted. The main accusers female associate bought a magnetic card reader and prepared a card reader strip and later parceled it to the accused. He sold the same to his allies and the gang would insert it in various ATM Kiosks to read the magnetic data present on the innocent public's Credit/ Debit Cards. By doing so they were stealing the PIN (Personal Identification Numbers) numbers and later would remove the reader, prepare a duplicate of the card and swipe them at various goods selling business outlets and ATM Kiosks. Around ten (10) complaints were registered for Fund Misuse using Fake Cards at Banaswadi Police Station and the subsequently a suspicion rose that led to the investigation. The gang then struck a deal with a Bangalore resident and then transferred the money they had illicitly withdrawn, to his account and then received commission for every individual transaction.

## II. MATERIALS AND METHODS

The chain of the fraud was found through their social networking site messages and their mobile artifacts. We used certain social media analysis tools and mobile

extraction softwares/ applications to retrieve all the deleted and undeleted text messages from Facebook Messenger, WhatsApp and their mobile e-wallets of their bit coin accounts.

### Tools and techniques used:

#### Technical Analysis for Mobile Data Retrieval:

1. UFED (Universal Forensic Extraction Device) Cellebrite 4PC(Extraction of deleted and undeleted messages and images related to magnetic card readers)
2. Magnet Axiom (Data recovery from all the mobile phones and the laptops)
3. EnCase Forensics (Hard Disk Imaging and Recovery of Deleted Data)

### Social media Examination:

1. X1 Social Discovery (It was used for analysis of the Facebook Media and Messenger)




8	<p><b>Name:</b> <a href="#">.thumbdata3--1967290299_embedded_100.jpg</a></p> <p><b>Path:</b> Unknown: 0xb/DCIM/.thumbnails/.thumbdata3--1967290299/.thumbdata3--1967290299_embedded_100.jpg</p> <p><b>MD5:</b> d5eed118c979150ad8ac68b00d3b47f9</p> <p><b>SHA256:</b> 5F16E47FDA7098B498BAA28A51E7BB5F59774DA5E1047C29B362D5F0E2AB8210</p>	<p><b>Size (bytes):</b> 2114</p>	
9	<p><b>Name:</b> <a href="#">.thumbdata3--1967290299_embedded_101.jpg</a></p> <p><b>Path:</b> Unknown: 0xb/DCIM/.thumbnails/.thumbdata3--1967290299/.thumbdata3--1967290299_embedded_101.jpg</p> <p><b>MD5:</b> 769cb80e4aade700b3b34339b428f9b0</p> <p><b>SHA256:</b> 3B810E15E34E5D4E392C42159C8B2EF3CA3011FADD6935D9877C8BB9C5074CFC</p>	<p><b>Size (bytes):</b> 2201</p>	
10	<p><b>Name:</b> <a href="#">.thumbdata3--1967290299_embedded_102.jpg</a></p> <p><b>Path:</b> Unknown: 0xb/DCIM/.thumbnails/.thumbdata3--1967290299/.thumbdata3--1967290299_embedded_102.jpg</p> <p><b>MD5:</b> 8317bf68d1c38a6369a8887c606bbebc</p> <p><b>SHA256:</b> E7AF7B23435960A1F52656F8A2E2B0E136280A7016351B8397FE97D884AEDD61</p>	<p><b>Size (bytes):</b> 2269</p>	

Figure 1. UFED Report- Findings of ATM machine and the Card Insertion Slot





546	<b>Name:</b> <a href="#">IMG-20160914-WA0016.jpg</a> <b>Path:</b> Unknown: 0xb/WhatsApp/Media/WhatsApp Images/IMG-20160914-WA0016.jpg <b>MD5:</b> 4aa36c850bade53eb2517f672c26f49 <b>SHA256:</b> 577C9821697ACAECAE8707CEE00E620175845E9E6743BDD05D78BA76883A214C	<b>Size (bytes):</b> 69556 <b>Created:</b> 14-09-2016 15:55:16 <b>Modified:</b> 14-09-2016 15:55:16 <b>Accessed:</b> 23-11-2016 00:00:00		Yes
547	<b>Name:</b> <a href="#">IMG-20160914-WA0017.jpg</a> <b>Path:</b> Unknown: 0xb/WhatsApp/Media/WhatsApp Images/IMG-20160914-WA0017.jpg <b>MD5:</b> 1faf1135760461992e0f93006141d0a8 <b>SHA256:</b> 9769D50221DF5CC0AF7967D3CBA81BA116CB31B2E54B2A5FF18FBC1F3E1B1027	<b>Size (bytes):</b> 16990 <b>Created:</b> 14-09-2016 15:59:24 <b>Modified:</b> 14-09-2016 15:59:24 <b>Accessed:</b> 23-11-2016 00:00:00		Yes
548	<b>Name:</b> <a href="#">IMG-20160914-WA0018.jpg</a> <b>Path:</b> Unknown: 0xb/WhatsApp/Media/WhatsApp Images/IMG-20160914-WA0018.jpg <b>MD5:</b> f1e3455333aeae5dbff1dd07efac44e0 <b>SHA256:</b> BF77AFD1D37B1EEE2C5309C002B7640249928C5848A7DE8A0861BF0D14ACC1C4	<b>Size (bytes):</b> 141071 <b>Created:</b> 14-09-2016 16:05:32 <b>Modified:</b> 14-09-2016 16:05:32 <b>Accessed:</b> 24-01-2017 00:00:00		Yes
549	<b>Name:</b> <a href="#">IMG-20160914-WA0019.jpg</a> <b>Path:</b> Unknown: 0xb/WhatsApp/Media/WhatsApp Images/IMG-20160914-WA0019.jpg <b>MD5:</b> 5298e18399f9fb9afc9206ebb461707e <b>SHA256:</b> FEDBA168CD1D3A2B45B28C817D1002205A89320DBDD47F641F9854A184AD3B34	<b>Size (bytes):</b> 33067 <b>Created:</b> 14-09-2016 16:05:20 <b>Modified:</b> 14-09-2016 16:05:20 <b>Accessed:</b> 23-11-2016 00:00:00		Yes

Figure 2. UFED Report- Findings of ATM Kiosks and Skimmers and Magnetic Card Readers recovered from their phones

### III. RESULTS AND DISCUSSION RESULTS AND DISCUSSION

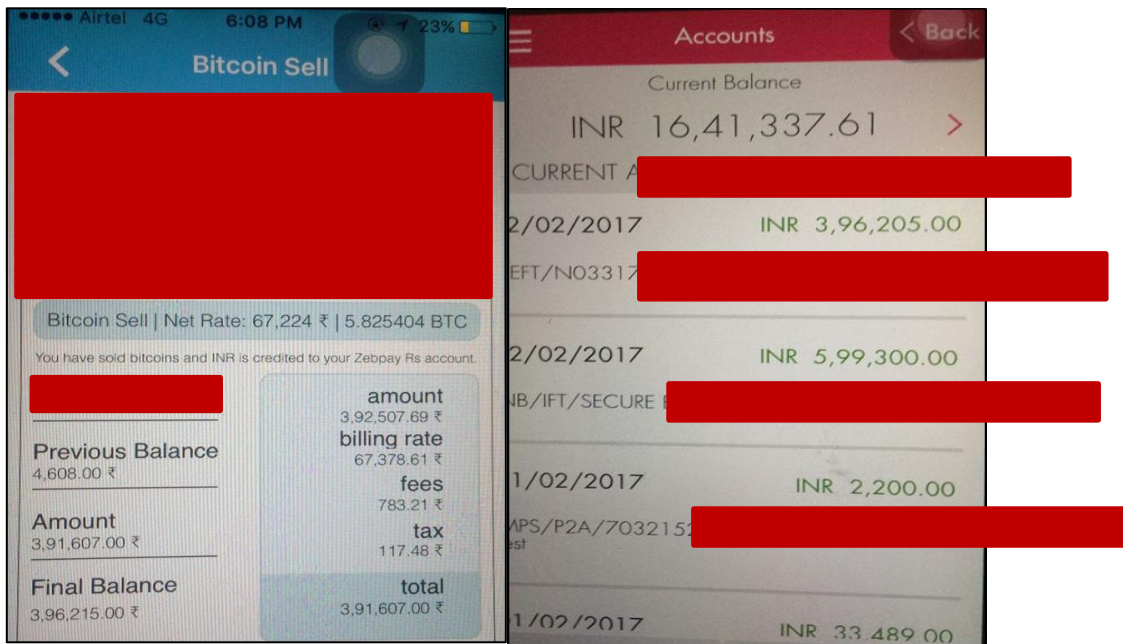


Figure 3. Snapshots of the e-wallet balances on their bit coin accounts wallets.

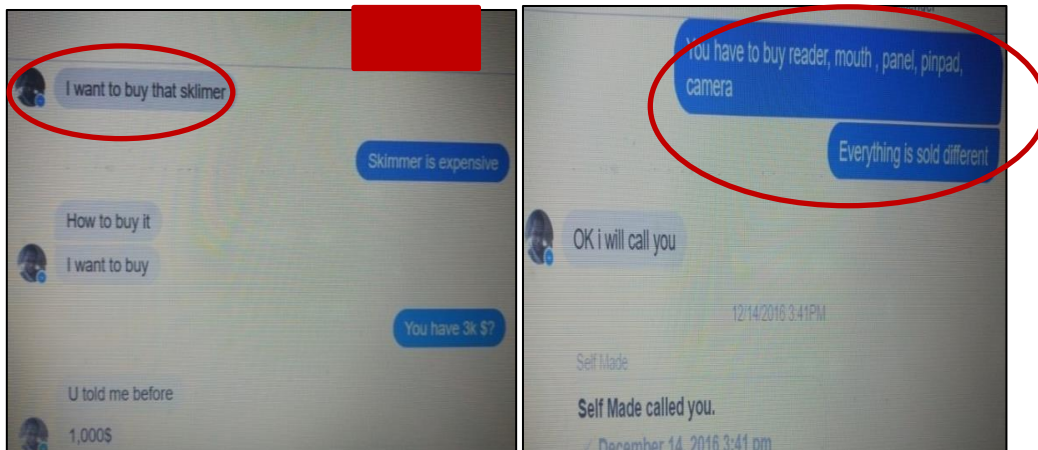


Figure 4. Facebook Messenger conversation between the accused

#### IV. RESULTS

Figure 4 describes about the Facebook Messenger conversation between the accused. It was noted that the fraudsters hadpreplanned the scam in India by co-ordinating with their Indian accomplice and their national's conman job well organized to spot their victims and hence paved a quick way to launder money. They made communications through social networking sites like Messenger and Facebook and finally integrated their money to the kingpin of this racket as shown in the figures named as Image 5 and Image 6.

The money obtained thereby has been refelected in their e-wallets on the involved person's bit coin account owned by another fraudster who helped them sequester huge amounts in the form of bitcoins as shown in the figures named as Image 3 and Image 4.

The UFED Mobile Extraction Report of the mobile phones of the accused acquitted at the Laboratory shows the transferred images of the ATM Kiosks, magnetic reader and other parts of the ATM Machines amongst the fraudsters and in turn these findings helped the Police Department to progress with the investigation of the mentioned Nigerian Financial Crime.

#### V. DISCUSSION

Ultimately using the evidences obtained from the extraction and data retrieval, we found a chain of suspects hailing from Nigeria who used the help of an Indian accomplice to store their illicit money that amounted to 21.4 lacs (approx.) on his unlicensed website in the form of bit coins.

For the purpose of our study, we have devised and used our corporate methodology and digital protocols using the emulated devices to provide a highly authentic and validated report on our respective findings/result obtained from the smart phones and the laptops.

#### VI. CONCLUSION

The above type of investigation is highly useful and eye opener to the law enforcement agencies. In the future there might be several cases related to drug trafficking, human trafficking related to digital crimes or say for that matter another bit coin case. Therefore prevention is better than cure, thus there should be stringent guidelines in terms of law and regulations related to Bit coin in India.

## VII. ACKNOWLEDGEMENT

We are highly thankful to Incognito Forensics for all the needful for solving the case and helping in forensics digital investigation.

**Conflict of Interest:** The authors do not have any conflict of interest.

## VIII. REFERENCES

- [1]. Jerry Brito & Andrea Castillo "Bitcoin: A Primer for Policymakers" . Mercatus Center. George Mason University.
- [2]. Sagona-Stophel, Katherine. "Bitcoin 101 white paper" November 2015
- [3]. S., L. "Who is Satoshi Nakamoto?". The Economist. The Economist Newspaper2 November 2015.
- [4]. Davis, Joshua "The Crypto-Currency: Bitcoin and its mysterious inventor". The New Yorker. 2011.
- [5]. The great chain of being sure about things". The Economist. The Economist Newspaper Limited. 31 October 2015.
- [6]. Retrieved from <http://www.investopedia.com/terms/b/bitcoin.asp>
- [7]. Nakamoto, Satoshi, "Bitcoin: A Peer-to-Peer Electronic Cash System," 2009. Unpublished Manuscript.
- [8]. Refer the news update retrieved from <http://www.deccanherald.com/content/595993/6-africans-among-7-arrested.html>; 2017

# Smart Mirror Notice Board

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## ABSTRACT

Notice Board is essential to display in any organization or at public places to provide the information. In the present situation, the notice/advertisement boards are almost always managed manually. But pasting various notices on a daily basis is a difficult/long process. This wastes a lot of time, paper, and manpower. Android notice boards are developed recently but still, it is found that there is still ignorance in reading notice board. So to make people read the notices we use the mirror display. We present the development of an innovating appliance that incorporates interactive services of information, erred through a user interface on the surface of a mirror. Our work is based on the idea that we all look in the mirror when we go out, so why wouldn't the mirror become smart. In this system, we propose a remotely send notice to smart mirror from an Android application based on Raspberry pi card. Now the world is moving towards automation, so in this world, if we want to do some changes in the previously used system we have to use the new techniques. The wireless operation provides fast transmission over long-range communication. It saves resources and time. Data can be sent from the remote location. User authentication is provided. Previously the notice board using GSM was used in that there was the limit of messages but in our system Multimedia data can be stored on-chip or on SD card. Text messages and multimedia data can be seen whenever we want to see. They were using the LCD display to display the notice which was not attractive so we are using a new technology known as the smart mirror to display the notice.

**Keywords:** Raspberry Pi, Android System, Authentication, User Interface.

## I. INTRODUCTION

Notice Board is essential to display in any organization or at public places to provide the information. In the present situation, the notice/advertisement boards are almost always managed manually. But pasting various notices on a daily basis is a difficult/long process. This wastes a lot of time, paper, and manpower. Android notice boards are developed recently but still, it is found that there is still ignorance in reading notice board. So to make people read the notices in this system use the mirror display. this system present the development of an innovating appliance that incorporates interactive services of information, erred through a user interface on the surface of a mirror.

Our work is based on the idea that we all look in the mirror when we go out, so why wouldn't the mirror become smart. In this system, we propose a remotely send notice to smart mirror from an Android application based on Raspberry pi card. Now the world is moving towards automation, so in this world, if we want to do some changes in the previously used system we have to use the new techniques. The wireless operation provides fast transmission over long-range communication. It saves resources and time.

Data can be sent from the remote location. User authentication is provided. Previously the notice



board using GSM was used in that there was the limit of messages but in this system Multimedia data can be stored on-chip or on SD card. Text messages and multimedia data can be seen whenever we want to see. They were using the LCD display to display the notice which was not attractive so we are using a new technology known as the smart mirror to display the notice.

## II. METHODS AND MATERIAL

Design and Implementation of Digital notice board by using raspberry pi board. The application has been installed on a Smartphone, a web server and a raspberry pi card to display text on display device. The main objective of this system is to develop a wireless notice board that display message sent from the user and to design a simple, easy to install, user friendly system, which can receive and display notice in a particular manner with respect to date and time which will help the user to easily keep the track of notice board every day and each time he uses the system.

### A. Goals and Objectives

The main goal is to provide Exciting new innovative way to send information to your Staff visitors and Students. The main objective of this system is to develop a wireless notice board that display message sent from the user and to design a simple, easy to install, user friendly system, which can receive and display notice in a particular manner with respect to date and time which will help the user to easily keep the track of notice board every day and each time he uses the system. Wi-Fi is the wireless technology used.

### B. Statement of scope

By using multiple screens for displaying the big size advertising purpose and the contents on the screen is made up of several images files and broadcasting display information and also remotely control it. The broadcasting information such as road highways

,subways, buses and bus station, train and train station, shopping malls, city squares, hospital, conference hall, colleges and schools for displaying notice for student information and displaying all institutional information for visitors and this same application in industry for displaying notices or useful information which has want to giving employees.

### C. Major Constraints

- 1) Authenticated User can post the message.
- 2) Internet connection is mandatory.
- 3) Registration is necessary for new user.

### D. Activity Diagram

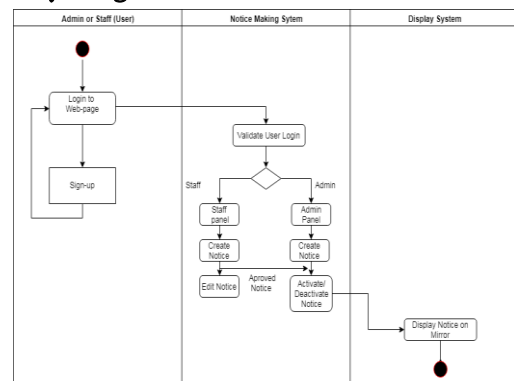


Figure 1

### E. System Architecture

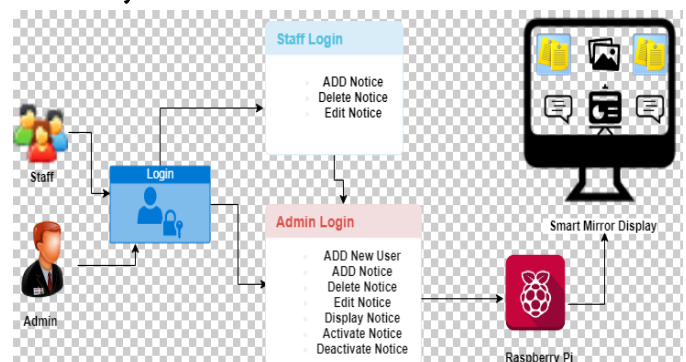


Figure 2

## III. HARDWARE REQUIREMENT

### A. Mirror Display

It is used to display the notice. User will post the text after the authentication. Notice will display through the raspberry pi.



Figure 3. Mirror Display

### B. Raspberry-Pi

The solution that we have adopted consists of the exploitation of the Raspberry pi card. It is a single nano computer card ARM processor designed by designer David Braben video games, as part of its foundation "Raspberry pi". (single motherboard, without housing, power supply, keyboard, mouse and screen) with the aim to reduce costs and enable the use of recovery equipment. Around the central part, there are different connectors for connecting devices to interact with the computer.



Figure 4. Raspberry pi 3 model b

### C. Hardware Setup

1) Connect the Ethernet cable from the Ethernet connector of the raspberry-pi to router. Internet connection should be working. We need to do this only first time when setup raspberry-pi, so that

program can update itself to the latest version. Updates are enabled by default and can be disabled later when we want.

- 2) Connect the HDMI cable from the HDMI connector on raspberry-pi to the HDMI connector on TV.
- 3) Plug the SD card into slot on the underside of the raspberry-pi. SD card should be pushed all the way in so that it is making a good contact with the connectors.
- 4) Plug the wireless adaptor from keyboard touchpad media controller into a USB port on raspberry-pi. Finally, insert the micro USB power supply. This will automatically boot the raspberry pi up. It shows raspberry-pi logo after successful installation.

## IV. SOFTWARE REQUIREMENT

### A. Android

Android provides a application platform that allows us to build the applications and games for mobiles in Java Programming language. The documents listed in the left navigation provide details about how to build apps using Android's various APIs. Apps provide multiple entry points Android apps are built as a combination of distinct components that can be invoked individually. For instance, an individual activity provides a single screen for a user interface, and a service independently performs work in the background. From one component you can start another component using an intent. You can even start a component in a different app, such as an activity in a maps app to show an address. This model provides multiple entry points for a single app and allows any app to behave as a user's "default" for an action that other apps may invoke. Apps adapt to different devices Android provides an flexible application platform that allows you to provide special resources for different device configurations. For example, you can generate different XML layout files for different screen sizes and the system decides

which layout to apply based on the current device's screen size.

## B. JSON

JSON (JavaScript Object Notation) is a data structure format. The data are considered as objects with properties and sub-properties. This formalism is close enough is based on XML and JavaScript.

## C. MySQL

MySQL is a relational database management system (RDBMS). It is distributed under a dual GPL and proprietary license. It is one of the database management software most used in the world.

## V. RESULT

### 1) Login page

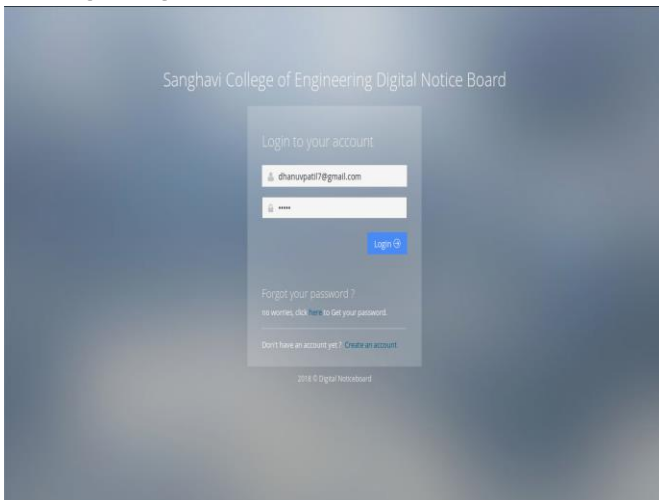


Figure 5. Login page

On login page user can login as admin or staff by using his/her user-id and password. If user forgot his password there is forgot password option through which user can recover his password. On login page there is create an account option where new user can create account.

### 2) Add Notice

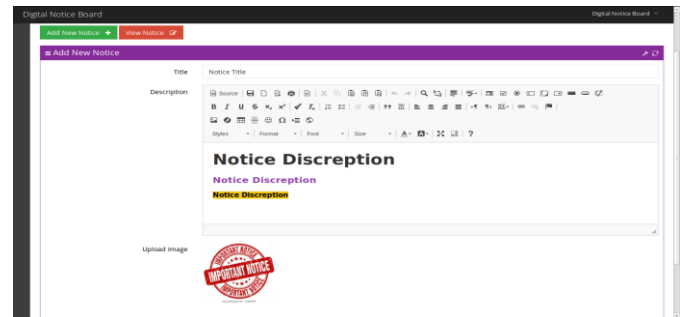


Figure 6. Add notice page

In this page user can add any notice which we want to display on the notice board. We can also add the image to the notice. We can set the font size, colour for the notice

### 3) Output



Figure 7. Smart Mirror display

This is the smart mirror display on this display you can see the notice that is send by the authorized user and at the same time you can see your face on the display.

## VI. CONCLUSION

As to days generation is moving towards automation, so in this generation if we want to do some changes in the previously used system we have to use the new techniques. We have implemented a smart mirror

with the use of raspberry pi. Wireless operation provides fast transmission over long range communication and due to fast transmission resources and time is saved. Data can be sent from remote location. User authentication is provided. Multimedia data can be seen whenever we want to see. Thus raspberry-pi being a small yet powerful device can work efficiently in smart mirror notice board connected with softwares.

## VII. REFERENCES

- [1]. Li, J., Da-You, L., and Bo, Y., "Smart home research," *Proceedings of the Third International Conference on Machine Learning and Cybernetics*, vol. 2, pp. 659–663, Shanghai, 26–29 August 2004.
- [2]. Choi, J., Shin, D., and Shin, D., *Research on Design and Implementation of the Artificial Intelligence Agent for Smart Home Based on Support Vector Machine*, Berlin/Heidelberg: Springer, p. 417, 2005.
- [3]. Li, B., Hathaipontaluk, P., and Luo, S., "Intelligent oven in smart home environment," *International Conference on Research Challenges in Computer Science (ICRCCS '09)*, pp. 247–250, Shanghai, 28–29 December 2009.

# IOT Based Soil Tester

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## ABSTRACT

Indian economy is mainly based on agriculture, still we are not able to make most favourable, commercial and sustainable use of our land resources. The main reason is the lack of knowledge regarding the soil analysis for the growth of crops. Agriculture is based on two important aspects *i.e.* weather and soil, as weather cannot be controlled, quality of soil can be analysed by soil testing. In every state, around 9 to 10 lakh soil samples have been received in labs and it is very difficult to test all the soil samples at a time by the labs. It takes more time to generate test reports. Hence there is need of soil analysis to be made available to the farmer. According to agriculture university survey, problem like infertility of soil increasing day by day because of excess use of chemical fertilizers. Farmers have inadequate knowledge of quality fertilizers to be used for soil.

**Keywords:** Soil, IOT, Analysis, Farmer.

## I. INTRODUCTION

Agriculture is the most important sector of Indian Economy. Indian agriculture contributes 18 per cent of India's gross domestic product (GDP) and provides employment to 50% of the countries employment. India is an agriculture based country, where more than 50% of population is depend on agriculture. This structures the main source of income. In agriculture, soil monitoring and analysis commonly refers to the analysis and verification of a soil sample to determine nutrient content, composition, yield and other characteristics such as pH level, nitrogen and moisture. Soil analysis is an essential process which is needed for efficient crop growth. 26% of the Earth's surface is exposed as land. Soil analysis and testing is often performed by commercial labs that offer a variety of tests, targeting groups of compounds and minerals. The advantages associated with local lab is, they are familiar with the chemistry of the soil in the area where the sample was taken. This enables experts to recommend the tests that are most likely to

reveal useful information. Soil testing is used to facilitate fertilizer composition and dosage selection for land employed in agricultural sectors. Lab tests are more accurate, In addition, lab tests frequently include professional interpretation of results and recommendations which are used for proper cultivation of crops. Crop production and cultivation requires adequate use of fertilizers and nutrients. Soil testing enables us to find proper contents of soil due to which we get information regarding how much fertilizers are needed for that specific soil, but the problem is soil test results takes couple of days sometimes even weeks to arrive back from the lab, soil testing labs are generally situated in cities, farmers from rural areas find it difficult to visit these labs as they are situated far away. A portable system is required to test the soil in rural areas which will be available at gram panchayat level. It will be easy to access to the farmer in deep rural areas. Lab reports reveal that the infertility of soil is increasing day by day because of excess use of chemical fertilizers. Development of agriculture using latest technology

will be very much useful in cultivation of crops. For a new agricultural area, without knowing or monitoring the important parameters of the soil, cultivation will be difficult and so the farmers might suffer financial losses.

## II. METHODS AND MATERIAL

### A. Overview of the system:

To develop a system for farmers which can test various soil parameters and according to that farmers can maintain their farm.

### B. IOT In agriculture:

The agricultural sector relies on innovative ideas and technological development to help increase yield and better allocation of resources. In earlier days innovation such as tractors and irrigation had a positive impact on farming architecture . Today, a driving force behind increased agricultural production at a lower cost is the Internet of Things which leaves the door wide open for engineers looking to bring a smart farming solution. The objective of IOT in agriculture is:

- Monitoring for soil moisture and nutrients.
- Reducing overuse of fertilizers.
- Fast and accurate results.
- Farmers can no longer depend on soil testing labs for getting results.
- Make room for smart farming.
- Efficiency in crop growth.

### C. Proposed System:

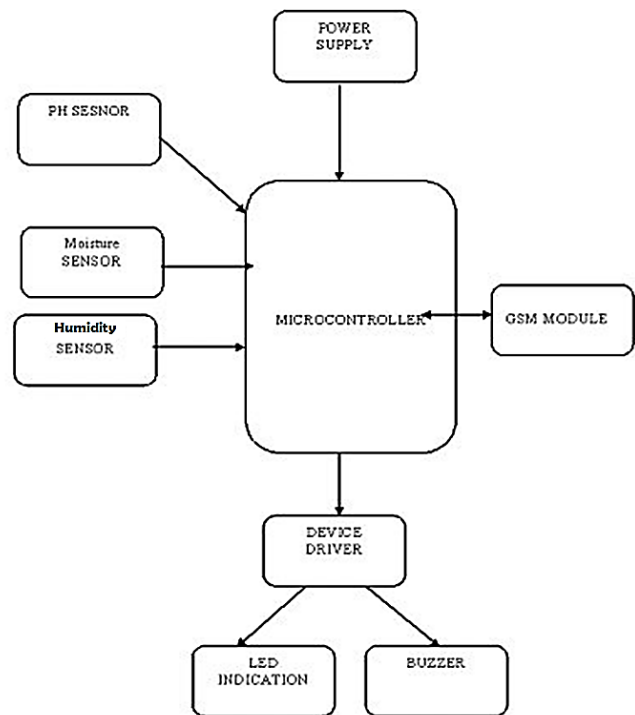


Figure 1

## III. HARDWARE REQUIREMENTS

### A. Ph Electrode:

The idea of this project is to interface common inexpensive pH probe that are very common these days to measure pH value. HR202 is basically an advanced humidity detector resistor which is made from organic materials, it can be used in various commercial applications like, hospitals, storage, workshop, textile industry, pharmaceutical field and meteorology.

### Specification:

- Sealed, gel-filled epoxy body
- Response Time: 90% of final reading in 1 second.
- Temperature Range: 5 to 80 degree Celsius.
- pH range: 0 to 14
- Resolution: 13 bit sensor DAQ

## B. Moisture Sensor

Soil moisture module is most effective way to measure the moisture contents of soil, when the soil humidity exceeds a set threshold value, the module D0 output low. The digital signal output D0 can be directly coupled with the microcontroller To detect or verify high and low control signal by the microcontroller. This in turn detects the moisture contents of the soil. The digital outputs DO signal module can directly activate the buzzer module, which can form soil moisture alarm equipment. AD and AO of analog output module is directly coupled with AD converter to get accurate and précised values of soil moisture contents.

### Specification

- Battery Life: 3 years
- Moisture : 0-100%
- Temperature Range: -40 to 85 degree Celsius.
- Battery Type: CR2450 X1

## C. GSM MODULE

GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface. The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having inbuilt TCP/IP stack to enable us to connect with internet via GPRS. It is beneficial for services such as SMS, Voice as well as DATA transfer application. The internal Regulated Power supply allows you to connect wide range unregulated power supply. With the help of this modem, you can read text messages, use data via internet, accept and attend the incoming and outgoing calls through basic AT protocols.

### Specification:

- Sealed, gel-filled epoxy body
- Response Time: 90% of final reading in 1 second.
- Temperature Range: 5 to 80 degree Celsius.
- pH range: 0 to 14
- Resolution: 13 bit sensor DAQ

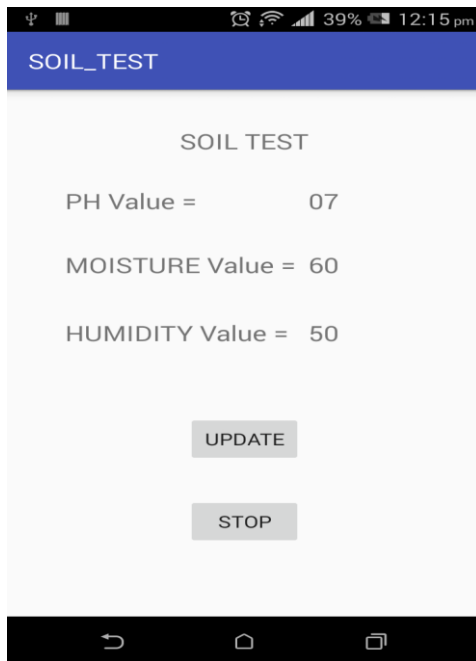
## D. Microcontroller:

The sensors which we are using are interfaced with PIC18F452. Electrodes are interfaced with I2C protocol. LCD is used to denote measured output. This controller has master controller synchronous module.

### Specification:

- Flash memory of 512kb
- Allows execution of RAM
- 8/16/32 bit timers
- USB, Ethernet, CAN interfacing support
- General purpose input output pins
- External memory interface

## IV. RESULTS AND CONCLUSION



Results are compared with soil testing lab, following table shows that results which are tested in labs and results recorded from pH electrode and moisture sensor.

## V. REFERENCES

1. Department of Agriculture & co-operation, Ministry of Agriculture Government of india, "soil testing lab" Nashik, 2017
2. <http://www.vernier.com/products/sensor/ion-selective-electrodes/no3-bta>.
3. PIC microcontroller and embedded system book, mohammad Ali Mazidi.
4. Gordon R.Brewster, TessemaAstatkie,John F. Adseet,"In-field measurement of soil nitrate using an ion-selective electoder", 2010.



# Smart Healthcare Kit for Cars Using Embedded System And IoT

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## ABSTRACT

Health and well being are the basic needs of people. Now-a-days everyone wants to be fit and healthy which brings out a better version of themselves. In this modern era most of the people use car for travelling. They spent a lot of time in travelling a long distances for a long period of time. There is a significant rise in innovations that came up to enhance the technology of cars. We can also improve the health of the people who spent a lot of time in their cars by implementing smart sensors which monitor the internal environment of the car as well as the person who is driving the car. An air humidifier can be utilized which monitors the humidity level inside the car and keeps it at a healthy level. Furthermore pulse oximeter measures the blood oxygen levels of the driver. This can be implemented in the steering wheel of the car. The sensors which are used for monitoring the health parameters are heart rate, blood pressure, alcohol and temperature. Apart from these sensors an oxygen sensor monitors the oxygen levels in air which enters the car. Using this system we can keep track of the car's inside environment as well as the health of the people who travel in car. And we can also keep track of the route using GPS.

**Keywords :** Pulse Oximeter, Air Humidifier, Sensors, GPS

## I. INTRODUCTION

In this 21<sup>st</sup> century almost every one owns a car and they travel from one place to another or they might go for long a drive which takes more time. And the emerging technology is also being improved in the automotive field tremendously. A lot of new features are being added in the car which provides entertainment as well as the safety to the people who travel. One among the safety features is the air bag system which provides the occupants a soft cushioning and restrain during the crash event to prevent or reduce any impact or impact caused injuries between the flailing occupant and the interior of the vehicle.

Not only the safety measures but also the innovations came up implementing the healthcare and wellness features into car. Using this system we can monitor the internal environment using sensors like Humidity – Air Humidifier and Oxygen. There might some situations like heavy traffic jam during which the environment inside the car might get affected. We can control these situations by providing a healthy environment for the occupants in car. Even if there are any irregularities in health of the person who is driving can be known and necessary help can be provided. This can be achieved by using the sensors which monitor the health of the driver.

These sensors are attached to the Arduino board which analyses the data and transfer the information to the emergency help service or the relatives of

concerned person who require medical assistance. Using this system we can also provide the necessary information regarding the location of the car and details of the person who is driving the car. Along with the healthy environment we can keep track on the car. The GPS provides the route by which the car is traveling to the person in the car and also to the people with whom we want to share the information. If the persons who are travelling in car need any immediate help then based on the tracking information they would receive it.

## II. Block Diagram

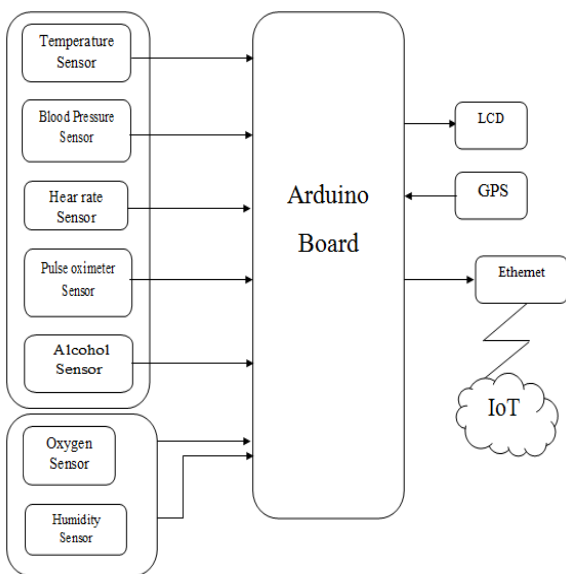


Figure 1: Block Diagram

## III. DESCRIPTION

### A. ARDUINO:

Arduino is an open source microcontroller which can be easily programmed, erased and reprogrammed at any instant of time. Introduced in 2005 the Arduino platform was designed to provide an inexpensive and easy way for hobbyists, students and professionals to create devices that interact with their environment using sensors and actuators. It is also capable of receiving and sending information over the internet

with the help of various Arduino shields. Arduino uses a hardware known as the Arduino development board and software for developing the code known as the Arduino IDE (Integrated Development Environment). The hardware consists of a simple open source hardware board designed around an 8-bit Atmel AVR microcontroller, or a 32-bit Atmel ARM. The software consists of a standard programming language compiler and a boot loader that executes on the microcontroller. This development board can also be used to burn (upload) a new code to the board by simply using a USB cable to upload. The Arduino IDE provides a simplified integrated platform which can run on regular personal computers and allows users to write programs for Arduino using C or C++.

### Types of Arduino Boards:

Arduino boards are available with many different types of built-in modules in it. Boards such as Arduino BT come with a built-in Bluetooth module, for wireless communication. These built-in modules can also be available separately which can then be interfaced (mounted) to it.



Figure 2: Arduino Board

### B. SENSORS:

#### 1) Heart Beat sensor:

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through ear lobe. As the heart forces blood

through the blood vessels in the ear lobe, the amount of blood in the ear changes with time. The sensor shines a light lobe (small incandescent lamp) through the ear and measures the light that is transmitted. The clip can also be used on a fingertip or on the web of skin between the thumb and index finger. The signal is amplified, inverted and filtered, in the box. By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen on the graph. Blood flowing through the earlobe rises at the start of the heartbeat. This is caused by the contraction of the ventricles forcing blood into the arteries and by shutting of the heart value at the end of active phase.

## 2) Temperature sensor:

The temperature sensor in the circuit will read the temperature from the surroundings and shown the temperature in Celsius (degrees). The LM35 is a low voltage IC which uses approximately +5VDC of power. This is ideal because the Arduino's power pin gives out 5V of power. The IC has just 3 pins, 2 for the power supply and one for the analog output. The output pin provides an analog voltage output that is linearly proportional to the Celsius temperature. Pin 2 gives an output of 1millivolt per 0.1°C (10mV per degree).

## 3) Blood Pressure sensor:

The Blood Pressure Sensor is a non-invasive sensor designed to measure human blood pressure. It measures systolic, diastolic and mean arterial pressure utilizing the oscillometric technique. Monitoring blood pressure at home is important for many people, especially if you have high blood pressure. Blood pressure does not stay the same all the time. It changes to meet your body's needs. It is affected by various factors including body position,

breathing or emotional state, exercise and sleep. It is best to measure blood pressure when you are relaxed and sitting or lying down.

## 4) Alcohol Sensor:

Alcohol sensor is suitable for detecting alcohol concentration on your breath, just like the common breathalyzer. MQ-3 is the alcohol gas sensor used. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple; all it needs is one resistor. A simple interface could be a 0-3.3V ADC.

### Features:

- 5V DC or AC circuit
- Requires heater voltage
- Operation Temperature: -10 to 70 degrees C
- Heater consumption: less than 750mW\*  
16.8mm diameter
- 9.3 mm height without the pins

## 5) Humidity Sensor:

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort. The presence of water vapor also influences various physical, chemical, and biological processes. Humidity measurement is critical because it may affect the health and safety of the personnel. In medical applications, humidity control is required for respiratory equipments, sterilizers, incubators, pharmaceutical processing, and biological products. In many applications **humidity sensors** are employed to provide an indication of the moisture levels in the environment. Humidity measurement can be done using dry and wet bulb hygrometers, dew point hygrometers, and electronic hygrometers. There has been a surge in the demand of electronic hygrometers, often called humidity sensors.

Humidifiers can ease the problems caused by dry indoor air. This increases the comfort for the driver and the condition of mucosa.

#### 6) Pulse Oximeter:

Pulse oximeter is used to measure the oxygen level in the blood. A clip on the finger measures the oxygen level using red and infrared light. The principle of pulse oximeter is based on the red and infrared light absorption characteristics of oxygenated and deoxygenated hemoglobin. Oxygenated hemoglobin absorbs more infrared light and allows more red light to pass through. Deoxygenated (or reduced) hemoglobin absorbs more red light and allows more infrared light to pass through. Red light is in the 600-750 nm wavelength light band. Infrared light is in the 850-1000 nm wavelength light band. People suffering from obstructive lung disease, asthma, heart failure or other diseases need this device to monitor their condition. It is a noninvasive method for monitoring a person's oxygen saturation (SO<sub>2</sub>). A pulse oximeter is a medical device that indirectly monitors the oxygen saturation of a patient's blood (as opposed to measuring oxygen saturation directly through a blood sample) and changes in blood volume in the skin, producing a photoplethysmogram. The oxygen level can be improved if it is not an optimum level which in turn enhances the overall well being.

#### 7) Oxygen Sensor:

An oxygen sensor (or lambda sensor) is an electronic device that measures the proportion of oxygen (O<sub>2</sub>) in the gas being analysed or in ambient air. In most recent days due to pollution the oxygen levels are being decreased while the carbondioxide levels are increasing significantly. The most common application is to measure the exhaust gas concentration of oxygen for internal combustion

engines in automobiles and other vehicles. Their structure is simple and reliable to use. They are cost effective and consume less power. Sometimes the person who is driving the car might feel sleepy or concentration might be decreased due the shortage of oxygen in vehicle thought to be one of the causes. In confined spaces, the levels of oxygen directly affect the persons inside, and have no open area, that is when travelling in a car while A/C is running. The oxygen content of atmosphere is about 21%. Oxygen deprivation also affects the functions of human brain.

#### 8) Ethernet:

Ethernet is a family of computer networking technologies commonly used in local area networks (LAN); metropolitan area networks (MAN) and wide area networks (WAN).). Systems communicating over Ethernet divide a stream of data into shorter pieces called frames. Each frame contains source and destination addresses, and error-checking data so that damaged frames can be detected and discarded.

#### 9) Graphics LCD:

Graphical LCD are different from the ordinary alphanumeric LCD, like 16x1 16x2 16x4 20x1 20x2 etc. They (ordinary) can print only characters or custom made characters. They have a fixed size for displaying a character normally 5x7 or 5x8 matrixes. Where as in graphical LCD we have 128x64=8192 dots each dot can be lit up as our wish or we can make pixels with 8 dots i.e. 8192/8=1024 pixels. We can design a character in a size which we need. We can make a picture on a graphical LCD as well. Graphical LCD is controlled by two KS0108 controllers. A single KS0108 controller is capable of controlling 40 characters. So for controlling a graphical LCD we need two KS0108 controllers. The 128x64 LCD is divided into two equal halves with each half being controlled

by a separate KS0108 controller. Such LCDs (using KS0108 controller) involve paging scheme, i.e., whole LCD is divided equally into pages.

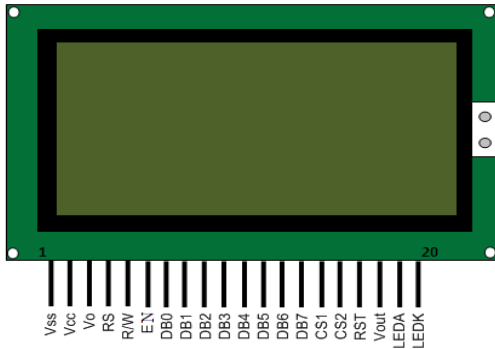


Figure 3: Graphics LCD

#### 10) GPS:

Global Positioning System tracking is a method of working out exactly where something is. A GPS tracking system, for example, may be placed in a vehicle, on a cell phone, or on special GPS devices, which can either be a fixed or portable unit. GPS works by providing information on exact location. It can also track the movement of a vehicle or person. So, for example, a GPS tracking system can be used by a company to monitor the route and progress of a delivery truck, and by parents to check on the location of their child, or even to monitor high-valued assets in transit. A GPS tracking system uses the Global Navigation Satellite System (GNSS) network. This network incorporates a range of satellites that use microwave signals that are transmitted to GPS devices to give information on location, vehicle speed, time and direction. So, a GPS tracking system can potentially give both real-time and historic navigation data on any kind of journey.

#### IV. IMPORTANT COMPONENTS

- Arduino Board
- Temperature Sensor

- Heart Rate Sensor
- Blood Pressure Sensor
- Alcohol Sensor
- Pulse Oximeter Sensor
- Oxygen Sensor
- Humidity Sensor
- GPS
- Graphics LCD

#### V. SOFTWARE TOOL

##### Arduino IDE (Integrated Development Environment):

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. A program written with the IDE for Arduino is called a sketch. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

## VI. ADVANTAGES

By using this system we can maintain a healthy atmosphere inside the car.

- It keeps the person healthy and fit who is driving the car
- It is portable and cost effective
- This also provides medical assistance by transferring the information to the concerned people.
- It also provides the location of the car.

## VII. APPLICATIONS

- This system can be used as an emergency kit in industries also.
- It can be used in homes, offices, schools etc

## VIII. CONCLUSION

Monitoring the health of people regularly is the major concern at present. This was made easy by implementing health care system in almost all the fields like automotive field, industrial field, etc. Emergency medical services are also being provided when it is necessary for the people. Using this system the health of the car as well as the people in it can be enhanced. The sensors collect the information required to analyze and take proper action based on the result obtained. A healthy and comfortable environment can be provided to the people who travel a lot in car using this system and can track their location or provide the details of the route to the concerned people.

## IX. REFERENCES

- [1] K. Galatsis, W. Wlodarski, B. Wells, and S. McDonald, SAE Transactions—Journal of Passenger Car—Mechanical Systems September (2001).
- [2] S. Sate, R&D Review of Toyota CRDL 39(1), 36 (2004).
- [3] Indoor Climate and Ventilation, Dantec Dynamics, Publication No: 104-102-01 URL: [www.dantecdynamics.com](http://www.dantecdynamics.com).
- [4] J. Anderson, Transport Ministers Attack Driver Fatigue. Media Release—Australian Commonwealth Department of Transport and Regional Services, December, 1998.
- [5] E. L. Anderson and R. E. Albert, “Risk Assessment and Indoor Air Quality.” CRC Press, Florida, 1999.
- [6] M. Maroni, B. Seifert, and T. Lindvall, “Indoor Air Quality, Monographs,” Vol. 3. Elsevier, Amsterdam, 1995.
- [7] N. Haworth, P. Vulcan, L. Bowland, and N. Pronk, Report on Estimation of Risk Factors for Fatal Single Vehicle Crashes, Monash University Accident Research Centre, September 1997.
- [8] Occupational Safety and Health Administration (OSHA), U.S. Department of Labor, Intro to 29 CFR Part 1910.146, Permit required Confined Spaces. V. H. Routley and J. Ozanne-Smith, Medical Journal of Australia 168, 65 (1998).
- [9] A.R.Ali, E. Imran Zualkerman, and Fadi Aloul, “A Mobile GPRS-Sensors Array for Air Pollution Monitoring”, vol. 8, pp. 415-422, 2010.
- [10] F.-S. Bai, Y.-L. Liu, “Design of Fault Monitoring Alarm System for Networks Based on GSM SMS,” pp. 45-67, 2010.
- [11] Al-Ali, member, IEEE, Imran Zualkerman, and Fadi Aloul, “A Mobile GPRS-Sensors Array for

- Air Pollution Monitoring”, vol. 6, pp. 410-422, Oct.2010.
- [12] Da-Jeng Yao, “A gas sensing system for indoor air quality control and polluted environment monitoring”, pp. 11-14, 2009.
- [13] W. Chung and C. H. Yang, “Remote monitoring system with wireless sensors module for room environment,” *Sens. Actuators B*, vol. 113, no. 1, pp. 35–42, 2009.
- [14] F. Tsow, E. Forzani, A. Rai, R. Wang, R. Tsui, S. Mastroianni, C. Knobbe, A. J. Gandolfi, and N. J. Tao, “A wearable and wireless sensor system for real-time monitoring of toxic environmental volatile organic compounds,” *IEEE Sensors J.*, vol. 9, pp. 1734–1740, Dec. 2009.
- [15] Chen Peijiang, Jiang Xuehua, “Design and implementation of Remote monitoring system based on GSM”, vol. 42, pp. 167-175, 2008.
- [16] K. Galatsis, Y. Li, W. Wlodarski, and K. Kalantar-Zadeh, *Sensors and Actuators B* 77, 478 (2001).
- [17] Sensor Business Digest, “VIP Sensor and Automation Research Homepage,” URL: [www.sensauto.com](http://www.sensauto.com), 2004.
- [18] Intechno Consulting, ITC Welcome Homepage, URL: [www.intechnoconsulting.com](http://www.intechnoconsulting.com), 2004.
- [19] H. V. Alexandru, C. Berbecaru, F. Stanculescu, L. Pintilie, I. Matei, and M. Lisca, *Sensors and Actuators A: Physical* 113, 387 (2004).
- [20] S. Eminoglu, D. Sabuncuoglu Tezcan, M. Y. Tanrikulu, and T. Akin, *Sensors and Actuators A: Physical* 109, 102 (2003).
- [21] D. Bauer, M. Heeger, M. Gebhard, and W. Benecke, *Sensors and Actuators A: Physical* 55, 57 (1996). D. Rossberg, *Sensors and Actuators A: Physical* 54, 793 (1996).
- [22] C. Cabuz, S. Shoji, K. Fukatsu, E. Cabuz, K. Minami, and M. Esashi, *Sensors and Actuators A: Physical* 43, 92 (1994).

# A Study on Non- Performing Assets and Its Impact on Public Sector Banks in India

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## ABSTRACT

The banking industry is an important player in making of any economy and more so in India in the current trend of economic slowdown since 2008. Banks need to be financially strong for this purpose. The impact of non-performing assets on the financial performance is the focus for this study. The level of profits as an indicator of financial performance and the level of non-performing assets were studied with select banks and we find that there is a very high relationship in reduction of profits and increase in such assets. These Banks need to focus more on managing financial assets better to increase profitability.

**Keywords :** Non performing assets, Public sector banks, Indian banking Industry, Financial Performance, Bank profitability

## I. INTRODUCTION

The Indian banking industry has played a major role in the economic growth for over 200 years. Banking intermediates transfer of financial resources from households to investors and thus enables economic growth. Further the banks also create money supply by the process of bank credit which is a channel of monetary policy transmission as well. These loans and advances given by banks to investors in expectation of future income are treated as assets for the banks.

Non-Performing Asset (NPA) is any type of asset of a bank which do not generate any income for the bank. That is a loan or advance which is not meeting its interest or principal payments which become NPA. The value of such assets will decline as they fail the requirements. The NPAs if left attended to in time become bad debts. Usually the borrowers are given a certain grace period, beyond which they are termed as NPA.

The RBI classifies loans on which interest or installment of principal that remain overdue for a period of more than 90 days from the end of a particular quarter as a Non-performing Asset.

The impact of NPAs on the profitability of the banks are as below:

1. They reduces earning capacity of the assets.
2. Uncovered NPAs carry risk weight of 100% and they block capital for maintaining Capital adequacy. As NPAs do not earn any income, they adversely affect the Capital Adequacy Ratio of the bank.
3. Carrying of NPAs increases Cost of Capital Adequacy, cost of funds, and Operating cost for monitoring and recovering NPAs.
4. The Economic Value Added (which is the Net operating profit after tax less the cost of capital) which measures business's performance towards shareholders value creation, is adversely affected by NPAs.
5. Because of NPAs, yield on loans and advances shows a lower figure than actual yield on regular Advances.



6. NPAs reduce earning capacity of the assets and thus the Return on Assets gets affected.

## II. REVIEW OF LITERATURE

A Review of relevant literatures will give an overview of the studies made on NPA. Also this helps in identifying the gap in earlier studies.

Bhati and Goyal (2012) had made a study of the Indian public sector banks and the Reserve Bank of India regulatory framework. They had concluded that the non-performing assets be strictly classified so as to control the high level of NPAs observed.[1]

Khedekar (2013) had studied the India banking industry after the global financial crisis of 2008 and underlined strengthening of banks to play a key role in economic revival for the country.[2]

Murthy and Bhanu Gupta (2012) had used Structure-Content-Performance model to study the Indian banking industry and had identified relationship between competition and NPAs of the banks.[3]

### I. PROBLEM AND OBJECTIVES OF STUDY

The importance of banks in Indian economy cannot be understated. For that purpose, the concerned stakeholders and public policy must take cognizance of the financial stability and performance of the banks, both in public and private sector. The foregoing studies also had pointed to the level of NPAs as one key factor for financial performance, though the exact level of relationship had not been deeply studied. Hence the problem focus of the current study would be identify the relationship between banks NPAs and profitability.

Further as in the past, there is a greater expectation from the public sector banks to play a major role in revival of economic affairs of the country now. Accordingly, the objective of the study is to study the

profitability and NPAs as well as the relationship between them especially for select public sector banks in India.

## III. METHODOLOGY AND OBSERVATIONS

Bank profitability needs secondary data from published bank annual statement. We have selected a few public sector banks as representative of the

### A. Research Hypothesis

The study focuses on the profitability and NPAs of the banks. When we look closer, we have different types of measuring profit like gross profit, net profit etc. However, the ultimate result of a bank's operations for its stakeholders will be its net profit. Similarly, the net NPA would be a better measure than the gross NPA. Hence the null hypothesis used in the study would be that there is no relationship between Bank net profit and net NPA.

### B. Analysis and Interpretation

To begin with we analyzed the trend of net profits across different banks over a 7-year time period to identify both good performers as well as bad performers in terms of net profit.

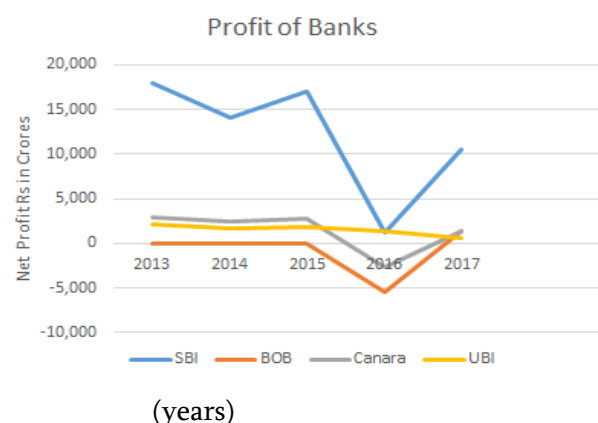


Fig. 1 Net Profit of select Banks across years

The foregoing graph makes it clear that not all public sector banks have performed equally and there are

good and average performers. Even the good performers have had lapses, especially in 2016. To understand further, we can explore one of the causes we have hypothesized, namely the net NPA data and how it had progressed over the same period.

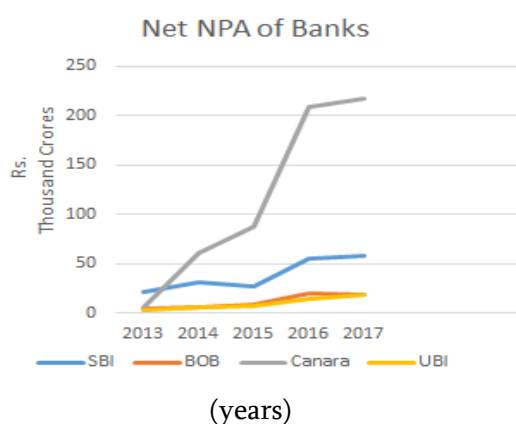


Fig. 2 Net NPA of select Banks across years

Now we could see that the decrease in net profits are accompanied by increase in Net NPAs as well. To check the extend of relationship between net NPA and profits the correlation between these two data for the different banks were calculated as below.

TABLE I

CORRELATION BETWEEN NET NPA AND NET PROFIT OF BANKS

Bank	Correlation Score
State Bank of India	-0.85
Bank of Baroda	-0.47
Canara Bank	-0.74
Union Bank of India	-0.95

The correlation analysis shows that the NPA and profits of banks are generally strongly negatively correlated. The level of inverse relationship is a weaker in case of Bank of Baroda only and in rest of the banks the impact of NPAs are strongly felt on the profitability.

#### IV. CONCLUSION

The banks we had studied have shown significant level of impact on profitability due to NPAs as seen from our analysis. Hence it is imperative on them to manage their NPAs with suitable measures so as to improve on their profitability. Further this research model also can be used to study the bank performance in other public sector and private sector banks as well.

#### V. REFERENCES

- [1] Bhati, G., & Goyal, C. K. Degradation in asset quality: A Sectoral study of non-performing assets in public sector banks in India.
- [2] Khedekar, P. S. (2012). Performance of Non-Performing Assets in India. Aweshkar Research Journal, 13(1).
- [3] Murthy, K. B., & Gupta, L. (2013). Growth Accounting Approach: Impact of Non-Performing Assets on Performance. The Indian Economic Journal, 60(4), 55-80.

# Implementation of Data Mining and Machine Learning Techniques in the Context of Disaster and Crisis Management

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## ABSTRACT

The explosive growth in social system content proposes that the biggest "sensor organize" yet may be human. Broadening the participatory sensing model, this undertaking investigates the possibility of using social systems as sensor systems, which offers ascend to an intriguing dependable sensing issue. In this issue, people are spoken to by sensors (data sources) who every so often mention objective facts about the physical world. These perceptions might be valid or false, and thus are seen as twofold claims. The dependable sensing issue is to decide the accuracy of detailed perceptions. From an organized sensing point of view, what makes this sensing issue detailing diverse is that, on account of human members, not exclusively is the reliability of sources normally obscure yet in addition the first data provenance might be uncertain. People may report perceptions made by others as their own. The commitment of this paper lies in building up a model that considers the effect of such data sharing on the diagnostic establishments of dependable sensing, and insert it into an instrument called Apollo that utilizes Twitter as a "sensor organize" for watching events in the physical world. Assessment, utilizing Twitter-based contextual analyses, demonstrates great correspondence between perceptions regarded adjust by Apollo and ground truth.

**Keywords:** Humans as Sensors, Social Sensing, Data Reliability, Uncertain Data Provenance, Maximum Likelihood Estimation, Expectation Maximization

## I. INTRODUCTION

Set up public safety systems rely upon joined emergency detection approaches, consistently relying upon expensive establishments of physical sensors which may not be open everywhere. The duplication of handheld contraptions, outfitted with a significant number of sensors and correspondence limits, would altogether be able to widen, or possibly substitute, normal sensing by engaging the collection of data through frameworks of humans. Novel perfect models, for instance, swarm, urban-or local sensing have been composed to depict how data can be sourced from the ordinary individual co-ordinately. Data social event can be either participatory or entrepreneurial, dependent upon whether the customer purposely adds to the acquiring exertion (possibly getting an inspiration), or she just goes about as the transport of a sensing device from which data is clearly accumulated by some

condition careful structure (Sheth 2009; Kapadia et al. 2009; Cimino et al. 2012).

In this circumstance, the presence of online social framework (OSN) stages, for instance, Twitter, Weibo and Instagram, that have turned out to be more noteworthy transforming into a fundamental focus point for public enunciation and joint effort, has included workplaces for unavoidable and progressing data-sharing (Demirbas et al. 2010). These exceptional sensing and sharing open entryways have enabled conditions where individuals expect the piece of sensor overseers, and in addition go about as data sources themselves. Surely, humans have a wonderful wellness in taking care of and isolating recognitions from their condition and, with correspondence workplaces close by, in speedily sharing the data they assemble (Srivastava et al. 2012). This unconstrained lead has driven another testing research field, called "social sensing" (Aggarwal

and Abdelzaher 2013), analyzing how human-sourced data, showed by the "human as a sensor" (HaaS)

perspective (Wang et al. 2014), can be collected and used to get situational care and to now cast events (Lamos and Cristianini 2012) in different regions, for instance, prosperity, transportation, essentialness, social and political crisis, and notwithstanding battling. Among the advantages of social sensing is the basic slant of OSN customers to rapidly pass on data about the particular circumstance (Liang et al. 2013; Cresci et al. 2015b) and that those proactively posted messages, especially while seeing emergency conditions, are presumably going to be free of weight or effect (Zhou et al. 2012). The most extraordinary case is Twitter, where customers are asked to make their messages (tweets) publicly available as per usual and where, in view of the 140 characters length imperative, they are constrained to share more point specific substance.

Given this photograph, it isn't shocking that OSNs, and Twitter particularly, have drawn the thought of makers of decision candidly strong systems for emergency management, and that in the midst generally disasters, for instance, the Tōhoku seismic tremor and wave (Japan—2011), the Hurricane Sandy (Central and North America—2012) and the Himalayan shake (Nepal—2015), basic confirmation associations swung to the Web and to OSN data to help following stricken regions, assessing the mischief and arranging the protect tries.

In perspective of the observation that a spreading out emergency is most likely going to offer climb to a burst of alerted messages, which may be used to early recognize the event, trailed by more smart messages, whose substance may be used to grasp its outcomes, a couple of structures have focused on the social affair and examination of messages shared in locales impacted by disasters (Hughes and Palen 2009; Bagrow et al. 2011; Adam et al. 2012; Gao et al. 2014; Avvenuti et al. 2014a). Nevertheless, such data is consistently unstructured, heterogeneous and isolated over incalculable to such an extent that it can't be direct used. It is therefore required to change that tumultuous data into different clear and minimal messages for emergency responders (Cresci et al. 2015b). Testing issues highlighted and looked by pioneer systems fuse the continuous securing of

unstructured data not especially engaged to the structure (data is much of the time free substance without structure or grouped semantics) (Goolsby 2010), the extraction of essential data overwhelmed by high surge of foolish prattles, the unmistakable verification of the most stricken districts in the consequence of an emergency (Cresci et al. 2015c; Sakai and Tamura 2015), security and insurance issues including the nonattendance of confirmation that human sensors viably pass on data about specific substances at specific conditions (Rosi et al. 2011). Regardless of these consistent disclosures, an examination of the best in class in the field of social sensing-based emergency management structures includes countless specific, unstructured and heterogeneous plans. Frankly, in the written work the blueprint of strong and vertical extraordinarily designated game plans still beats configuration approaches having a tendency to estimated quality, improvement and flexibility (Imran et al. 2015). This paper demonstrates a study on different framework for recognizing creating crisis events using humans as sensors.

Agreeing Avvenuti et al. SpringerPlus (2016) to the structure, particular emergency creates (e.g., seismic, hydrological, meteorological) can be perceived by masterminding an item plan, where re-usable parts can change in accordance with different substance and cases of messages displayed on the OSN while the event spreads out. The dedication of the paper is both connected and practical. To the inspiration driving creating and sharing the cognizance of the properties and associations of data gave by human sensors, we have described a wording and a transcendentalism for the HaaS perspective with respect to emergency detection. From the helpful viewpoint, we have laid out a region self-sufficient, outline and isolated structure that incorporates by a wide margin the majority of systems proposed to date. The feasibility of the proposed configuration in dealing with standard issues, for instance, data finding, data filtering and emergency event detection, has been appeared by a proof-of-thought utilization including seismic tremor detection by methods for Twitter. The application has been endorsed using datasets of tweets assembled in the midst of tremors occurred in Italy.

## II. NEED OF THE STUDY

In this undertaking investigates the possibility of using social systems as sensor systems, which offers ascend to a fascinating solid sensing issue. In this issue, people are spoken to by sensors (data sources) who once in a while mention objective facts about the physical world.

Set up public safety frameworks depend on incorporated emergency detection approaches, frequently depending on costly foundations of physical sensors which may not be accessible all around. The expansion of handheld gadgets, outfitted with countless and correspondence abilities, can essentially expand, or conceivably substitute, customary sensing by empowering the accumulation of data through systems of humans.

Actually, I imagine that outlining or enhancing data mining procedures is more testing than utilizing effectively existing systems. I propose an unfurling crises recognizing framework utilizing data mining method, named Data mining and machine learning with regards to fiasco and crisis management. We are occupied with participatory sensing of outside physical state. In the outcome of essential events, numerous smaller scale blog sections offer physical depictions of the event (e.g., "Shooting ejects on Liberty Square!"). Such announcing is a demonstration of sensing of the physical condition that is outside to the (human) sensor.

## III. IMPLEMENTATION METHODOLOGY

Remote sensing by and large alludes to distinguishing, checking and recognizing objects on Earth utilizing flying sensor innovation. Remote sensing applications incorporate condition checking, common asset management, national security, and reports of nature catastrophes. In these applications, particular physical sensors are picked and substantial scale data securing and handling foundation is fabricated. Conversely, this paper ventures out model humans as sensors. Contrasted with physical sensors, humans can watch a substantially more extensive range of physical and social events at much lower costs (e.g., fiasco following utilizing on the web social media). Notwithstanding, humans are not as

solid too tried framework sensors and humans can engender perceptions through the social system.

This paper tended to these exceptional difficulties conveyed by taking humans as sensors to report the status of the physical world.

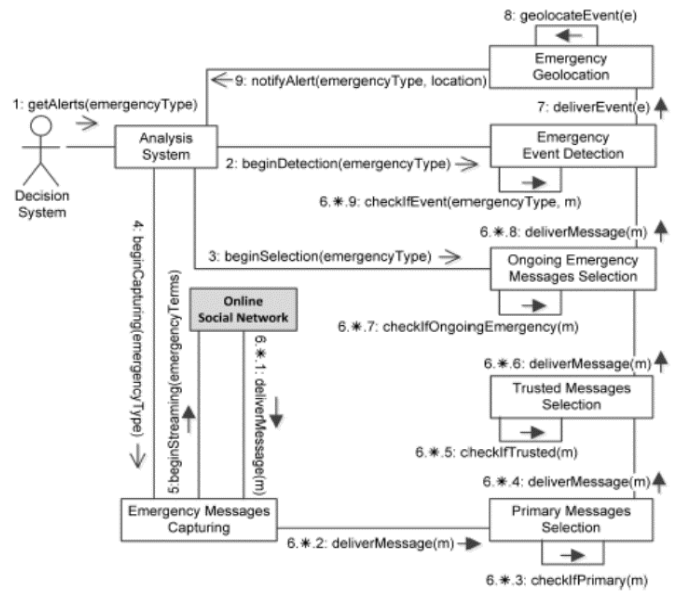


Figure 1. System Architecture

### A. Data Collection Module

We perform data accumulation utilizing database. In database we can store and can gather data from any participatory sensing front end, for example, an advanced cell application. In this undertaking, we investigate gathering data from Twitter. Tweets are gathered through a long-standing question by means of the sent out Twitter API to coordinate given inquiry terms (watchwords) and a showed geographic locale on a guide. These can either be anded or ored. Fundamentally, Apollo goes about as the "base station" for a participatory sensing system, where the inquiry characterizes the extent of data gathered from members.

### B. Registering the Source-Guarantee Graph Module

We have to decide the inner consistency in revealed perceptions. Hence, perceptions are bunched in view of a separation work. This capacity, separate (t1; t2), takes two detailed perceptions, t1 and t2, as information and returns a measure of likeness between them, spoke to by an intelligent separation. The more unique the perceptions, the bigger the separation. On account of data gathering from Twitter, we see singular tweets as

individual perceptions, and obtain from regular dialect preparing writing a straightforward cosine similitude work that profits a measure of closeness in light of the quantity of coordinating tokens in the two sources of info.

### C. Taking Care of the Estimation Problem Module

With inputs processed, the following stage is to play out the investigation that evaluations rightness of cases. For each claim,  $C_j$ , our application decides whether it is valid or false. Our application utilizes a sliding window approach for examining got tweets.

### D. The Outcome and Examination Module

In this module we indicate aftereffect of our proposed calculation and process after than we investigation the outcome and make diagram outline for result. In this undertaking we have talked about how the HaaS worldview can be abused for emergency detection. Center ideas, real parts and functionalities have been indicated to work in a wide class of crises. The plan of structural parts reusable for some kinds of events, and perhaps versatile as for the distinctive qualities of each sort, has been nitty gritty.

## IV. CONCLUSION

This venture exhibited an activity in demonstrating social systems as sensor systems. A moderate model was exhibited and its execution was assessed. In this model, human sources speak to sensors. The perceptions they make speak to (data) claims. The sensing issue is to figure out which claims are right; which is to state, isolate data from commotion. This is like combination issues in sensor systems, with the exception of two difficulties originating from the idea of the human eyewitness: in the first place, the reliability of our human sensors is for the most part obscure from the earlier. Second, the provenance of revealed perceptions is uncertain. The paper exhibited a maximum likelihood answer for the sensing issue that is novel in tending to both of the over two difficulties at the same time. The arrangement was executed in the application and tried utilizing data from Twitter. Test outcomes demonstrate that the model offers adequate precision in legitimately discovering the accuracy of cases from human sources.

## V. REFERENCES

- [1] D. Haddow, A. Bullock, P. Coppola, Introduction to Emergency Management, Oxford, U.K.:Butterworth-Heinemann, 2010.
- [2] G. Valkanas, D. Gunopulos, "How the live web feels about events", Proc. ACM Conf. Inf. Knowl. Manage., pp. 639-648, 2013.
- [3] V. Krishnamurthy, H. Vincent Poor, "A tutorial on interactive sensing in social networks", IEEE Trans. Comput. Soc. Syst., no. 1, pp. 3-21, Mar. 2014.
- [4] Ruths D, Pfeffer J., "Social media for large studies of behavior", Sci., vol. 346, no. 6213, pp. 1063-1064, 2014.
- [5] Liberman N. et al., "The effect of level of construal on the temporal distance of activity enactment", J. Experimental Soc. Psychology, vol. 43, no. 1, pp. 143-149, 2007.
- [6] L. Hong et al., "Discovering geographical topics in the twitter stream", Proc. 21st Int. Conf. World Wide Web, pp. 769-778, 2012.
- [7] M. Cataldi, L. Di Caro, C. Schifanella, "Emerging topic detection on twitter based on temporal and social terms evaluation", Proc. Int. Workshop Multimedia Data Mining, pp. 4:1-4:10, 2010.
- [8] Cresci S, Cimino A, Dell'Orletta F, Tesconi M (2015c) Crisis mapping during natural disasters via text analysis of social media messages. In: Web Information Systems Engineering-WISE 2015, pp 250-258. Springer
- [9] Cresci S, Petrocchi M, Spognardi A, Tesconi M, Di Pietro R (2014) A criticism to society (as seen by twitter analytics). In: IEEE 34th international conference on distributed computing systems workshops (ICDCSW), 2014, pp 194-200. IEEE
- [10] Crooks A, Croitoru A, Stefanidis A, Radzikowski J (2013) # Earthquake: Twitter as a distributed sensor system. Trans GIS 17(1):124-147
- [11] Demirbas M, Bayir MA, Akcora CG, Yilmaz YS, Ferhatosmanoglu H (2010) Crowd-sourced sensing and collaboration using twitter. In: IEEE international symposium on a world of wireless mobile and multimedia networks (WoWMoM), 2010, pp 1-9. IEEE
- [12] D'Andrea E, Ducange P, Lazerini B, Marcelloni F (2015) Real-time detection of traffic from twitter stream analysis. IEEE Trans Intell Transp Syst 16(4):2269-2283
- [13] Earle P (2010) Earthquake twitter. Nat Geosci 3(4):221-222
- [14] Earle PS, Bowden DC, Guy M (2012) Twitter earthquake detection: earthquake monitoring in a social world. Ann Geophys 54(6):708-715
- [15] Ebina R, Nakamura K, Oyanagi S (2011) A real-time burst detection method. In: 23rd IEEE international conference on tools with artificial intelligence (ICTAI), 2011, pp 1040-1046. IEEE
- [16] Foresti GL, Farinosi M, Vernier M (2015) Situational awareness in smart environments: socio-mobile and sensor data fusion for emergency response to disasters. J Ambient Intell Humaniz Comput 6(2):239-257
- [17] Gao L, Song C, Gao Z, Barabási A-L, Bagrow JP, Wang D (2014) Quantifying information flow during emergencies. Sci Rep 4:3997. doi:10.1038/srep03997
- [18] Goolsby R (2010) Social media as crisis platform: the future of community maps/crisis maps. ACM Trans Intell Syst Technol (TIST) 1(1):7

# Grid Voltage and Current Harmonic Compensation using Fuzzy Logic Based Coordinated Controller

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## ABSTRACT

In this project the compensation of neighborhood load harmonic current utilizing a single DG interfacing converter may make the intensification of supply voltage harmonics delicate burdens, especially when the fundamental grid voltage is very mutilated. Dissimilar to the operation of unified power quality conditioners (UPQC) with arrangement converter, another harmonic current supply voltage and grid current harmonic pay methodology is proposed utilizing facilitated control of two shunt interfacing converters. In particular, the primary converter is in charge of neighborhood load supply voltage harmonics suppression. The second converter is utilized to alleviate the harmonic current created by the communication between the primary interfacing converter and the nearby nonlinear load. To understand a basic control of parallel converters, an altered mixture voltage and current controller is additionally created in the paper. By utilizing this proposed controller, the grid voltage stage bolted circle and the identification of the heap current and the supply voltage harmonics are pointless for both interfacing converters. In this way, the computational heap of interfacing converters can be fundamentally lessened.

**Keywords :** UPQC, DVR, APF, DG

## I. INTRODUCTION

There are developing requests of utilizing power molding circuits in low and medium voltage control circulation system. Contrasting with massive detached filters that are very touchy to circuit parameters varieties, the dynamic power molding hardware including dynamic power filter (APF), dynamic voltage restorer (DVR), and unified power quality conditioner (UPQC) is favored due the quick element reaction and the great resistance to system parameter changes. Then again, the high entrance of distributed generation (DG) unit with power devices interfacing converter offers the likelihood of power appropriation

system harmonic current compensation utilizing multi-utilitarian DG interfacing converter.

Past research predominantly centered around the control of a single DG shunt interfacing converter as an APF, as their energy devices circuits have comparative topology. To understand an upgraded dynamic separating objective, the ordinary current control techniques for grid tied DG interfacing converter might be adjusted. To start with, the wide data transfer capacity current controllers are utilized so that the frequencies of harmonic load current can fall into the transmission capacity of the present controller. On the other hand, the particular

frequency harmonic pay utilizing multi-resounding current controller has gotten a consider generation measure of constrictions, as detailed. In the killjoy controller is created for different DG units with dynamic harmonic separating capacity. In the neural system strategy is utilized to enhance the harmonic separating execution of DG interfacing converters that are associated with a grid with substantial variety of grid impedance. Notwithstanding the pay of harmonics at low voltage dissemination arranges, the dynamic separating of music in higher voltage circulation system utilizing multi-level converters. Nonetheless, it is critical to note that previously mentioned compensation strategies are primarily utilized as a part of grid tied converter systems. In late writing, the hybrid voltage and current control is likewise created to understand a fundamental voltage control for DG control direction and a harmonic current control for nearby load harmonic compensation. Contrasted with the previously mentioned customary current control strategies, the crossover controller permits an interfacing converter to repay music in both network tied and islanding micro grids with help of the low transmission capacity interchanges between DG units, it likewise harmonic extraction to accomplish harmonic power sharing among parallel DG systems.

## II. Review of Conventional APF and DVR

This area quickly audits the control of shunt APFs for network current harmonic alleviation and arrangement DVRs for supply voltage harmonic suppression. To contrast and the proposed parallel-converter utilizing adjusted half and half voltage and current controller as appeared in the following segment, the surely knew double-loop current control and voltage control are connected to APFs and DVRs, individually.

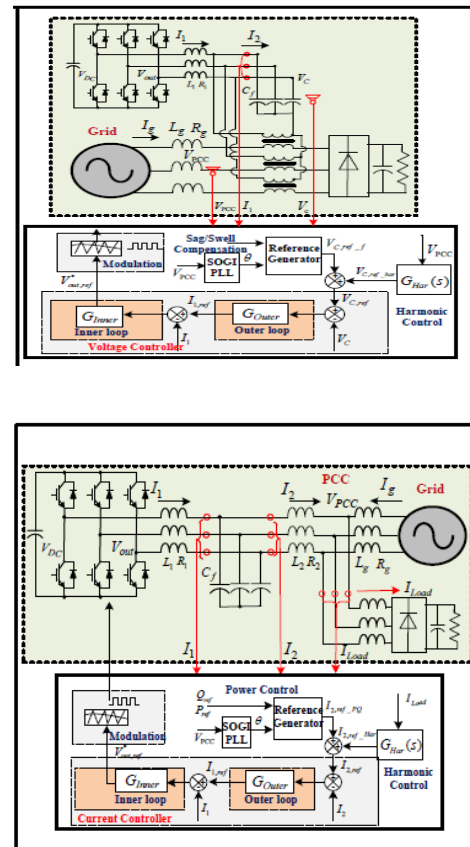


Fig.1. Diagram of local harmonic compensation using interfacing converter

### A. Shunt Interfacing Converters for Grid Current Harmonic Mitigation

Fig. 1(a) demonstrates the topology and control system of an interfacing converter for compensating generation ting harmonic current from a neighborhood nonlinear load. To start with, the neighborhood load is associated with the output of the interfacing converter, and afterward, they are coupled to the primary network through the grid feeder. The parameters of the interfacing converter LCL filter and the network feeder are recorded as  $z1(s) = sL1 + R1$ ,  $z2(s) = sL2 + R2$ ,  $z3(s) = 1/(sCf)$ , and  $zg(s) = sLg + Rg$ , where  $L1$ ,  $L2$ ,  $R1$ , and  $R2$  are the inductance and resistance of the filter arrangement stifles,  $Cf$  is the capacitance of the shunt capacitor, and  $Lg$  and  $Rg$  are grid inductance and resistance.



The present control plan is appeared in the lower some portion of Fig. 1(a). As per the customary APF control hypothesis, the neighborhood stack current is measured and the harmonic segments are distinguished as:

$$I_{2,ref\_h} = H_{Har}(s) \cdot I_{Load} \tag{1}$$

Where  $H_{Har}(s)$  is the exchange capacity of the harmonic segment indicator and  $I_{Load}$  is the nearby load current.

At the point when both the key and the harmonic parts are resolved, the reference current is acquired as  $I_{2,ref} = I_{2,f} + I_{2,ref\_h}$  and it is utilized as the contribution for a double-loop line current  $I_2$  control.

$$I_{1,ref} = H_{Outer}(s) \cdot (I_{2,ref} - I_2) \tag{2}$$

$$V_{out,ref}^* = H_{Inner}(s) \cdot (I_{1,ref} - I_1) \tag{3}$$

Where  $H_{Outer}(s)$  and  $H_{Inner}(s)$  are the controllers of the external and the internal control loops, separately.  $I_1$ , and  $I_1$  are the reference and the quick inverter output current, separately.  $V_{out,ref}^*$  is the output voltage reference of the inverter.

**B. Series Interfacing Converters for Supply Voltage Harmonic Mitigation**

It is important generation to note that notwithstanding when the harmonic current of shunt nonlinear burdens is adjusted, the supply voltage to neighborhood load is not gen generation simply sinusoidal. This can be brought on by a couple reasons including the fundamental system voltage consistent state harmonic bends. Assume the system current  $I_g$  in Fig. 1(a) is without swell, the harmonic voltage drop on the grid feeder  $R_g$  and  $L_g$  is zero. For this situation, the harmonic voltage at PCC is the same as the harmonics from the principle network. To address the previously mentioned issue, an arrangement DVR can be introduced as appeared in Fig. 1(b), where the system is combined with the power distribution

arrange utilizing an arrangement associated coordinating transformer. The auxiliary of the transformer is associated with a converter with output LC filter.

To begin with, the PCC voltage is measured by the DVR controller and the central and harmonic PCC voltage segments are isolated. At that point, the supply voltage harmonic parts are repaid by setting up the harmonic voltage reference of the DVR as  $V_{ref\_h} = V_{PCC\_h}$  [35] and the basic voltage reference  $V_{ref\_f}$  of the DVR is resolved by the droop and swell compensation necessity of the system [3].

At the point when the central and harmonic part references are resolved, the DVR reference voltage is gotten as  $V_C = V_{C,f} + V_{C,ref\_h}$ . A while later, a double-loop voltage control is connected to guarantee a quick voltage following as

$$I_{1,ref} = H_{Outer}(s) \cdot (V_{C,ref} - V_C) \tag{4}$$

$$V_{out,ref}^* = H_{Inner}(s) \cdot (I_{1,ref} - I_1) \tag{5}$$

Where  $H_{Outer}(s)$  and  $H_{Inner}(s)$  are the controller of the external and the inward control loops, separately.  $V_C$ , and  $V_C$  are the reference and the immediate estimation of DVR voltage, separately.

**III. THE PROPOSED COORDINATED CONTROL METHOD**

To have harmonic current alleviation of the supply voltage and the grid current harmonics, a compensation technique utilizing facilitated control of two parallel interfacing converters is proposed in this segment. The hardware and control outlines of the proposed system are appeared in Fig. 2 and Fig. 3, individually. Initial, a DG unit with two parallel interfacing converters having a similar DC rail is associated with PCC. Each interfacing converter has a output LCL filter and the nearby nonlinear load is put at the outputfilter capacitor of converter1. In this

topology, the supply voltage to neighborhood nonlinear load is upgraded by controlling the harmonic part of interfacing converter1. In the interim, the network current harmonic is relieved by means of the power molding through interfacing converter2. Their definite control systems are talked about separately, as demonstrated as follows:

**A. Control Strategy for Converter**

To start with, the line current  $I_{2,1}$  of converter1 and the PCC voltage  $V_{PCC}$  as appeared in Fig. 2 are measured to compute the genuine and receptive outputpower of this converter.

$$\begin{cases} P_{C1} = \frac{3\tau}{2(s+\tau)} (V_{PCC,\alpha} \cdot I_{2\alpha,C1} + V_{PCC,\beta} \cdot I_{2\beta,C1}) \\ Q_{C1} = \frac{3\tau}{2(s+\tau)} (V_{PCC,\beta} \cdot I_{2\alpha,C1} - V_{PCC,\alpha} \cdot I_{2\beta,C1}) \end{cases} \quad (6)$$

where  $PC1$  and  $QC1$  are the output genuine and receptive power of converter1,  $V_{PCC,\alpha}$  and  $V_{PCC,\beta}$  are the PCC voltage in the two-hub stationary reference outline, and  $I_{2\alpha,C1}$  and  $I_{2\beta,C1}$  are the line current of converter1, and is the time  $\tau$  constant of low pass filters. The time steady of the low pass filter is for the most part controlled by two components. To begin with, the genuine and receptive power swells brought on by line current music must be appropriately sifted through. Besides, the quick element control should be kept up. As per the outline rule.

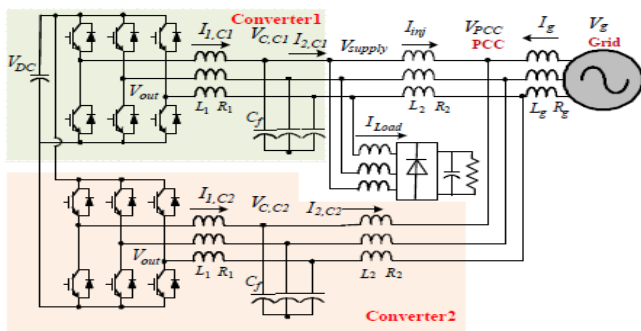


Fig. 2. Diagram of the proposed topology.

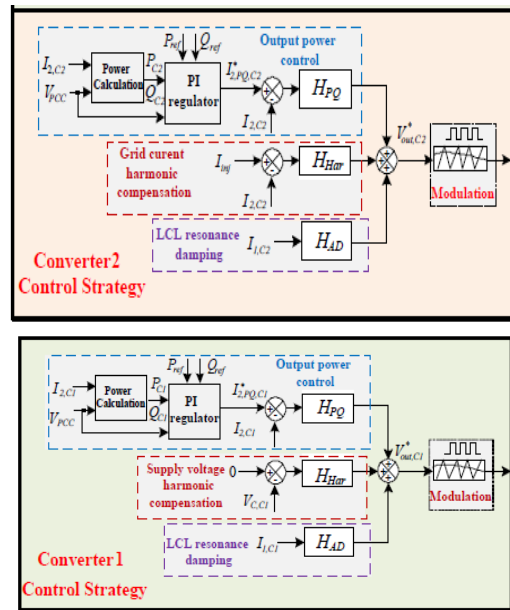


Fig.3. Diagram of the proposed interfacing converter control strategies

Note that the power reference is gen generation decided by the accessible power from the back phase of the DG unit. At the point when there is vitality stockpiling system in the DG unit, the power reference can likewise be controlled by the vitality administration arrangement of a DG unit or a micro grid. Along these lines, for straightforwardness, the harmonic pay administration is typically initiated when there is adequate power rating in the interfacing converters.

The output of the power reference gen generation tor is the line current reference  $I_{2,,1}$

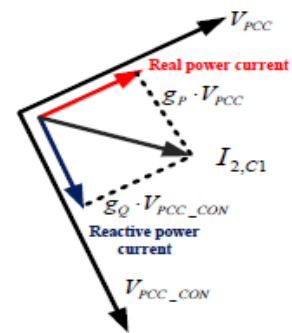


Fig. 4. Phasor diagram of converter1 line current.

$$I_{2,PQ,C1}^* = g_p \cdot (V_{PCC,\alpha} + jV_{PCC,\beta}) + g_q \cdot (V_{PCC,\beta} - jV_{PCC,\alpha}) \tag{7}$$

Where  $g_p$  and  $g_q$  are two customizable additions that can control converter1 output genuine and receptive power, separately. This controller just uses a duplicate of the momentary PCC voltage vector ( $V_{PCC,\alpha} + jV_{PCC,\beta}$ ) and the conjugated part as the present reference. This depends on a reality that the genuine output power is in extent to the line current  $I_2$  that outsiders to immediate PCC voltage vector, while the receptive power is corresponding to the line current that outsiders to the conjugated PCC vector  $V_{PCC,\beta} - jV_{PCC,\alpha}$ , as appeared in Fig. 4.

The additions  $g_p$  and  $g_q$  in are controlled by two PI controllers as

$$\begin{cases} g_p = (k_{p\_PQ} + \frac{k_{i\_PQ}}{s}) \cdot (P_{ref} - P_{C1}) \\ g_q = (k_{p\_PQ} + \frac{k_{i\_PQ}}{s}) \cdot (Q_{ref} - Q_{C1}) \end{cases} \tag{8}$$

Where  $k_{p\_PQ}$  and  $k_{i\_PQ}$  are PI controller coefficients.  $P_{ref}$  and  $Q_{ref}$  are the reference genuine and receptive power, individually.

Customarily, the half and half controller in controls the DG key voltage for power control and the harmonic current for load harmonic current relief. As this converter is in charge of repaying harmonic parts of the supply voltage, the controllers in the half breed voltage and current controller is changed with harmonic supply voltage control and central line current control as:

$$V_{out,C1}^* = \overset{\text{Power Control}}{H_{PQ}(s)} \cdot (I_{2,PQ,C1}^* - I_{2,C1}) + \overset{\text{Voltage Harmonic Mitigation}}{H_{Har}(s)} \cdot (V_{C,C1}^* - V_{C,C1}) + \overset{\text{Active Damping}}{H_{AD}(s)} \cdot I_{1,C1} \tag{9}$$

where  $V_{out,C1}^*$  is reference voltage for PWM preparing,  $I_{2,PQ,C1}^*$  is the line current reference of the Power Control term,  $V_{C,C1}^*$  is the reference voltage of the Voltage Harmonic Mitigation term,

$V_{C,C1}$  is the filter capacitor voltage, and  $I_{1,C1}$  is the converter1 output current. As appeared in Fig. 2, the filter capacitor voltage ( $V_{C,1}$ ) is the same as the heap voltage ( $V_{supply}$ ). The controllers of the Power Control, Voltage Harmonic Mitigation and Active Damping terms are recorded as

$$H_{PQ}(s) = k_{p1,C1} + \frac{\angle k_{i,f,C1} \omega_c s}{s^2 + 2\omega_c s + \omega_o^2} \tag{10}$$

$$H_{Har}(s) = k_{p2,C1} + \sum_{h=5,7,11,13} \frac{2k_{v,h,C1} \omega_c s}{s^2 + 2\omega_c s + (h \cdot \omega_o)^2} \tag{11}$$

$$H_{AD}(s) = k_{AD,C1} \tag{12}$$

where  $k_{p1,C1}$  is the relative pick up and  $k_{i,f,C1}$  is the thunderous controller pick up for the power control controller  $H_{PQ}(s)$ ,  $k_{p2,C1}$  is the corresponding addition and  $k_{v,h,C1}$  is the full controller pick up for the voltage harmonic relief controller  $H_{Har}(s)$ , and  $k_{AD,C1}$  is the relative control that can effectively stifle the LCL filter reverb generation.

It is important to note that lone the essential relative additions  $k_{p1,1}$  and  $k_{p2,C1}$  is much lower than the full controller pick up  $k_{v,h,C1}$ . Accordingly, the output of the Power Control term in (9) has low harmonic part. Because of this element, the contorted network voltage can be straightforwardly utilized as the contribution of (7), as its harmonic part can be naturally sifted through by (10). In the meantime, it can be seen that the output of the second Voltage Harmonic Mitigation term just has low major parts, as just resounding controllers at the chose harmonic frequencies are received in the control term. Accordingly, the Power Control term and Voltage Harmonic Mitigation term are exceptionally all around decoupled. As needs be, an interfacing converter can dispatch energy to the system and repay supply voltage music in the meantime. Furthermore, dissimilar to the routine DVR with PCC harmonic voltage extractions, the Voltage Harmonic Mitigation term can understand dynamic supply voltage harmonic compensation with no harmonic extractions. What's more, it can be seen that a shut

circle control is acknowledged without utilizing stage bolted loops.

At last, it is important to accentuation that contrasting with the customary half breed controller that uses the hang control to acknowledge mod generation mod generation power control flow, the principal current control in (9) could successfully enhance the power control dynamic reaction.

### A. Control Strategy for Converter2

The control procedure of converter2 is like that of converter1, as additionally exhibited in Fig. 3. Be that as it may, both the fundamental and the harmonic converter streams are controlled. In the first place, the controllers as appeared in (6) to (8) are embraced to get the power control term reference  $I_{2\alpha,1}$  and  $I_{2\beta,C1}$  are the line current of converter1, and  $\tau$  for converter2. Subsequently, another mixture controller is utilized to understand the shut circle line current control of conveter2 as:

$$V_{out,C2}^* = \overset{\text{Power Control}}{H_{PQ}(s) \cdot (I_{2,PQ,C2}^* - I_{2,C2})} + \overset{\text{Current Harmonic Mitigation}}{H_{Har}(s) \cdot (I_{2,Har,C2}^* - I_{2,C2})} + \overset{\text{Active Damping}}{H_{AD}(s) \cdot I_{1,C2}} \quad (13)$$

where  $V_{out,C2}^*$  is reference voltage for converter2 PWM handling,  $I_{2,PQ,C2}^*$  is the present reference for converter2 control,  $I_{2,Har,C2}^*$  is the present reference for converter2 line current harmonic control,  $I_{1,C2}$  is the converter2 output current. The controllers of Power Control, Current Harmonic Mitigation and Active Damping terms are recorded here as

$$H_{PQ}(s) = k_{p1,C2} + \frac{2k_{i,f,C2}\omega_c s}{s^2 + 2\omega_c s + \omega_o^2} \quad (14)$$

$$H_{Har}(s) = k_{p2,C2} + \sum_{h=3,7,11,13} \frac{2k_{i,h,C2}\omega_c s}{s^2 + 2\omega_c s + (h \cdot \omega_o)^2} \quad (15)$$

$$H_{AD}(s) = k_{AD,C2} \quad (16)$$

Similar to converter1, the Power Control term and the Current Harmonic Mitigation term are exceptionally very much decoupled. In this manner, PLLs is a bit much and the contribution of Power Control term  $I_{2,2}^*$  can have a few bends when utilizing an immediate duplicate of PCC voltage. Moreover, take note of that the distinction between the converter1 line current and the heap current  $I_{inj}$  (found in Fig. 2, equivalent to  $I_{2,1} - I_{Load}$ ) is received as the contribution of Current Harmonic Mitigation term of converter2 as  $I_{2,Har,C2}^* = I_{inj}$ . As just harmonic full controllers are utilized as a part of the Current Harmonic Mitigation term and the corresponding increase  $k_{p2,2}$  is much littler than  $k_{i,h,C2}$  in (15), converter2 can effectively compensating generation the harmonic current from converter1 with no harmonic current recognition. For this situation, the infused current  $I_g$  to the primary network is harmonic free.

In rundown, the proposed topology and the altered cross breed controller can understand an upgraded nature of supply voltage to the neighborhood stack and the grid current to the primary system in the meantime. Through the organized control of two parallel converters, the previously mentioned control quality change target is acknowledged in a computationally compelling way, without including any PLLs and harmonic voltage/current extractions in the whole procedure. What's more, when the principal current direction in the Power Control term in (13) and (9) is supplanted by the surely knew hang control for major voltage control, the proposed

technique can be utilized as a part of an islanded micro grid in a comparative way.

### C. Frequency Domain Analysis

As both converter1 and converter2 have frequency specific element at the major and they chose harmonic frequencies, the supply voltage harmonic and system current harmonic compensation execution can be analyzed by frequency area investigation utilizing Bode plots. Initial, a LCL filter of a converter is appeared in Fig. 5, where the neighborhood load is disentangled as a harmonic current source associated with the shunt capacitor of converter LCL filter. The reaction of the filter plant is given as

$$\left(\frac{V_{out}}{z_1} + \frac{V_{PCC}}{z_2} - I_{Load}\right) \cdot \left(\frac{1}{z_1} + \frac{1}{z_2} + \frac{1}{z_c}\right) = V_C \quad (17)$$

$$V_{out} - V_C = z_1 \cdot I_1 \quad (18)$$

$$V_C - V_{PCC} = z_2 \cdot I_2 \quad (19)$$

In light of the control methodologies in (9) and (13), the exchange capacity of the LCL filter circuit (see (17) to (19)) for both converter1 and converter2, and expecting that  $V_{out,C2} = V_{out,C1}$  and  $V_{out,C1} = V_{out,C1}$ , the shut circle current and voltage reaction of parallel converters can be set up as

$$V_{C,C1} = R_{11}(s)V_{C,C1}^* + R_{12}(s)I_{2,PQ,C1}^* - R_{13}(s)I_{2,C1} \quad (20)$$

$$I_{2,C1} = R_{21}(s)V_{C,C1}^* + R_{22}(s)I_{2,PQ,C1}^* + R_{23}(s)V_{PCC} \quad (21)$$

$$I_{2,C2} = R_{31}(s)I_{2,PQ,C2}^* + R_{32}(s)I_{2,Har,C2}^* - R_{33}(s)V_{PCC} \quad (22)$$

Where the coefficients  $R_{11}(s)$  to  $R_{33}(s)$  in portray the reaction of these two converters to different excitations of the system. In particular, (20) predominantly centers the execution of converter1 at harmonic frequencies, while expects to depict the execution of the system at around basic frequency. As it were, converter1 has voltage source trademark at

harmonic frequencies however current source trademark at around the essential frequency. Then again, as both essential and harmonic line current are controlled for converter2, just a single current source proportional circuit in can be utilized to show the execution of converter2. With a specific end goal to make the examination more direct, a mind boggling circuit arrange as appeared in Fig. 6 is produced to show how the harmonic voltage and current harmonic are at the same time adjusted. Take note of that this identical circuit arrange in Fig. 6 is just viable at the chosen harmonic frequencies.

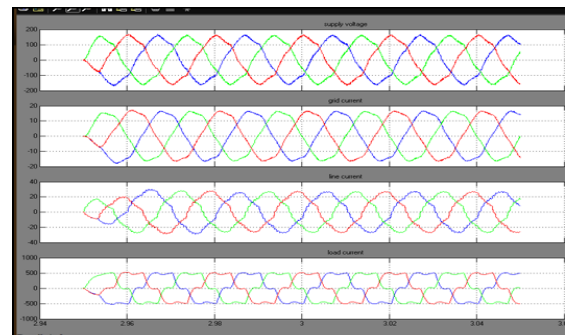


Fig.11. only the local load harmonic current is compensated. (From upper to lower:  $V_{supply}$ ,  $I_g$ ,  $I_2$ ,  $I_{Load}$ )

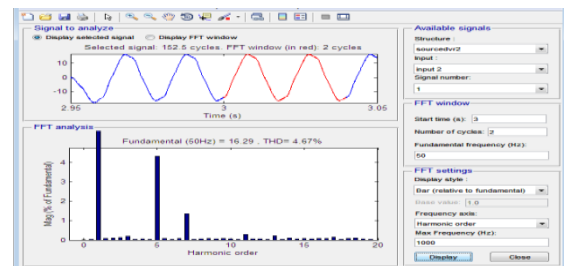


Fig.12. The harmonic spectrum of grid current  $I_g$

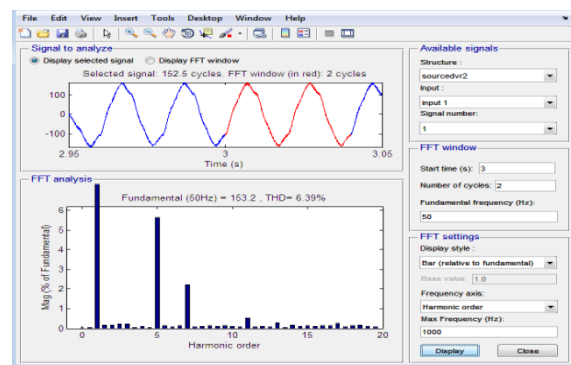


Fig.13. the harmonic spectrum of supply voltage  $V_{supply}$

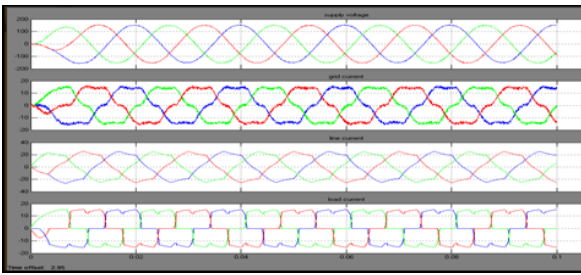


Fig.14. only the supply voltage harmonic component is compensated. (From upper to lower:  $V_{supply}$ ,  $I_g$ ,  $I_2$ ,  $I_{Load}$ )

Grid Current

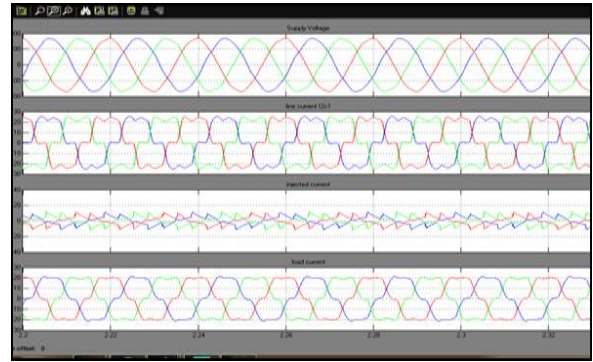


Fig.18. Performance of converter1. (From upper to lower:  $V_{supply}$ ,  $I_2,1$ ,  $I_{inj}$ ,  $I_{Load}$ )

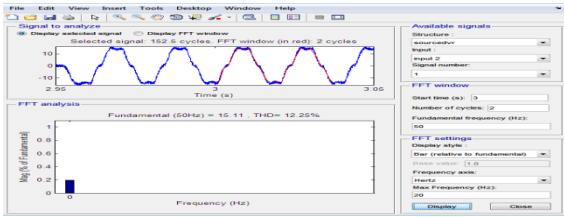
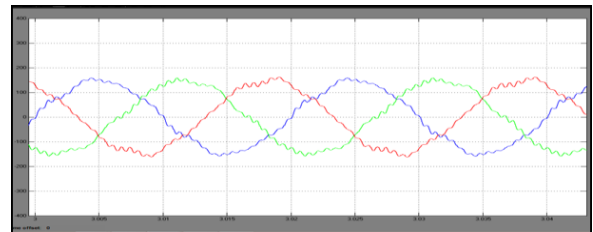


Fig.15. The harmonic spectrum of grid current  $I_g$



Filter Capacitor Voltage

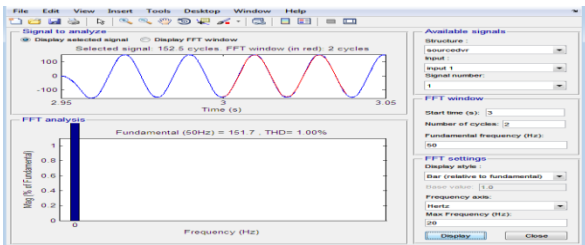
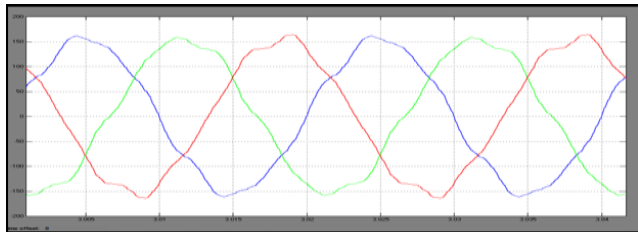
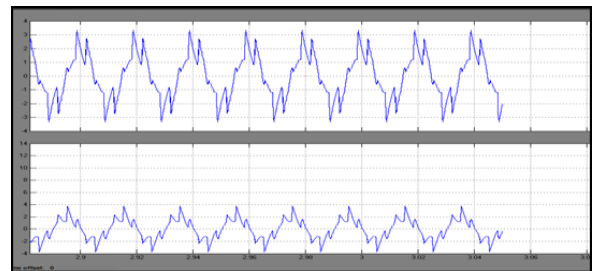
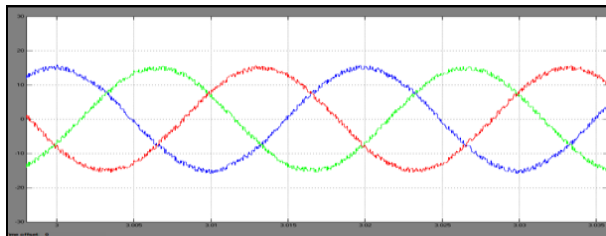


Fig.16. The harmonic spectrum of supply voltage  $V_{supply}$



Grid Voltage



Harmonic Current Component

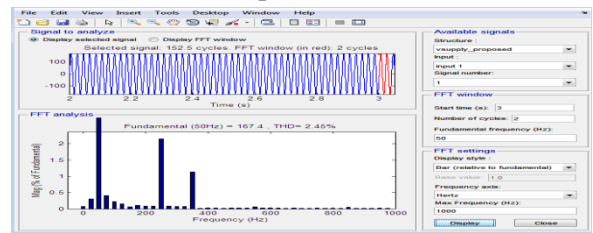


Fig.21. The harmonic spectrum of supply voltage  $V_{supply}$

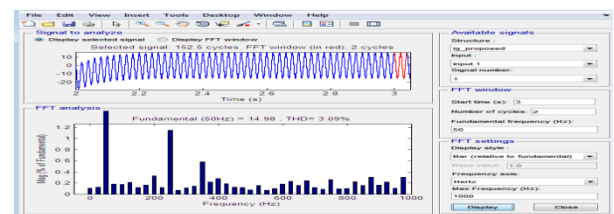


Fig.20. The harmonic spectrum of grid current  $I_g$

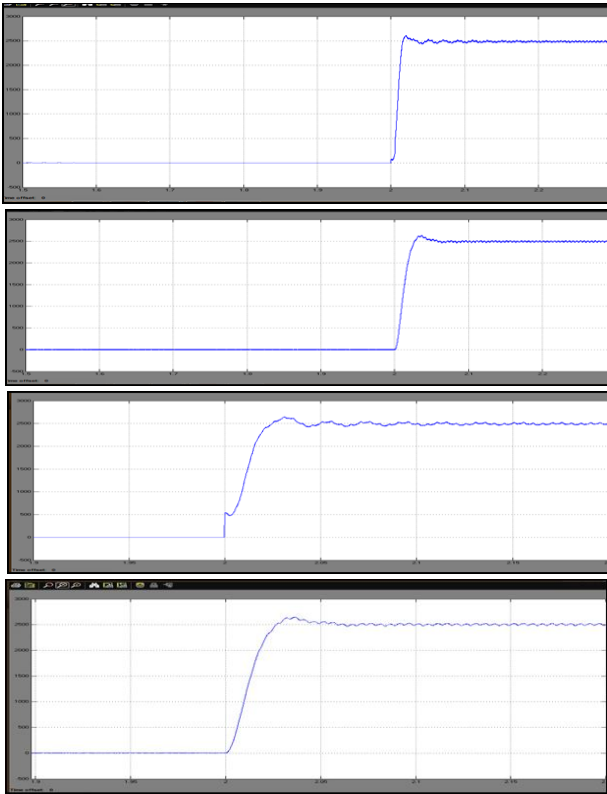


Fig. 22. Real and reactive power of converter1 and converter2

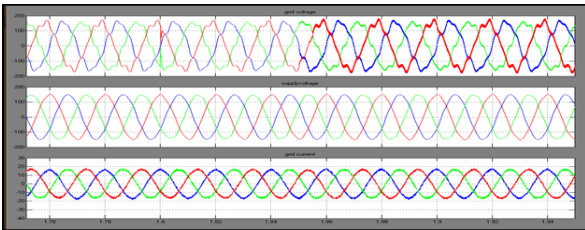


Fig. 23. The performance of the dual-converter system during 10% grid voltage sags, with 10.03% THD

**Extension topic**

**Fuzzy logic**

Fuzzy technique for thinking is a kind of different respected avocation in which reality estimations of factors might be any true blue number some place around 0 and 1. By partition, in Boolean strategy for thinking, reality estimations of factors may just be 0 or 1. Fuzzy technique for thinking has been reached out to handle the likelihood of halfway truth, where reality quality may extend between completely certifiable and totally false. Moreover, when etymological factors are utilized, these degrees might be managed by particular points of confinement.

Routinely Fuzzy technique for thinking control structure is delivered utilizing four immense sections showed on Figure fuzzification interface, Fuzzy insincerity motor, cushy standard system and Defuzzification interface. Every part near to foremost Fuzzy strategy for thinking operations will be depicted in more detail below.

The Fuzzy technique for thinking examination and control approaches appeared in Figure 1 can be depicted as:

1. Receiving one or sweeping number of estimations or other assessment of conditions existing in some system that will be investigated or controlled.
2. Processing all got contributions as appeared by human based, Fuzzy "expecting then" models, which can be granted in fundamental dialect words, and joined with normal non-Fuzzy arranging.
3. Averaging and weighting the outcomes from all the individual norms into one single yield choice or sign which picks what to do or urges a controlled system what to do. The outcome yield sign is an exact defuzzified respect. Most importantly else, the unmistakable level of yield (fast, low speed et cetera.) of the stage is described by deciding the cooperation capacities with respect to the fuzzy sets.

**FUZZY CONTROLLER**

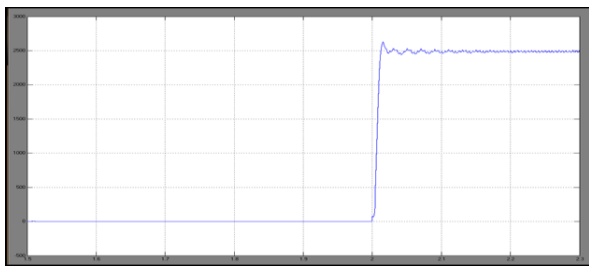
Fuzzy logic is a complex mathematical method that allows solving difficult simulated problems with many inputs and output variables. Fuzzy logic is able to give results in the form of recommendation for a specific interval of output state, so it is essential that this mathematical method is strictly distinguished from the more familiar logics, such as Boolean algebra. This paper contains a basic overview of the principles of fuzzy logic.

**Fuzzy Logic System**

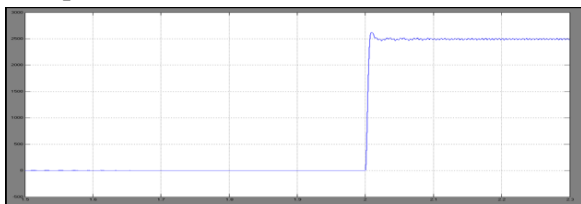
Today control systems are normally portrayed by numerical models that take after the laws of material

science, stochastic models or models which have risen up out of scientific rationale. A general trouble of such built model is the manner by which to move from an offered issue to an appropriate numerical model. Without a doubt, today's propelled PC innovation makes it conceivable; however overseeing such systems is still excessively perplexing. These perplexing systems can be rearranged by utilizing a resilience edge for a sensible measure of imprecision, dubiousness and instability amid the demonstrating stage. As a result, not totally consummate system comes to presence; by and by in the greater part of the cases it is equipped for taking care of the issue in proper way. Notwithstanding missing information data has officially ended up being agreeable in learning based systems.

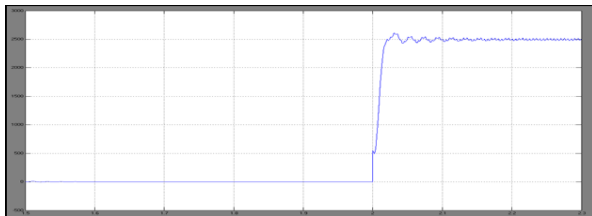
Fig. 22. Real and reactive power of converter1 and converter2



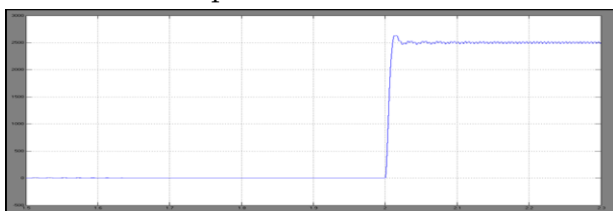
Real power of converter 1



Reactive power of converter 1



Real power of converter 1



Reactive power of converter1

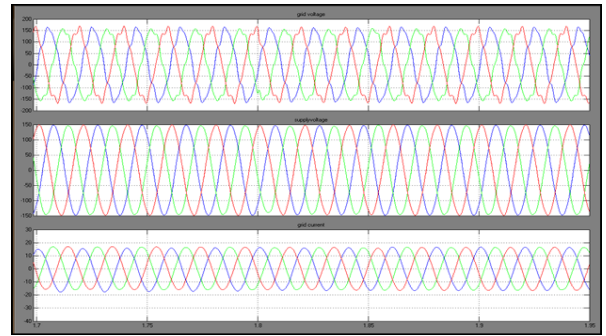


Fig. 23. The performance of the dual-converter system during 10% grid voltage sags, with 10.03% THD.

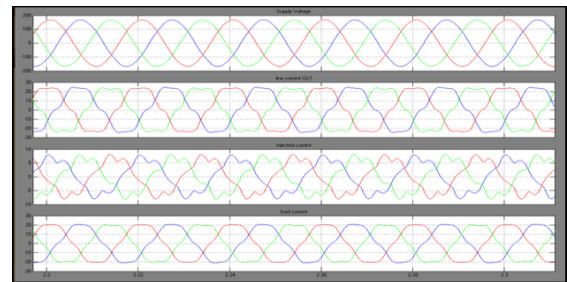
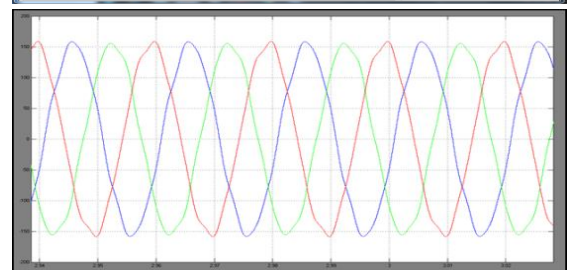
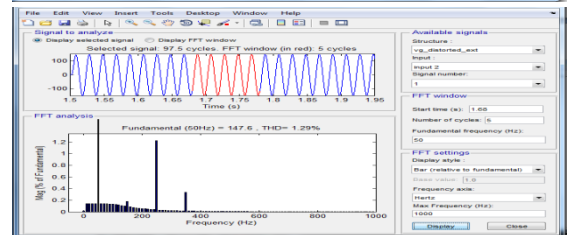
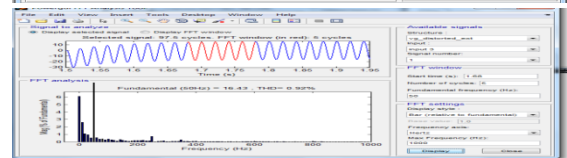
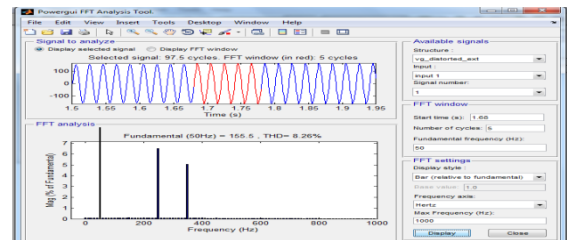
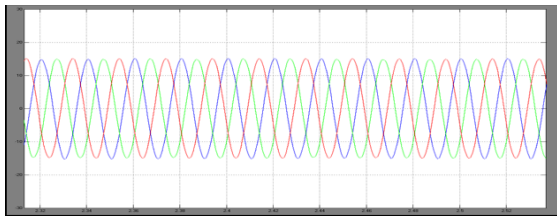


Fig. 18. Performance of converter1. (From upper to lower:  $V_{supply}$ ,  $I_{2,1}$ ,  $I_{inj}$ ,  $I_{Load}$ )

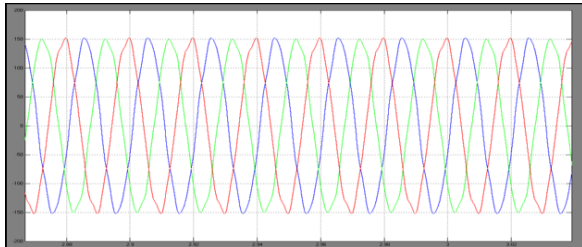


Grid voltage

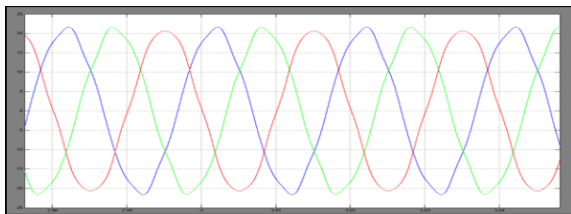




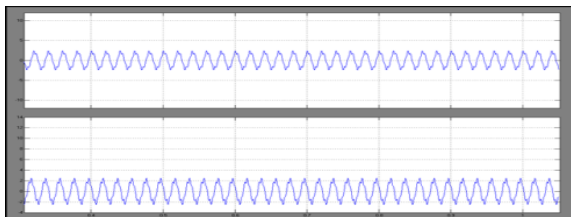
Grid current



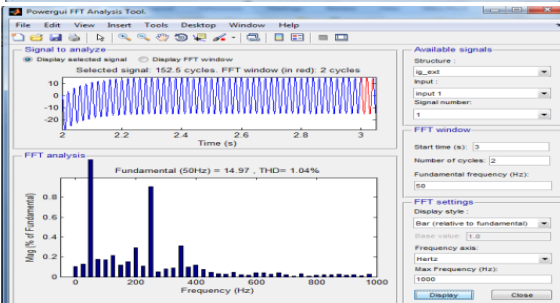
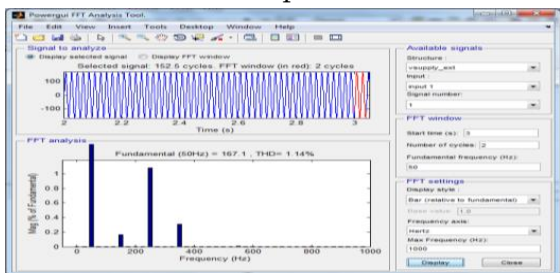
Filter capacitor voltage



Line current



Harmonic current component



## Conclusion

At the point when a single multi-useful interfacing converter is received to compensating generation the harmonic current from nearby nonlinear burdens, the nature of supply voltage to neighborhood load can barely be enhanced in the meantime, specific when the fundamental network voltage is blended. This paper examines a novel composed voltage and current controller for double converter system in which the nearby load is straightforwardly associated with the shunt capacitor of the primary converter. With the setup, the nature of supply voltage can be improved by means of a direct shut circle harmonic voltage control of filter capacitor voltage. In the meantime, the harmonic current brought on by the nonlinear load and the principal converter is repaid by the second converter. Consequently, the nature of the network current and the supply voltage are both essentially progressed. To lessen the computational heap of DG interfacing converter, the organized voltage and current control without utilizing load current/supply voltage harmonic extractions or stage bolt loops is produced to acknowledge to composed control of parallel converters.

## IV. REFERENCES

- [1]. P Acuna, L. Moran, M. Riv generation , J. Dixon, and J. Rodriguez, "Improved active power filter performance for renewable power generation systems," *IEEE Trans. Power Electron.*, vol. 29, no.2, pp. 687-694, Feb. 2013.
- [2]. Y W. Li, F. Blaabjerg, D. M. Vilathgamuwa, and P. C. Loh, "Design and Comparison of High Performance Stationary-Frame Controllers for DVR Implementation," *IEEE Trans. Power Electron.*, vol. 22, pp. 602-612, Mar. 2007.
- [3]. C Meyer, R. W. DeDoncker, Y. W. Li, and F. Blaabjerg, "Optimized Control Strategy for a Medium-Voltage DVR - Theoretical

- Investigations and Experimental Results,” IEEE Trans. Power Electron., vol. 23, pp. 2746-2754, Nov. 2008.
- [4]. F. Blaabjerg, Z. Chen, and S. B. Kjaer, “Power electronics as efficient interface in dispersed power generation systems,” IEEE Trans. Power Electron., vol. 19, pp. 1184-1194, Sep. 2004.
- [5]. A. Timbus, M. Liserre, R. Teodorescu, P. Rodriguez, and F. Blaabjerg, “Evaluation of current controllers for distributed power generation systems,” IEEE Trans. Power Electron., vol. 24, no. 3, pp. 654-664, Mar. 2009.
- [6]. J. M. Guerrero, L. G. Vicuna, J. Matas, M. Castilla, and J. Miret, “A wireless controller to enhance dynamic performance of parallel inverters in distributed generation systems,” IEEE Trans. Power Electron., vol. 19, no. 4, pp. 1205-1213, Sep. 2004.
- [7]. J. M. Guerrero, J. C. Vasquez, J. Matas, L.G. de Vicuna, and M. Castilla, “Hierarchical control of droop-controlled AC and DC microgrids - A general approach toward standardization,” IEEE Trans. Ind. Electron., vol. 55, no. 1, pp. 158 - 172, Jan. 2011.
- [8]. J. He and Y. W. Li, “Analysis, design and implementation of virtual impedance for power electronics interfaced distributed generation,” IEEE Trans. Ind. Appl., vol. 47, no. 6, pp. 2525-2038, Nov/Dec. 2011
- [9]. Q. Zhang, “Robust droop controller for accurate proportional load sharing among inverters operating in parallel,” IEEE Trans. Ind. Electron., vol. 60, no. 4, pp. 1281-1290, Apr. 2013.
- [10]. W. Issa, M. Abusara, and S. Sharkh, “Control of transient power during unintentional islanding of microgrids,” IEEE Trans. Power Electron., online early access.
- [11]. C.-L. Chen, Y. Wang, J.-S. Lai, Y.-S. Lee, D. Martin, “Design of parallel inverters for smooth mode transfer microgrid applications,” IEEE Trans. Power Electron., vol. 25, no. 1, pp. 6-15, Jan. 2010.
- [12]. N. Pogaku and T.C. Green, “Harmonic mitigation throughout a distribution system: a distributed-generation based solution,” IEEE Proc. Gener. Transm. Distrib., vol.153, no.3, pp. 350- 358, May. 2006.

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# Brain Tumor Segmentation by using Ant Colony Optimization

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## ABSTRACT

Ant Colony Optimization (ACO) meta heuristic is a current populace based approach motivated by the perception of genuine ants settlement and in light of their aggregate rummaging conduct. Evolution Multi-Objective Optimization (EMO) is fusion of tracked ultrasound (US) with MR has many applications in diagnostics and interventions. Unfortunately, the fundamentally different natures of US and MR imaging modalities renders their automatic registration challenging. In this paper, the proposed technique ACO Optimization. MRI brain image is Segmented ACO method to extract the suspicious region. Residue is computed by adding noise at each stage of decomposition to obtain the neighbor pixels through the difference restricted versatile histogram evening out (CLAHE). It is a picture differentiate upgrade calculation that beats impediments in standard histogram evening out (HE). The two essential highlights is versatile HE (AHE), which isolates the pictures into districts and performs nearby HE, and the complexity constrained AHE (CLAHE), which decreases clamor by mostly reducing the local HE. MR and US imaging is used to analyze images for medical purpose, both MR and US imagery are registered using EMO method so that we can get registered image with high clarity to analyze for physicians.

**Keywords:** EMO, ACO, Accuracy, PSNR and FPR

## I. INTRODUCTION

This research paper proposes a savvy characterization procedure to perceive typical and unusual MRI cerebrum picture. Medicinal picture like ECG, MRI and CT-check pictures are critical approach to analyze malady of individual productively. The manual analysis of tumor based on visual inspection by radiologist/physician is the conventional method, which may lead to wrong arrangement when countless are to be broke down. To keep away from the human blunder, a mechanized keen order framework is proposed which caters the requirement for characterization of picture. One of the major causes of death among people is Brain tumor.

Ultrasound sweeps, or sonography, are sheltered in light of the fact that they utilize sound waves or echoes to make a picture, rather than radiation.

Ultrasound filters are utilized to assess fetal improvement, and they can distinguish issues in the liver, heart, kidney, or stomach area. They may likewise help with playing out specific kinds of biopsy. Picture division is a basic and fundamental segment of picture investigation framework. It is a standout amongst the most troublesome undertakings in picture preparing in light of the fact that it decides the nature of the last aftereffect of examination [1]. Division is essentially gathering of the pixels in the photo as per a few criteria of the EMO. The ant province streamlining calculation (ACO) is a probabilistic strategy for taking care of computational issues which can be diminished to discovering great ways through image and graphs.

## II. EXISTING METHODS

There are many image processing techniques so far used in literature by different researchers to accomplish different problem solutions. In input we are given MRI image and ultra sound images to the Transformative multi-target improvement. Next preprocessing the MRI image and ultra sound images with the salt & pepper noise. Registration & fusion using EMO through the both pictures. The stationary wavelet change is a wavelet change calculation intended to conquer the absence of change invariance of the discrete wavelet change. The stationary wavelet disintegration structure is more tractable than the wavelet one. Play out a stationary wavelet deterioration of the two pictures. Next Inverse stationary wavelet change through the both images. Cuckoo search for the both pictures. In the middle channel frequently used to expel clamor from an image or signal and it shows the non-linear digital filtering techniques and the smooth the images. It can be helps to use on the smooth patches or smooth regions of a signal or image.

### **Evolutionary multi-objective optimization:**

Picture division is a basic and basic segment of picture investigation framework. It is a standout amongst the most troublesome errands in picture handling since it decides the nature of the last aftereffect of examination [1]. Division is fundamentally gathering of the pixels in the photo as demonstrated by a couple of criteria. The fact is to see homogeneous areas inside a photo as specific and having a place with different articles. Commonplace example grouping action includes an arrangement of steps [2] where there is a choice to make from a rundown of accessible alternatives at each progression. One needs to consider numerous viewpoints as far as its particular objective of division so the coveted yield can be achieved. A new pattern of issue detailing for picture division is to utilize approaches with numerous goals in its basic leadership process [3-4]. For issues with

numerous destinations, the target capacities characterized are for the most part clashing, anticipating concurrent advancement of every goal.

### **Stationary wavelet transforms:**

A wavelet transform algorithm designed to overcome the lack of transform-invariance of the SWT through the discrete wavelet transform. Load and picture perform a stationary wavelet decay of the pictures Construct approximations and points of interest from the coefficients. Demonstrate the gauge and detail at 1D & 2D pictures. Recover a picture by utilizing backwards stationary wavelet change plays out a multilevel stationary wavelet decay of stationary wavelet decomposition of the pictures. The reverse CWT is traditionally exhibited in the twofold vital shape. Expect you have a wavelet with a Fourier change that fulfills the suitability condition.

### **Cuckoo search:**

A new met heuristic enhancement calculation, Cuckoo Search (CS), is completely actualized, and the vectorized rendition is given here. This code exhibits how CS functions for unconstrained enhancement, which can without much of a stretch be reached out to take care of different worldwide improvement issuesblems efficiently. It is constrained optimization for designing a spring through the MRI and the ULTRA sound images.

## III. PROPOSED METHODS

We are propose in the method are the ant colony optimization through the MRI image and the ULTRA sound images. Next preprocessing the images through the salt & pepper. Median filter image for ACO (ant colony optimization). Non-linear digital filtering technique with neighboring pixels. Image enhancement of the CLAHE through the ACO. Scale invariant shift transform, the make transform, apply change implies bunching is a technique for vector

quantization, initially from flag handling, that is well known for group examination in information mining.

**ANT COLONY OPTIMIZATION:**

In software engineering and tasks explore, the ant state enhancement calculation (ACO) is a probabilistic method for tackling computational issues which can be decreased to discovering great ways through charts. Subterranean insect province streamlining (ACO) is a populace based metaheuristic that can be utilized to discover rough answers for troublesome advancement issues. In ACO, an arrangement of programming specialists called artificial ants scan for good answers for a given enhancement issue

**FLOWCHART:**

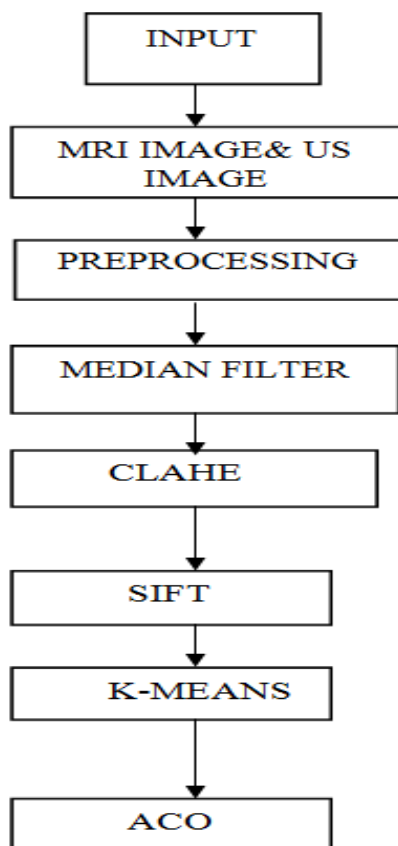


Image upgrade of the Ant Colony Optimization (ACO) to determine picture handling issue with an introduction to another programmed picture

improvement strategy in light of genuine coded molecule insect state is proposed in this paper.

**MEDIAN FLITER:**

The median channel is a nonlinear digital filtering procedure, regularly used to expel clamor from a picture or flag. Such commotion decrease is a run of the mill pre-handling venture to enhance the aftereffects of later preparing. One such method is known as median sifting. In middle separating, the neighboring pixels are positioned by brilliance (power) and the middle esteem turns into the new incentive for the centra pixel. Median filters can do an excellent job of rejecting certain types of noise, in particular, “shot” or impulse noise in which some individual pixels have extreme values. In the middle separating task, the pixel esteems in the area window are positioned by power, and the center esteem (the middle) turns into the yield an incentive for the pixel under assessment. Middle filter used convolution techniques to implement weighting kernels as a neighborhood function, which represented a linear process.

Neighborhood averaging can overwhelm disengaged out-of-extend commotion, however the reaction is that it additionally obscures sudden changes, for example, line highlights, sharp edges, and other picture points of interest all relating to high spatial frequencies all corresponding to high spatial frequencies, edge recognition on a picture. Middle separating is a nonlinear technique used to expel clamor from images. It is widely used as it is exceptionally powerful at evacuating clamor while protecting edges. It is especially viable at expelling ‘salt and pepper’ type noise.

$$y[m, n] = \text{median}\{x[i, j], (i, j) \in \omega\}$$

Where  $\omega$  speaks to an area characterized by the client, focused on location  $[m, n]$  in the image.

### **CLAHE:**

The restorative pictures are gathered from various sorts of the refined imaging camera frameworks and optical innovations Viz. X-ray, CT output, Somography and X-beams. Because of these procedures caught medicinal pictures experiences commotion and poor difference issues. Along these lines, differentiate improvement methods [5] are broadly used to enhancing the nature of the restorative pictures and their preparing in the low light conditions. Complexity improvement is the most well-known strategy for upgrading the picture quality [6]. These techniques essentially enhance the apparent distinction between the picture powers in nearness. Therefore, differentiate improvement systems [5] are broadly used to improving the quality of the medical images and their processing in the low illumination conditions. Contrast enhancement is the most common method of enhancing the image quality [6]. These methods basically improve the perceived difference between the image intensities in close proximity.

Effectiveness of the sicknesses recognizable proof through therapeutic pictures relies upon the proficiency of differentiation improvement. At that point intertwined wavelet coefficient guide can be built from the wavelet coefficients of the source pictures as indicated by the combination choice guide. Another well known spatial area strategy for differentiate improvement is CLAHE technique [5]. Technique delivers the ideal adjustment as far as most extreme entropy and furthermore constrains the differentiation of a picture. The CLAHE technique is exceptionally valuable where the shine prerequisite is high similar to as in topographical channels or submerged situations. the optimal equalization in terms of maximum entropy and also limits the contrast of an image. The CLAHE method is very useful where the brightness requirement is high like as in geographical channels or underwater environments.

### **SCALE INVARIANT FEATURE TRANSFORM (SIFT):**

We propose then - dimensional scale invariant component change (n-SIFT) technique for separating and coordinating notable highlights from scalar pictures of subjective dimensionality, and contrast this current strategy's execution with other related highlights. The proposed highlights expand the ideas utilized for 2-D scalar pictures in the PC vision SIFT strategy for separating and coordinating particular scale invariant highlights. We apply the highlights to pictures of self-assertive dimensionality using hyper round directions for slopes and multidimensional histograms to make the component vectors.

### **K-MEANS:**

It is an algorithm to classify or to group your objects based on attributes/features into K number of group. K is positive integer number. The grouping is done by limiting the whole of squares of distances between data and the corresponding cluster centroid. Thus, the purpose of K-mean clustering is to arrange the information.

K-means algorithm each cluster is represented by the focal point of the bunch and the calculation meets to stable centroid of groups. K-means algorithms the simplest partitioning method for clustering analysis and widely used in data mining applications.

Dividing Clustering Approach is a run of the mill grouping investigation approach by means of iteratively parceling preparing informational collection to take in a segment of the given information space – taking in a segment on an informational index to deliver a few non-purge bunches are as a rule, the quantity of groups given ahead of time on a basic level, ideal segment accomplished by means of limiting the entirety of squared partition to its the quantity of bunches given in advance in principle, optimal partition achieved via

minimizing the sum of squared distance to its “representative object” in each cluster.

$$E = \sum_{k=1}^K \sum_{X \in C_k} d^2(X, m_k)$$

In this technique the normal estimation of each gathering was introduced from picture histogram then the names of the pixels that have a place with which aggregate is instated utilizing dark levels contrast between each pixel what's more, the mean estimation of each gathering, at that point contrasted the outcomes and least separation (meant parallel 255 dim levels). The mean estimation of the gathering that have been ascertained and the marked esteems were refreshed. The yield picture has diverse power locales. At that point the slope estimations of this picture were figured utilizing angle administrator

**ACCURACY:**

A measure you should consider is also a ratio of the detection area compared to the ground truth area, because you may have a detection that covers the whole image, and have a score of 100% accuracy on the above formulation. Yours truly think multiple measures should be used when you want to evaluate your segmentation result.

**SENSITIVITY:**

The fill factor of a pixel assigns the proportion of light delicate region versus add up to territory of a pixel, since a piece of the zone of an image sensor pixel is constantly utilized for transistors, cathodes or registers, which have a place with the design or readout innovation of the pixel of the corresponding image sensor.

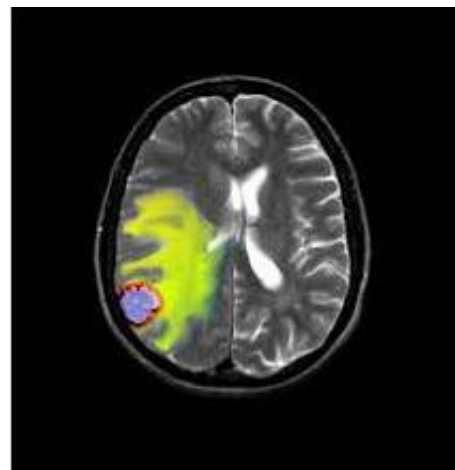
**FALSE POSITIVE RATE:**

In the falls positive images through the MRI image and ULTRA sound images, the mean period of ladies at the season of introductory screening bosom MRI was 45.8; 78.8% were premenopausal. High hazard was credited to solid family history of bosom

malignancy in 87.6%, BRCA transformation in 18.3%, and earlier atypical biopsy in 13.1%. Breast MRI added to mammography builds screening affectability for high-hazard ladies yet false-positive (FP) rates are higher and the ideal screening plan for coordination with mammography is unclear.

**IV RESULTS AND DISCUSSIONS**

The results of Figure 11 show that the quality of the MR-US alignment substantially improves with ACO. This registration is of significant clinical importance for multiple reasons. First, the contrast of MRI image is often low in the US images, and therefore fusion of the MR can improve tumor visualization. Second, Surgical and hemorrhage can further deteriorate the quality of the post-resection US images. Finally, MR images show exquisite details of brain anatomy and most neurosurgeons are trained with this modality. Therefore, accurate registration of MR and post-resection US can potentially reduce the presence of residual tumors. We plan to integrate Raptor with our neuro-navigation system IBIS, and use it



**Figure 1.** input test image

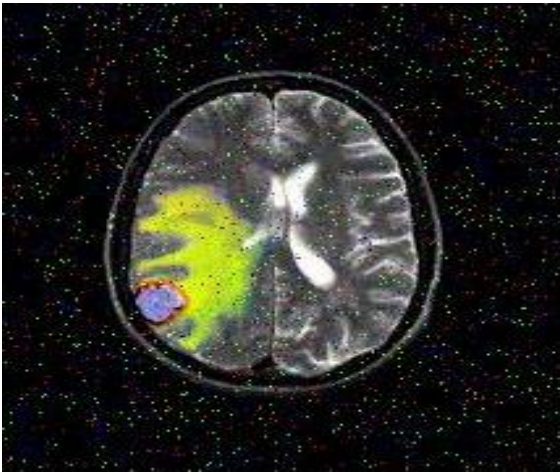


Figure 2. noisy image

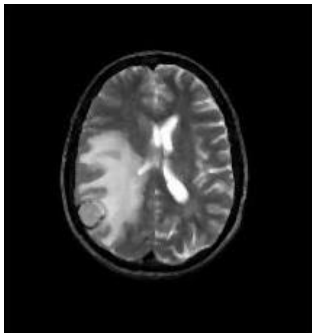


Figure 3. median filtered image



Figure 4. CLAHE for image enhancement

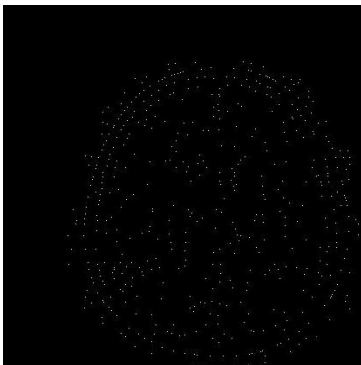


Figure 5. sift featured image

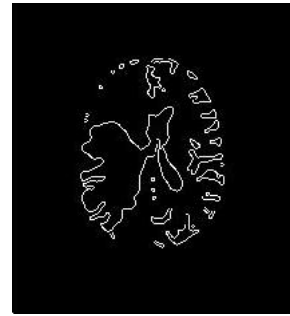


Figure 6. Segmented image using cuckoo search optimization technique

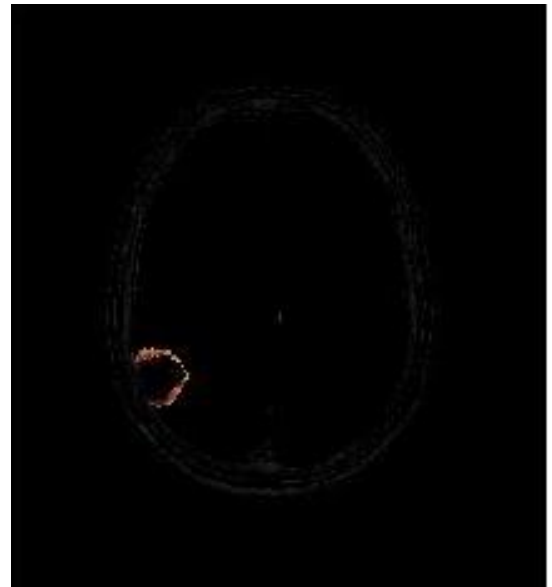


Figure 7. segemented using cuckoo

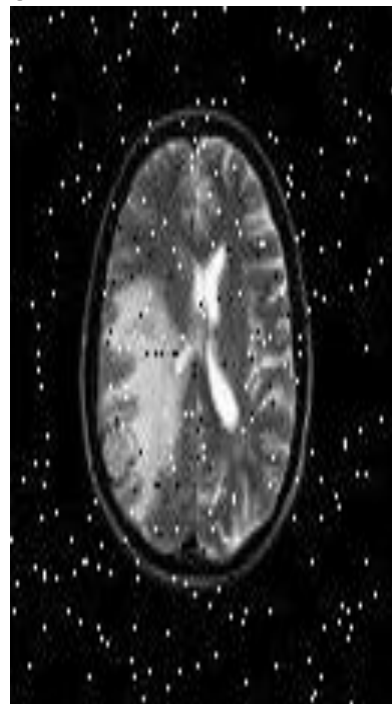


Figure 8. noisy image for ACO



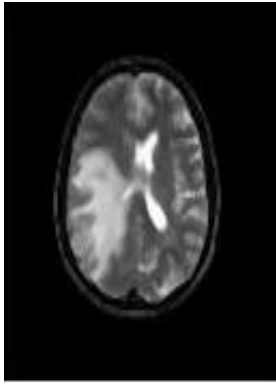


Figure 9. median image for ACO

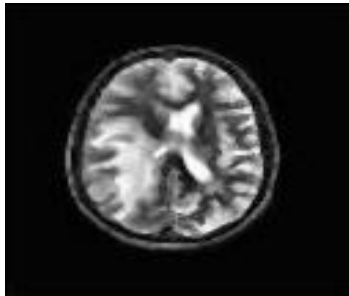


Figure 10. CLAHE for image enhancement

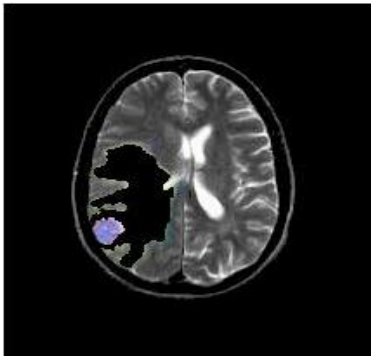


Figure 11. segmented tumour using ACO

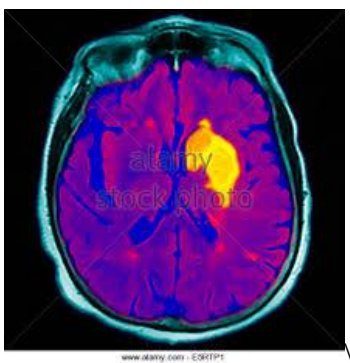


Figure 12. Test Image2



Figure 13. Test Image3

Table 1. comparison of Accuracy, Sensitivity, False positive Rate and sensitivity for Evolutionary multi object optimization and Ant colony optimization methods

	Test Images	Developmental multi-target improvement	Ant colony optimization
Accuracy	image1	26.0051	55.551
	image 2	37.4980	56.0720
	image 3	49.9912	92.6180
Sensitivity	image 1	34.7662	66.3190
	image 2	30.5776	66.07263
	image 3	37.0976	84.0244
False Positive Rate	image 1	29.0987	11.6945
	image 2	32.9087	12.33918
	image 3	34.5964	10.9469
PSNR	image 1	40.5432	51.09433
	image 2	42.8765	53.1025
	image 3	48.8697	52.7379

#### IV. CONCLUSION

We introduced RaPTOR, a calculation for non-inflexible enlistment of testing clinical pictures of pre-agent MR and post-agent US. We logically determined the subsidiaries of RaPTOR and upgraded it utilizing proficient stochastic angle plunge enhancement. We likewise proposed a novel instinctive method for limiting the impact of exceptions. We will give our information accessible on the web, which we trust, speeds the interpretation of future enlistment strategies to the working rooms.

#### V. REFERENCES

- [1]. Demirci, R., Rule-based automatic segmentation of color images, International Journal of Electronics and Communication, 60, (2006), 435 – 442.
- [2]. Jain, A.K., Murty, M.N., and Flynn, P.J., Information Clustering: A Review. ACM Computing Surveys, 31, (1999).
- [3]. Saha, S., and Bandyopadhyay, S.: A new symmetry based multiobjective clustering technique for automatic evolution of clusters. Pattern Recognition (2010).
- [4]. Maulik, U., and Saha, I.: Changed differential development based fluffy grouping for pixel order in remote detecting symbolism. Example Recognition, 42, (2009).
- [5]. Muhammad SuzuriHitam, Wan NuralJawahirHj Wan Yussof, EzmahamrulAfreenAwalludin,
- [6]. ZainuddinBachok, Mixture Contrast Limited Adaptive Histogram Equalization for Underwater Image Enhancement , IEEE universal conf. 2013.
- [7]. Bhavana. Va, Krishnappa. H. Kb, Multi-Modality Medical Image Fusion A survey International Journal of Engineering Research & Technology (IJERT) Vol. 4 Issue 02, February-2015.



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# Development and Processing of Instant Mango Pulihora Mix and Its Shelf Life Studies

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## ABSTRACT

Formulation of instant Raw Mango Pulihora Mix with incorporation of dried raw mango powder. On various trails of instant raw mango pulihora mix to make convenient pre mix which is easy to prepare instantly, and rich in Vitamin C (Ascorbic acid) .Since Mango (*Mangifera indica*) is one of the most seasonal fruit of tropical and subtropical countries .By drying mango into fined powder form it can be used throughout the year and asses the physio chemical properties for the product. In the present studies has been conducted on three various trails changing the ratios of the ingredients. Based on the sensory evaluation and nutritive value trail 2 is the best suitable product in the various aspects such as sensory, nutritive value, cost analysis and shelf life studies.

**Keywords:** Sensory, Nutritive values, Cost analysis, Shelf Life studies.

## I. INTRODUCTION

The mango fruit (*Mangifera indica*) is one of the most important seasonal fruits of tropical and subtropical countries. Since industrial capacities for the processing of highly perishable mangoes into storable products are limited due to seasonal over-production of the fruits, drying of excess and partially defected mangoes is a promising preservation technique, meeting the processing requirements of small- and medium-size producers.

Raw mango (*Mangifera indica*) is known as King of fruit and Pride of garden and choicest fruit of Hindustan, its posse's good amount of citric acid and malic acids along with other nutrients. Raw green mangoes are mainly use in the processing of pickles, chutneys, and dehydrated powders .Dehydration of raw mangoes is carried out in India households or at cottage scale and in some traditional practices by

mixing with salt add turmeric. The dehydrated mango powder is known as amchur and is categorized under spices for various reasons such as its applications in spice mixes for various snack /chat foods ,and is generally used as an acidulated in place of tamarind in the Northern America.

Mango (*Mangifera indica*) fruits contain about 85-g water/100-g solids and are highly perishable. Dehydration to low moisture content can extend the shelf life. Conventional drying methods are normally time and energy consuming and hence most often uneconomical. Cabinet and Solar drying has been suggested by many researchers as a pre-treatment for reducing the high water content of fresh fruits and vegetables before further processing

## II. MATERIALS AND METHODS

In the present study standardization and development of Instant raw mango pulihora mix i.e. raw mango and other ingredients were collected aseptically from local super markets and analyzed for physio-chemical and sensory parameters. The entire methodology adopted for the current study is presented as follows:

1. Research design
2. Market survey
3. Consumer survey
4. Selection of raw mangoes and various ingredients
5. Physicochemical analysis
6. Sensory analysis
7. Cost analysis

## III. EXPERIMENTAL PROCEDURE

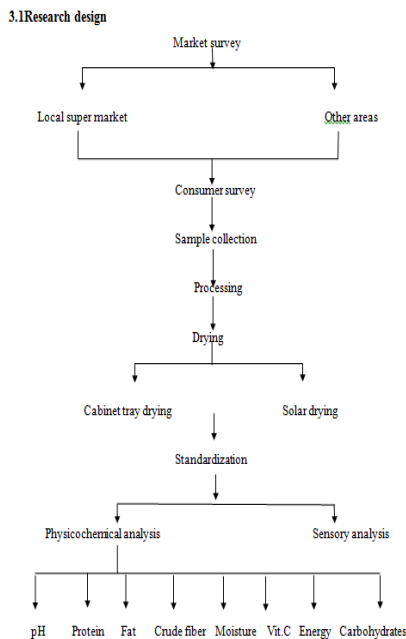


Figure 1: Experimental Research design

### 3.3 MANGO POWDER PROCESSING FLOW CHART

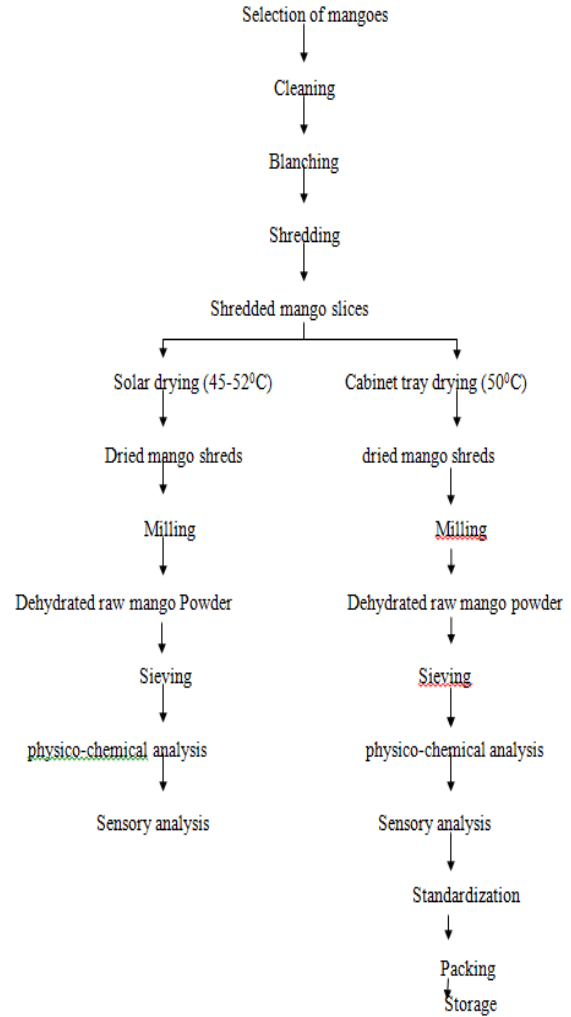


Figure 2

## IV. STANDARDIZATION OF PRODUCT

### Standardization of Ingredients (Table-1)

Various trails were carried out to standardize the product. Based on the subjective evaluation, the trail that scored the maximum for all the sensory attributes and overall acceptability was selected as the best standard sample and was chosen for product development further

Table 1

S.No	Ingredients	Trail I	Trail II	Trail III
1	Mango powder	35	40	45

2	Salt	10	6.5	7
3	Turmeric	1.8	2	3.5
4	Red chilli powder	3	5	5
5	Black gram	3	10	8
6	Red chillies	10	5	4
7	Ground nuts	10	7	6
8	Mustard	5	5	3
9	Cumin	04	5	4
10	Bengal gram	9	5	6
11	Dried curry leaves	3	3	3
12	Asafoetida	0.2	0.5	.3
13	Sugar	5	6	5
	TOTAL	100	100	100

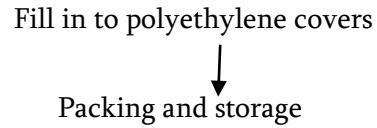
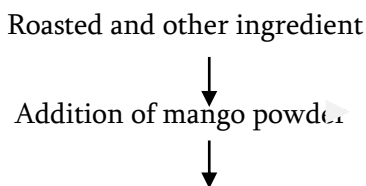
**Procedure**

The ingredients (Mango Powder) were weighed according to the quantities given in table. Salt, turmeric, sugar, asafoetida, red chilli powder, roasted chick pea, ground nut, mustard, DE husked Bengal gram, curry leaves was added to the mango powder. The above mixture was blended for uniform distribution of particles. The Above trails prepared instant phulihora mix was carried for sensory evaluation & Nutritive Value

**Processing of instant mango pulihora mix**

The roasted ingredients and other ingredients were added to the mango powder and mixed thoroughly, filled in to Polyethylene covers and sealed the covers by using laboratory scale sealer

**Preparation of instant mango pulihora mix flow chart**

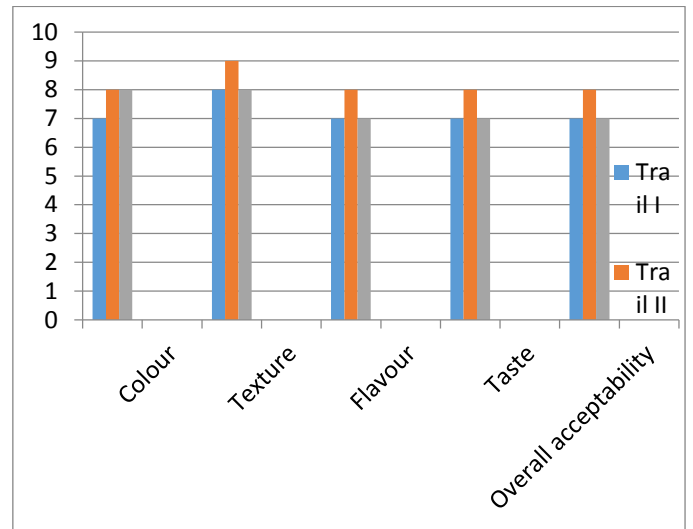


**V. RESULTS AND DISCUSSION**

The major aim of the present study was development of Instant mango pulihora mix which is rich in vitamin-C and fiber content. The results which was obtained is presented under the following sub heads

- 5.1 Standardization of product
- 5.2 Sensory Evaluation of product
  - 5.2.1 Sensory score of the instant raw mango pulihora mix
- 5.3 Nutritive values of Instant raw mango pulihora mix
- 5.4 Packaging

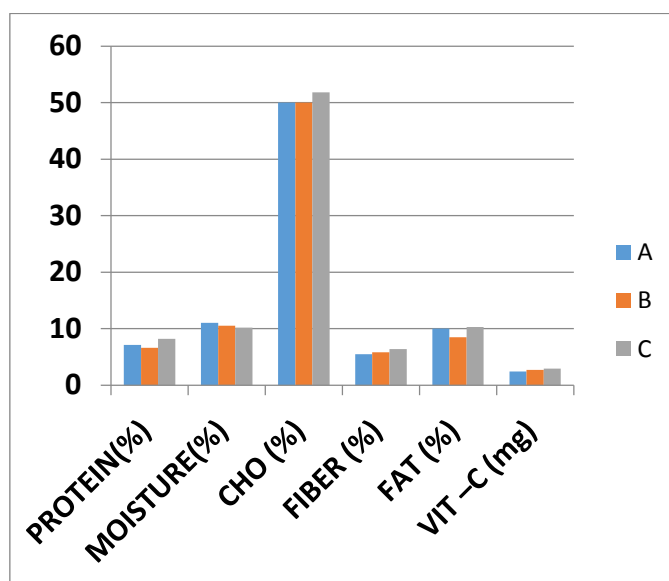
**ORGANOLEPTIC EVALUATION OF VARIOUS TRAILS ON INSTANT MANGO PULIHORA MIXES (Figure-3)**



**Figure 3**

**Table 2**

Parameters	TRAIL I	TRAILII	TRAIL III
Energy Kcal	318.4	322.5	332.7
Moisture %	11	10.5	10.2
Protein %	6.4	6.6	6.8
CHO mg	48	50	52
pH	4.3	4.6	4.8
Fibre %	5.5	5.8	6.1
Fat %	8.3	8.5	8.7
Vitamin-C mg	2.4	2.7	2.9



**Nutritive value calculation (Table-2 , Figure-3)**

**Figure 3**

**Shelf life Studies –Trail II (Table-3)**

**Table 3**

Parameters	Control	Day 0	Day 30	Day 60	Day 90
Moisture %	8.50	10.5	10.68	10.72	10.88
Protein %	13.27	6.6	6.57	6.58	6.6
CHO mg	45	50	50	51	51
pH	4.3	4.6	4.5	4.6	4.5
Fibre %	5.4	5.8	5.6	5.7	5.7
Fat %	18.21	8.5	8.4	8.5	8.4
Vitamin-C mg	NA	2.7	2.5	2.6	2.5

**COST ANALYSIS (Table-4)**

**Table 4**

S.No	Ingredients	%	Cost Per Kg	1kg per Product
1	Mango Powder	40.00	300.00	120.00
2	Salt	6.50	9.00	0.59
3	Turmeric	2.00	98.00	1.96
4	Red chilli	5.00	90.00	4.50
5	Black gram	10.00	75.00	7.50
6	Mustard	5.00	40.00	2.00
7	Cumin	5.00	140.00	7.00
8	Bengal gram	5.00	75.00	3.75
9	Asafoetida	0.50	150.00	0.75
10	Curry leaves	3.00	120.00	3.60

11	<b>Sugar</b>	6.00	34.00	2.04
12	<b>Chilli powder</b>	5.00	110.00	5.50
13	<b>Ground nut</b>	7.00	100.00	7.00
				166.19

## VI. CONCLUSION

IMPM was acceptable for nearly six months.

Rich in protein, fiber & Vitamin-C.

It can be stored at room temperature by using polyethylene as packaging material.

Mix not only contains mango powder, also contains other ingredients which have health benefits.

TRAIL II has good nutritional composition than TRAIL I and TRAIL III.

## VII. REFERENCES

- [1]. Abonyi, B. I. (2000). Evaluation of Refractance Window drying method for fruits and vegetables-MS Thesis. Pullman: Washington State University
- [2]. Akhtar, S., S. Mahmood, S. Naz, M. Nasir and M.T. Sultan. 2009. Sensory evaluation of mangoes
- [3]. Akinpelu, D.A. 2001. Antimicrobial activity of *Anacardium occidentale* Bark. 72: 286
- [4]. American Public Health Association, Washington, DC
- [5]. Amin, M., U.M. Aman, M.S. Mazhar, U.D. Islam, M.S. Khalid and A. Saeed. 2008. Mango fruit
- [6]. Anonymous. 1992. Compendium of Methods for the Microbiological Examination of Foods.
- [7]. Compendium on postharvest operations. Rome' FAO (INPhO).(Chap. 20, sec. 2.8, <http://www.fao.org/inpho/compend/allintro.htm>).
- [8]. Dey ,A.,&Mukerjee,R.(1999).Fractional factorial plans.
- [9]. De la Cruz Medina, J., & Garcia, H. S. (2003). Mango: Post-harvest operations. In D. Mejia, & B. Lewis (Eds.),
- [10]. Evans, E. A. (2008). Recent Trends in World and U.S. Mango Production Trade, and Consumption. University of Florida. Gainesville, Florida: Food and Resource Economics Department. Evans, E. A. (2008). Recent Trends in World and U.S. Mango Production Trade, and Consumption. University of Florida. Gainesville, Florida: Food and Resource Economics Department.
- [11]. FAO (2002) Mango – Post Harvest Operations, INPhO post harvest compendium, Food and Agricultural Organizations of United States, 54-55.
- [12]. Chavasit, V., Pisaphab, R., Sungpuag, P., Jittinandana, S., & Wasantwisut. desapping in relation to time of harvesting. Pakistan Journal of Botany, 40(4): 1587-1593.
- [13]. .Dahade RS &KhedkarDM , Dehydrated raw mangoes for preparation of amchur powder ,Indian Food Packers,34(3) (1980) 43-49
- [14]. Kaushik V and Nath N (1992). Effect of cooking procedure and variety on acceptability of unripe
- [15]. Maneepun S and Yuchalad M (2004). Developing processed mango products for international markets. Acta Horticulture, 64(5): 93-105. Mango beverage. Journal of Food Science and Technology, 29(2): 127-129.
- [16]. Mehta GL &TomarMc. Dehydrated and utilized of raw mangoes, Indian Food packer 36(6) (1982)75.
- [17]. New S Market Opportunities for Mango Growers, Kenya Horticultural Development Program 2004 – 2010, Sponsored by USAID, February 2010. Available on-line

- through, [www.kilimo.go.ke/kilimo\\_docs/mango\\_conference/market.41\(6\):2821-2829](http://www.kilimo.go.ke/kilimo_docs/mango_conference/market.41(6):2821-2829).
- [18]. Nanjundaswamy AM, Shetty GR and Saroja S (1976). Studies on the production of newer products from mango. *Indian Food Packer*, 30(5): 95-108.
- [19]. Nigam S, Bhatt DK and Jha A (2007). Different product of mango: the king of fruits. *Processed Food Industry*, 10 (9): 32-40.
- [20]. Ponting J.D., Walter, G.G., Forrey, R.R., Jackson, W.L., 1966. Osmotic dehydration of fruits. *Food Technol.* 20, 125-128.
- [21]. Robertson and JR Lupien (Eds) *Using Food Science and Technology to Improve Nutrition and Promote National Development*, International Union of Food Science and Technology, 2008; 6: (on-line publication).
- [22]. [www.iufost.org/publications/books/documents/Mercer\\_1.pdf](http://www.iufost.org/publications/books/documents/Mercer_1.pdf). Website accessed November 27, 2012.
- [23]. Siddappa GS and Ranganna S (1961). Strained Baby Foods – Part II-Drying of strained Mango pulp and Mango Custard. *Food Science*, 10(2): 37-38.
- [24]. Subbiah K (M.Sc. Horti. thesis). (1961). Indian agricultural research institute. New Delhi, India
- [25]. Usha K and Anand JC (1981). Quality aspects of commercial raw mango powder (amchur). *Journal of Food Science and Technology*, 18(5): 208-210.
- [26]. AOAC. (1998). *Official methods of analysis*. Washington, DC, USA: Association of Official Analytical Chemists.
- [27]. ASAE (2001). Moisture relationships of plant-based agricultural products. ASAE Standard D245.5 Dec. 01.
- [28]. Brett, A., Cox, D. R. S., Trim, D. S., Simmons, R., & Anstee, G. (1996). Practical aspects of processing. In G. Anstee (Ed.), *Producing solar dried fruit and vegetables for micro- and small-scale rural enterprise development* (pp. 1 – 30). Kent' NRI Publications.
- [29]. Britnell PM (1991). The development of structured mango products. *Acta Horticulturae*, 291: 554-562.



# A Neoteric Approach Based on Multi Task Learning Network for Skeletal 3D Action Recognition

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## ABSTRACT

This paper presents a new representation of skeleton sequences for 3D action recognition. Existing methods based on hand-crafted features or recurrent neural networks cannot adequately capture the complex spatial structures and the long term temporal dynamics of the skeleton sequences, which are very important to recognize the actions. In this paper, we propose to transform each channel of the 3D coordinates of a skeleton sequence into a clip. Each frame of the generated clip represents the temporal information of the entire skeleton sequence, and one particular spatial relationship between the skeleton joints. The entire clip incorporates multiple frames with different spatial relationships, which provide useful spatial structural information of the human skeleton. We also propose a Multi-task Learning Network (MTLN) to learn the generated clips for action recognition. The proposed MTLN processes all the frames of the generated clips in parallel to explore the spatial and temporal information of the skeleton sequences. The proposed method has been extensively tested on challenging benchmark datasets. Experimental results consistently demonstrate the superiority of the proposed learning method for 3D action recognition compared to existing techniques.

## I. INTRODUCTION

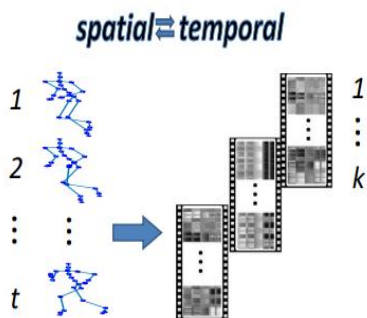
Human action recognition has a wide range of applications, including video surveillance, human-machine interaction and robot control [1]. Nowadays due to the prevalence of highly-accurate and affordable depth devices, there are more and more works using depth videos for computer vision tasks [2], [3], [4], [5]. Action recognition based on 3D skeleton sequences has also been attracting increasing attention [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16]. Compared to RGB videos, skeleton data is more robust to cluttered backgrounds and illumination changes [17], with human actions described as movements of the skeleton joints [18]. To recognize an action from a skeleton sequence, the temporal dynamics of the skeleton sequence and the spatial structure among the

joints need to be exploited for a good understanding of the action class [10]. Hidden Markov Models

(HMMs) [19], [20], Conditional Random Fields (CRFs) [21] and Temporal Pyramids (TPs) [7], [22] have been used to model the temporal structure of a sequence. To exploit the spatial structure among the joints, various features have been investigated, such as histogram of joint positions [6], pairwise relative position [22] and 3D rotation and translation [7]. These traditional models are based on hand-crafted features, which cannot effectively capture the long-term temporal structure and the discriminant spatial information of the skeleton sequence [8]. Recently, recurrent neural networks (RNNs) with LongShort Term Memory (LSTM) neurons [23], [24] have also been used to model the spatial and temporal information of skeleton sequences for action

recognition [8], [25], [10], [9], [11]. LSTM networks operate the input sequentially and return an output at each timestep. Human actions are generally very complex with many timesteps. The earlier timesteps of an action sequence might contain ambiguous sub-actions and the context of the entire sequence needs to be learned to accurately recognize the action. Although LSTM networks are designed to explore the problem of long-term temporal dependency, they are incapable of memorizing the information of an entire sequence with many timesteps [26], [27]. Besides, it is also difficult to construct deep LSTM networks to learn high-level features [28], [29].

In order to learn the long-term temporal information and the complex spatial information of the skeleton sequences for action recognition, in this paper, we transform each skeleton sequence into three clips. Each clip consists of only a few frame images, as shown in Figure 1.



**Figure 1.** A skeleton sequence of an arbitrary length  $t$  is transformed into three clips

We propose to change every skeleton succession to another portrayal, i.e., three clips, to permit worldwide long haul fleeting demonstrating of the skeleton grouping by utilizing profound CNNs to take in progressive highlights from outline pictures. (31) We acquaint a MTLN among the procedure; the entire CNN highlights of the boundaries in conveyed cuts, during this manner take the spatial formation as well as the provisional information of the skeleton gathering.

The MTLN enhances the execution by using inherent connections among various frames of the created clips. Our test results come about show that MTLN performs superior to connecting or then again pooling the highlights of the housings. [32] The proposed approach accomplishes the best in class execution on three skeleton datasets.

## II. RELATED WORKS

In this section, we briefly review relevant literature on skeleton-based action recognition methods using hand-crafted features and using deep learning networks. Hand-crafted Features Traditional methods extract handcrafted features and utilize sequential models to represent the spatial temporal information of the skeleton sequences. Xia et al. [6] computed histograms of 3D joint locations (HOJ3D) to represent each frame of the skeleton sequences, and used discrete hidden Markov models (HMMs) to model the temporal dynamics.

Wang et al. [45] represented actions with the histogram of spatial-part-sets and temporal-part-sets, which are constructed from a part pose dictionary. Chaudhry et al. [46] used a set of Linear Dynamical Systems (LDSs) to encode a hierarchy of spatial temporal information of the 3D skeleton data, and performed action recognition using discriminative metric learning. Vemulapalli et al. [7] used the 3D rotations and translations between various body parts as a representation, and modeled the skeleton sequence as a curve in the Lie group. Lv et al. [19] extracted a set of features corresponding to the motion of an individual joint or multiple joints, and used HMM to model the temporal dynamics. Wu et al. [20] concatenated the posture motion and the offset features as representation, and estimated the emission probability for action inference using a deep neural network.

Hussein et al. [47] computed the covariance matrices of the trajectories of the joint positions over hierarchical temporal levels to model the skeleton sequences. Wang et al. [22] computed the pairwise relative positions of each joint with other joints to represent each frame of the skeleton sequences, and used Fourier Temporal Pyramid (FTP) to model the temporal patterns. Yang et al also used the pairwise relative positions of the joints to characterize the posture features, the motion features, and the offset features of the skeleton sequences, and applied Principal Component Analysis (PCA) to the normalized features to compute EigenJoints as representations. These traditional methods are based on handcrafted features, which are not powerful enough to extract discriminant spatial temporal information from the skeleton sequences for action recognition.

Liu et al. [11] designed a spatial temporal LSTM with a Trust Gate to jointly learn both the spatial and temporal information of skeleton sequences and to automatically remove noisy joints. Although LSTM networks are designed to explore long-term temporal dependencies, it is still difficult for LSTM to memorize the information of the entire sequence with many timesteps [26], [27]. In addition, it is also difficult to construct deep LSTM to extract highlevel features [28], [29]. In contrast to LSTM, CNNs can extract such high-level features, but do not have the capacity to model the long-term temporal dependency of the entire video [50].

### III. PROPOSED SYSTEM

To resolve this problem, we propose to transform the skeleton sequences into clips, which allows for the spatial and temporal information learning of the skeleton sequences based on CNNs. More specifically, we propose a novel MTLN to exploit the intrinsic relationships among different frames of the clips for

action recognition. The classification of each frame is treated as a separate task.

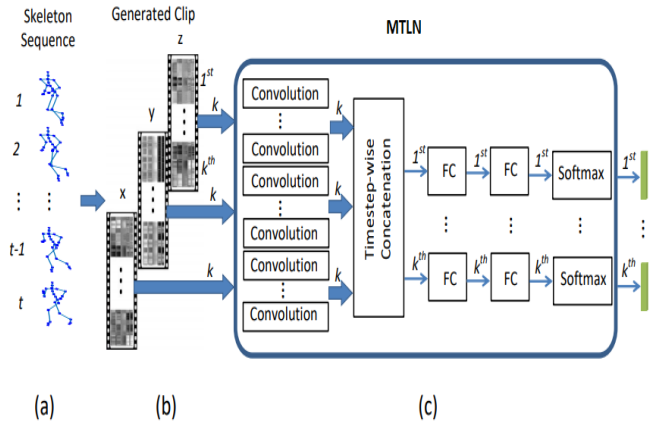
MTLN jointly learns multiple tasks of classification, and then outputs multiple predictions. Each prediction corresponds to one task. The labels of all the tasks are the same as the action label of the skeleton sequence. During training, the loss value of each task is individually computed using its respective class scores. The network parameters are learned using the total loss that is defined by the sum of the loss values of all tasks.

During testing, the class scores of all tasks are averaged to form the final prediction of the action class. The proposed method captures both the temporal and the spatial structural information of the skeleton sequences and also makes the representation more robust to view variations. MTLN explores both the spatial and temporal information of the skeleton sequence from the generated clips for action recognition. In our experiments, we compare the proposed method with other methods. We also compare the multitask learning of the clips with the single-task learning of an individual frame, as well as feature concatenation and pooling methods of multiple frames, to show the advantages of the proposed clip representation and learning method.

### IV. CLIP GENERATION

Instead of frame images, skeleton sequences only provide the 3D trajectories of the skeleton joints. In this section, we introduce two different methods of transforming the skeleton sequences to a set of clips. Each clip consists of several images to allow for spatial temporal feature learning based on deep CNNs. More specifically, for each skeleton sequence, both methods generate three clips. Each clip corresponds to one channel of the 3D coordinates of the skeleton joints. Each frame of the clips includes the information of one particular spatial relationship between the

skeleton joints and the temporal information of the entire sequence. Each clip aggregates multiple frames with different spatial relationships, which provides important information of the spatial structure of the joints



**Figure 2.** structural design of the future system. particular skeleton series (a), three clips (b) related toward the three channels of the cylindrical coordinates are generated.

A important approved CNN show (c) and a transient mean pooling layer (d) are utilized to separate a reduced interpretation from each edge of the clips. The amount produce CNN interpretations of the three clips in the meantime step are connect together, coming about four component vectors (e). Every part vector tests to the transient data of the skeleton association and a difficult spatial connection of the skeleton joints.

The proposed MTLN (f) which joins a totally linked (FC) layer, a redressed instantly unit (ReLU), a different FC layer and a Soft max layer normally shapes the four section vectors in equivalent and yields four blueprints of set scores (g), each identifying with one endeavor of portrayal using one component vector. Times of introduction, the difficulty estimations of the four assignments are demonstrated portray the misfortune estimation of the framework used to revive the formation parameters. For taxing the set scores of the four coursework are

inwards at the average to express the previous calculation of the expansion class.

The robust and invariant transient data of the first skeleton arrangement could be caught with the capable CNN representations gained from each casing picture. The instance route of movement of each joint of a skeleton interest group can be tended to as three 1D bring to light regions appearing in a different way relation to the three channels of the 3D Cartesian headings (x, y, and z).

$$\Omega = \{q_i \in R^3 : i = 1, m\}(1)$$

wherever m is the measure of the skeleton joints, and  $q_i = [x_i; y_i; z_i]$  speaks to the 3D facilitate of the ith joint.

To change Where m is the quantity of the skeleton joints, and  $q_i = [x_i; y_i; z_i]$  speaks to the 3D facilitate of the ith joint. line measurement in a successive inquire. The four reference joints are perused four body parts, particularly, the left shoulder, the correct shoulder, the left hip and the correct hip.

For each reference joint, a course of action of vectors can be controlled by enlisting the qualification of bearings between the reference joint and alternate joints. Each arrangement of vectors mirrors specific spatial connections between the joints.

Let the reference joint be

$$q_0^k = [x_0^k y_0^k z_0^k] k = 1, \dots, 4, \text{ and define}$$

$$V_k \triangleq \{q - q_0^k : q \in \Omega, k = 1, \dots, 4\}(2)$$

Where  $V_k$  is the set of the vectors of the k<sup>th</sup> reference joint in one frame.

## V. CLIP LEARNING

The three CNN highlights of the three fastens in the mean time step are associated in a section vector, which verbalizes to the concise data of the skeleton movement and one specific spatial relationship between the skeleton joints in three channels tube

## VI. RESULTS

shaped directions. At that point the element vectors ever steps are together handled in parallel utilizing multi-undertaking adapting, in this way to use their inborn connections for activity response.

Give the enactment at the  $I$  th a chance to push and the  $j$  th fragment of the  $k$  th feature direct be  $x_{i,j,k}$ . After transient mean pooling, the yield of the  $k$  th highlight outline given by

$$y^k = [y_1^k \dots, y_j^k \dots, y_{14}^k]$$

OR

$$y_j^k = \frac{1}{1} \sum_{i=0}^{14} \max(0, x_{i,j}^k) \quad (3)$$

### 1.3.3 Multi-Task Learning Network:

Multi-Task Learning Network is then proposed to mutually process the four element vectors to use their natural connections for activity acknowledgment. The characterization of each component vector is dealt with as a different assignment with a similar grouping name of the skeleton succession.

i. During training, the class scores of each task are used to compute a loss value.

$$L_k(Z_k Y) = \sum_{i=1}^m y_i \left( -\log \left( \frac{\exp z_{ki}}{\sum_{j=1}^m \exp z_{kj}} \right) \right) \quad (4)$$

$$= \sum_{i=1}^m y_i \left( \log \sum_{j=1}^m \exp z_{kj} \right) - z_{ki}$$

Where  $z_k$  is the vector fed to the Softmax layer generated from the  $k$ th input feature,  $m$  is the amount of action classes and  $y_i$  is the ground-truth label for class  $i$ .

ii. Then the loss values of all tasks are summed up to generate the final loss of the network used to update the network parameters.

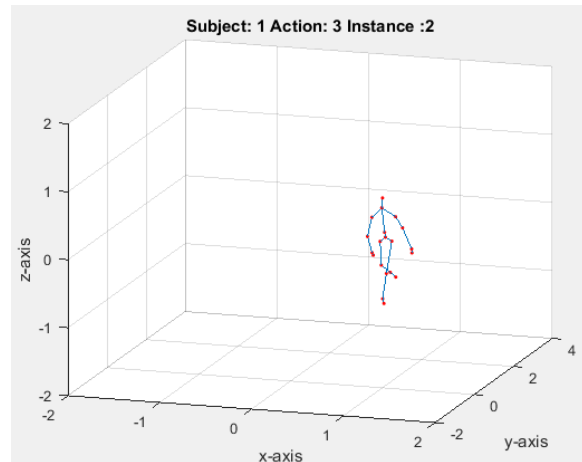


Figure 3. Input Image

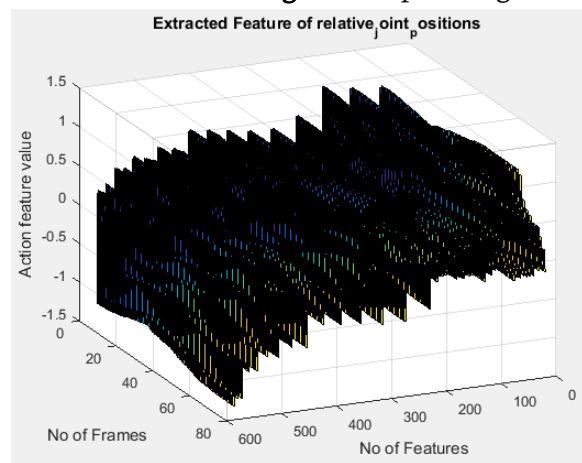


Figure 4. Extracted feature of relative joint positions

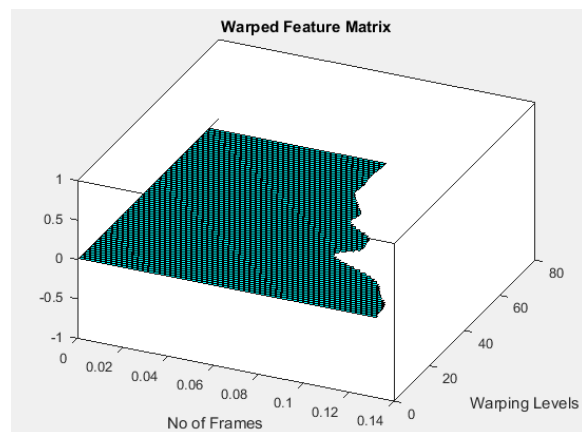


Figure 5. Warped Feature matrix

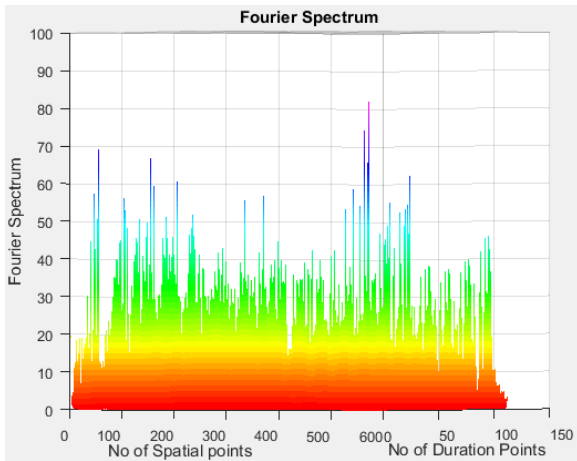


Figure 6. Fourier spectrum

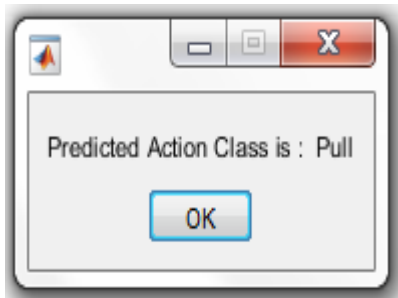


Figure 7. Predicted action

Table 1. Comparison table for different methods

Method	Accuracy	Sensitivity	Specificity
DRNN	73.9051	77.2302	78.2121
Uni-directional	85.7011	82.3212	80.4567
Bi-directional	86.9317	83.8361	83.9317
MTLN	93.4237	87.2398	85.6127

## VII. CONCLUSION

In this paper, we have proposed to transform a skeleton sequence into three clips for robust feature learning and action recognition. Each frame of the generated clips depicts the temporal information of the skeleton sequence. The entire clips incorporate different spatial relationships between the joints and provide useful spatial structural information of the skeleton sequence. The generated clips are then processed with an MTLN to capture both the spatial and temporal information for action recognition.

MTLN learns the clips in a multi-task learning manner in order to utilize the intrinsic relationships between the clip frames. This improves the performance (compared to the concatenation or the pooling methods). We have tested the proposed method on datasets and have compared it to previous state-of-the-art methods and several baselines. Experimental results have shown the effectiveness of the proposed new representation and feature learning method.

## VIII. REFERENCES

- [1]. X. Yang and Y. Tian, "Super normal vector for activity recognition using depth sequences," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2014, pp. 804-811.
- [2]. G. Zhang, J. Liu, Y. Liu, J. Zhao, L. Tian, and Y. Q. Chen, "Physical blob detector and multi-channel color shape descriptor for human detection," *Journal of Visual Communication and Image Representation*, 2018.
- [3]. G. Zhang, J. Liu, H. Li, Y. Q. Chen, and L. S. Davis, "Joint human detection and head pose estimation via multistream networks for rgb-d videos," *IEEE Signal Processing Letters*, vol. 24, no. 11, pp. 1666-1670, 2017.
- [4]. P. Wang, W. Li, J. Wan, P. Ogunbona, and X. Liu, "Cooperative training of deep aggregation networks for rgb-d action recognition," *arXiv preprint arXiv:1801.01080*, 2017.
- [5]. H. Rahmani, A. Mian, and M. Shah, "Learning a deep model for human action recognition from novel viewpoints," *IEEE transactions on pattern analysis and machine intelligence*, 2017.
- [6]. L. Xia, C.-C. Chen, and J. Aggarwal, "View invariant human action recognition using histograms of 3D joints," in *IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*, 2012, pp. 20-27.

- [7]. R. Vemulapalli, F. Arrate, and R. Chellappa, "Human action recognition by representing 3d skeletons as points in a lie group," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2014, pp. 588-595.
- [8]. Y. Du, W. Wang, and L. Wang, "Hierarchical recurrent neural network for skeleton based action recognition," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2015, pp. 1110-1118.
- [9]. A. Shahroudy, J. Liu, T.-T. Ng, and G. Wang, "NTU RGB+D: A large scale dataset for 3D human activity analysis," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2016. 10W. Zhu, C. Lan, J. Xing, W. Zeng, Y. Li, L. Shen, and X. Xie, "Co-occurrence feature learning for skeleton based action recognition using regularized deep lstm networks," in *AAAI Conference on Artificial Intelligence (AAAI)*, 2016. 11J. Liu, A. Shahroudy, D. Xu, and G. Wang, "Spatio-temporal LSTM with trust gates for 3D human action recognition," in *European Conference on Computer Vision (ECCV)*. Springer, 2016, pp. 816-833.
- [10]. P. Koniusz, A. Cherian, and F. Porikli, "Tensor representations via kernel linearization for action recognition from 3d skeletons," *arXiv preprint arXiv:1604.00239*, 2016.
- [11]. P. Wang, Z. Li, Y. Hou, and W. Li, "Action recognition based on joint trajectory maps using convolutional neural networks," in *Proceedings of the 2016 ACM on Multimedia Conference. ACM*, 2016, pp. 102-106.
- [12]. Q. Ke, S. An, M. Bennamoun, F. Sohel, and F. Boussaid, "Skeletonnet: Mining deep part features for 3-d action recognition," *IEEE Signal Processing Letters*, vol. 24, no. 6, pp. 731-735, 2017.
- [13]. J. Liu, A. Shahroudy, D. Xu, A. K. Chichung, and G. Wang, "Skeletonbased action recognition using spatio-temporal lstm network with trust gates," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2017.
- [14]. J. Liu, G. Wang, L.-Y. Duan, K. Abdiyeva, and A. C. Kot, "Skeletonbased human action recognition with global context-aware attention lstm networks," *IEEE Transactions on Image Processing*, vol. 27, no. 4, pp. 1586-1599, 2018.
- [15]. F. Han, B. Reily, W. Hoff, and H. Zhang, "space-time representation of people based on 3d skeletal data: a review," *arXiv preprint arXiv:1601.01006*, 2016.
- [16]. M. Ye, Q. Zhang, L. Wang, J. Zhu, R. Yang, and J. Gall, "A survey on human motion analysis from depth data," in *Time-of-Flight and Depth Imaging. Sensors, Algorithms, and Applications*. Springer, 2013, pp. 149-187.
- [17]. F. Lv and R. Nevatia, "Recognition and segmentation of 3-D human action using HMM and multi-class adaboost," in *European Conference on Computer Vision (ECCV)*, 2006, pp. 359-372.
- [18]. D. Wu and L. Shao, "Leveraging hierarchical parametric networks for skeletal joints based action segmentation and recognition," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2014, pp. 724-731.
- [19]. C. Sminchisescu, A. Kanaujia, and D. Metaxas, "Conditional models for contextual human motion recognition," *Computer Vision and Image Understanding*, vol. 104, no. 2, pp. 210-220, 2006. 22J. Wang, Z. Liu, Y. Wu, and J. Yuan, "Mining actionlet ensemble for action recognition with depth cameras," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2012, pp. 1290-1297.
- [20]. A. Graves, "Neural networks," in *Supervised Sequence Labelling with Recurrent Neural Networks*. Springer, 2012, pp. 15-35.
- [21]. A. Graves, A.-r. Mohamed, and G. Hinton, "Speech recognition with deep recurrent neural networks," in *IEEE International Conference on*

- Acoustics, Speech and Signal Processing. IEEE, 2013, pp. 6645-6649.
- [22]. V. Veeriah, N. Zhuang, and G.-J. Qi, "Differential recurrent neural networks for action recognition," in IEEE International Conference on Computer Vision (ICCV), 2015, pp. 4041-4049.
- [23]. J. Weston, S. Chopra, and A. Bordes, "Memory networks," arXiv preprint arXiv:1410.3916, 2014. 27J. Gu, G. Wang, and T. Chen, "Recurrent highway networks with language cnn for image captioning," arXiv preprint arXiv:1612.07086, 2016. 28T. N. Sainath, O. Vinyals, A. Senior, and H. Sak, "Convolutional, long short-term memory, fully connected deep neural networks," in Acoustics, Speech and Signal Processing (ICASSP), 2015 IEEE International Conference on. IEEE, 2015, pp. 4580-4584.
- [24]. R. Pascanu, C. Gulcehre, K. Cho, and Y. Bengio, "How to construct deep recurrent neural networks," arXiv preprint arXiv:1312.6026, 2013. 30Y. LeCun, Y. Bengio et al., "Convolutional networks for images, speech, and time series," *The handbook of brain theory and neural networks*, vol. 3361, no. 10, p. 1995, 1995.
- [25]. K. Chatfield, K. Simonyan, A. Vedaldi, and A. Zisserman, "Return of the devil in the details: Delving deep into convolutional nets," arXiv preprint arXiv:1405.3531, 2014.
- [26]. D. Ciregan, U. Meier, and J. Schmidhuber, "Multi-column deep neural networks for image classification," in Computer Vision and Pattern Recognition (CVPR), 2012 IEEE Conference on. IEEE, 2012, pp. 3642- 3649.
- [27]. A. Krizhevsky, I. Sutskever, and G. E. Hinton, "Imagenet classification with deep convolutional neural networks," in *Advances in neural information processing systems*, 2012, pp. 1097-1105.
- [28]. K. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition," arXiv preprint arXiv:1409.1556, 2014. 35C. Szegedy, W. Liu, Y. Jia, P. Sermanet, S. Reed, D. Anguelov, D. Erhan, V. Vanhoucke, and A. Rabinovich, "Going deeper with convolutions," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2015, pp. 1-9.
- [29]. Y. Xiong, K. Zhu, D. Lin, and X. Tang, "Recognize complex events from static images by fusing deep channels," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2015, pp. 1600-1609.
- [30]. Q. Ke and Y. Li, "Is rotation a nuisance in shape recognition?" in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2014, pp. 4146-4153.
- [31]. Q. Ke, M. Bennamoun, S. An, F. Boussaid, and F. Sohel, "Human interaction prediction using deep temporal features," in *European Conference on Computer Vision Workshops*. Springer, 2016, pp. 403-414.
- [32]. Q. Ke, M. Bennamoun, S. An, F. Sohel, and F. Boussaid, "Leveraging structural context models and ranking score fusion for human interaction prediction," *IEEE Transactions on Multimedia*, 2017. 40W. Luo, Y. Li, R. Urtasun, and R. Zemel, "Understanding the effective receptive field in deep convolutional neural networks," in *Advances in Neural Information Processing Systems*, 2016, pp. 4898-4906.
- [33]. K. Yun, J. Honorio, D. Chattopadhyay, T. L. Berg, and D. Samaras, "Two-person interaction detection using body-pose features and multiple instance learning," in *IEEE Conference on Computer Vision and Pattern Recognition Workshops (CVPRW)*, 2012, pp. 28-35.
- [34]. A. Yao, J. Gall, G. Fanelli, and L. Van Gool, "Does human action recognition benefit from pose estimation?," in *Proceedings of the 22nd British machine vision conference-BMVC 2011*,



2011. 43R. Caruana, "Multitask learning," in Learning to learn. Springer, 1998, pp. 95-133.
- [35]. Q. Ke, M. Bennamoun, S. An, F. Sohel, and F. Boussaid, "A new representation of skeleton sequences for 3d action recognition," in IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2017.
- [36]. C. Wang, Y. Wang, and A. L. Yuille, "An approach to pose-based action recognition," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2013, pp. 915-922.
- [37]. R. Chaudhry, F. Ofli, G. Kurillo, R. Bajcsy, and R. Vidal, "Bioinspired dynamic 3d discriminative skeletal features for human action recognition," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops, 2013, pp. 471-478.
- [38]. M. E. Hussein, M. Torki, M. A. Gowayyed, and M. El-Saban, "Human action recognition using a temporal hierarchy of covariance descriptors on 3d joint locations." in IJCAI, vol. 13, 2013, pp. 2466-2472.

# Detection and classification of combined real time power quality disturbance signals with Hidden Markov Models incorporating wavelet features

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## ABSTRACT

In this paper, Maximum Overlapping Discrete Wavelet Transform (MODWT) has been implemented along with the traditional discrete Wavelet Transform (DWT) for the detection and localization of different types of power quality (PQ) disturbance signals. Selected features have been extracted from the detail coefficient of the variants of WT and then fed as inputs to the classifiers in order to characterize the signals. Moreover, a comparative assessment of the PQ signal carried out with different classifiers such as Multilayer perceptron (MLP) and Hidden Markov Models (HMMs). Moreover, in order to represent in realistic environment, these proposed techniques are tested with signals captured from transmission line panels. Further, to aid this PQ disturbance detection, different types of real time fault signals are also characterized with these aforementioned approaches.

## I. INTRODUCTION

The Power Quality disturbance (PQD) study has become an emerging issue in the area of power system, as the disturbances affect the overall harmony of the system. The proper and the continuous monitoring of the power quality disturbances has become a significant issue both for the utilities and the end-users. The operation of the power system can be improved by analyzing the PQ disturbances consistently. Hence, the development of the techniques and the methodologies in order to diagnose the power quality disturbances has acquired great importance in research. The PQ is actually the combination of quality of the voltage and the quality of current [1], [2] but in most of the cases, it is generous with the quality of voltage as the power system can only control the voltage quality. Hence, the yardstick of the power quality area is to preserve the supply voltage within the tolerable limits [3], [4]. The maintenance of quality of power in terms of voltage requires proper selection of the suitable detection and the characterisation methods. These are the crucial steps for maintenance of healthy power system by mitigating the PQ disturbances.

In order to identify the disturbances, the different techniques such as the Fourier transform (FT), the short-time Fourier transform (STFT), wavelet transform (WT), Neural Network, Fuzzy logic, S-transform have been used [5], [6]. The FT is a fast technique which only provides the information about the frequency component. So, FT is unsuitable for the analysis of non-stationary signal. On the other hand, the time frequency information related to the disturbance waveform can be obtained in STFT [7]. However, STFT is not suitable to track the transient signals perfectly due to its fixed window property [8]. Similarly, the S-transform suffers from computational burden which limits its applications [9]. The wavelet transform affords the timescale analysis of

the non-stationary signal due to Multi-Resolution Analysis (MRA) property. The property of MRA of WT represents the signals into different time-scales rather than the time-frequency like the STFT. Thus, WT is a suitable technique for analysis of the transient signals as it provides long window at low frequencies and short window at high frequencies [10].

The automatic detection of PQ events with the discrete wavelet transform (DWT) is a common topic in past studies [11], [12]. But the DWT is restricted with the size of the signal. A modified version of DWT is known as maximal overlap discrete wavelet transform (MODWT) is adopted in this paper. The coefficients of the proposed method are not affected by changing the starting point and also has no restrictions on the size of signal unlike the traditional DWT. The MODWT has been implemented [13], [14] as 'undecimated DWT' with the context of infinite sequence. Similarly, MODWT is implemented as 'translation invariant DWT' [15], [16] and 'time-invariant DWT' [17].

In order to reduce the memory consumption, the features are extracted from the detail coefficients of the WT decomposition instead of giving the raw data directly. In this paper, the traditional DWT and the modified DWT are integrated with the feature extraction [18], [19] of PQD signals which is followed by classification.

The accurate detection of the PQ disturbance is the important performance indices in power quality analysis. However, the most common automated classification models are based on the Artificial Neural Network (ANN) [20], [21], fuzzy and neuro-fuzzy systems [22], [23], [24]. But the main disadvantage of ANN based classifier is the requirement of retraining when a new phenomenon is added. Hence, in this paper, two classifiers such as, Multilayer perceptron (MLP) and the Hidden Markov Model (HMMs) have been implemented to classify the PQD signals in order to establish a comparative assessment of MODWT application in PQ environment.

This paper organized as follows. The Section 2 describes the theory of the Second Generation Wavelet Transform (MODWT) along with the Discrete Wavelet transform (DWT). The feature extraction processes are presented in the Section-III. Section-IV provides the brief theory about the classifiers. Similarly, the Section-V deals with the construction of PQ model as well as the effectiveness of MODWT and DWT in the localization of the PQ disturbances. The classification results are presented in the Section-VII. Finally, Section-VIII provides the concluding remark.

## II. LOCALIZATION APPROACH

The basic block diagram of the classification of PQ signals which is preceded by decomposition and feature extraction. The detection of the PQ disturbance has been carried out with the help of DWT and the MODWT. These have been described briefly in this section while the feature extraction and classification are described in the subsequent sections.

### A. Continuous Wavelet Transform

The wavelet transform represents the signal as a combination of the wavelets at different location (position or amplitude) and scales (duration or time). The continuous wavelet transform generally implements for the continuous time signal analysis. The surface of the wavelet coefficients has been obtained from the different values of the scaling and the translation factors.

Mathematically, for a signal  $x(t)$ , the continuous wavelet transform [25] is expressed as

$$CWT(a, b) = \frac{1}{\sqrt{a}} \int_{-\infty}^{\infty} x(t)g\left(\frac{t-b}{a}\right) dt \quad (1)$$

where  $g(\cdot)$  is the mother wavelet. Similarly,  $a$  is the scale factor and  $b$  is the translation factor. Both  $a$  and  $b$  are varies in continuous manner in continuous wavelet transform. In order to remove the redundancy due to continuous coefficients, discrete Wavelet transform has been introduced which has been discussed in next subsequent subsection.

### B. Discrete Wavelet Transform

The discrete wavelet transform (DWT) implements in order to decompose a discretized signal into different resolution levels. The DWT reduces the substantial redundancy of CWT. In the multiresolution analysis (MRA), the wavelet function generates the detail coefficients of the decomposed signal and the scaling function generates the approximation coefficients of the decomposed signal. The DWT can be expressed with  $g$  as the mother wavelet

$$DWT(m, k) = \frac{1}{\sqrt{a_0^m}} \sum_n x(n)g\left(\frac{k-nb_0a_0^m}{a_0^m}\right) \quad (2)$$

where  $k$  is an integer. The scaling parameter and translation parameter  $a$  and  $b$  vary in the discrete manner. The time signal  $S[n]$  decomposed in to detailed  $d_1(n)$  and smoothed  $c_1(n)$  employing high pass ( $h(n)$ ) and low pass filters ( $l(n)$ ). Thus the detail version contains high frequency components than the smooth version  $c_1(n)$ . Mathematically, they are specified [26] as

$$c_1(n) = \sum_k h(k-2n)c_0(k) \quad (3)$$

$$d_1(n) = \sum_k g(k-2n)c_0(k) \quad (4)$$

where  $\omega(n)$  is the discretised time signal (sampled version of  $S_0(n)$ ). The outputs of the two filters are down sampled by a factor of 2 in order to obtain the DWT coefficients. The output of the low pass filter is called the approximation coefficients and the output of the high pass filter is called as the detail coefficients. The approximation coefficients are further fed to the low pass and high pass filter and the process is repeated. The high pass and low pass filters are called as the ‘Quadrature mirror filters’ and are related by the equation

$$h[L-1-n] = (-1)^n l(n) \quad (5)$$

where,  $L$  is the length of filter. The basic block diagram of DWT is shown in Fig.1.

The implementation of DWT is restricted with the length of signals. Similarly, the coefficients are affected by the change of initial point. The MODWT has been implemented in order to overcome the sensitivity of DWT with the choice of starting point of a time series.

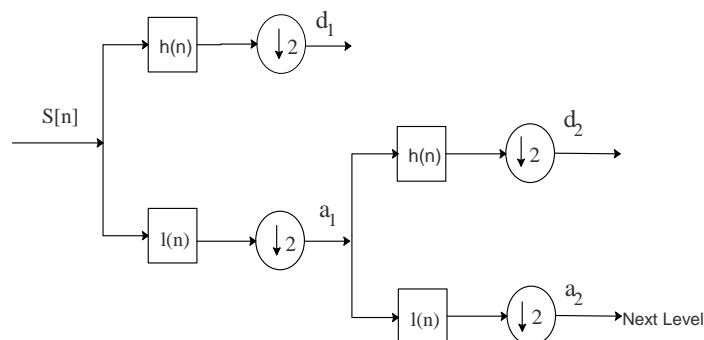


Fig. 1: Block diagram of DWT decomposition

### C. Maximum Overlapping Discrete Wavelet Transform (MODWT)

The motivation to formulate the MODWT over the conventional DWT is the ability of the free selection of a starting point of a time series signal. The orthogonal transform of DWT suffers the lack of the invariance translation in time series analysis. The Maximum Overlap Discrete Wavelet Transform is the enhanced version of the Discrete Wavelet Transform (DWT). This transform can be employed to any sample size whereas the DWT is limited to the signal length  $N$  to be an intermultiple of  $2^j$  where  $j = 1, 2, 3, \dots, J$  is the scale number [27]. The representation of MODWT is shown in Fig.2. The MODWT scaling filters  $h_l$  and wavelet filters  $g_l$  are related to the DWT filters through (6) and (7)

$$\tilde{h}_l^o = \frac{h_l}{\sqrt{2}} \tag{6}$$

$$\tilde{g}_l^o = \frac{g_l}{\sqrt{2}} \tag{7}$$

The MODWT filters are also the Quadrature mirrors like DWT filters is given as (8) and (9)

$$\tilde{h}_l^o = (-1)^{l+1} h_{L-1-l} \tag{8}$$

$$\tilde{g}_l^o = (-1)^{l+1} g_{L-1-l} \tag{9}$$

where  $l = 0, 1, 2, \dots, L-1$  and  $L$  is the width of the filter.

The  $n^{th}$  element of the first-stage wavelet and the scaling coefficients of MODWT with the input time series signal  $X(n)$  is as follows

$$\tilde{W}_{1,n} = \sum_{l=0}^{L_1-1} \tilde{h}_l X_{n-l \bmod N} \tag{10}$$

$$\tilde{V}_{1,n} = \sum_{l=0}^{L_1-1} \tilde{g}_l X_{n-l \bmod N} \tag{11}$$

where  $n = 1, 2, 3, \dots, N$  and  $N$  is the length of signal in sample.

$$\tilde{A}_{1,n} = \sum_{l=0}^{L_1-1} \tilde{g}_l^o \tilde{X}_{1,n+l \bmod N} \tag{12}$$

The first-stage approximations and details can be calculated by the equations (12) and (13). The MODWT scaling coefficients  $\tilde{V}_j^o$  and  $\tilde{W}_j^o$  wavelet coefficients at the  $n^{th}$  element of the  $j^{th}$  stage are given by the equations (14) and (15)

$$\tilde{V}_{j,n} = \sum_{l=0}^{L_j-1} \tilde{g}_{j,1} \tilde{X}_{n-l \bmod N} \tag{14}$$

$$\tilde{W}_{j,n} = \sum_{l=0}^{L_j-1} \tilde{h}_{j,1} \tilde{X}_{n-l \bmod N} \tag{15}$$

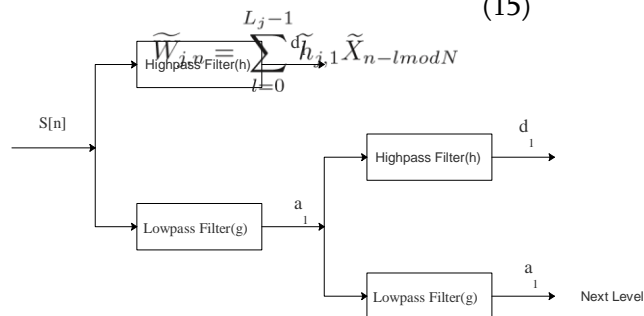


Fig. 2: Block diagram representation of MODWT decomposition

Similarly, the approximations  $A_j$  and the details  $D_j$  of the  $n^{th}$  element of the  $j^{th}$  stage MODWT are given by the equations

(16) and (17).

$$A_{j,n}^{\phi} = \sum_{l=0}^{L_j-1} g_{1,n+l \bmod N}^{\phi} \quad (16)$$

$$B_{j,n}^{\phi} = \sum_{l=0}^{L_j-1} h_{1,n+l \bmod N}^{\phi} \quad (17)$$

Where  $\tilde{g}_l^{\phi}$  is periodized  $g$  to length  $N$  and also the  $\tilde{h}_l^{\phi}$  is periodized  $h$  to length  $N$ . So, the original time series signal can

be stated in terms of the approximations and the details as followse

$$X(n) = \sum_{l=0}^j B_l^{\phi} + A_l^{\phi} \quad (18)$$

### III. THEORY OF THE FEATURE EXTRACTION

#### A. Feature extraction

The input to the classifiers has been extracted features from the output of the signal decomposition instead of directly using the raw data in ordered to reduce the computational burden. The quantitative analysis in terms of features like the energy content, the standard deviation (STD), the cumulative sum (CUSUM) and the entropy of the transformed signal has been performed to reduce the classification error. The basis of choosing the features has been explained below along with the proper expressions [28].

- **Energy** : According to Parseval's theorem the energy of the distorted signal will be partitioned at different resolution levels in different ways depending on the power quality disturbances signals. So, it has been established that energy distribution pattern changes when the amplitude and frequency of the signal changes [29] and [5].

$$\text{Energy } ED_i = \frac{1}{N} \sum_{j=1}^N |D_{ij}|^2 \quad (19)$$

where  $i = 1,2,3,\dots,I$  (level of decomposition) and  $N$  is the number of samples in each decomposed data.  $D$  stands for detail coefficient.

- **Entropy** : The spectral entropy of the non-stationary power signal disturbances is an effective parameter for the classification of the signal. The entropy value for low frequency disturbances like the voltage swell, the voltage sag, the momentary interruption and the pure undistorted sinusoidal signal is minimum. The harmonics contained in the signals such as sag with harmonics, swell with harmonics have a comparatively high entropy value. For flicker type signals the entropy value is minimum. Similarly in case of the short duration non-stationary power signal disturbances such as the notches and the spikes have very low entropy values. While transients have relatively higher entropy value [8].

$$\text{Entropy } ENT_i = -\sum_{j=1}^N D_{ij}^2 \log(D_{ij}^2) \quad (20)$$

- **Standard Deviation** : Assuming a zero mean, the standard deviation can be considered as a measure of the energy of the considered signal. Standard deviation has been employed to differentiate the low frequency and the high frequency signals [5].

$$\text{Standard Deviation } \sigma_i = \left( \frac{1}{N} \sum_{j=1}^N (D_{ij} - \mu_i)^2 \right)^{\frac{1}{2}} \quad (21)$$

- **CUSUM** : The cumulative sum method implements the samples for the localization of the distortion in the signal. The CUSUM has been computed by the sum of the consecutive samples of the power quality signal after being passed through the aforementioned transforms [30].

$$\text{CUSUM } CM_i = \sum_{j=1}^N (D_{ij} - \mu_i)^2$$

(22)

$$\text{where Mean } \mu_i = \frac{1}{N} \sum_{j=1}^N D_{ij}$$

These four features have been extracted from the output of the transformation. At each level four features have been extracted, so for each signal in WT 4 \* 7 feature vector have been formed. After calculating the features for the complete data sets, the feature vectors are normalised between [0,1] by considering the maximum value of the corresponding feature vectors as the base. However, the normalisation is one of the important steps of pre-processing of the data before classification. This vector normalisation has been carried out in order to avoid the influence of high range feature vectors over low range ones. The extracted features have been fed as put to the classifiers.

#### IV. CLASSIFICATION APPROACH

The extracted features are fed as inputs to the classifier such as MLP and HMMs.

##### A. Hidden Markov models (HMMs)

The HMMs have been applied to feature vector extracted from the coefficient in order to determine the maximum likelihood in the data set. The HMM, extension of the Markov model in which the stochastic process is not directly observable through another set of stochastic processes. However, an HMM can be defined as  $\lambda = (M, N, \pi, A, B)$  where the parameter  $N$  denotes the number of states of the model,  $M$  is the number of distinct observation symbols per state,  $\pi$  is the initial state distribution vector, similarly,  $A$  denotes the state transition probability and finally  $B$  is observation probability matrices respectively. A discrete HMM is explained in [25], [8] through the model of individual states.

Like other classifiers, the HMMs operation has been partitioned into the training and the testing stage of dataset. The HMM training model uses both continuous and discrete density modelling and also employs the Baum-Welch algorithm to construct the HMMs [31]. Starting with a very simple prototype system, the HMMs are repeatedly modified and re-estimated until the required level of model complexity and performance is reached. In this study, ten different HMMs has been trained for ten different disturbance classes. For this classification process, the logarithmic probability of each model output has been determined for the unknown input signals. In order to develop a proper HMM, the selection of the optimum number of state and the density function are very important but there is no explicit rule for the selection of these factors except the application type and the parameters. In this work, three states has been selected to stipulate the output with the Gaussian mixtures function. The prior distribution has been used over the state transition to favour the transitions in order to stay in the same state. The prior is multiplied by the likelihood function and then normalised according to the Bayes theorem. The CA depends on the number of matching of the testing with the trained model using the equation.

## V. POWER QUALITY DISTURBANCE MODEL

The theory described in Section-II has been used to compute the approximation and detail coefficients up to fourth finer levels using the DWT and MODWT. The PQD signals are simulated in MATLAB with sampling frequency is 3.2 kHz. Class labels assigned to PQ signals of synthesized signals are given in Table I.

TABLE I: Power signal Class labels of synthesis signal

PQD events	Class
Sag	<i>CL1</i>
Swell	<i>CL2</i>
Interruption	<i>CL3</i>
Oscillatory transient	<i>CL4</i>
Flicker	<i>CL5</i>
Harmonics	<i>CL6</i>
Sag + Harmonics	<i>CL7</i>
Swell + Harmonics	<i>CL8</i>
Notch	<i>CL9</i>
Spike	<i>CL10</i>

## VI. DECOMPOSITION OF PQ SIGNALS

### A. Pure Sinusoidal Voltage Signal

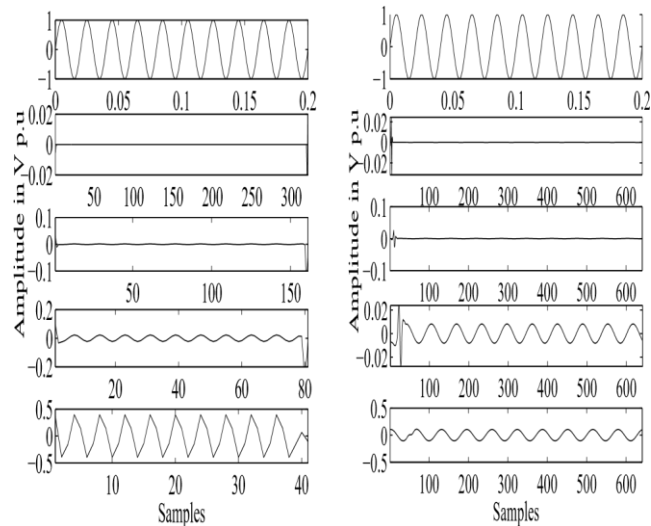
A pure sinusoidal wave of voltage signal is considered in Fig.3. With DWT and MODWT, the signal has been decomposed up to four decomposition levels are shown in Fig.3 along with the original sine wave. The vertical axis represents the amplitude of voltage signal in volt V p.u. (per unit) and similarly the horizontal axis presents the time (in second) in terms of samples. Both DWT and MODWT has been implemented on the aforementioned PQ signals in order to carry out the analysis.

By decomposing normal voltage, similar types of waveforms are produced at the respective decomposition level both in DWT and the MODWT present in Fig. 3 along with the original waveform. In MODWT, the initial point is shifted due to circular shifting which helps in future prediction. The decomposition levels and the corresponding description of the pure sine wave with sag and swell are shown in Fig. 4 and Fig. 5 respectively.

### B. Pure sine wave with sag

Pure sine wave with sag has been considered for analysis. In Fig. 4, sag detection can be observed at levels 1,2,3 and 4. In DWT decomposition, the starting and the end point of the distortion of each decomposition level are in same alignment with the original signal, however in MODWT decomposition the first decomposed level is at the alignment with the original signal but the others are shifted due to the circular shifting.





From the Fig. 4, it is observed that, both the DWT and the MODWT decomposition provided similar type of waveforms along with the shifting.

### C. Pure sine wave with swell

The procedure adopted for this type of signal is the same as the previous case. In Fig. 5, similar types of waveforms have been found in the same decomposition levels.

Similarly, the rest PQ disturbances are subjected to the process of decomposition using the DWT and the MODWT. Similar types of waveforms has been also obtained from both the types of the wavelet transforms.

In decomposition levels other than the 1<sup>st</sup>, the initial point of the signal is also sifted along with the distortions. So, MODWT can be implemented to predict the occurrence of power quality distortions.

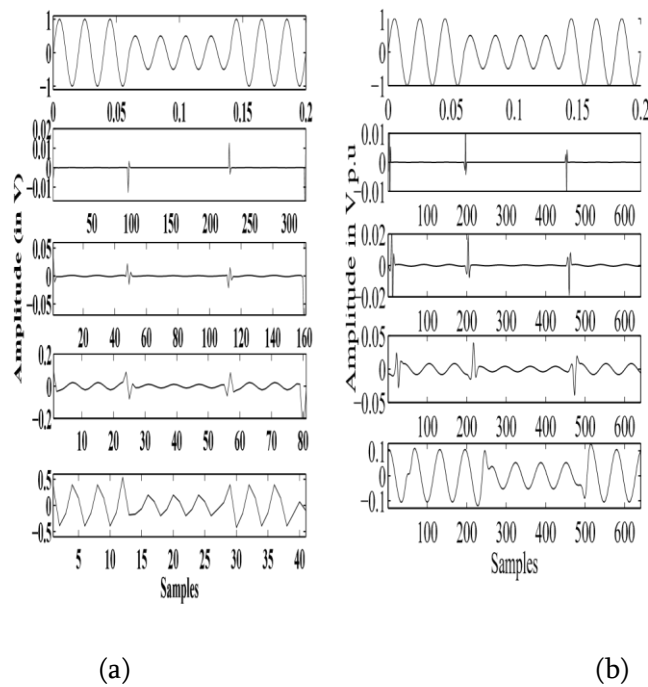


Fig. 3: Localization of pure sine wave in (a) DWT decomposition (b) MODWT decomposition

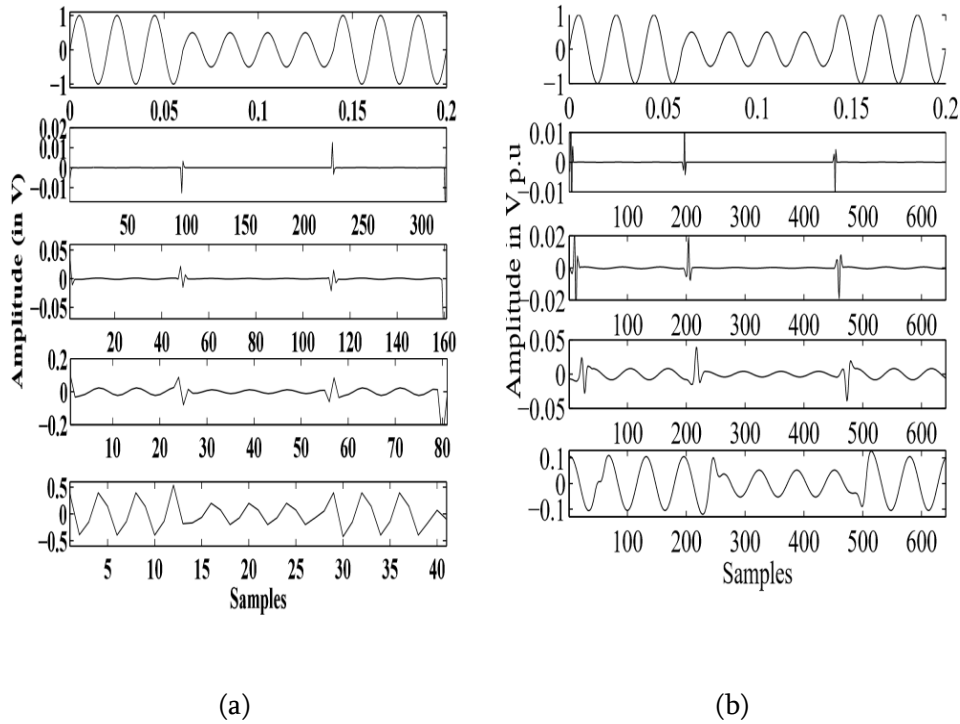


Fig. 4: Localization of sine wave with sag in (a) DWT decomposition (b) MODWT decomposition

#### D. Harmonic voltage signal

Consider the harmonic signal shown in Fig. 6. By observing 1<sup>st</sup> two levels of Fig. 3 and Fig. 6, it can be observed that for sinusoidal signal the magnitude of 1<sup>st</sup> two levels are almost zero and for harmonic signal, 1<sup>st</sup> two levels have some magnitude. Hence, it can be concluded that the waveforms of each level are different for different disturbance and this property helps in classification of those disturbances.

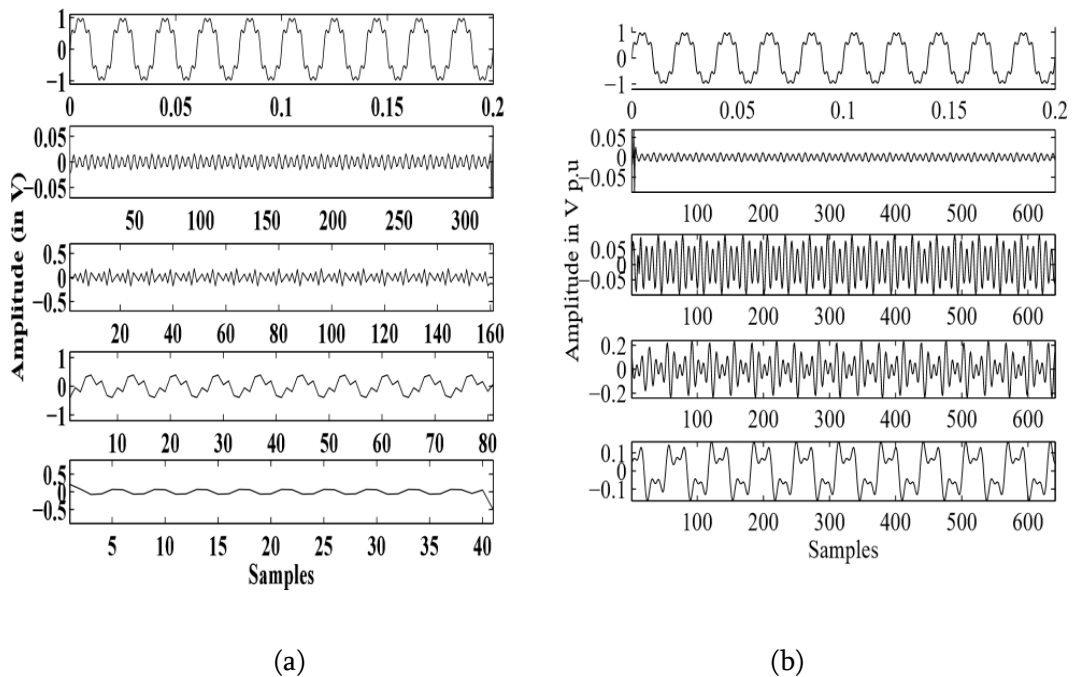


Fig. 5: Localization of sine wave with swell in (a) DWT decomposition (b) MODWT decomposition

**E. Pure sine wave with Harmonic and sag**

A pure sine wave voltage signal with harmonic and sag has been considered for analysis in Fig. 7. Similar type of wave form have been found.

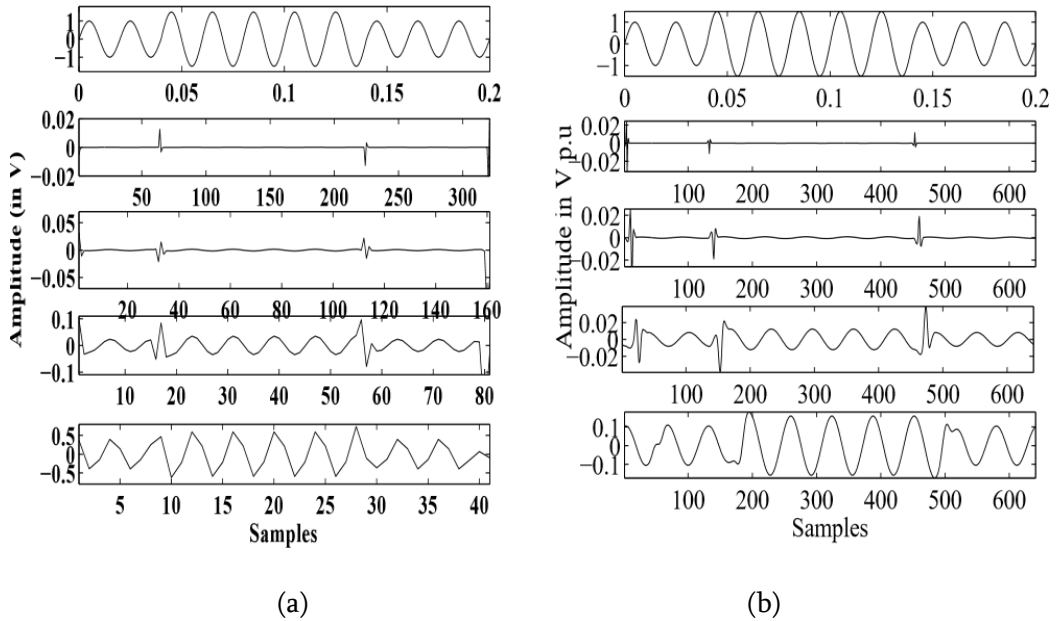


Fig. 6: Sine wave with Harmonic (a) DWT decomposition (b) MODWT decomposition

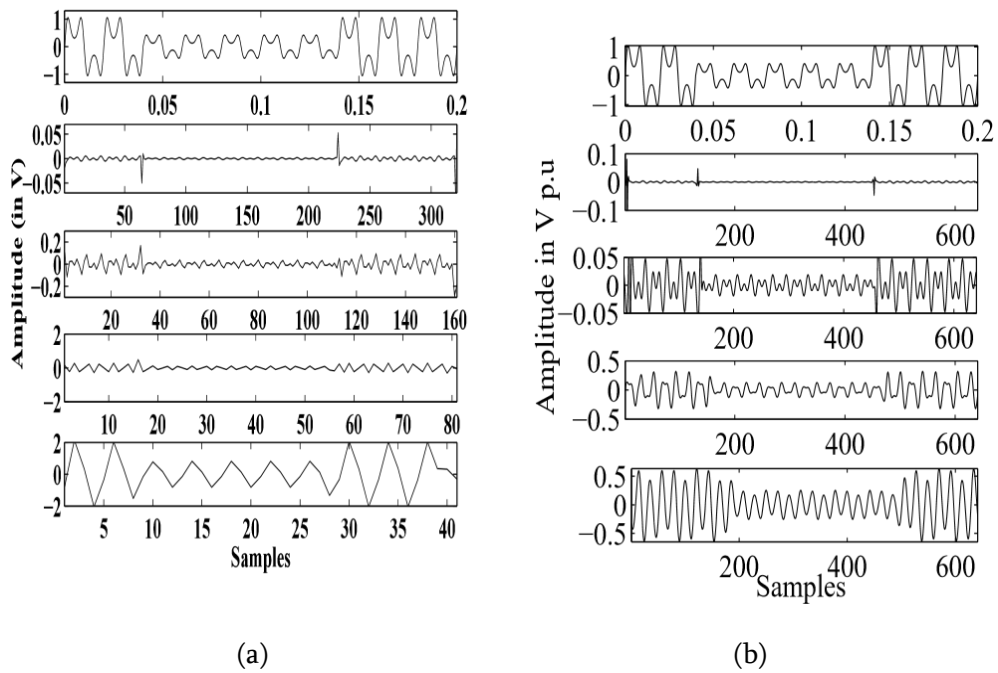


Fig. 7: Sine wave with Harmonic and sag (a) DWT decomposition (b) MODWT decomposition

Similar to that of other cases, the origin point of signals shifted along with the distortion in the decomposition levels  
 MODWT.

### F. Experimental PQD Signal generation

In order to get the real data, seven types of PQ signals have been generated by employing transmission line panel, the load and the storage oscilloscope. The transmission demo panel comprises a line model with the length 400 Km and voltage of 220 kV. The lumped parameter line model with five cascaded networks each of them has been designed for 80 km parameters. The fault simulating switch has been provided to create the fault condition. This transmission line panel also comprises digital DSP based power analyzers, voltmeters, ammeters, push buttons, indicating lamp and accessories. A digital timer is also present. The demo panel is also provided with protective devices i.e MCB'S to give protection from any abnormal condition occurring

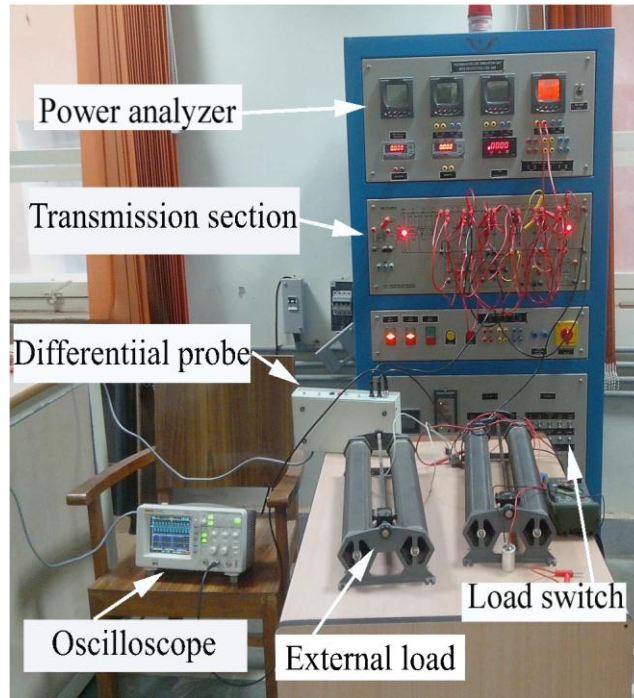


Fig. 8: Experimental setup for single phase voltage signal collection

during the actual demonstration and experiments. The numerical impedance relay and the numerical over current relay are also associated to give trip signal to the circuit breaker. The current carrying capacity of the model is 5 Amp.

The seven types of signals are sag, swell, interruption, sag with swell, sag with interruption, swell with interruption and sag and swell with interruption. A 220 V is applied to the transmission line panel and by changing the load and creating fault, the various disturbances are created. The disturbances are then stored in storage oscilloscope. Then data is extracted from the oscilloscope and fed to the MATLAB for feature extraction and subsequent classification. The details of experimental set up is given in Fig. 8. Similarly, the circuit diagram of the transmission panel has been shown in Fig. 9. The captured single phase voltage signals with sag, swell and interruption are presented in Fig. 10.

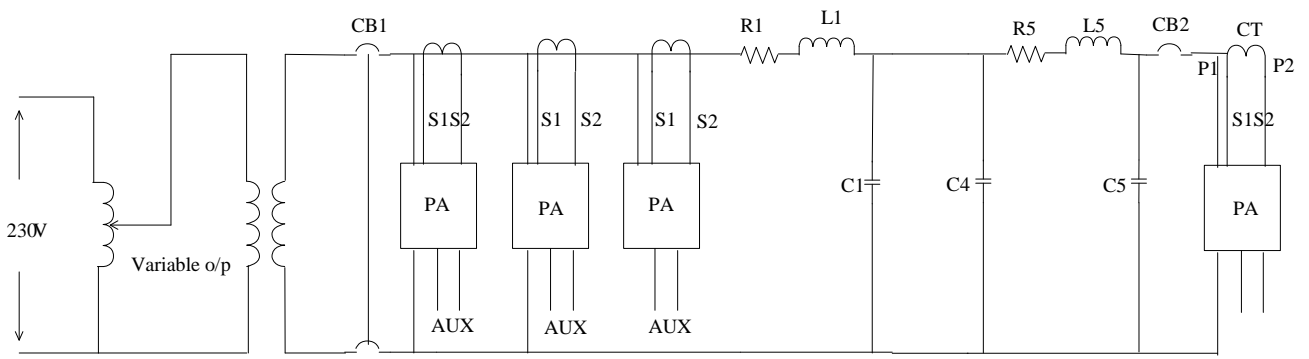
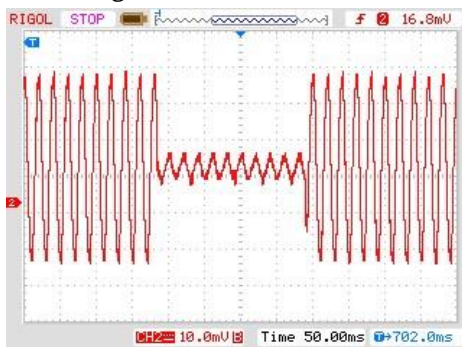


Fig. 9: Circuit diagram of the single phase transmission panel connection

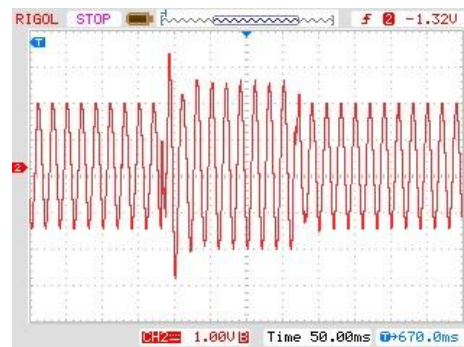
## VII. CLASSIFICATION RESULTS

### A. Classification with simulated PQD signals

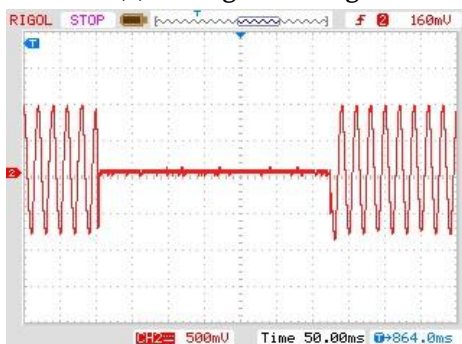
The classification accuracy is computed by the automated classifiers described in Section-III. The total 10936 numbers PQD signals are simulated with MATLAB. Each data set contains variable  $X$  ( $X1$ - standard deviation,  $X2$ - energy of details,  $X3$ - entropy,  $X3$ -  $X3$ -) and  $L(L1, L2, \dots, L7$  level of decomposition) which constitute 28 features. For each classifier 70% of the total data has been treated as the training data and the rest 30% data are employing for the testing.



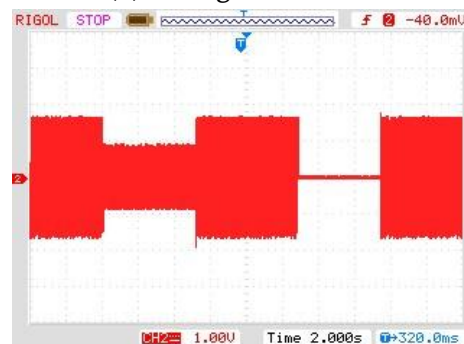
(a) Voltage with sag



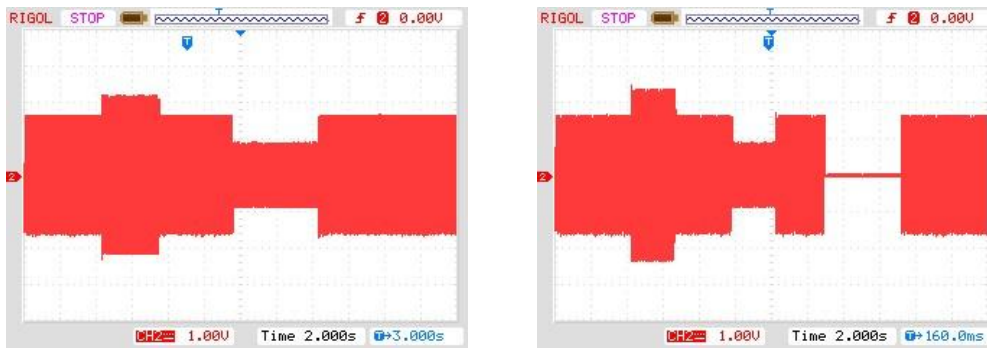
(b) Voltage with swell



(c) Voltage with interruption



(d) Voltage with interruption and sag



(e) Voltage with sag and swell

(f) Voltage with sag, swell and interruption

Fig. 10: Single phase real voltage signals with disturbances

For ten different types of disturbances the overall classification accuracy (%CA) is also calculated individually. The classification accuracy is a measure of the performance index of the PQ defined [32] as

$$\text{Classification Accuracy}(\%) = \frac{\text{Number of samples correctly classified}}{\text{Total number of samples in the class}} \times 100 \quad (23)$$

In the Table II, the (CA%) of MLP and HMMs classifiers also have been presented. From, Table II, it has been observed that for each data set the overall (CA%) of MLP is better than the HHMs as HHMs fail to classify interruption, harmonic like slow disturbances. Moreover, from the individual (CA%), it can be observed, the HMMs has better (CA%) than the MLP in case of fast signals like transient, notch and spike etc.

TABLE II: CA (%) of Pure Signals

CLASS	DWT		SGWT	
	MLP	HMMs	MLP	HMMs
CL1	86.56	76.21	87.57	77.09
CL2	86.96	98.32	87.12	98.34
CL3	90.01	0	90.78	0
CL4	89.94	98.01	90.03	98.45
CL5	87.79	92.01	88.02	93.12
CL6	91.11	47.61	92.13	48.63
CL7	87.34	43.32	88.09	44.78
CL8	88.47	73.60	89.91	74.37
CL9	90.34	100	90.78	100
CL10	89.07	98.02	90.65	98.45
TOTAL %CA	89.82	71.02	90.50	72.32

The classification of three phase PQ disturbances have been presented in Table III. From Table III, it can be observed that %CA value of three phase signals are similar to the synthetic signal %CA value. TABLE II: CA (%) of Pure Synthesized Signals

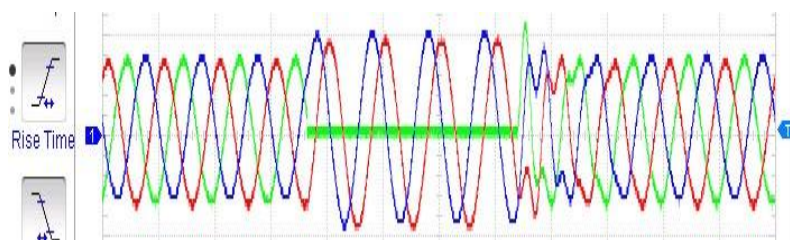
TABLE III: CA (%) of real time single phase signals

CLASS	DWT		MODWT	
	MLP	HMMs	MLP	HMMs
C1	82.56	72.36	83.50	72.72
C2	83.36	92.47	84.21	93.07
C3	87.21	0	87.79	0
C1+C2	85.34	88.34	85.83	91.32
C1+C3	84.39	13.01	84.93	90.07
C2+C3	83.16	47.61	83.19	47.92
C1+C2 +C3	84.34	43.32	85.02	33.45
TOTAL %CA	84.21	60.34	85.75	62.02

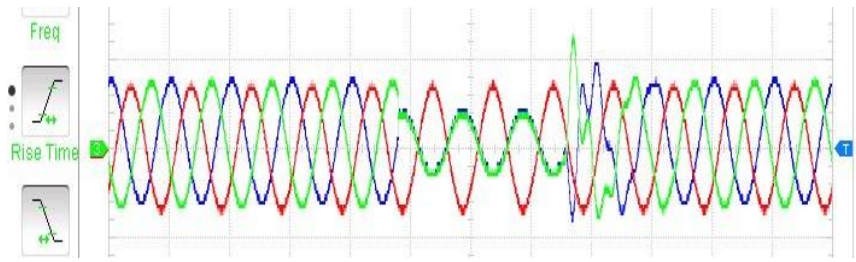
### B. Fault Classification

Under normal operating condition, the power system operates under balanced conditions with all the equipments carrying normal currents and voltages within the prescribed limits. This healthy operating condition can be disrupted due to a fault in the system. The power system faults are divided in to three phase balanced fault and unbalanced fault. The different types of unbalanced fault are single line to ground fault (L-G), line to line fault (L-L), double line to ground (L-L-G). The balanced faults are three phase fault which are severe type of fault. These faults can be two types such as line to line to line to ground (L-L-L-G) and line to line to line fault (L-L-L).

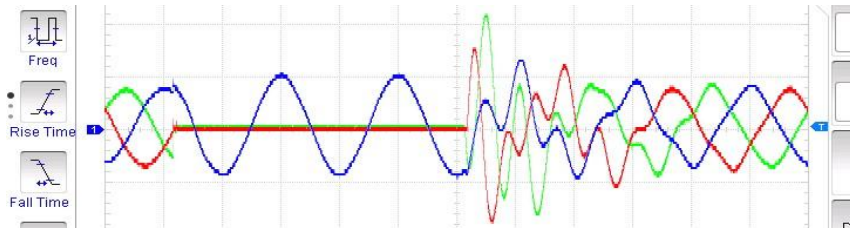
Three phase voltage signals with fault are captured from an overhead  $\pi$  modelled transmission line of length 360 (Km) like the other cases. Total five types of fault signals are captured. Some of fault signals have been presented in Fig.11. Fault signals have been captured from the oscilloscope and fed to MATLAB for analysis like the previous cases. From the details of the WT and the ST contours four features have been extracted and fed to the classifiers in order to recognise the type of fault. The recognition rate in terms of %CA is given in Table IV. Different approaches have been implemented for calculation of %CA in Table IV. From these tables, it can be observed that all these proposed techniques are working satisfactorily. The HMM has provided good results unlike the PQ disturbance recognition where it failed to recognise slow disturbances perfectly.



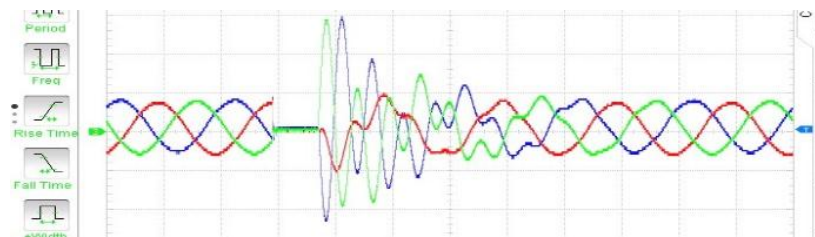
(a) L-G fault



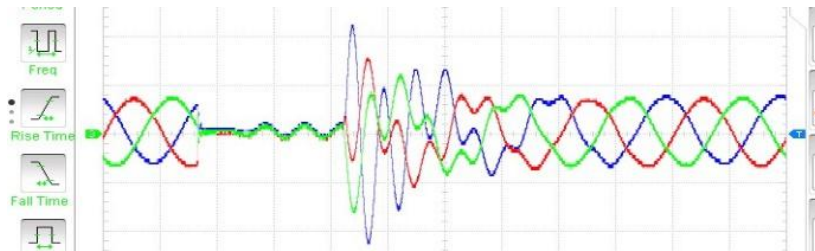
(b) L-L fault



(c) L-L-G fault



(d) L-L-L-G fault



(e) L-L-L fault

Fig. 11: Three phase real voltage signals fault  
 TABLE IV: CA (%) of three phase fault signals

CLASS	DWT		MODWT	
	MLP	HMMs	MLP	HMMs
L-G	75.21	80.0	82.00	80.71
L-L	83.76	78.76	82.01	83.52
L-L _G	86.75	88.33	81.82	85.70
L-L- L-G	74.14	81.17	85.33	91.58
L-L -L	91.42	91.94	88.63	82.41
TOTAL %CA	83.51	85.42	87.35	87.96



## VIII. CONCLUSION

The useful features of the PQD signals have been extracted from the DWT and the MODWT decomposition. The classification accuracy of these simulated and the three phase real signals are obtained by MODWT and DWT with the combination of automatic classifiers such as HMMs, DT and RF. From these aforementioned classifiers, it is observed that although DWT has yielded similar classification accuracy like the MODWT. The down sampling free MODWT provides the proper localization of PQ disturbances along with the shifting. Elimination of down sampling overcomes the restriction in the choice of signal length. The insensitivity to the choice of starting point of time series has made MODWT as a suitable technique in real time environment. The HMMs have classified the fast signals successfully. In case of fault recognition, HMMs have provided good result. Moreover, the HMMs also perform satisfactorily on real time environment.

## IX. REFERENCES

- [1] M. Bollen, "What is power quality?," *Electric Power Systems Research*, vol. 66, no. 1, pp. 5–14, 2003.
- [2] P. Janik and T. Lobos, "Automated classification of power-quality disturbances using svm and rbf networks," *IEEE Transactions on Power Delivery*, vol. 21, no. 3, pp. 1663–1669, 2006.
- [3] S. Khokhar, A. Mohd Zin, A. Mokhtar, and N. Ismail, "Matlab/simulink based modeling and simulation of power quality disturbances," in *IEEE Conference on Energy Conversion (CENCON)*, pp. 445–450, IEEE, 2014.
- [4] D. O. Koval, "Power system disturbance patterns," *IEEE Transactions on Industry Applications*, vol. 26, no. 3, pp. 556–562, 1990.
- [5] A. Gaouda, M. Salama, M. Sultan, and A. Chikhani, "Power quality detection and classification using wavelet-multiresolution signal decomposition," *IEEE Transactions on Power Delivery*, vol. 14, no. 4, pp. 1469–1476, 1999.
- [6] L. Angrisani, P. Daponte, M. D'apuzzo, and A. Testa, "A measurement method based on the wavelet transform for power quality analysis," *Power Delivery, IEEE Transactions on*, vol. 13, no. 4, pp. 990–998, 1998.
- [7] D. Gabor, "Theory of communication. part 1: The analysis of information," *Journal of the Institution of Electrical Engineers-Part III: Radio and Communication Engineering*, vol. 93, no. 26, pp. 429–441, 1946.
- [8] B. Biswal, M. Biswal, S. Mishra, and R. Jalaja, "Automatic classification of power quality events using balanced neural tree," *Industrial Electronics, IEEE Transactions on*, vol. 61, no. 1, pp. 521–530, 2014.
- [9] R. A. Brown and R. Frayne, "A fast discrete s-transform for biomedical signal processing," in *Engineering in Medicine and Biology Society, 2008. EMBS 2008. 30th Annual International Conference of the IEEE*, pp. 2586–2589, IEEE, 2008.
- [10] I. Daubechies, "Orthonormal bases of compactly supported wavelets," *Communications on pure and applied mathematics*, vol. 41, no. 7, pp. 909–996, 1988.
- [11] A. G. Hafez, E. Ghamry, H. Yayama, and K. Yumoto, "A wavelet spectral analysis technique for automatic detection of geomagnetic sudden commencements," *Geoscience and Remote Sensing, IEEE Transactions on*, vol. 50, no. 11, pp. 4503–4512, 2012.
- [12] D. B. Percival and A. T. Walden, "Wavelet methods for time series analysis (cambridge series in statistical and probabilistic mathematics)," 2000.
- [13] M. J. Shensa, "The discrete wavelet transform: wedding the a trous and mallat algorithms," *Signal Processing, IEEE Transactions on*, vol. 40, no. 10, pp. 2464–2482, 1992.
- [14] G. P. Nason and B. W. Silverman, "The stationary wavelet transform and some statistical applications," *LECTURE NOTES IN STATISTICS-NEW YORK-SPRINGER VERLAG-*, pp. 281–281, 1995.

- [15] R. Coifman and D. Donoho, "Translation-invariant de-noising, in wavelets and statistics(a. antoniadis, ed.)," 1995.
- [16] R. Coifman and D. Donoho, "Translation-invariant de-noising, in wavelets and statistics(a. antoniadis, ed.)," 1995.
- [17] J.-C. Pesquet, H. Krim, and H. Carfantan, "Time-invariant orthonormal wavelet representations," *Signal Processing, IEEE Transactions on*, vol. 44, no. 8, pp. 1964–1970, 1996.
- [18] C.-Y. Lee and Y.-X. Shen, "Optimal feature selection for power-quality disturbances classification," *Power Delivery, IEEE Transactions on*, vol. 26, no. 4, pp. 2342–2351, 2011.
- [19] B. Panigrahi and V. R. Pandi, "Optimal feature selection for classification of power quality disturbances using wavelet packet-based fuzzy k-nearest neighbour algorithm," *IET generation, transmission & distribution*, vol. 3, no. 3, pp. 296–306, 2009.
- [20] A. S. Yilmaz, A. Subasi, M. Bayrak, V. M. Karsli, and E. Ercelebi, "Application of lifting based wavelet transforms to characterize power quality events," *Energy conversion and management*, vol. 48, no. 1, pp. 112–123, 2007.
- [21] A. K. Ghosh and D. L. Lubkeman, "The classification of power system disturbance waveforms using a neural network approach," *Power Delivery, IEEE Transactions on*, vol. 10, no. 1, pp. 109–115, 1995.
- [22] S. Hasheminejad, S. Esmaili, and S. Jazebi, "Power quality disturbance classification using s-transform and hidden markov model," *Electric Power Components and Systems*, vol. 40, no. 10, pp. 1160–1182, 2012.
- [23] M. B. I. Reaz, F. Choong, M. S. Sulaiman, F. Mohd-Yasin, and M. Kamada, "Expert system for power quality disturbance classifier," *Power Delivery, IEEE Transactions on*, vol. 22, no. 3, pp. 1979–1988, 2007.
- [24] S. Mishra, C. Bhende, and B. Panigrahi, "Detection and classification of power quality disturbances using s-transform and probabilistic neural network," *Power Delivery, IEEE Transactions on*, vol. 23, no. 1, pp. 280–287, 2008.
- [25] S. Santoso, E. J. Powers, W. M. Grady, and P. Hofmann, "Power quality assessment via wavelet transform analysis," *Power Delivery, IEEE Transactions on*, vol. 11, no. 2, pp. 924–930, 1996.
- [26] C. H. Kim and R. Aggarwal, "Wavelet transforms in power systems. i. general introduction to the wavelet transforms," *Power Engineering Journal*, vol. 14, no. 2, pp. 81–87, 2000.
- [27] D. B. Percival and A. T. Walden, *Wavelet methods for time series analysis*, vol. 4. Cambridge University Press, 2006.
- [28] B. Panigrahi and V. R. Pandi, "Optimal feature selection for classification of power quality disturbances using wavelet packet-based fuzzy k-nearest neighbour algorithm," *IET generation, transmission & distribution*, vol. 3, no. 3, pp. 296–306, 2009.
- [29] T. Zhu, S. Tso, and K. Lo, "Wavelet-based fuzzy reasoning approach to power-quality disturbance recognition," *Power Delivery, IEEE Transactions on*, vol. 19, no. 4, pp. 1928–1935, 2004.
- [30] S. Mohanty, A. Pradhan, and A. Routray, "A cumulative sum-based fault detector for power system relaying application," *IEEE Transactions on Power Delivery*, vol. 23, no. 1, pp. 79–86, 2008.
- [31] L. R. Rabiner, "A tutorial on hidden markov models and selected applications in speech recognition," *Proceedings of the IEEE*, vol. 77, no. 2, pp. 257–286, 1989.
- [32] M. Biswal and P. K. Dash, "Measurement and classification of simultaneous power signal patterns with an s-transform variant and fuzzy decision tree," *Industrial Informatics, IEEE Transactions on*, vol. 9, no. 4, pp. 1819–1827, 2013.

# Microjob.in

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## ABSTRACT

Microjob.in is the Indian website wherein the employers have an indirect access to the workers through the website. The employers make the payment to the website and post the work that need to be done. On the other hand , the workers search for the work on the website and complete the task that they are capable of and in return the website release the payment to them. Freelancers are more likely to prepare by actively re-skilling than non-freelancers — in fact, more than half of freelancers participated in some kind of skill-related education . They're also finding to diversify their services and their clients.The people can work ull time and part time work according to their choice. They are increasingly selecting into a different way of working and increasing their own income

**Keywords :** Microjob, Task, Freelancers, Non-Freelancers, Skill-Related

## I. INTRODUCTION

Microjob.in is the best place for freelancers because there are many microjobs related to social media, graphics design, video and animation, writing, advertising, building backlinks, blog commenting, logo design, business cards, SEO, copy-writing and many more.

Just name any online work and you will find people offering their services in just 99Rs.

They have various categories on their website which you can select as per your skills and start making money online by sitting at your home.

### HOW DOES IT WORKS.?

Microjob.in offers two types of people:

One is the employer and other is the worker.

Employers are the person who wants a task to be done and the workers are the one who complete the task to earn money.

The task is posted on the microjob.in by the employer after depositing the payment that is to be made to the

worker.To avoid any non payment issues, the payment is kept held by the website(microjob.in) . The workers then search task at the website and complete those which they are capable of. After the completion, the workers submit the proof of completing the task as per the employers demand. Then the employers check whether the work has been completed or not.

If the Job is completed , employers mark it as completed and the microjob.in give the payment to the workers. The website also charge certain amount as their commission. The workers are not charged anything. If there is the dispute, the website at it's sole discretion settle the same either in favor of worker or employers.

### HOW WILL I GET PAID?

Microjob.in pay in rupees. Since workers are from india, this website make payments through Payment Service providers like debit or credit card. Some companies also make payments through a check to people in India.

You can find Payment Modes for this websites.

## II. BUSINESS MODEL

### MICROJOB BUSINESS MODEL:

The MICROJOB.IN business model : its very easy to understand. Each user can publish up to Rs 99.

Microjob Prices:

A Basic microjob has the cost of Rs 99  
The cost of service is from Rs 99 to Rs 999

### III. PROPOSED METHODOLOGY

1. **Improve your skills:** skills used by a freelancer are divided into three types of skills. Soft skill is the main part of any business and life. It determines the relationship between any two persons. Any relation depends on soft skills, respect, communication skills, negotiation and others. Secondly improve your experience. To get a job you have to integrate your experience in your field. Use practical training and internet courses since the field experience extends everyday. Your experience has to be up to date especially with the existence of others who update and integrate their experience every hour. After that improve your English skills because that's your way to contact others.

2. **Register in microjob.in website:** register in microjob.in

3. **Use your skills:** use your skill to hunt jobs. Use your skills in writing your coverletter which enables you to make a perfect bid. You have to read the offered job description carefully, some employers examine that by asking to write a word like Coffee at the beginning of your bid. Also use your soft skills to show respect and interest in offered job. Note that people who have skills, without soft skills will lose a lot of offers. English is your way to express about all of previous skills and interest to get the job. Many employers will refuse your bid because you don't have English writing or conversation skills. Finally for any job, you have to be patient and positive.

### IV. DATA ANALYSIS

The sample from website consists of framework of ecommerce freelancers. The profiles of freelancers should be obtained. The error percentage were people who seem to be freelancers, people taken during the search for freelancers .

They are from somewhere else. Note that there is no field in which there is 0% freelancers in some fields as soon as 9% only from freelancers work in companies. It will be so nice if there are companies that collect designers who constitute 32% or collect web developers who constitute 26% or any under the company's umbrella. This distribution gives an indication of Gaza

freelancer's situation. Figure 4-1 shows the highest and lowest freelancer percentage, note that others constitute 40% which indicates normal distribution. (1%) from freelancers are translators, it is not too bad which means the ambitions of those translators. And step by step it will be better for all.

See Figure 1.

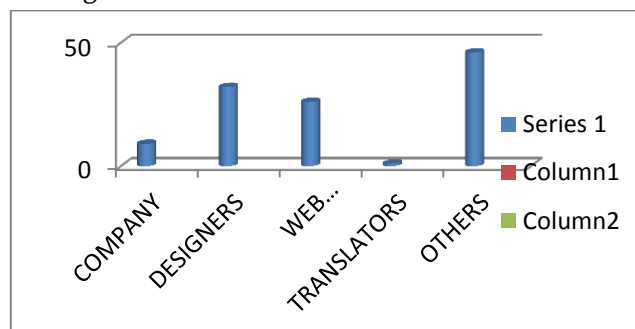


Figure 1. Freelancers Distribution

The model merged with your personal skills. If you care for some skills you don't need a model, you need just to practice. No one can deny the experience role in this field. But you must support and develop these skills. Skills like technical skills, business skills, organizational skills, and interpersonal skills. These

skills are the success secret of any freelancer as shown in Figure 2.

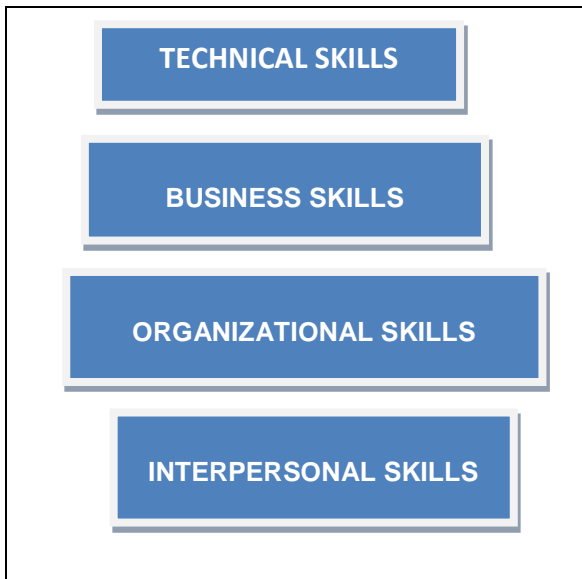


Figure 2. "Principles of successful freelancing" Model.

## V. LIMITATION OF MICROJOB.IN

- 1) The small number of respondents constitutes a limitation to the thesis. With a larger number of respondents, further statistical analysis could have been done.
- 2) The number of respondents was small, mainly due to difficulty in finding contact information of users of freelance marketplaces.
- 3) Freelance marketplaces purposefully do not display the buyers' contact information to prevent disintermediation and thus avoiding paying their fees.
- 4) Very little projects have identifying information, such as the name of the website or product the project relates to. Furthermore, nearly all of the contact with potential respondents was cold, resulting in a lower response rate.

## VI. CONCLUSION

This chapter presents a discussion of the results drawn from this research. The major contributions of the thesis are presented. The principal findings are

summarized. The known limitations of the thesis are discussed. Finally, future research ideas are outlined.

## VII. FUTURE SCOPES

More and more people are attracted to it not because of the money but other factors like increased satisfaction, increased feeling of security provided by trusted platforms which leads to a happier lifestyle where you are your own boss and live and grow on your terms and get paid for stuff you like doing.

This tells us that the future of the freelancers are prosperous and with the corporate structure already penetrating India at an exponential rate, it can be predicted that in time more and more people will move away from its rigid structure and limitations and begin to embrace freelancing as part of their lives. This means the future looks bright for freelancing with a broad, diversified and positive scope of growth.

## VIII. REFERENCES

- [1]. Fivver.com Name of Auhtors, "Title of the research", Citation Details, year. (Times New Roman, Normal, 9pt)Name of Auhtors, "Title of the research", Citation Details, year. (Times New Roman, Normal, 9pt)Name of Auhtors, "Title of the research", Citation Details,year.
- [2]. Brighton Fuse 2
- [3]. Towards the freelancing model of Gaza
- [4]. Success Factors in Leveraging Freelance Marketplaces in Software Development Projects , By Alexandre Walter

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# Bus Driver Fatigue Monitoring and Accident Alert System Based on Analysis of Eye State

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## ABSTRACT

Now a day's traffic is a main problem on roads and causes many accidents. Driver's fatigue is one of the major causes of traffic accidents, particularly for drivers of large vehicles. It causes heavy loss of civilians. In this paper, we propose a vision-based fatigue detection system for bus driver monitoring, which is easy and flexible for deployment in buses and large vehicles. This project reduces those types of accidents. By using sensors and microcontroller we can detect driver fatigue state. In this project we are used mems, eye blink sensors Arduino, relays as hard ware components and wireless data transfer technologies. In this project we have used Arduino microcontroller. Microcontroller detects the sensor signal. Depending on the sensor values microcontroller turns on the buzzer if any accidents occurred then it sends the longitude, latitude positions of the location through GSM. The experimental output shows the advantages of the system on accuracy and robustness for the situations used for driving state monitoring.

## I. INTRODUCTION

Tiredness and lethargy are regularly utilized synonymously in driving state depiction. Including different human variables, it is multidimensional in nature that specialists have discovered hard to characterize over past decades. In spite of the vagueness encompassing exhaustion, it is a basic factor for driving security. Studies have demonstrated that weariness is one of the main contributing components in car crashes around the world. It is especially basic for word related drivers, for example, drivers of transports and overwhelming trucks, because of the way that they may need to work over a drawn out length of the driving undertaking, amid the pinnacle sluggishness periods and under dull or weariness working conditions. Research to identify driver tiredness can be arranged into three classes 1) vehicle-based methodologies, 2) conduct based approaches, and 3) physiological-signal based approaches.

## BLOCK DIAGRAM

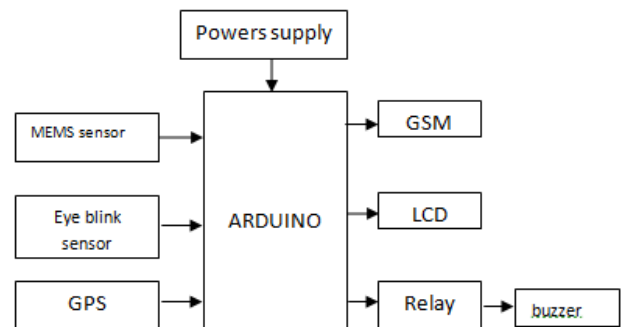


Figure 1

### Hardware requirements:

#### POWER SUPPLY:

Power supply is for providing power to each module. It has transformer, rectifier, filter and regulator each have separate functions.

#### Transformers

Transformers are used for to step down the AC high voltage into low AC voltage. There are two sorts of

transistors. Venture down transformers and advance up transformers. Here we utilize advance down transformers. These transformers are utilized to dispose of some power and give low power yield. Here we utilize 1Amp 12V transformer.

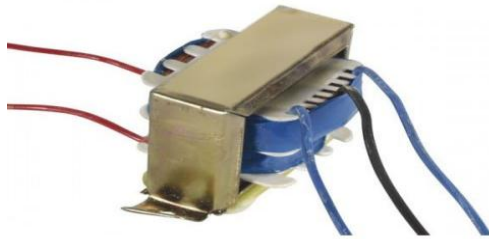


Figure 2

**Rectifier:**

Rectifier circuit is used to change over AC voltage to DC voltage. It is essentially isolated into Full wave and half wave rectifiers. At the point when forward one-sided there will be voltage drop in diodes of around 0.7v. In this way when two Diodes are related together for spread of light of the way there will be a voltage drop of 1.4v since each diode as a voltage drop of 0.7v. Regardless, by virtue of full wave associate rectifier there will be a voltage drop of 0.7v.

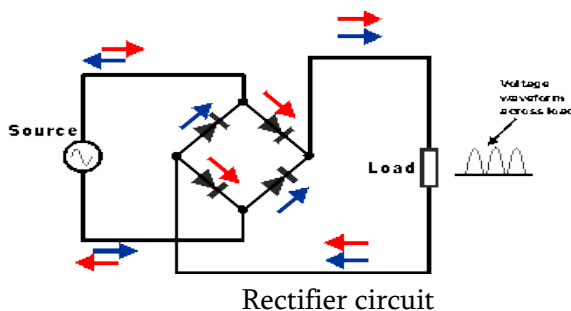


Figure 3

**Voltage Regulator:**

The 78XX voltage controller is fundamentally general used controller for voltage controllers. The XX addresses the voltage of which the voltage controller conveys as the respectthe particular device. 7805 will convey and control the yield voltage of 5v.

**MEMS SENSOR:**

The MEMS accelerometers can be divided into two important micro system architectures: piezo resistive and capacitive. Even though both of these two types of accelerometers possess internal proof masses which are excited by acceleration, the differences of these two architectures lie in the transduction mechanism which is used to the movement correlation of the internal proof mass to accelerate.

The Capacitive accelerometers possess a differential capacitor whose balance is disrupted by the proof mass movement. Piezo resistive accelerometers commonly rely on inducing, which attach the proof mass to the sensor which is used for identification of the movement of the mass.

Fujitsu successfully developed the 'FAR-S2AB' series, 3-axis Accelerometer, using state-of-the-art MEMS technology. This small and highly sensitive accelerometer can detect acceleration, inclination and vibration by measuring the motion in the x-, y-, and z-axis simultaneously. The MEMS 3-axis accelerometer consists of a Mass at the centre of the sensor's chip, which is suspended by 4 Beams doped with resistive material.

By sensing the mounting angle, the sensor can assist in compensating for the devices mounting angle, and therefore makes it possible to use ACCELEROMETER FACTSHEET MEMS 3-AXIS ACCELEROMETER normal SMD technology in high density boards, and also to realise the precise detection of the inclination angle. An interface IC within the sensor package also has temperature sensing and self-diagnosis functions.

**EYE BLINK SENSOR:**

This project involves measure and controls the eye blink using IR sensor. The IR transmitter is used to transmit the infrared rays in our eye. The IR receiver is used to receive the reflected infrared rays of eye. If the eye is closed means the output of IR receiver is

high otherwise the IR receiver output is low. This to know the eye is closing or opening position. This output is give to logic circuit to indicate the alarm.



Figure 4

**Arduino:**

The Arduino Micro Controller is a to a great degree simple to use and introduced on an unmarried chip. It is an In-System-Programmable Device this suggests the client haven't any need to use the discard the IC, we can immediately join the Arduino to the PC and picking the most ideal COMM port. The Arduino has many sorts like UNO, MEGA and various others; here we use Arduino UNO board. The UNO board will show up thusly.



Figure 5

**ATMEGA328P FEATURES:**

- Elite constancy, Low Power use with 8-Bit Microcontroller.
- Advanced Reduced Instruction Set Computer (RISC) Architecture which has the going with parts as takes after
  - ❖ It has 131 Strong Instructions.
  - ❖ Most executable instruction is single clock cycle.
  - ❖ It escort totally static operation
- ❖ It has senior non-whimsical Memory Segments

- ❖ It has 32 KB In-scheme self-designed Flash memory
- ❖ It has 1KB EEPROM
- ❖ It has 2KB Intramural static RAM
- ❖ facultative boot code territory with self-deciding jolt bits which has both In-System planned by on-chip boot loader program and absolute read while create operation
- The program can bolted with the help of the item security.
- A segment of the periphery components are according to the accompanying
- ❖ There are two 8-bit clocks counters with free re-scale and consider mode
- ❖ There are two 8-bit clocks/counters with independent re-scale and think about mode
- ❖ It has consistent counter with detached oscillator work
- ❖ It has six pulse width modulation channels
- ❖ It has 10-bit analog to digital converter in TQFP and QFN
- ❖ An arrangement of 10-bit ADC in Plastic DIP
- ❖ A USART for serial communication
- ❖ There are two-master slave SPI linkup's
- Special features of the microcontroller are detailed:
  - ❖ It was reset when power on.
  - ❖ It has on chip internal Oscillator
  - ❖ An extra 6 sleep modes are available, stand-by mode is also available
  - ❖ It has 28 Input and Output lines in plastic DIP
  - ❖ It was operate in 1.8 - 5.5 Volts

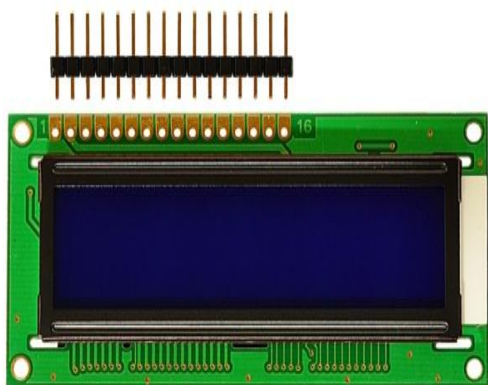
**LCD:**

LCD (Liquid Crystal Display) screen is a digital display module and discover a vast hodgepodge of employments. A 16x2 LCD show is fantastically basic module and is commonly used as a piece of numerous gadgets and circuits. These modules are supported more than seven elements and different multi segment LEDs.



The fee enlist shops the summon directions given to the LCD. A summon is a heading given to LCD to do a predefined undertaking like presenting it, clearing its show, setting the cursor work, controlling exhibit et cetera. The measurements enroll shops the insights to be appeared on the LCD. The facts are the ASCII estimation of the character to be proven at the LCD. Snap to soak up more about inner structure of a LCD. There are numerous styles of LCD's like 16x2 and 20x4. Here on this challenge we use 16x2 LCD. Here we use dot matrix LCD.

**PinDiagram:**



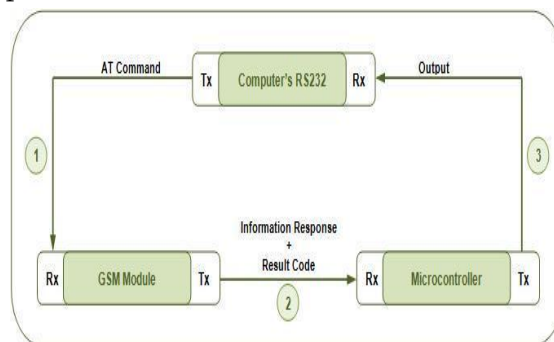
**Figure 6**

**GSM:**

It is a standard set made by the European Telecommunications Standards Institute (ETSI) to depict traditions for second time (2G) electronic cell frameworks used by mobile phones. A Modem is a gadget which tweaks and demodulates motions as required to meet the correspondence necessities. It regulates a simple transporter flag to encode computerized info, and furthermore demodulates such a bearer flag to interpret the transmitted data.

A GSM/GPRS module has a MAX-232 interface for serial response with an outside World. For this circumstance, the transmitter (Tx) of the PC's Serial port is connected with the Receiver (Rx) of the GSM module's MAX-232 interface. The transmitter (Tx) of

the MAX-232 of GSM/GPRS module is related with Receiver (Rx) of microcontroller's serial transmission stick. Besides, the serial transmit stick of the microcontroller is related with the get stick of the PC's Serial port. In this way the summons and their results are transmitted and gotten in a triangular way as depicted underneath.



**Figure 7**

In resulting ventures (see MC075 and MC076), the HyperTerminal will be supplanted by the microcontroller itself; along these lines staying away from the need of utilizing a Computer to set up an interface. This would prompt a free GSM based framework. The microcontroller is modified to get and transmit information at a baud rate of 9600. For more points of interest on setting the baud rate of microcontroller, elude serial correspondence with Arduino

GSM module is interfaced with Arduino Processor by adjusting the TX, RX and ground pins in it. The instruction to the GSM is altered in the code itself when there is need of the GSM, ARM processor initiates the instruction through the AT (Attention Commands) such as AT, ATEO, AT+CMGF, AT+CMGS etc;

**GPS**

GPS is used in vehicles for both tracking and navigation. Tracking systems enable a base station to keep track of the vehicles without the intervention of the driver where, as navigation system helps the driver to reach the destination. Whether navigation

system or tracking system, the architecture is more or less similar. When an accident occurred in any place then GPS system tracks the position of the vehicle and sends the information to the particular person through GSM by alerting the person through SMS or by a call.

### Introduction to GPS functions/features

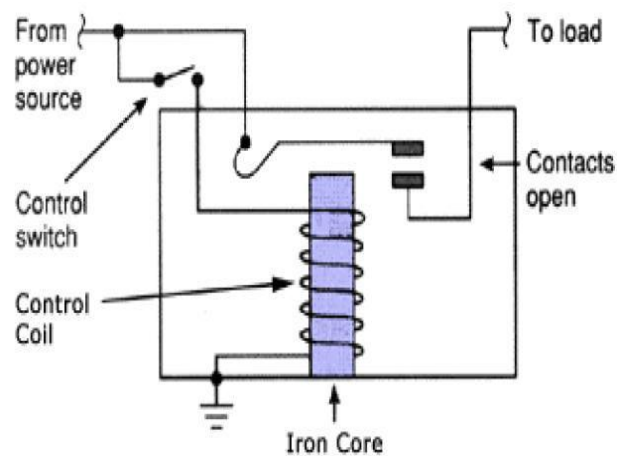
GPS use satellite data to calculate an accurate position on the earth. These calculations can relate the user's position to almost any map projection within milliseconds. All GPS work in a similar manner but they often look very different and have different software. The most significant difference between GPS receivers is the number of satellites they can simultaneously communicate with. Most receivers are described as 12 channels meaning they can communicate with 12 satellites. Older models may be 8 or even 5 channels with more modern receivers capable of communicating with 14 – 20. Given the current (2005) makeup of the GPS satellite's constellation 12 channel is more than adequate.

Almost all units have an LCD screen or at least software that links to a PC/PDA with an output screen. The unit might have several different pages that can be displayed on screen but usually the default page is very similar. Commonly on starting a receiver you will be presented with a map of the satellites in view. The GPS receiver shows a view of the sky split into four quadrants. These represent the NE, SE, SW, NW parts of the sky, with the concentric circles representing the horizon at 90° from the zenith, with the inner circles representing 60° and 30°. The cross at the centre represents the zenith. The dots/circles represent the satellites and the bars at the bottom represent satellite signal strength. The higher bar the stronger the signal. This display is typical of a 12 channel set. The dots and bars will commonly be labeled with a number to represent the identity of the satellite. The bars are commonly either hollow or solid (usually white or black on a monochrome display). Hollow lines represent a satellite for which

the Ephemeris data is not known. It is therefore not being used to calculate a position. Black bars represent "Fixed" satellites whose ephemeris data has been collected successfully. These satellites are thus available for calculating a position. This is not consistent across all models and some may use grey bars as well as hollow bars to represent satellites not yet fixed.

### Relay:

We know that most of the high end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their applications. Most of the devices have the application of relays.



Relay construction

**Figure 8**

The diagram shows an inner section diagram of a relay. An iron core is surrounded by a control coil. As shown, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control coil, the electromagnet starts energizing and thus intensifies the magnetic field. Thus the upper contact arm starts to be attracted to the lower fixed arm and

thus closes the contacts causing a short circuit for the power to the load. On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit.

As soon as the coil current is off, the movable armature will be returned by a force back to its initial position. This force will be almost equal to half the strength of the magnetic force. This force is mainly provided by two factors. They are the spring and also gravity.

Relays are mainly made for two basic operations. One is low voltage application and the other is high voltage. For low voltage applications, more preference will be given to reduce the noise of the whole circuit. For high voltage applications, they are mainly designed to reduce a phenomenon called arcing.

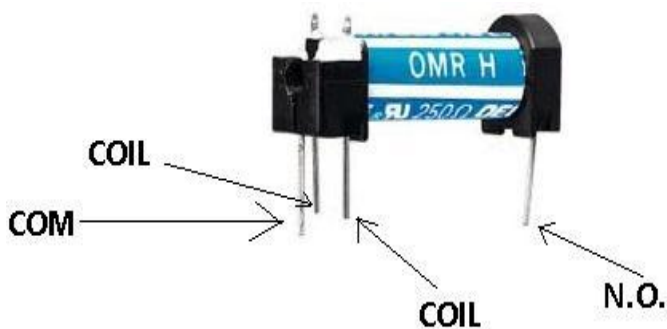


Figure 9

### 1) Terminal Descriptions

**COIL-** This is the other end of the coil. These are the terminals where you apply voltage to in order to give power to the coils (which then will close the switch). Polarity does not matter. One side gets positive voltage and the other side gets negative voltage. Polarity only matters if a diode is used.

**NO-** This is Normally Open switch. This is the terminal where you connect the device that you want the relay to power when the relay is powered, meaning when the COIL receives sufficient voltage. The device connected to NO will be off when the relay has no power and will turn on when the relay receives power.

**COM-** This is the common of the relay. If the relay is powered and the switch is closed, COM and N.O. have continuity. This is the terminal of the relay where you connect the first part of your circuit to.

### BUZZER:

A Buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as microwave oven. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong(which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Sonalert which makes a high-pitched tone. Usually these were booked up to “driver” circuits which varied the pitch of the sound or pulsed the sound on and off.

In game shows it is also known as a “lockout system”, because when one person signals (“buzzes in”), all others are locked out from signaling. Several game shows have large buzzer buttons which are identified as “plungers”.

The word “buzzer” comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles.



Buzzer  
Figure 10

### Software Description:

#### Arduino IDE:

The Arduino IDE programming is an open source programming, where we can have the case codes for the apprentices. In the Present world there is lot of version in the Arduino IDE in which present usage is Version 1.8.5. It is very easy to connect the PC with Arduino Board.

#### WORKING:

In this system Towards Detection of Bus Driver Fatigue Based On Robust Visual Analysis of Eye State the sensors are continuously monitors the driver condition of his drowsiness if he is in feel sleepy mood then it alerts the driver by buzzer. If any accidents are occurred the mems sensor get activated then controller tracks the location using GPS and sends the message to the rescue team like police, hospital etc...

## II. CONCLUSION

In this paper, we presented a sensor-based method and system towards bus fatigue detection in vehicles. Our approach is based on electronic sensors and devices. Exploratory outcomes demonstrate that our proposed strategy can recognize the recreated languid and sluggish states from the typical condition of driving. Hence, our system might be able to effectively monitor bus driver's attention level without extra requirements.

### APPLICATIONS:

Very useful in every heavy vehicle

### ADVANTAGES:

- ✓ Low power consumption
- ✓ More reliable
- ✓ More compatible

## III. REFERENCES

- [1]. W. Dement and M. Carskadon, "Current perspectives on daytime sleepiness: The issues," *Sleep*, vol. 5, no. S2, pp. S56–S66, 1982.
- [2]. L. Hartley, T. Horberry, N. Mabbott, and G. Krueger, "Review of fatigue detection and prediction technologies," *Nat. Road Transp. Commiss., Melbourne, Vic., Australia, Tech. Rep.*, 2000.
- [3]. A. Sahayadhas, K. Sundaraj, and M. Murugappan, "Detecting driver drowsiness based on sensors: A review," *Sensors*, vol. 12, pp. 16 937–16 953, 2012.
- [4]. S. Kee, S. Tamrin, and Y. Goh, "Driving fatigue and performance among occupational drivers in simulated prolonged driving," *Global J. Health Sci.*, vol. 2, no. 1, pp. 167–177, 2010.

# Achieving Advance Security System over Raspberry Pi Controlled via Android Application

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## ABSTRACT

As we have seen the tremendous development in the human life, we found that even after the improvement in the technology still lacks many scopes. The technology needs an increasing and advancing in the technology. The most trending technique in the human life is face detection security. The various techniques are available such as entry controlled security, door intercoms, etc. The main technical aspect of face detection security is the image capture by camera as like human eye. The cameras in the present time are digital and their working and performances are improving the image capture process. When any camera takes the image, it may get error due to additive noise or other factors; that's why they need image processing algorithms for detecting the various phenomena such as background, image edges, grey levels, etc. for this purpose we have several amount of image processing algorithms such as Haar, PCA, etc. Hence to create a better image processing we are using advance PCA algorithm. This algorithm can be compatible on the automation instrument such as, microcontroller, raspberry pi, etc. The raspberry pi as a controlling instrument thus for the best result along with the cost effectiveness. This instrument provides the ability of the store data in the form of database. The android applications used for this system will help us to control the existing scenario from remote place. The future scope for this security system are too many such as car security, cabin security, etc. this system can be much useful to society as it can be implemented in every area with some changes. Thus this system is much useful for existing and futuristic conditions. This paper consists of the extended work review of the face detection project based on the raspberry pi module.

**Keywords:** DC Motor, GSM Module, LCD Display, Raspberry Pi Module, Pi Camera, Wireless Network

## I. INTRODUCTION

Face detection based security systems evolution creates the optimized security system which restricts the entry of unknown. There were so many new technical instruments like door intercoms but the security was still the question of matter as it is not that much compact and have no storage. So to improve the existing security and reduce the risks we come with this advance PCA algorithm for face detection based security.

A Face recognition System is a system which usually automatically identifies or verifies the identity of a person from digital images or a video frames from a video source and allow the user to interface with scenario. The image capture and identification is done by OPEN CV and stores in database.

The basic work structure of our face detection system is: - the camera captures the image. After this, using advance PCA algorithm, system compares the captured images with data base images which provide

the result as image matched or not. Based on comparison result GSM module sends a security alert to the authorised person which is 'person identified. You can enter now.' or 'unknown intruder trying to unlock, take action'. But, if the unknown person is in knowledge with authorized user then the authorised user will provide the entry to that person by using the android application. As soon as the door gets unlocked it will reset the system.

## II. LITERATURE REVIEW:

The author Akshay N. Patil and et al [1] describes the working of the face recognized door unlocking system in which they use the raspberry pi along with the GSM module. This module contains a secured face recognizer for automatic door opening. In this project they have the facility of the informing to the user regarding the door unlocking. But, this system lags the feature of making the door unlocking for known persons to the user. This system uses the basic PCA algorithm to execute the process, but still lacks in many feature; hence need to improve.

The author Sarath Chandu Gaddam and et al [2] describes the working of face recognized attendance system in which they use raspberry pi along with GSM module and Ethernet cable. In this project the automatic attendance of the students can be possible without wasting the time and send the attendance to the respective student after 24 hours. But, this system lags the feature of making the latecomers attendance available. In this system they have used the Eigen algorithm to execute the system, but due to huge mathematical calculation there may be chance of failure. Hence need to improve.

The author K.Shiva Prasad and et al [3] describes the working of the technique for real time human face detection and tracking using a modified version of the algorithm by using the raspberry pi module along with USB camera. In this project Simulation results of this developed algorithm shows the Real time human

face detection and tracking supporting up to 50 human faces. This lags the feature of the making more than 50 faces storage in the database. This system uses the viola jones algorithm for the execution but this system lacks the efficiency in the harsh backlighting and occlusions.

The author Mr. Ashwin K Kashyap and et al [4] describes the working of face recognition using raspberry pi module by using the python language. In this project the saved faces are detected using OPEN CV simulation. But, this project lags the feature of informing the user regarding the any unknown intruder and hence any burglary. This system uses the HAAR algorithm for execution but this system to depend on the OPEN CV simulation.

The author Akshay Kumar C and et al [5] describes ORB-PCA based face extraction technique for face recognition to overcome the problems of SIFT-PCA and SURF-PCA techniques. It improves the efficiency in face detection and also reduces the face detection time in comparison to other PCA techniques. But this technique is very much complex and much may produce the errors while combining the results of ORB and PCA techniques. Hence need to improve.

The author Hemant Makwana and et al [6] describes comparisons in various types of face detection algorithms such as geometry based and face appearance based algorithms. This kind of comparison will be helpful in the construction of this project.

The author Sungyoung Lee and et al [7] describes improvement in the PCA algorithm for face recognition which shows that the PCA algorithm can be improved and some of this improved features will be used for our project.

The author Ms. Varsha Gupta and et al [8] describes study of various face detection methods which focuses on the adaptations in various face detection algorithms such as Viola-Jones, LPB, Adaboost, SQMT. This kind of literature will be helpful.

The author Liton Chandra Paul and et al [9] describes face recognition using principle component analysis method which shows the statistical approach to reduce the variable based on the eigen values. This paper shows the image identification along with changes in poses. This system will help to produce a good face detection result. But this system only deals with the eigen values and if this values may get mismatch for huge amount of images hence need to improve.

The author Santosh Kumar and et al [10] describes advance approach for faced detection using PCA algorithm and region based colour segmentation which Eigen values and noise removal in image. This system may get failed if there may have any noise disturbance. Practically this system is for testing captured images with stored images in database and based on that it will give result. This technique achieves much higher efficiency and execution time reduces but don't have ability to provide self-storage as well as reduction in errors. Hence need to improve.

The author Sougata Das and et al [11] describes a embedded system for home automation using SMS where the system uses the microcontroller as a main controlling component. In this system GSM module was used and it sends the SMS over the authorised users cell. In this system the the appliance condition can be monitored over a remote place. The status is send over the wireless network. Hence it provide the wireless control. But the system uses the GSM module along with microcontroller and some electronic circuit making system more bulkier and even more complicated when it comes to improvement. Hence it needs to improve and it comes with a raspberry pi module.

The author Kuen-Min Lee and et al [12] describes the an intelligent universal remote control system for home appliances uses the IOT technology for creating the point – n – press remote controller. In this system IR transceiver is used to connect the home appliances.

This leads to the reduction in the malfunctioning of the appliances and also creates a user controlled system which leads to the simplification of life. As this system is connected to the various time varying systems, it will create deterioration in performance in the system as long it works. Also this system totally depends on the IR transceivers work hence may get complicated when in any disturbance. Hence need to improve.

The author Mrutyunjaya Sahani and et al [13] describes an wireless network based system for monitoring of the kitchen on the internet. In this system it uses GSM model and zigbee and microcontroller as a sensor module. This system works for the any kind of extreme scenario such as fire ,LPG detection, room temperature,etc. it send message or email over the wireless network and allow the user to take action. But as we know this kind of system works on the JAVA. Hence it may create confusion when detection of so many kind of gases has to do. Hence proper care has to be taken. Hence need to improve.

The author Biplav Choudhury and et al [14] describes the sms based home security system. This system is equipped with the GSM module, microcontroller, etc. to control the android over the remote place. Hence it is cost very negligible when comparing to other security system. But this system mostly works on the GPS performance and the advancing GPS in todays time limits the scope of this system. Hence need to improve the system and also to increase its performing areas.

The author H. K. Merchant and et al [15] describes the industrial automation using IOT with raspberry pi, this system is equipped with the bulb, various sensors such as hall, PIR, smoke, etc. This system is used for the measurement of the current consumption of cutting tool and checks the condition of blade and temperature from the remote place by creating the webpage. This system uses various sensors and need various connections and this creates very much bulkier system and this will lead to early wear and

tear of the system. Hence it is very limited use system as considering automation. Thus needs to improve.

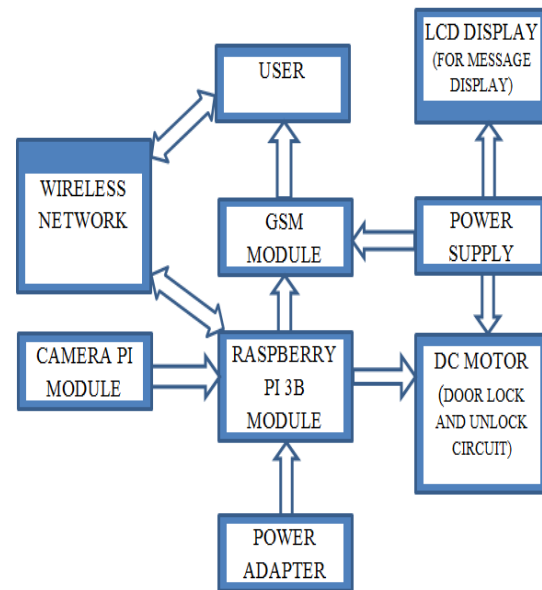
The author Kalyani Pampattiwar and et al [16] describes the home automation using raspberry pi controlled via android application. This system uses webcam, android applications, and speakers along with the Gmail using the raspberry pi as a controller. This system is basically a home automation as well as alarm system of the home devices. This system provides the information of the home appliances conditions and also allows making this appliance to operate from remote place. This system gives these features at low cost. But this system is very basic as it can give only the limited coverage but if improve this system we will definitely have a compact and a comfortable automation system which can be useful in every case.

The author Aniket V Joshi and et al [17] describes the IOT based home automation using raspberry pi. This system consists of relay and relay driver circuit, mobile device along with the raspberry pi as a controller. This system is a server and client based. This system is also a use the php software and thus makes it work on the pc – based automation. Also this system is only limited to only certain areas and hence it is very small scope and complex as it needs the UI on the web. Hence need to improve and simplify.

The author Sneha Kasrung and et al[18] describes the development of smart home security system using raspberry pi. This system consists of HDMI cable, relay interface circuit, LAN cable along with raspberry pi as a controller. This system uses the android application and it gets activated only when fan and light button is pressed on cell. This will gives the home condition of appliances. But when considering to home automation this concept can be very small if the current and other parameters are not defined properly. Hence it needs to improve along with proper parameter in control.

### III. PROPOSED SYSTEM

#### A) BLOCK DIGRAM



**Figure 1.** block diagram of “achieving advance security system over raspberry pi controlled via android application”.

#### B) COMPONENTS

In above figure 1 shows the basic block diagram of “achieving advance security system over raspberry pi via android”. The component working is described as follows:

**Pi Camera module:** Camera module is Pi camera interfacing to the raspberry pi module. It is used for captures an image and send captured image to the Raspberry pi 3B module. The captured images are used to create the database. This will also help to take videos in fraction of times if destined for it.

**Raspberry pi 3B module:** Raspberry pi 3B module is small computer board. When image taken by the pi camera, it is compared with stored face image. At the first time when we capture the image to create a data base raspberry pi module using pi camera captures six types of the images to create a data base in the system based on the different texture and intensity of light



and this data base is compared with the live captured image. After comparing two images output is positive/negative; and based on the output response then it gives commands to GSM module and rest of the system.

**GSM module:** GSM module i.e. sim 900(GPS/GPRS module) is used to sending a message to the authorities after comparing the images based on whether output is positive or negative. If output is positive then "Person Identified!!you can enter now!!" message send to the authority person otherwise send "unknown person is trying to unlock the door". If the unauthorised person is detected then the motor will block the door. If the unknown person is known to authorised user, the user through his android application will open the door for that person.

**Display:** The 16 pin LCD display will be a key instrument while checking the systems proper working. The LCD display will show every action of the system whether it is of camera or it is of GSM, it will give information regarding every action.

**Wireless network:** this network is basically a wireless network, in which the captured image of unknown person is send over the network to the authorizer users Gmail account. This will also help to interface the user with the system in the existing conditions. Also the android application will help the user to control the direct entry of the unknown intruder. The wireless network is also providing the platform to the have various controls such as automations, health care, security, etc.

**Dc motor:** the dc motor is the simple rotating device which has the ability to work as an blocking device. This motor is having the rotations and this will help user to program this motor for both clockwise and anti-clockwise rotation. In our proposed system the working of dc motor is controlled by motor driver IC.

This will also help the user to control the direct entry of the intruder.

### C) WORKING

Figure 1 shows the block diagram of the "achieving advance security system over raspberry pi controlled via android application". This system is basically Internet of Things (IOT) system. The working of this system can be explained as follows:

Our project system can be viewed in two different sections, i.e. one for capturing and creating a data base and the other section is to capture the image and which is used for identifying or comparing the images in the database.

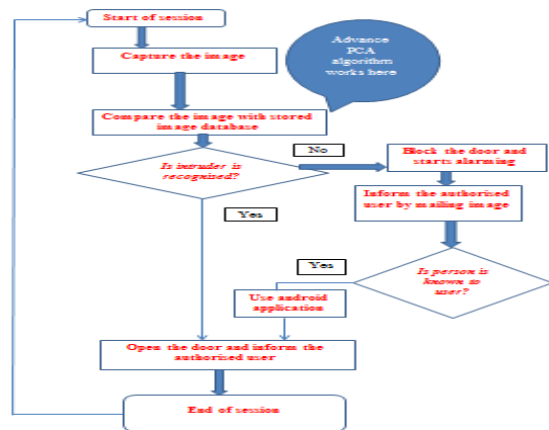
When first the system gets on, the LCD display will shows the message regarding the pi cameras on/off status. When the camera gets on, it starts to take images. When it takes the images of intruder, it compares the captured image with the images stored in the system database. Based on the result of comparison it produces the signals for the system to proceed. The captured image if gets matched with the database image, the LCD shows that "the person is identified; you can enter now". The same message is send over the GSM module to the authorised user.

If the captured image is not matched with the database image, it then blocks the door and the buzzer starts ringing. The LCD displays "the unknown person is detected. Door is blocked". The same message is send over the GSM module to authorised user along with the captured image of unknown intruder. If the unknown intruder is known to user then the user can allow that intruder to enter by using the android application from his cell. This will help the authorised user to interface the existing scenario from the remote place. As soon as the door gets open the buzzer stops ringing and system gets reset.

In this way the system is very useful to the security where there is no any minute mistake is allowed. The

ringing buzzer allows the surrounding people to know that the unknown person is entered in the premises. This system is very low power consuming and also is very powerful enough to produce a well eco-friendly and economic system in the terms of security for any kind.

#### D) FLOWCHART



**Figure 2.** Flowchart of “achieving advance security system over raspberry pi controlled via android application”.

The system first starts to take initialise by checking whether the camera is on. The pi camera module the starts to take images and this captured images are compared with the images stored in the database. This gives rise to two conditions:

##### 1) When the intruder is recognized:-

The pi camera will first take the image and send it to the raspberry pi module. The raspberry pi module will then compare the captured image with the stored images in database. The advance pca algorithm comes in the action by comparing the captured image with stored images and based on this it produce the results. If the result is positive then door gets unlocked; the system informs the authorised user that “identified person has got entry” over the GSM module and the system gets reset.

##### 2) When intruder is not recognized:-

When the result is negative, the system blocks the door and alarm starts ringing informing nearby about the unknown is trying to unlock the door. The system sends the message to the authorised user that “unknown intruder is trying to unlock the door” and also the system sends the image of the intruder to authorised used over the wireless network to user’s Gmail account. If the intruder is known to the authorised user, he can allow the intruder to enter by using the android application in his cell. As soon as the door gets unlocked, the ringing alarm stops alarming and system gets reset.

#### IV. APPLICATIONS

The “ achieving advance security system over raspberry pi controlled via android application” is basically based on embeded security system; the applications of this project are not limited as the each application gives rise to the new applications. so it can be implement in the following area of securities; for example,

- In car security.
- In home security.
- In budgeted industies .
- In survillance from remote place(depending on the communication network).
- In the office cabins.
- In the shopping malls , etc.

#### V. FUTURE SCOPE:

There are many future scopes regarding this project such as follows: -

1. If the condition improved, we can implement this system by using multimedia GSM module,in future.
2. To achieve more sound security, we can use the iris scan method.
3. To improve the system peformance, we can use the advance versions of the raspberry pi module as per requirement.

4. If needed, we can make this system to be used in the air services.

## VI. REFERENCES

- [1]. Akshay N. Patil, Rohit B. Ranavare, Dayasagar V. Ballal: "Raspberry pi based face recognition system for door unlocking", International journal of innovative research in science and engineering vol.no.2,issue 3 march 2016.
- [2]. Sarath Chandu Gaddam, N. V. K. Ramesh and Hema dhanekula: " face recognition based attendance management system with raspberry pi 2 using eigen faces algorithm", ARPN Journal of Engineering and Applied Sciences vol. 11, no. 13, July 2016 ISSN 1819-6608
- [3]. K.Shiva Prasad: "Human Face Detection and Tracking Using Raspberry PI processor", International Journal & Magazine of Engineering, Technology, Management and Research, Volume No: 2 (2015), Issue No: 8 (August)
- [4]. Mr. Ashwin K Kashyap, Mr. Abhishek S, Mr. Abhishek S A, Ms. Ratnakumari. C: " Face Detection using Raspberry Pi and Python", National Conference on Product Design (NCPD 2016), July 2016.
- [5]. Vinat A., Akshay Kumar C., Gaurav Shenoy,K.N. Balasubramanayam Murthy, S. Natarajan: "ORB-PCA based features extraction technique for face recognition", second international symposium on computer vision and internet-2015.
- [6]. Hemant Makwana & Taranpreet Singh: "Comparison of Different Algorithm for Face Recognition", Global Journal of Computer Science and Technology Graphics & Vision Volume 13 Issue 9 Version 1.0 Year 2013
- [7]. Vo Dinh Minh Nhat and Sungyoung Lee:" An Improvement on PCA Algorithm for Face Recognition", J. Wang, X. Liao, and Z. Yi (Eds.): ISNN 2005, LNCS 3496, pp. 1016.1021, 2005. © Springer-Verlag Berlin Heidelberg 2005
- [8]. Ms. Varsha Gupta, Mr. Dipesh Sharma: "A Study of Various Face Detection Methods", International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 5, May 2014
- [9]. Liton Chandra Paul1, Abdulla Al Sumam2: " Face Recognition Using Principal Component Analysis Method", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 1, Issue 9, November 2012
- [10]. Santosh Kumar, Ajmer Manish Mathuria, Atul Chaudhary, Ajmer Kailash Rathore: " An Advance Approach Of Face Recognition Using PCA And Region Base Color Segmentation", International Journal Of Computer Applications (0975-8887) Volume 89-No 17, March 2014
- [11]. Sougata Das, Nilava Debabhuti, Rishabh Das, Sayantan Dutta, Apurba Ghosh:- " Embedded System For Home Automation Using Sms", International Conference On Automation,Control,Energy And Systems(Aces),Feb 2014,978- 1 -4799- 3732-5/14@2014 IEEE
- [12]. Kuan-Min Lee, Wei-Guang Teng,Ting Wei Hon:- " Point-N –Press: An Intelligent Universal Remote Controlsystem For Home Appliances", Ieee Transactions On Automation Science And Engineering, 1545-5955@2016 IEEE
- [13]. Mrutyunjaya Sahani, Avinash Nayak, Rishabh Agrawal, Debhanshu Sahu:- " A Gsm, Wsn And Embedded Web Server Architecture For Internet Based Kitchen Monitoring System", International Conference On Circuit, Power And Computing Technologies(Iccpct), 978-1-4799 -7075-9/15@2015 IEEE
- [14]. Biplav Choudhary, Tameem S. Choudhary, Aniket Pramanik, Wasim Arif,J. Mehandi:- " Design And Implementation Of An Sms Based

Home Security System",978-1-4799-6085-9/15@2015 IEEE

- [15]. H. K. Merchant, D. D. Ahire:- " Industrial Automation using IoT with Raspberry Pi", International Journal of Computer Applications (0975-8887) Volume 168-No.1, June 2017
- [16]. Kalyani Pampattiwar, Mit Lakhani, Rinisha Marar and Rhea Menon:- " Home Automation using Raspberry Pi controlled via an Android Application", International Journal of Current Engineering and Technology E-ISSN 2277-4106, P-ISSN 2347-5161 ©2017 INPRESSCO®
- [17]. Prof B.P Kulkarni, Aniket V Joshi, Vaibhav V Jadhav, Akshaykumar T Dhamange:- " IoT Based Home Automation Using Raspberry PI", International Journal of Innovative Studies in Sciences and Engineering Technology (IJISSET) ISSN 2455-4863 (Online) www.ijisset.org Volume: 3 Issue: 4 | April 2017
- [18]. Pragati Ukey, Anita Shinde,Sneha Kasrung, Satish Kamble,Jidnyesh Kadu:- " Development Of Smart Home security system using Raspberry Pi", International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 06 | June -2017 p-ISSN: 2395-0072

# Comparative Study of Electro – Discharge Machining with the use of Additional Rotary Tool EDM Performance During Machining of EN-8 Material

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## ABSTRACT

Electrical Discharge Machining (EDM) is a non-conventional machining process in which the machining takes place through spark erosion between tool electrode and workpiece. EDM is used for hard materials which are generally difficult to machine using conventional machining method. Research has been done by comparison of EDM with Rotary EDM with the use of additional rotary attachment on EDM to improve its performance measures like Material removal rate (MRR), tool wear rate (TWR). Various researchers have performed the work on various types of EDMs like Die Sinking EDM, Dry EDM, Powder Mixed EDM (PMEDM) and Wire EDM (WEDM) etc. In this paper objective is to compare EDM with rotary EDM. In this paper there is also a depiction about the machining and non-machining parameters used during the particular research work. In Present paper the research work done on rotary and EDM to improve its performance measures like MRR & TWR.

**Keywords:** Electrical Discharge Machine, Rotary tool EDM, Material Removal Rate, Tool Wear Rate

## I. INTRODUCTION OF ROTARY TOOL EDM

In rotary EDM, rotational movement is imparted to the tool electrode immersed in a dielectric fluid during the machining process. The upper plate of the attachment was attached to ram of EDM machine. DC motor drive provides the rotary motion to the tool electrode. A tool chuck was provided at the bottom of the assembly to hold the tool electrode. In this process cylindrical solid or hollow tube electrode can be used to machine the materials.

The rotary motion is an additional motion imparted to the tool electrode as compared to die-sinking EDM.

The various components of the rotary spindle attachment fabricated for the development of Electric Discharge Surface Grinding (EDSG) experimental set up on EDM machine. Setup is used to generate rotary motion for the electrode and is fixed with the quill of the machine. DC motor is attached with the clamp and further with its main spindle. The input voltage is supplied to the rotary arrangement by the DC power supply.

A schematic drawing shown in Fig. 2 and 3 illustrates the fixing of rotary arrangement with the main spindle of the machine. Rotary motion is transferred from horizontal plane to the vertical plane

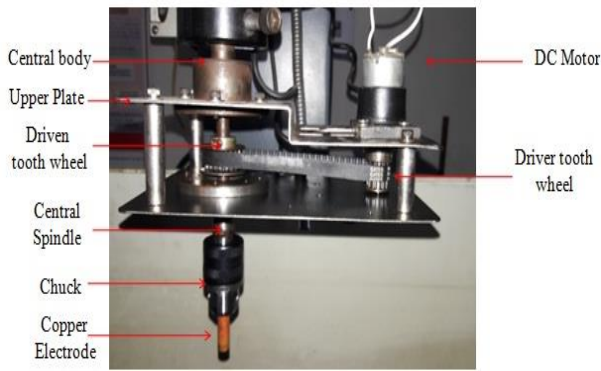


Figure 2 : Rotary Attachment

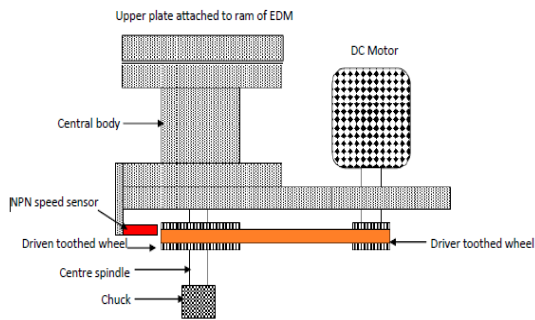


Figure 3 : Components of the electrode rotational attachment

**II. SURVEY ON EDM & ROTARY TOOL EDM**

Chattopadhyay et.al (2008) examined the machining characteristics of EN-8 steel with copper as a tool electrode during rotary electrical discharge machining process. In the case of MRR and EWR, it has been examined that the decrease in pulse on time, decrease in electrode rotation and increase in peak current, increases both the machining output.

Chattopadhyay et.al (2009) explored the machining qualities of EN-8 steel with copper as a tool electrode during rotary electrical discharge machining process. The experimental models for forecast of output parameters have been created utilizing linear regression analysis by applying logarithmic data transformation of non-linear equation. Three independent input parameters of the model peak current, pulse on time and rotational speed of tool electrode were selected as variables for evaluating the output parameters such as metal removal rate (MRR),

electrode wear ratio (EWR) and surface roughness (SR). Analysis has been carried out using Taguchi's suggested signal-noise ratio formula and ANOVA has been conducted to recognize the significant parameters and their degree of contribution in the process output. Analyzed results shows that peak current and pulse on time are the most significant and significant parameters for MRR and EWR, respectively. But peak current and electrode rotation become the most significant and significant parameters for SR, respectively. Experimental results further exposed that maximizing the MRR while minimizing EWR and improving the surface roughness, cannot be achieved simultaneously at a particular combination of control parameters setting. In addition, the predictions based on the above developed models have been verified with another set of experiments and are found to be in good agreement with the experimental results.

Darji & Pillai (2012) have presented that by using solid tool in Micro EDM has been broadly utilized for micromachining of materials like EN-8 steel, composite material, Inconel etc. In this paper it focused on optimization of Material Removal Rate (MRR) utilizing Rotary electrode attachment. The analyses study was led for changing machining parameter like polarity, peak current, rotational speed of electrode and pulse on time utilizing Taguchi system to research the machining qualities of Hastelloy C276 with 0.5 mm Graphite pole as Electrode. Significant machining parameter for MRR were identified by using signal to noise ratio and ANOVA, The results of the Experiment state that Polarity is more in flushing Parameter than Peak current, Rotational speed of Electrode and Pulse on time for material removal rate.

Dave et.al (2013) have explored various effects of basic machining parameters on dimensional accuracy of the micro holes by measuring top and bottom radial overcuts and taper angle and electrode gets more utilized during micro-electro-discharge machining of

aluminium (Al 1100) with tungsten electrode of diameter 300 $\mu$ m. The microelectrodes have been cut using a foil electrode and shaped using a Wire Electric Discharge Grinding (WEDG) system. Taguchi methodology has been utilized for design of experimentation with gap voltage, capacitance, and pulse ON time as electrical parameters and thickness and electrode rotation as non-electrical parameters. The result shows that the stationary electrode condition is found to be the optimum condition for top and bottom radial overcuts and taper angle, while for electrode depletion, the lowest level of rotational speed considered for experimentation is observed to be optimal.

Dwivedi & Choudhury (2016a) has performed experiments on AISI-D3 steel using rotary tool motion. The comparison between stationary EDM and rotary EDM is done. The result represents that the tool rotation phenomenon significantly improves the average MRR and surface finish by 41% and 12% respectively. The surface finish was more uniform in structure with less number of micro cracks and thinner recast layer as compared to the stationary tool EDM.

Dwivedi & Choudhury (2016b) focused on the surface integrity improvement of the AISI D3 tool steel using the tool rotation during the EDM process. Surface Roughness (Ra), Micro-Cracks and Recast Layers have been examined and studied as the output parameters. Their research was focused on the surface integrity improvement of the AISI D3 tool steel utilizing the rotary EDM attachment. Surface Roughness (Ra), Micro-Cracks, Recast Layer have been inspected and considered as output parameters. The outcomes demonstrate that the machined work piece has a better surface, fewer micro-cracks and thinner recast layers as compared to the stationary tool EDM process.

Gaur & Bharti (2015) explored the impact of gap current, pulse on time, duty factor, tool electrode rpm and especially the polarity of the machine on Material

Removal Rate (MRR) and surface roughness (Ra) for machining of Nimonic alloy. It was examined with suitable control of input parameters of Electrical Discharge Drilling (EDD), MRR and Ra value both found to be improved together from 60 to 90 mg per minute and 4.8 to 2.9  $\mu$ m respectively which confirm the viability of using tool electrode rotation in EDM machining.

Kumar (2013) has investigated the advancement of Electrical Discharge Machining processes with main focus of the surface quality and MRR. He has concluded that increasing the current, MRR and surface roughness increases and with increase in pulse on time MRR and surface roughness decreases.

Teimouri & Baseri (2012) surveyed on the impact of tool rotation and different intensities of external magnetic field on electrical discharge machining (EDM) performance. The Experiments was done in three parts of low energy, middle energy and high energy. The impact of process parameters were examined on main outputs of material removal rate (MRR) and surface roughness (SR). In order to compare the input parameters and output values two mathematical models were developed to predict the MRR and SR according to variations of discharge energy, magnetic field intensity and tool rotational speed. Results indicated that by applying a rotational magnetic field around the machining gap, improves the MRR and SR. Combination of rotational magnetic field and rotary electrode increases the machining performance, in comparison of previous conditions. This is due to better flushing debris from machining gap. This work introduced a new method for improving the machining performance, in cost and time points of view.

Vincent & Kumar (2016) presented the execution parameters of EDM process to accomplish the feasibility in machining of nitride steel En41b. The machining was done using rotary tubular copper and brass electrodes, in which the tool electrodes may

have an additional rotary or orbiting motion, in addition to the servo-controlled feed. Taguchi's signal-to-noise ratio and grey relational analysis were applied in this work to improve the multi-response characteristics such as MRR and EWR on En41b steel and the optimum combination of control parameters such as current, gap voltage, pulse ON time and pulse OFF time were obtained.

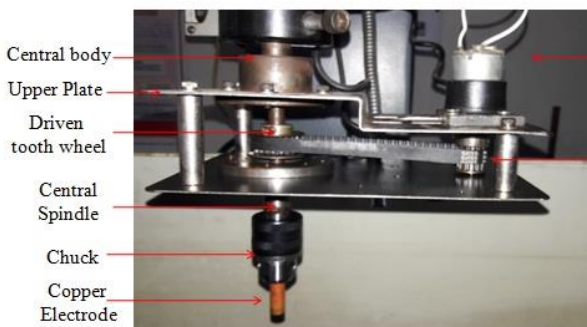
### III. EXPERIMENTAL SETUP

The Electrical Discharge Machine experiments were carried out using a EA8-S. The Rotary electrode attachment was developed and held on the machine head for performing rotary machining. The work piece material was of EN-8 steel. The Copper rod having 10 mm diameter was used as Rotating Electrode Material. EDM setup and rotary tool

attachment used in the present work is shown in Figs. 2 and 3 respectively.



Figure 3. EDM Setup



### IV. EXPERIMENTAL PROCEDURE

EN-8 Alloy steel material particulate was using Copper electrode with 10mm diameter. The developed Rotary electrode attachment was held in the machine head for performing Rotary Micro machining is used. Spark Erosion oil was used as dielectric fluid. For a four factor are tackled with a total number of 18 experiments performed on die sinking EDM with rotary attachment. The present experiment was designed based on L9 Orthogonal Array.

The calculation of material removal rate by using electronic balance weight machine. This machine capacity is 200 gram and accuracy is 0.001.

The process parameters chosen for the experimentation are peak current ( $I$ ), pulse on-time ( $t_{on}$ ), pulse off-time ( $t_{off}$ ), electrode speed ( $N$ ) and other factors such as, gap voltage, machine servo sensitivity and mode of flushing were kept constant during the experimentation. Observation table is shown in Table 2.

The experiment were conducted to see the affect of rotational speed of electrode, peak current, pulse on time, pulse off time on MRR and TWR. The machining condition and number of levels of the parameters selected is shown in Table 1.



**Table 1: Design of the experiment with different level**

Control Parameters	Units	Levels		
		Level 1	Level 2	Level 3
		1	2	3
Peak Current	Ampere	3	7	11
Pulse On Time	µsec	12	15	18
Pulse off Time	µsec	3	6	9
Speed	RPM	100	200	300

The process parameters chosen for the experimentation are Peak Current (I), pulse time-on ( $t_{on}$ ), Pulse off time ( $t_{off}$ ) and electrode speed (N) other factors such as gap voltage, machine servo sensitivity and mode of flushing were kept constant during the experimentation.

The experiment were conducted to see the affect of Rotational speed of electrode, Peak current, Pulse on time and Pulse off Time on Material Removal Rate (MRR) using L9 OA. Material removal rate was obtained by calculating the weight difference of work material before machining and after machining per unit time and density of EN8. Weight of work piece was measured with the help of electronic weight balance machine having least count of 0.0001 gm. In this experiment keeping Peak current constant and other parameters like Pulse on time, Pulse off time, Polarity, Rotational speed of electrode variable 18 observation (9 each for rotary EDM and EDM) are done

**Table 2: Design matrix and Observation table for Conventional EDM**

Sr No	Peak Current	Pulse On time	Pulse Off Time	Speed	Time	Weight of WP		Weight of tool	
						Initial	Final	Initial	Final
1	3	12	3	100	116.75	177.19	176.42	27.72	26.51
2	3	15	6	200	87.51	189.52	188.43	25.84	25.15
3	3	18	9	300	73.43	183.12	182.53	26.81	26.03
4	7	12	6	300	65.11	177.62	176.51	28.21	27.23
5	7	15	9	100	57.27	175.51	174.92	26.22	25.31
6	7	18	3	200	37.49	167.82	167.09	25.91	25.43
7	11	12	9	200	33.21	163.31	162.59	27.12	26.62
8	11	15	3	300	29.12	151.74	151.44	21.95	21.43
9	11	18	6	100	22.41	157.34	156.92	23.73	23.39

**Table 3: Design matrix and Observation table for Conventional EDM**

Sr No	Peak Current	Pulse On time	Pulse Off Time	Speed	Time	Weight of WP		Weight of tool	
						Initial	Final	Initial	Final
1	3	12	3	100	107.56	188.19	187.42	24.92	24.61
2	3	15	6	200	74.45	187.42	185.72	25.54	25.15
3	3	18	9	300	69.57	183.12	181.05	26.51	25.93
4	7	12	6	300	44.19	179.82	178.41	27.12	26.72
5	7	15	9	100	35.46	178.51	177.82	27.15	26.95
6	7	18	3	200	29.32	177.82	177.04	26.82	26.51
7	11	12	9	200	29.09	165.31	164.74	26.91	26.59
8	11	15	3	300	24.12	164.74	164.13	23.4	23.04
9	11	18	6	100	17.22	163.34	163.07	24.88	24.73

### V. Result and Discussion

An investigation to study on MRR and TWR was carried out as discussed above. Result of MRR and TWR found from the experimental investigation is presented in Table 4 & 5. Effect of various parameters on MRR and TWR are discussed below.

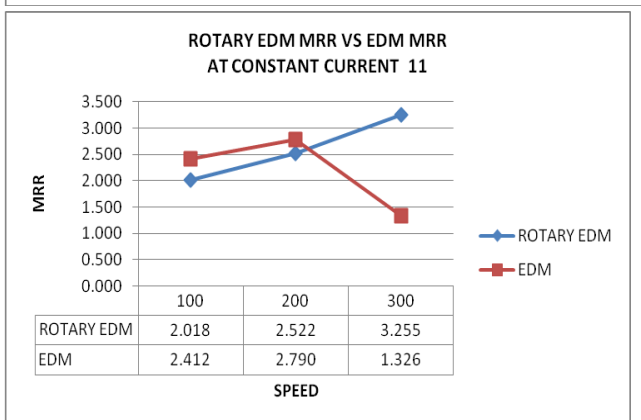
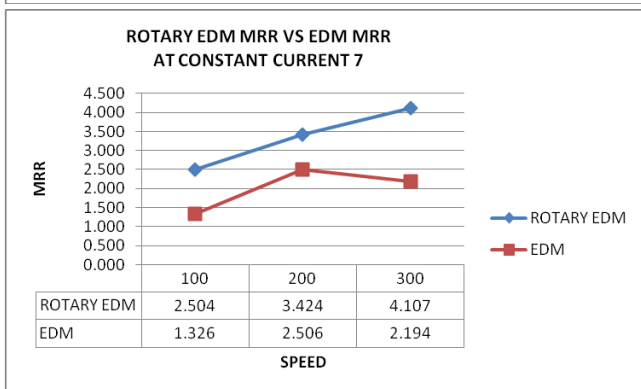
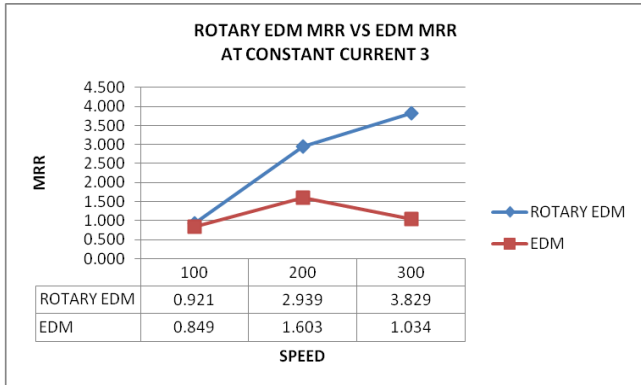
**Table 4 Response Table for Rotary EDM**

Sr No	Current	Pulse On time	Pulse Off Time	Speed	Time	Weight of WP		MRR	Weight of tool		TWR
						Initial	Final		Initial	Final	
1	3	12	3	100	107.56	188.19	187.42	0.921	24.92	24.61	0.322
2	3	15	6	200	74.45	187.42	185.72	2.939	25.54	25.15	0.585
3	3	18	9	300	69.57	183.12	181.05	3.829	26.51	25.93	0.930
4	7	12	6	300	44.19	179.82	178.41	4.107	27.12	26.72	1.010
5	7	15	9	100	35.46	178.51	177.82	2.504	27.15	26.95	0.629
6	7	18	3	200	29.32	177.82	177.04	3.424	26.82	26.51	1.180
7	11	12	9	200	29.09	165.31	164.74	2.522	26.917	26.59	1.255
8	11	15	3	300	24.12	164.74	164.13	3.255	23.4	23.04	1.666
9	11	18	6	100	17.22	163.34	163.07	2.018	24.88	24.73	0.972

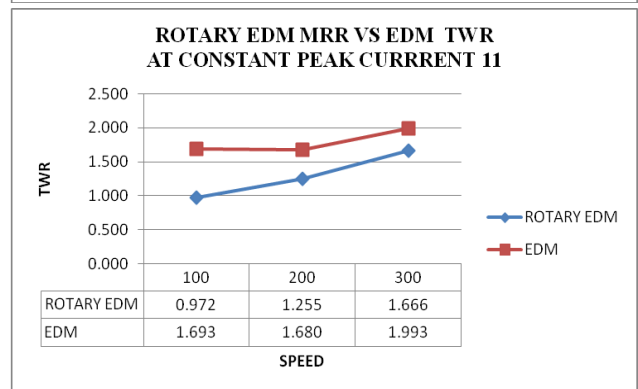
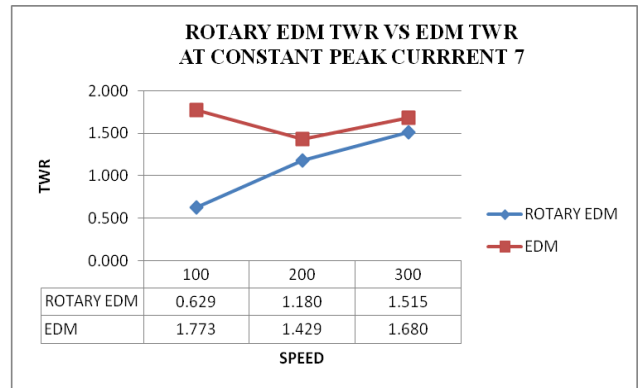
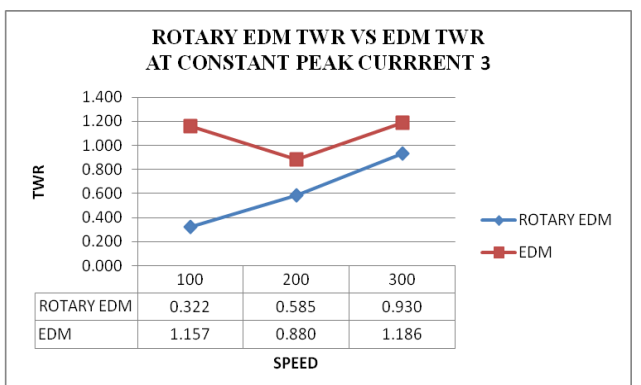
**Table 5. Response Table for Conventional EDM**

Sr no	Current	Pulse On time	Pulse Off Time	Speed	Time	Weight of WP		MRR	Weight of tool		TWR
						Initial	Final		Initial	Final	
1	3	12	3	100	116.75	177.19	176.42	0.849	27.72	26.51	1.157
2	3	15	6	200	87.51	189.52	188.43	1.603	25.84	25.15	0.880
3	3	18	9	300	73.43	183.12	182.53	1.034	26.81	26.03	1.186
4	7	12	6	300	65.11	177.62	176.51	2.194	28.21	27.23	1.680
5	7	15	9	100	57.27	175.51	174.92	1.326	26.22	25.31	1.773
6	7	18	3	200	37.49	167.82	167.09	2.506	25.91	25.43	1.429
7	11	12	9	200	33.21	163.31	162.59	2.790	27.12	26.62	1.680
8	11	15	3	300	29.12	151.74	151.44	1.326	21.95	21.43	1.993
9	11	18	6	100	22.41	157.34	156.92	2.412	23.73	23.39	1.693

### VI. ANALYSIS OF COMPARATIVE RESPONSE PARAMETERS FOR MATERIAL REMOVAL RATE



### VII. ANALYSIS OF COMPARATIVE RESPONSE PARAMETERS FOR TOOL WEAR RATE



### VIII. CONCLUSION

As per the analysis it is observe that the MRR increases as the Speed increases in Rotary EDM as compare to Conventional EDM. It is also observe that the TWR decreases in Rotary EDM as compare to Conventional EDM. Rotary EDM Process holds a bright promising application of EDM, particularly with regard to process productivity and surface quality of work-piece. Rotary EDM can be carried out with the added benefits of flushing out machined debris. Peak current, pulse off time and pulse on time significantly affects the MRR and TWR in EDM.

### XI. REFERENCES

[1] K. D. Chattopadhyay, P. S. Satsangi, S. Verma & P. C. Sharma, "Analysis of rotary electrical discharge machining characteristics in reversal magnetic field for copper-EN8 steel system", Int J Adv Manuf Technol (2008), pp.925-937

[2] K. D. Chattopadhyay, P. S. Satsangi, S. Verma & P. C. Sharma, "Development of empirical model for different process parameters during rotary

- electrical discharge machining of copper–steel (EN-8) system”, *Journal of materials processing technology* (2009) pp.1454–1465
- [3] Sushil Kumar Choudhary & Dr. R.S Jadoun, “Current Advanced Research Development of Electric Discharge Machining (EDM): A Review”, *International Journal of Research in Advent Technology*, Vol.2, No.3, March 2014, pp.273-297
- [4] Swaraj Darji & Bindu Pillai, “Estimation of MRR for Micro-EDM Machining Of Hastelloy C 276 using Taguchi Methodology”, *Int. J. Mech. Eng. & Rob. Res.* 2012 pp.261-267
- [5] H. K. Dave, V. J. Mathai, K. P. Desai & H. K. Raval, “Studies on quality of microholes generated on Al 1100 using micro-electro-discharge machining process”, *Int J Adv Manuf Technology*, 2013.
- [6] Anand Prakash Dwivedi, Sounak Kumar Choudhury, “Increasing the Performance of EDM Process Using Tool Rotation Methodology for Machining AISI D3 Steel”, 7th HPC 2016 – CIRP Conference on High Performance Cutting, *Procedia CIRP* 46 (2016) pp.131–134
- [7] Anand Prakash Dwivedi & Sounak Kumar Choudhury, “Improvement in the Surface Integrity of AISI D3 Tool Steel using Rotary Tool Electric Discharge Machining Process”, 3rd International Conference on Innovations in Automation and Mechatronics Engineering, ICIAME 2016, *Procedia Technology* 23 (2016) pp.280–287
- [8] Sanjeev Kumar, Rupinder Singh, T.P. Singh & B.L. Sethi, “Surface modification by electrical discharge machining: A review”, *Journal of Materials Processing Technology* 209 (2009) pp.3675–3687
- [9] Sushil Kumar Choudhary & Dr. R.S Jadoun, “Current Advanced Research Development of Electric Discharge Machining (EDM): A Review”, *International Journal of Research in Advent Technology*, Vol.2, No.3, March 2014, pp.273-297
- [10] Gurvir Singh, Manjinder Singh, Narinder Singh Jassal & Baljinder Ram, “To study the effect of electrode Rotational speed and machining parameters on MRR and SR using EDM”, *Advances In Materials And Manufacturing Technology* 2015, pp.87-90
- [11] Reza Teimouri & Hamid Baseri, “Study of Tool Wear and Overcut in EDM Process with Rotary Tool and Magnetic Field”, *Advances in Tribology Volume 2012*, Article ID 895918 pp.1-8

# An Exhaustive Investigation of Security Issues Tended to by Different Cryptographic Algorithms

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## ABSTRACT

Internet applications and disseminated portable systems are better and expanding at extremely quick. Because of the modern advancement, secured method for information communicate over the Internet is turning into a testing errand. Interlopers hack the information and utilize it for their great reason. To defeat these undesirable demonstrations, cryptography is utilized to guarantee security of the secretive and secure message. While encoded information is difficult to translate, it is similarly simple to identify. Physically capable encryption calculations and appropriate key administration methods for the frameworks will help in accomplishing classification, validation and trustworthiness of information. In the present examination, different encryption calculations which can be utilized for dispersed portable systems are researched. The work depicts the different security issues tended to by the cryptography calculations by consolidating key administration plans. The proposed Key Escrow based Elliptic Curve Cryptographic calculation ensures for a hearty and more secure conveyed Certificate less specialist in dispersed portable systems. The security in view of the elliptic bend division key offering issue to key escrow idea can be a best selected security device for productive information transmission in disseminated versatile systems.

**Keywords** - Cryptography, Distributed Networks, Elliptic Curve Cryptography, Key Escrow, Mobile Networks, Security Issues

## I. INTRODUCTION

Cryptography is the technique for accomplishing security by encoding messages utilizing key to make them reasonable. The fast improvement in the systems administration innovation drives a normal culture for exchanging of the information in a huge way. Henceforth the introduction of copying of information and re-dispersion by programmers additionally happen. In such circumstances, data must be secured while transmitting it. Touchy data like Mastercards, managing an account exchanges and standardized savings numbers should be secured. The encryption of information assumes a noteworthy part

in remote versatile correspondence and securing the information is essential in the appropriated condition. Diverse encryption strategies are utilized to shield the classified information from unapproved utilize. A powerful key administration framework alongside the protected system has turned into the premise of such framework. The framework is secured if the data isn't uncovered to an unapproved client. The Encryption calculations are utilized to ensure data in the framework. Inquires about completed in 1970 and 80s concentrated on the outline and tomb investigation of the calculations, with no attention on applications. However there are a couple of special cases: Diffie Hellman's work (DH) [1] and Data Encryption

Standard (DES) calculation [2]. These have continued as the concentration for think about in cryptography. The DES is overall acknowledged square figure for the past quarter century. The cryptographic calculations grew so far were not examined for the potential shortcomings against conceivable assaults on the framework [3]. National Institute of Standards (NIST), made an exhaustive investigation of existing cryptographic calculations and built up a typical standard by name Advanced Encryption Standard (AES) [4]. A Belgian accommodation, Rijndael, turned into the main AES [5] because of its cautious and rich outline alongside its adaptable execution characteristics. Specialists around there foreseen DES would be supplanted by AES of institutionalizing encryption, which is valid in a portion of the items today. AES was supplanted by DES in piece figure class. The secured frameworks required a standard casing work, and the Public key foundation (PKI) is the first of such structure.

Intrusion location for remote framework is mind boggling and filled of unpredictability fundamentally because of the dynamic character of conveyed portable systems, their exceedingly constrained hubs, and the absence of focal observing focuses. Old IDSs are not connected effectively to remote system. Scientists needed to grow new methodologies or else adjust existing philosophies/approaches for dispersed versatile systems [6]. In the present work, we propose and completely execute another procedure for Intrusion identification framework named Key escrow with Elliptic Curve Algorithm uniquely intended for disseminated versatile systems. Contrasted with different methodologies, Key escrow based Elliptic Curve Cryptography exhibits higher malignant conduct recognition rates in disseminated condition while does not enormously influence the system QoS exhibitions to accomplish arrange standard. Encryption is an exceptionally regular method for advancing the data security. There is probability of hacking the information while sharing from balanced.

To keep the information being hacked there are such a large number of methods, for example, Digital Signature, Key escrow Cryptography can be actualized. The present work centers around the Key escrow based procedures in elliptic bend cryptography which is utilized to ensure the information in dispersed condition.

### **Motivation behind Cryptography**

Cryptography fills following needs as appeared in Figure 1.

**Classification:** The decide of privacy indicates that lone the sender and the proposed beneficiary ought to have the capacity to get to the substance of a message.

**Validation:** Authentication components help to make evidence of personalities. This technique guarantees that the wellspring of the message is effectively recognized.

**Respectability:** This honesty technique checks that the substance of the message remain a similar when it achieves the right beneficiary as sent by the sender.

**Non-Repudiation:** Non-denial does not enable the sender of a message to discredit the claim of not sending the message.

**Access Control:** Access Control determines and joystick who can get to what.

**Accessibility:** The decide of accessibility expresses that assets ought to be accessible to approved gatherings every one of the circumstances.

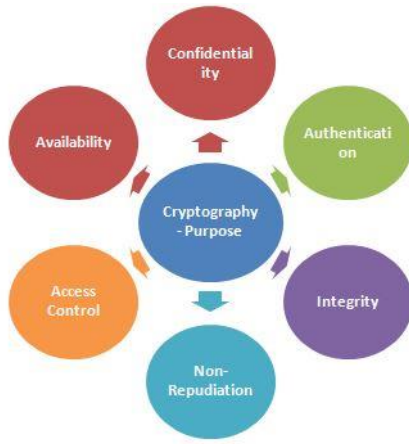


Figure 1: Motivation behind Cryptography

## II. KINDS OF CRYPTOGRAPHY

### Open Key Cryptography

It includes two sets of keys: one for encryption and another for decoding. Key utilized for encryption is an open key and appropriated. On the opposite side key utilized for decoding is private key.

### Key Escrow Cryptography

This is well constructed application for encryption and decoding keys are created by key escrow specialists (outsider endowed key escrow). The decoding keys are part into two sections and given to isolate escrow experts. Access to one a player in the key does not help unscramble the information; both keys ought to be acquired.

### Translucent Cryptography

In this framework the administration can unscramble a portion of the messages, however not all. Just portion of message can be unscrambled and remaining part can't be decoded.

### Symmetric Key Cryptography

System utilizes same key for encoding and deciphering data. The sender and beneficiary of information must share same key and keep data mystery keeping information access from outside.

The Kinds of cryptography are charted in Figure 2.

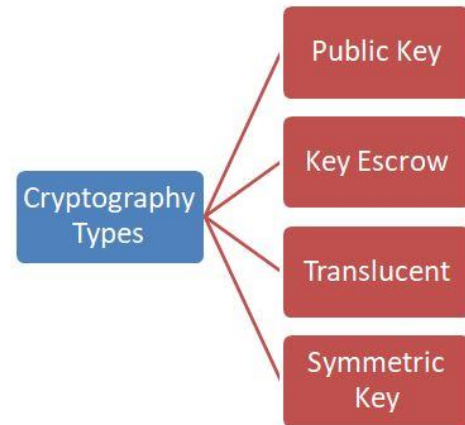


Figure 2: Kinds of Cryptography

Different uses of cryptographic plans are talked about and abridged. The accompanying Table 1 demonstrates the different cryptographic applications.

TABLE 1  
APPLICATIONS OF CRYPTOGRAPHIC SCHEMES

S.No	Cryptography	Application area	Description	Examples
1	Public Key Cryptography	Secure message transmission using proxy	Encryption and decryption keys (two pairs) are used	Low power computers in the networks
2	Public key cryptography(SSL)	Certificates and authentication	Public and private keys used	Password authentication
3	Public Key Cryptography	Digital Signature and Authentication	Public and private keys used	Electronic Mail
4	Key Escrow Cryptography	Monitoring communications in the mobile networks	Third party escrow key is used	Used by government mobile network agencies to monitor the messages
5	Translucent Cryptography	Fractional Observing of Data in the network	Partial key viewing of data based on the parameter	Monitored by agencies where absolute monitoring is not required

### Dispersed Key Generation Algorithms

As of late, organize security has outside basic consideration from both sight and sound and versatile correspondence. As the information organize turns out to be all the more concealing and its degree winds up bigger, arrange intrusion and assault have turned out to be serious dangers to portable system clients [7-10]. This is feasible for the rising remote portable

systems. The present portable system innovation includes gadgets, for example, phones, PDAs, and keen cards. These gadgets are developing quick, and work with batteries in the remote condition. On the off chance that these frameworks draw in cryptographic calculations for the security reasons, at that point the power misfortune will be high. In sight of this, despite the fact that a few conventions like Validated Key Trade for Low Power Figuring

customer conventions are talked about in the work [14], their utilization is limited. This is on the grounds that:

1. These conventions are not considered for huge quantities of versatile clients.
2. They encounter inadequately from inconvenience like absence of versatility of the Key Distribution Centre (KDC), which maintains outsider that disperses cryptographic keys safely and keeps up all the included login and logout records.

In both the ordinary wired parcel systems and framework upheld Remote systems, security in organize is acquired utilizing joint validation and encryption of the data. General society key transportation and the outsider are regularly used to meet the security wants. Remote systems have asset limitation subsequently PKI based conventions are hard to work in the appropriated condition [15]. These conventions are troublesome and vitality expending subsequently not valuable for expansive scale remote conveyed systems. The remote systems have little radio range for correspondence, precarious system topology and irregularity activities which make the outsider confirmation convention implausible to work. Serious source imperatives and expansive system adaptability of remote systems require a security convention which is productive and secured. Latest examinations show, preloading of symmetric keys [16] in gadgets can take care of the issue of key appropriation and administration in remote systems after the hub game plan [17]. A safe connection between the neighboring hubs in the system can be position up because of the shared keys. Pre-execution of key escrow keys into remote gadgets have two basic procedures, in particular, ace key approach and outsider key approach.

#### Key Escrow Plan for Remote Systems

In the key escrow based technique, symmetric key is over-burden in the memory of the gadgets if there

should arise an occurrence of Ace key approach and this key is utilized for secured information exchange. The approach is clear and proficient because of low overhead of key foundation and utilization of just a single key, however it doesn't create enough security for remote systems. These strategy ineffectively experience the ill effects of even a solitary hub catch assault bargains the total system in the event of ace key approach as all the keys utilized by the system are presented to the assailant. Combine insightful key based approach utilizes [18], an arrangement of symmetric keys rather than one key are stacked in the gadget in the system. The preloading is done to such an extent that any two hubs have a select match for the correspondence between them. The strategy guarantees enough security since restricting of a key of any combine of hubs can change coordinate correspondence between those two hubs as it were. This technique asks for a substantial key stockpiling memory. The technique is likewise not adaptable with respect to a system involving 'n' hubs, it ends up obligatory for each gadget to store (n-1) keys. The streamlining system can be utilized to decrease this number in the system. Be that as it may, even with above advanced numbers, the adaptability remains an issue.

Further, the remote gadgets have a little memory to store thus the Key pre appropriation strategies examined above end up hard to sort out. The two methodologies specified above include key pre-circulation plans which prompt exchange off should be accomplished with the end goal that the security isn't traded off and the capacity overhead is likewise helpful for the constrained memory gadgets, which can't store an excessive number of keys. Key dissemination is a vital region of examination and of high need in late period. Numerous improved key pre-circulation techniques have been prescribed and endeavored to have proficient and secured key administration framework for remote disseminated systems. For this examination each framework must



be checked enigmatically and the defenselessness to particular assaults must be tried for every single conceivable case in the system. The current proposed philosophies were grave dissected. Based on examination, one can order assaults in various classes. Thinking about the general security of any framework, Assaults are ordered into four kinds in particular, honesty, classification, verification and accessibility [19]. Honesty assault tries to adjust or changes the present condition of data of the framework. Accessibility assaults happen when a legitimate client is precluded access from claiming information or assets, because of simultaneous unapproved access of these assets. Secrecy assaults happens if a restricted segment get to is finished by noxious client deliberately. Verification assault happens if a legitimate client isn't recognized and approval comes up short. In spite of the fact that analysts have made an endeavor to discover ways to deal with protect from all the above assaults, sadly, none are effective. A total and viable measure of security isn't found yet. The current techniques change in their measure of security against these conceivable assaults. There are strategies accessible that recognize such assaults [20]. Some of the time, the assault is identified simply after the assault or the incomplete assault. It is additionally conceivable that these assaults may go unrevealed. However such approaches assume a key part, regardless of whether the assurance is fragmented, as it decreases the general demolition in the system. The genuine worries about the framework in the later stage are diminished [21].

Utilization of cryptographic capacity has been proposed by a few mathematicians that disallow decoding of the code under these states of the assault. It is exceptionally uncommon to recognize cryptographic capacity related to every issue. To look at wired partner, remote systems are level to security assaults extending from aloof listening stealthily to fiery meddling. As it is considerably harder to guard arrange elements against the gatecrashers in

appropriated versatile condition, occasional break-ins in a substantial scale portable system are almost unsurprising over a vast day and age. Since two customary accreditation Innovations, to be specific the single confirmation expert (CA) and the various leveled CA innovation don't function admirably in expansive versatile impromptu systems, so we have to propose novel way to deal with keep up security in this condition. Among them, Computerized signature confirmation benefit innovation in light of limit mystery sharing instrument is the most troublesome strategy [11-13]. The essential thought of the plan is that a trusted merchant is set up at the framework improvement stage, and after that the framework mystery key is shared among the system elements by the edge division mystery sharing instrument. At last the applicable data about the trusted merchant is annihilated and the trusted merchant is repudiated. The present work displays a circulated key age calculation in light of Elliptic Bend Division Advanced Mark Calculation, which influences the key match and key offer to be produced totally by the collaboration of Shared hubs disseminated in the systems, and framework key itself isn't recouped in any hub, consequently understanding the confirmation benefit without trusted merchant at the framework improvement stage.

The accreditation benefit innovation in view of limit Division mystery sharing system in versatile specially appointed systems is profoundly dissected. The circulated key age calculation in view of Elliptic Bend Division Advanced Mark Calculation is proposed, which create the key and key offer without accepting any confided in merchant, and enhance the security of conveyed affirmation in portable Specially appointed systems. The preparatory investigations uncover that the appropriated key age calculation for conveyed confirmation is practical.

Importance of Elliptic Curve Cryptography in Mobile Networks

The wireless mobile expertise is the most promising field in this world; the unwired endeavour has long been an objective in most organizations, and the advent of 802.11 now makes achieving that goal a realistic dependability. A Distributive mobile network is nothing but collection of independent mobile nodes that can communicate to each other by the use of radio waves. The mobile node communicate with each other by using two ways one is the mobile nodes communicate directly if they are in radio range of each other, whereas others needs the help of intermediate nodes to route their packets in the distributed network. Due to its important characteristics, such as wireless distributed medium, dynamic distributed topology, distributed cooperation key management, Distributed mobile network is vulnerable to different kinds of security attacks like worm hole, black hole, rushing attack etc. Intrusion detection for wireless infrastructure is more difficult and filled of difficulty mainly due to the dynamic character of such networks, their highly forced nodes, and the lack of central monitoring points. Previous IDSs are not applied easily to wireless network. Researchers have to develop new approaches or else adapt existing approaches for the mobile network. We propose and fully implement a new methodology for intrusion-detection system named Enhanced Key escrow based with Elliptic Curve Algorithm (ECC) specially designed for distributed mobile networks. Compared to modern approaches, Key escrow based ECC demonstrates higher malicious- behaviour-detection rates in certain conditions while does not greatly affect the network QoS performances.

Dispersed versatile system is a developing, rousing and fundamental innovation nowadays because of the brisk extension, enlargement in remote applications. There are principally five wellbeing administrations as appeared in Figure 3.

1. **Confirmation:** Correct uniqueness is known to the correspondence connect.
2. **Privacy:** Correspondence data is held shielded from criminal gathering.
3. **Integrity:** Message is unaffected all through correspondence.
4. **Non Denial:** The wellspring of the message can't dismiss having sent the message.
5. **Availability:** The typical administration details in resistance of all sort of assaults.



Figure 3: Mobile Network Safety Services

### III. Security in Mobile Networks

Security implies the security technique for all conventions worried in this (circulated portable system) administration to post the basic occupation of disseminated versatile system implies security all through piece transmit starting with one hub then onto the next [22]. Subsequently we require distinctive plans which are utilized to secure the Versatile specially appointed system. Interruption identification isn't an original thought in the system think about. Interruption Identification Framework (or IDS) generally recognizes superfluous controls to frameworks the anticipated plan of the interruption recognition framework.

Appropriated Open key Elliptic bend Cryptography validation conspire offers extensively more prominent information security for a given key size. On the off chance that the bit key size is littler it is additionally conceivable to execute for a given level of security so it devour less power and less cost generation. The littler key size makes speedier cryptographic tasks, running on littler hubs and conservative programming in dispersed versatile applications.

So for information security ECC is the immense decision for following reasons. The information security reasons are graphed in Figure 4.

1. ECC build up great security of given key size amid information transmission in the system.
2. By utilizing littler keys it make more minimal usage, quick cryptographic tasks.
3. Less power utilization and warmth generation.
4. In ECC, there is efficient and smaller equipment usage in cell phones.
5. It is for all intents and purposes difficult to discover private key so it isn't workable for outsider to get the mystery.

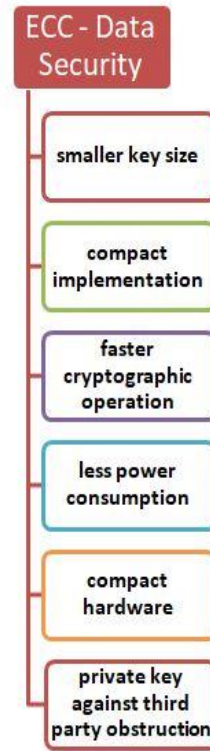


Figure 4: ECC Data Security

#### IV. ECC based Digital Signature Schemes

ECC based Advanced mark plans can be utilized to offer the accompanying essential cryptographic administrations in the disseminated condition:

1. Information honesty (the guarantee that information has not been changed by prohibited or obscure way)
2. Information validation (the certification that the wellspring of information is as asserted)
3. Non-Disavowal (the assurance that an element can't dispose of prior occasions or duties) Elliptic Bend Advanced Mark Calculation is actualized over elliptic bend P. This ECC contains critical modules for field parameters creation, key creation, signature creation, and mark validation over the elliptic bend. It has three stages, key creation, division creation, and division signature validation.

Bundle disappointment assault has dependably been a most imperative danger to the security in circulated versatile systems and in addition arrange time postpone makes framework moderate and influences the system choice steering power. Our proposed plot is utilized to avoid assaults in the disseminated systems. We reach the conclusion that plan is more reasonable to be executed in appropriated arrange.

A distributed frame work is required to keep such information up to date about the compromises and removal due to expiration of the time. This distributed framework is responsible to authenticate the user who is component of the system. For secure communication authentication is major key factor. In the absence of authentication it is easy to forge or spoof someone's key in the network. The PKI cryptosystem has two dominating trust models, namely, centralized and web-of-trust trust models. To attain network scalability, the centralized key distributed model is a hierarchical key distributed structure instead of a single CA. Multiple CA roots are necessary for a large network, such as the Internet and this model is the so called distributed key distributed model. To obtain an efficient key management system for heterogeneous networks two more variations of the distributed key models are added to the initial types. These key distributed models are CA-view and hybrid models. The CA view is similar to the distributed key model. The Key escrow distributed model glues the centralized and the distributed ECC models together. To establish the secret key a series of protocols are required to be built. The protocols in the distributed mobile networks suffer from problems like weak security, lack of scalability, high energy overhead for key management, and increased end to end data latency.

Appropriated Convention trade keys between hubs inside a control aggregate through the focal of the control head give the basic mystery key. The mystery keys are invigorated intermittently and the control

hubs are changed occasionally to upgrade security. The convention improves the survivability of the system by dealing with trade off and disappointments of control hubs. It gives the certification that the correspondence stays secure notwithstanding the bargain of some other hub in the appropriated arrange. The issue of the correspondence cost, bit key size is as yet unsolved. The current key administration framework is moderate and not adaptable. By and large the present situation requests a superior and speedier key administration conspire in portable systems. Working towards this, an endeavor has been made propose a plan which utilizes transitively shut structure. People in general key cryptosystem like elliptic bend cryptography circulated demonstrate is utilized to trade the keys between the true blue clients. In this way, the entire key administration life cycle is accomplished. The encryption and unscrambling of the message is accomplished alongside the transmission of them to the substantial clients. The parameters utilized as a part of the procedure are dynamic and change is capricious to make the interloper's activity troublesome promotion lessened the cost. Consequently, the general framework will have the capacity to deal with the entire procedure of conveyed key administration.

## V. Key escrow based ECC Cryptography Scenario

The talk above stresses the need of security and the mystery key administration. The current PKI and its appropriateness issue in the present situations are examined. The clarifications reason that the Conveyed key escrow based ECC instrument can be a superior other option to make the PKI relevant in current situations. The key administration issues can be upgraded in better way if Open key Elliptic Bend cryptography key administration strategies are utilized. The key escrow is one of the techniques utilized as a part of cryptography to locate the ideal answer for the dispersed key administration

condition. This technique is called as Key escrow based ECC calculation. This safe correspondence likewise is fit for adjusting to the adjustment in the portable hubs and assaults in the appropriated natural conditions. It is conceivable to make the dynamic circulated mystery key administration condition reproduction. The reproduced execution can be noted. This reproduction is likewise equipped for improving the calculations and diminished the correspondence cost amid information transmission.

A Portable System is an arrangement of remote versatile hubs that can talk with each other without the utilization of predefined foundation or brought together administrator controller. In the versatile specially appointed system, client hubs can specifically speak with other client hubs utilizing their radio range; if the hubs are not in the immediate correspondence run they utilize the middle of the road hubs to speak with each other in the system. Among all the current security issues of specially appointed system, the nature of correspondence and absence of foundation bolster make the security especially all the more difficult. Various security components has been created and proposed, yet it is still hard to guarantee that entire system is free from any malevolent assault. This work centers around key escrow based Elliptic bend enter administration in completely disseminated versatile specially appointed systems.

Exhibit approaches for confirmation administrations rely upon unified administration approaches by either authentication experts (CA) or key appropriation focuses. A brought together approach might be worthy in situations where a particular hub can be secured and is available by different hubs of the system. Notwithstanding, for the remote specially appointed systems that we envision for our focused on applications, an incorporated approach will experience the ill effects of a solitary purpose of administration dissent and might be inaccessible by

organize hubs requiring CA administrations. Along these lines a more strong ECC based CA approach must be utilized. This requirement for remote specially appointed systems is directly an extremely dynamic research zone. To Give CA technique in a specially appointed system is to allocate a solitary hub to be the CA not to all. The accomplishment of this plan relies upon that solitary CA hub. Since disappointment of one hub breaks the framework, this approach isn't blame tolerant. Thus this approach is very helpless, since a foe needs just to bargain one hub to secure the mystery key. At last, given the unusualness and expected portability of specially appointed systems, it might be conceivable that hubs won't have the capacity to achieve the CA in due course, making accessibility significantly capricious. Accordingly, a solitary CA can't adequately benefit an entire specially appointed system.

In the present work, we propose a dynamic completely circulated Key escrow construct endorsement expert plan situated in light of a polynomial over elliptic bend for Portable Systems, which however has better cryptography in nature. The security depends on the elliptic bend discrete logarithm issue, yet the members' keys are disseminated by a Division focus, which takes a considerable measure of badly designed in handy applications. The work offers a Division sharing plan in view of a polynomial over elliptic bend, in these plan members will hold conceivable sub-mystery keys.

The Mostly Disseminated Authentication Specialist Methodologies is the primary technique to take care of the key administration issue in Portable systems distributed in Securing Impromptu Systems [23]. This paper proposed a key escrow based circulated open key administration benefit for nonconcurrent specially appointed systems, where the division limit is appropriated between an arrangement of hubs by permitting the hubs share the framework mystery.

The Key escrow based conveyed testament less expert, comprises of  $n$  server hubs which, overall, have an open/private key combine  $K$ . People in general key  $K$  is known to all hubs in the system, while the private key  $k$  is separated into  $n$  shares ( $s_1, s_2, s_3, \dots, s_n$ ), one for every server. The Key escrow based dispersed endorsement less specialist signs a testament by delivering a division limit bunch signature. Every hub creates a halfway division signature utilizing its division mystery key offer and presents the incomplete authentication less signature to a combiner  $C$ . The combiner can be any hub and requires at any rate  $t + 1$  offers to effectively recreate the division advanced mark. The reference paper work [24] demonstrates that Completely Circulated Testament Specialist Methodologies utilizes a  $(k, n)$  edge plan to disseminate a RSA endorsement marking key to all hubs in the system. It likewise utilizes certain and proactive mystery sharing systems to trade off the authentication marking key and secure against dissent of administration assaults however not for all hubs. This arrangement infer that, long haul specially appointed systems with hubs fit for open key encryption. Be that as it may, since the administration is dispersed among every one of the hubs when they join the system, there is no compelling reason to pick or choose any specific server hubs. Their answer likewise utilizes a  $(n, k)$  limit signature plan to frame a circulated testament expert. They improve the accessibility highlight of Commonsense PKI (open key foundation) for Specially appointed Remote Systems [25] by picking  $n$  to be every one of the hubs in the system.

## VI. Security Analysis

The Key Escrow based Elliptic Bend Cryptography requires a conveyed organize framework to give the set up, mystery key sharing and confirmation period of the administrations. The principle advantages of this plan are its accessibility and that its polynomial

over the elliptic bend. The security of our plan relies upon the Unmanageability of Elliptic Bend Division mystery key sharing Issue. This procedure makes the Division Mystery key authentication less specialist more powerful against a few sorts of assaults. This is alluded to the elliptic bend logarithm issue, on the off chance that we make an examination between the RSA and ECC calculations by practically identical key sizes as far as computational exertion for cryptanalysis. Impressively littler key size can be utilized for ECC contrasted with RSA. Along these lines, there is a computational preferred standpoint to utilizing key escrow based ECC with a shorter key length than an equivalently secure RSA. Since all hubs are a piece of the Division mystery key sharing administration, it is sufficient that an asking for hub has  $t$  one-bounce neighbors for the Division mystery key sharing administration to be accessible. The measure of system wide activity is additionally restricted. The cost of accomplishing this accessibility is an arrangement of rather complex support conventions, e.g. the offer set up and the offer check conventions. A well-assembled number of mystery key offers are additionally shown to bargain since every hub has its own particular offer when contrasted with just the specific information hubs in the mostly dispersed arrangement. The parameter of key size in this way may should be picked bigger since an aggressor might have the capacity to trade off a bigger number of offers between each offer refresh. This thusly influences the accessibility of the administration.

Versatile impromptu systems are powerless against numerous assaults and malevolent practices. Division mystery Open key framework based security frameworks build up the fundamental line of resistance and ensure the specially appointed system against outer assailants. Division Mystery Advanced Authentication less specialist is the essential segments of Division mystery open key security arrangements and different techniques for overseeing them have been characterized in the writing. Key escrow based

Dispersed Division mystery key sharing specialists are one of the principle strategies that have been utilized for issuing, checking and dealing with the matched keys in portable impromptu systems. In our plan we proposed a Key escrow with conveyed testament less specialist in light of polynomial over elliptic bend and in view of division limit key cryptography. This plan gives a strong and more secure disseminated Declaration less expert over the appropriated versatile system, which however has better cryptography in nature. The security depends on the elliptic bend Division key sharing issue.

## VII. CONCLUSION

The field of cryptography used to pass on messages safely. The objective of cryptography is to affirm the message got by the expected beneficiaries safely. Cryptography tries to maintain a strategic distance from the gategcrasher from understanding the message. In the present work, essential ideas of cryptography regarding security and information exchange effectiveness measures are considered. In the work, we attempted to sort the issues of multi bounce message seek over encoded information in conveyed versatile system. We ought to build up a plan which gives greater security while keeping up the inquiry and information protection in the circulated arrange. We can achieve it by consolidating Key Escrow ideas with Elliptic bend based calculation. This plan will offer preferred standpoint of added substance includes together with a superior level of security. As a result of ECC and key blending utilized as a part of the plan, this is appropriate for the system applications with restricted computational cost. With investigation, we can demonstrate that proposed plan may give adaptability towards the information and inquiry security. This will diminish the correspondence cost over the information transmission in the conveyed arrange. This plan gives best extension to different

security issues and offer conceivable outcomes for incorporated key administration plans.

## VIII. REFERENCES

1. W. DIFFIE AND M. E. HELLMAN, —NEW DIRECTIONS IN CRYPTOGRAPHY,| IEEE TRANSACTIONS ON INFORMATION THEORY, VOL. IT-22, NOV. 1976, PP. 644–54.
2. W. F. EHRSAM, S. M. MATYAS, C. H. MEYER, AND W. L. TUCHMAN, —A CRYPTOGRAPHIC KEY MANAGEMENT SCHEME FOR IMPLEMENTING THE DATA ENCRYPTION STANDARD,| IBM SYST. JOURNAL, VOL. 17, PP. 106-125, FEB. 1978
3. CATHERINE MEADOWS —FORMAL METHODS FOR CRYPTOGRAPHIC PROTOCOL ANALYSIS: EMERGING ISSUES AND TRENDS| IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 21, NO. 1, JANUARY 2003 PP 44-53
4. W. STALLINGS, CRYPTOGRAPHY AND NETWORK SECURITY: PRINCIPLES AND PRACTICE, 2ND ED., PRENTICE HALL, 1999.
5. K. SHIM, —CRYPTANALYSIS OF MUTUAL AUTHENTICATION AND KEY EXCHANGE FOR LOW POWER WIRELESS COMMUNICATIONS,| IEEE COMMUN. LETT., VOL. 7, PP. 248–250, 2003.
6. PRANJALI DEEPAK NIKAM , VANITA RAUT,- IMPROVED MANET SECURITY USING ELLIPTIC CURVE CRYPTOGRAPHY AND EAACK. 2015 INTERNATIONAL CONFERENCE ON COMPUTATIONAL INTELLIGENCE AND COMMUNICATION NETWORKS
7. ADRIAN P. LAUF, RICHARD A. PETERS AND WILLIAM H. ROBINSON, "A DISTRIBUTED INTRUSION DETECTION SYSTEM FOR RESOURCE-CONSTRAINED DEVICES IN AD-HOC NETWORKS," AD HOC NETWORKS, VOL. 8, NO. 3, PP. 253-266, MAY 2010.
8. WOLFGANG KIESS AND MARTIN MAUVE, "A SURVEY ON REAL-WORLD IMPLEMENTATIONS OF MOBILE AD-HOC NETWORKS," AD HOC NETWORKS, VOL. 5, NO. 3, PP. 324-339, APRIL 2007.
9. ANA CAVALLI AND JEAN-MARIE ORSET, "SECURE HOSTS AUTO-CONFIGURATION IN MOBILE AD HOC

- NETWORKS," AD HOC NETWORKS, VOL. 3, NO. 5, PP. 656-667, SEPTEMBER 2005.
10. NIKOS KOMNINOS, DIMITRIS VERGADOS AND CHRISTOS DOULIGERIS, "DETECTING UNAUTHORIZED AND COMPROMISED NODES IN MOBILE AD HOC NETWORKS," AD HOC NETWORKS, VOL. 5, NO. 3, PP. 289-298, APRIL 2007
  11. SHAMIR A, "HOW TO SHARE A SECRET," COMMUNICATIONS OF THE ACM, VOL. 22, NO. 11, PP. 612-613, 1979.
  12. A.D.SANTIS, Y.DESMEDT, Y.FRANKLE, AND M. YUNG, "HOW TO SHARE A FUNCTION SECURELY (EXTEND SUMMARY)," PROCEEDINGS OF THE TWENTY-SIXTH ANNUAL ACM SYMPOSIUM ON THEORY OF COMPUTING, PP. 522-533, 1987.
  13. JIEJUN K AND ZERFOS P, "PROVIDING ROBUST AND UBIQUITOUS SECURITY SUPPORT FOR MOBILE AD-HOC NETWORKS," PROC. OF THE 9TH INTERNATIONAL CONFERENCE ON NETWORK PROTOCOLS, 2001, PP. 251-260.
  14. RONALD L. RIVEST, ADI SHAMIR AND LEONARD M. ADLEMAN, A METHOD FOR OBTAINING DIGITAL SIGNATURES AND PUBLIC-KEY CRYPTOSYSTEMS, COMMUNICATIONS OF THE ACM 21 (1978) (2), PP. 120-126
  15. L. ESCHENAUER, V.D. GLIGOR, A KEY-MANAGEMENT SCHEME FOR DISTRIBUTED SENSOR NETWORKS, IN: PROCEEDINGS OF THE 9TH ACM CONFERENCE ON COMPUTER AND COMMUNICATIONS SECURITY, NOVEMBER 2002.
  16. J. HEATHER AND S. SCHNEIDER. TOWARDS AUTOMATIC VERIFICATION OF AUTHENTICATION PROTOCOLS ON AN UNBOUNDED NETWORK. IN 13TH COMPUTER SECURITY FOUNDATIONS WORKSHOP, PAGES 132-143.
  17. ABDELHAMID OUARDANI, SAMUEL PIERRE, HANIFA BOUCHENEB SECURITY PROTOCOL FOR MOBILE AGENTS BASED UPON THE COOPERATION OF SEDENTARY AGENTS ELSEVIER JOURNAL OF NETWORK AND COMPUTER APPLICATIONS 30 (2007) 1228-1243
  18. L. ESCHENAUER AND V. D. GLIGOR, —A KEY-MANAGEMENT SCHEME FOR DISTRIBUTED SENSOR NETWORKS,| IN PROC. CCS'02. NEW YORK, , USA ACM PRESS, 2002, PP. 41-47
  19. K. LU, Y. QIAN, M. GUIZANI, AND H.-H. CHEN, —A DISTRIBUTED KEY MANAGEMENT SCHEME IN HETEROGENEOUS WIRELESS SENSOR NETWORKS,| IEEE TRANSACTION ON WIRELESS COMMUNICATIONS, 2007.
  20. EL RHAZI A, PIERRE S, BOUCHENEB H. SECURE PROTOCOL IN MOBILE AGENT ENVIRONMENTS. IEEE CCECE 2003, MAY 4-7, VOL. 2, MONTREAL, PP.777-80.
  21. WALTER FUMY AND PETER LANDROCK —PRINCIPLES OF KEY MANAGEMENT| IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 11, NO. 5, JUNE 1993 PP 785 TO 793
  22. M. ZAPATA AND N. ASOKAN, "SECURING AD HOC ROUTING PROTOCOLS," IN PROC. ACM WORKSHOP WIRELESS SECURE. 2002, PP. 1-10.K. ELISSA, "TITLE OF PAPER IF KNOWN," UNPUBLISHED.
  23. L. ZHOU AND Z. J. HAAS, SECURING AD HOC NETWORKS. IEEE NETWORKS, VOLUME 13, ISSUE 6 1999.
  24. H. LUO AND S. LU, .UBIQUITOUS AND ROBUST AUTHENTICATION SERVICES FOR AD HOC WIRELESS NETWORKS., TECHNICAL REPORT200030, UCLA COMPUTER SCIENCE DEPARTMENT 20005JP. HUBAUX, L. BUTTYÁN AND S. CAPKUN.



# Harmonic Analysis and Switching Angle Calculation by Equal Phase Method for Cascade H-Bridge five level Inverters

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## ABSTRACT

Multilevel inverters have become very popular in the last few years, due to their advantages over the conventional two level inverters, in producing sinusoidal waveform with low distortion, high quality and high efficiency. Many topologies of multilevel inverter have been proposed during the last three decades, aiming to construct a sinusoidal waveform. It is hard to connect a single power semiconductor switch directly to medium voltage grids (2.3, 3.3, 4.16, or 6.9 kV). For these reasons, a new family of multilevel inverters has emerged as the solution for working with higher voltage levels. Multilevel inverters have received more attention in industrial application, such as motor drives, static VAR compensators and renewable energy systems, etc. Primarily multilevel inverters are known to have output voltages with more than two levels. As a result, the inverter output voltages have reduced harmonic distortions and high quality of waveforms. Additionally, the devices are confined to fraction of dc-link voltage. These characteristics make multilevel inverter to adopt for high-power and high-voltage applications. Although different multilevel inverter exists, Cascade Multilevel Inverter (CMI) is one of the productive topology from multilevel family. In reality, on comparing with other multilevel based topologies, CMI feature a high modularity degree because each inverter can be seen as a module with similar circuit topology, control structure, and modulation. Therefore, in the case of a fault in one of these modules, it is possible to replace it quickly and easily. Moreover, with an appropriated control strategy, it is possible to bypass the faulty module without stopping the load, bringing an almost continuous overall availability. All this features make CMI an outstanding power converter.

**Keywords :** Multilevel Inverters, Cascaded, Switching Time, Equal Phase Method

## I. INTRODUCTION

### MULTISOURCE CASCADED H-BRIDGE MULTILEVEL INVERTER

The serially connected H-bridge with separate DC source is called as cascaded H-bridge multilevel inverter. In this type of configuration voltage on each DC source is same value. The multi-level inverter has been introduced since 1975 as alternative in high power and medium voltage situations. The Multi-level inverter is like an inverter and it is used for industrial

applications as alternative in high power and medium voltage situations.

#### A. Concept of Multilevel Inverters

Multilevel inverter includes an array of power semiconductor devices and capacitors voltage sources, the output of which generates voltages with stepped waveforms [1-2]. The commutation of the switches permits the addition of the capacitor voltages to obtain high- voltage at the output, while the power

semiconductors have to withstand only reduced voltages.

Herein, we should remember one important thing i.e. as the number of steps increases in the output waveforms; harmonic content comes down [3]. Thus power quality of such waveforms will increase drastically. However, in order to generate step kind of waveforms in output side, different *Multilevel* based archetypes are successfully built and verified. But general principle of multilevel inverters is the synthesis of the ac voltage from several different voltage levels on the dc bus. As the number of voltage levels on the input dc side increases, the output voltage adds more steps [4-6], which approach the sinusoidal wave.

The need of multilevel converter is to give a high output power from medium voltage source. Sources like batteries, super capacitors, solar panel are medium voltage sources. The multi-level inverter consists of several switches. In the multi-level inverter the arrangement switches' angles are very important.

Multilevel inverters are three types.

- Diode clamped multilevel inverter
- Flying capacitors multilevel inverter
- Cascaded H- bridge multilevel inverter

#### B. Cascaded H-Bridge Multilevel Inverter:

The cascaded H-bridge multi-level inverter is to use capacitors and switches and requires less number of components in each level. This topology consists of series of power conversion cells and power can be easily scaled. The combination of capacitors and switches pair is called an H-bridge and gives the separate input DC voltage for each H-bridge. It consists of H-bridge cells and each cell can provide the three different voltages like zero, positive DC and negative DC voltages. One of the advantages of this type of multi-level inverter is that it needs less number of components compared with diode clamped

and flying capacitor inverters. The price and weight of the inverter are less than those of the two inverters. Soft-switching is possible by the some of the new switching methods.

Multilevel cascade inverters are used to eliminate the bulky transformer required in case of conventional multi-phase inverters, clamping diodes required in case of diode clamped inverters and flying capacitors required in case of flying capacitor inverters. But these require large number of isolated voltages to supply the each cell.

Example: 5- H-bridge multi-level inverter, 9- H-bridge clamped multi-level inverter. This inverter is also same like that diode clamped multi inverter.

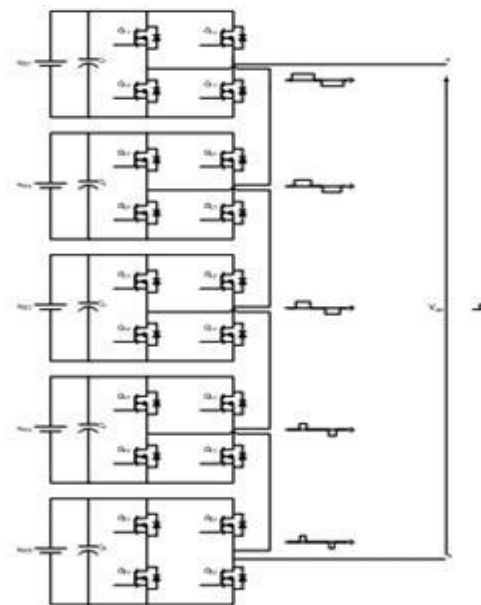


Fig 1 H Bridge multi-level inverter

Cascade multilevel inverters are based on a series connection of several single-phase inverters. This structure is capable of reaching medium output voltage levels using only standard low-voltage mature technology components. Typically, it is necessary to connect three to ten inverters in series to reach the required output voltage. These converters also feature a high modularity degree because each inverter can be

seen as a module with similar circuit topology, control structure, and modulation [8]. Therefore, in the case of a fault in one of these modules, it is possible to replace it quickly and easily. Moreover, with an appropriated control strategy, it is possible to bypass the faulty module without stopping the load, bringing an almost continuous overall availability [9].

CHB-MLIs formed by the series connection of two or more single-phase H-bridge inverters, hence the name [11]. Each H-bridge corresponds to two voltage source phase legs, where the line-line voltage is the inverter output voltage. Therefore, a single H-bridge converter is able to generate three different voltage levels. Each leg has only two possible switching states, to avoid dc-link capacitor short-circuit. Since there are two legs, four different switching states are possible, although two of them have redundant output voltage. So when two or more H-bridges are connected in series, their output voltages can be combined to form different output levels, increasing the total inverter output voltage and also its rated power.

## II. SWITCHING ANGLE

Switching angle is the moment of the voltage level change at the output. For an m-level waveform as shown in fig.4 there are 2(m-1) switching angles are needed. We call them as  $\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_{m-2}, \alpha_{m-1}$ . Since the sine wave is a symmetrical waveform, as shown in fig., the negative half cycle is centrally symmetrical to its positive half cycle; and the waveform of the second quarter period is mirror symmetrical to the waveform of its first quarter period. So we call the switching angles in the first quadrant period i.e.,  $0^\circ$ - $90^\circ$  as main switching angles.

### A. Main Switching Angles

In the first quarter of the sine wave (i.e.,  $0^\circ$  to  $90^\circ$ ):

$$\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_{(m-1)/2} \quad (1)$$

The switching angles in the second quarter of the sine wave (i.e.,  $90^\circ$  to  $180^\circ$ ) are:

$$\alpha_{(m+1)/2} = \pi - \alpha_{(m-1)/2}, \pi - \alpha_{(m-2)/2}, \dots, \pi - \alpha_1 \quad (2)$$

The switching angles in third quadrant of the sine wave (i.e.,  $180^\circ$  to  $270^\circ$ ) are

$$\alpha_m = \pi + \alpha_1, \dots, \pi + \alpha_{(m-1)/2} \quad (3)$$

The switching angles in the fourth quadrant (i.e.,  $270^\circ$  to  $360^\circ$ ) are:

$$\alpha_{(3m-1)/2} = 2\pi - \alpha_{(m-1)/2}, \dots, 2\pi - \alpha_1 \quad (4)$$

From the above analysis it was concluded that we need to determine only the main switching angles (i.e., from  $0^\circ$  to  $90^\circ$ ), the other switching angles (i.e., from  $90^\circ$  to  $360^\circ$ ) can be obtained from the main switching angles in the first quadrant.

### B. Methods to calculate switching angle for cascade H-bridge inverters

There are following four methods:-

1. Equal Phase (EP) Method.
2. Half Equal Phase (HEP) Method.
3. Half Height (HH) Method.
4. Feed Forward (FF) Method.

We are discussing only Equal phase method in this paper.

- 1) **Equal Phase (EP) Method:** In the equal phase method the switching angles are distributed averagely in the range  $0$ - $\pi$ . The main switching angles are obtained by the formula given below:

$$\alpha_i = i * 180^\circ / m \text{ where } i=1, 2, \dots, (m-1) / 2 \quad (5)$$

## III. SINGLE PHASE FIVE LEVEL INVERTER BY EQUAL PHASE METHOD

Figure shows a five level cascaded H-bridge multilevel inverter. The converter consists of two series connected H-bridge cells which are fed by independent voltage sources. The outputs of the H-bridge cells are connected in series such that the synthesized voltage waveform is the sum of all of the

individual cell outputs. The output voltage is given by  $V=V1 +V2$  Where the output voltage of the first cell is labeled  $V1$  and the output voltage of the second cell is denoted by  $V2$ . There are five level of output voltage i.e  $2V, V, 0, -V, -2V$ .The main advantages of cascaded H-bridge inverter is that it requires least number of components, modularized circuit and soft switching can be employed. But the main disadvantage is that when the voltage level increases, the number of switches increases and also the sources, this in effect increases the cost and weight.

The cascaded H-bridge multilevel inverters have been applied where high power and power quality are essential, for example, static synchronous compensators, active filter and reactive power compensation applications, photo voltaic power conversion, uninterruptible power supplies, and magnetic resonance imaging. Furthermore, one of the growing applications for multilevel motor drive is electric and hybrid power trains.

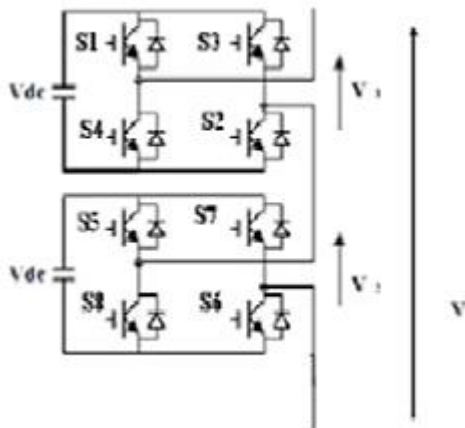


Figure: 2 Single phase five level multilevel inverter

A. Switching Time Table for five level Single Phase Inverter

Pulse number	0	V	2V	V	0	-V	-2V	-V	0
Angle	$36^0$	$72^0$	$108^0$	$144^0$	$216^0$	$252^0$	$288^0$	$324^0$	$360^0$
Time(sec)	0.002	0.004	0.006	0.008	0.012	0.014	0.016	0.018	0.02
S1,S2&S6		On period pulse width							

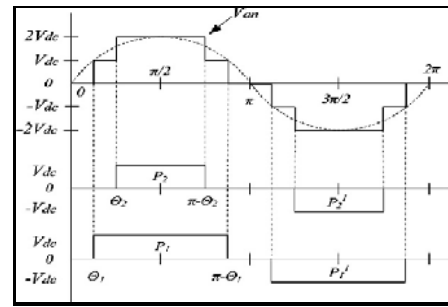


Figure: 3 output voltage

The number of H bridges  $(N) = (m-1)/2$

Here  $m= 5$  so  $N =2$  H bridges

The main switching angles are obtained by the formula given below:

$\alpha_i = i * 180^0/m$  where  $i=1, 2, \dots, (m-1)/2$

Where,

$m=$  level of output voltage, here  $m= 5$

$\alpha =$  switching angle

Total switching angles  $= 2(m-1)$ ,

here total switching angles  $= 8$

Now main switching angles are

$\alpha_1 = 1*180^0/5 = 36^0$

$\alpha_2 = 2*180^0/5 = 72^0$

Rests of the switching angles are

$\alpha_3 = 180^0 - 72^0 = 108^0$

$\alpha_4 = 180^0 - 36^0 = 144^0$

$\alpha_5 = 180^0 + 36^0 = 216^0$

$\alpha_6 = 180^0 + 72^0 = 252^0$

$\alpha_7 = 360^0 - 72^0 = 288^0$

$\alpha_8 = 360^0 - 36^0 = 324^0$

			(30%)					
S3							10%	
S7,S4and S8						On period pulse width (30%)		
S5			10%					

Table 1 Switching Time table for five level inverter

**B. Simulations and Result Discussion**

In this chapter simulations are carried out with and without filter for different cascaded 3, 5 and 7 level inverters and FFT analysis is done in MATLAB/SIMULINK to obtain

THD. For all simulation results on Y-axis voltage in volts is taken and on X-axis time is taken in seconds. Dc voltage is taken as 100 volts for every multi-level inverter.

LCL filter is used to reduce the harmonics.

**C. Five level inverter with and without filter with staircase technique**

Figures shows block diagram structure in MATLAB/SIMULINK for 5 level cascaded MLI. It shows single phase cascaded H-Bridge multilevel inverter consisting of two H-Bridges with 8 MOSFET switches, two DC sources and, R-L load. In this eight MOSFET switches are (switch1, switch2,switch3, switch4, switch5, switch6, switch7, and switch8) are used. Two H-Bridges are connected in series to generate five level output voltage.

The output voltage of H-Bridge inverter 1 is V1 and H-Bridge 2 is V2 & total output voltage of 5 level inverter is V, is  $V=V1+V2$ .

**1) Working Operation of Five Level Inverter:**

The working operation of cascaded H bridge five levels multilevel is explained below:

**Model1:-** In this mode of operation single phase five level cascaded H-Bridge multilevel inverter switch1; switch3,switch5 and switch7 are turned on without connecting source to the load. The output voltage across the load obtained is zero.

**Mode2:-** In this mode of operation single phase five level cascaded H-Bridge multilevel inverter switch1, switch3, switch5 and switch8 are turned on. The output voltage across the load obtained is +Vdc2.

**Mode3:-**In this mode of operation single phase five level cascaded H-Bridge multilevel inverter switch1, switch4, switch5 and switch8 are turned on. The output voltage across the load obtained is Vdc1+Vdc2.

**Mode4:-**In this mode of operation single phase five level H-Bridge cascaded multilevel inverter switch2, switch4, switch6 and switch7 are turned on. The output voltage across the load obtained is -Vdc2.

**Mode5:-**In this mode of operation single phase five level H-Bridge cascaded multilevel inverter switch2, switch4, switch6 and switch8 are turned on. The output voltage across the load obtained is zero.

**Mode6:-** In this mode of operation single phase five level H-Bridge cascaded multilevel inverter switch3, switch2, switch7 and switch6 are turned on. The output voltage across the load obtained is -Vdc1-Vdc2.

**2) Simulink model and output of five level inverter without filter**

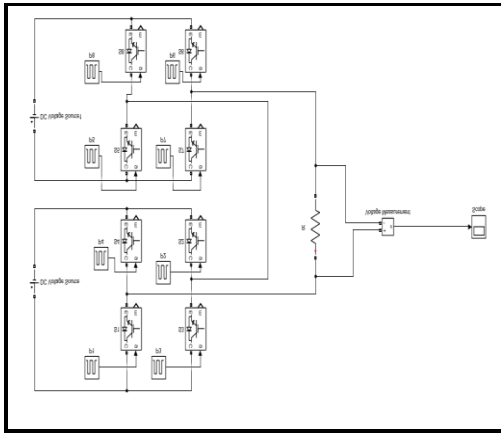


Figure 4. Simulink model of 5 level inverter without filter

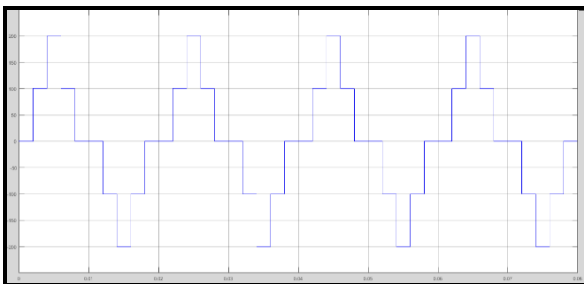


Figure 5. Scope output of 5 level inverter without filter

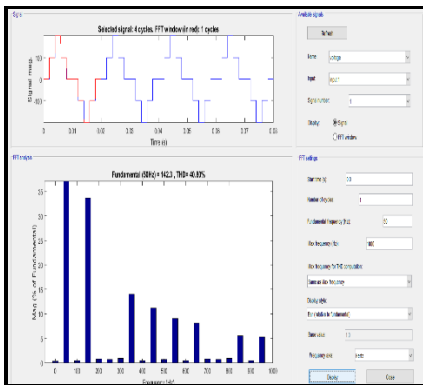


Figure 6. FFT analysis of 5 level inverter without filter

3) Simulink model and output of five level inverter with filter

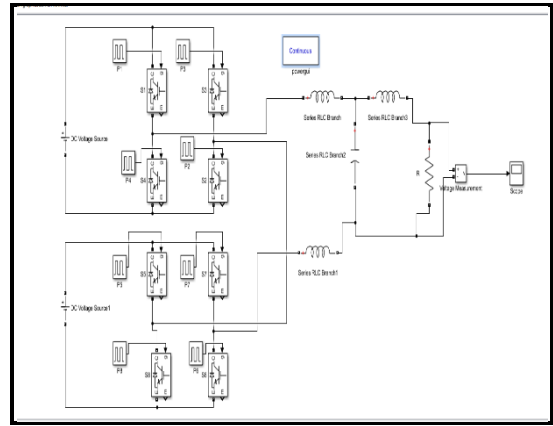


Figure 7. Simulink model of 5 level inverter with filter

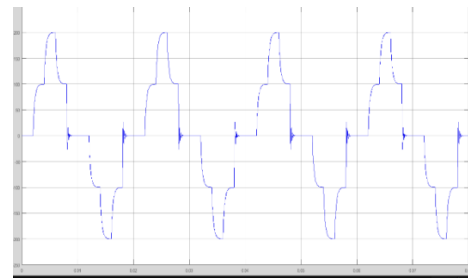


Figure 8. Scope output of 5 level inverter with filter

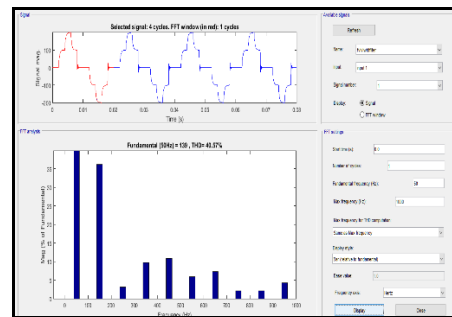


Figure 9. FFT analysis of 5 level inverter with filter

#### IV. RESULT AND CONCLUSION

The following table shows the effect on total harmonic distortion calculation of 5 level multilevel inverters with and without filter. This shows that by using filter distortion is reduced to lower level. This distortion can be further reduced by increasing the number of levels in a multilevel inverter, for eg. A 7 level inverter can be used.

Total harmonic distortion(THD) calculation of Five level multilevel inverters	
Without Filter THD	With Filter THD (%)

(%)	
41.04	40.57

Table 2. total harmonic distortion calculation with and without filter

**V. REFERENCES**

[1]. IEEE Recommended Practices and Requirements for Harmonics Control in Electric Power Systems, IEEE Std. 519, 1992.

[2]. A. Moreno-Munoz, Power Quality: Mitigation Technologies in a Distributed Environment. London, U.K.: Springer-Verlag, 2007.

[3]. N. G. Hingorani, "Introducing Custom Power," IEEE Spectrum, Vol.32, n. 6, pp. 41-48, June 1995.

[4]. Ghosh and G. Ledwich, Power quality enhancement using custom power devices, London, Kluwer Academic Publishers, 2002.

[5]. A Pandey, B Singh, B N Singh, A Chandra, K Al-Haddad, D P Kothari, "A Review of Multilevel Power Converters", IE (I) Journal.EL, vol. 86, pp.220231, March, 2006.

[6]. K.A Corzine, and Y.L Familant, "A New Cascaded Multi-level H-Bridge Drive," IEEE Trans. Power. Electron., vol.17, no.1, pp.125-131. Jan 2002.

[7]. Nasrudin Abd. Rahim, Mohamad Fathi Mohamad Elias, Wooi Ping Hew, IEEE transaction. Industry Electronics, "Design of filter to reduce harmonic distortion in industrial power system", Vol. 60, No: 8, 2943-2956, August 2013.

[8]. M Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Pérez, "A Survey on cascaded multilevel inverters," IEEE Trans. Ind. Electron., vol. 57, no. 7, pp. 2197-2206, July 2010.

[9]. Mohammad Ahmad and B.H. Khan, Senior Member, IEEE "New Approaches for harmonic reduction in solar inverters".

[10]. J. Rodriguez. J.-S. Lai, and F.Z. Peng, "Multilevel inverters: A survey of topologies, controls and applications," IEEE Trans. Ind. Electron., vol. 49, No. 4, pp. 724-738, Aug.

[11]. Mariusz Malinowski, Senior Member, IEEE, K. Gopakumar, Senior Member, IEEE, Jose Rodriguez, Senior Member, IEEE, and Marcelo A. Perez, Member IEEE "A Survey on Cascaded Multilevel Inverters".

[12]. Gobinath.K1, Mahendran.S2, Gnanambal.I3 "New cascaded H-bridge multilevel inverter with improved efficiency." International journal of advanced research in Electrical, Electronics and Instrumentation Engineering Vol.2, issue 4, April 2013.

[13]. C. Govindaraju and K. Baskaran, Member, IEEE "Efficient Sequential Switching Hybrid-Modulation Techniques for Cascaded Multilevel Inverters" vol. 26, no. 6, June 2011.

# Enhancement of Solubility of Mefenamic Acid by Hydrotrop Based Solid Dispersion

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## ABSTRACT

Therapeutically active substances are often associated with bio-availability problems due to lower solubility, these leads to lack of in-vivo and in-vitro correlation, poor patient compliance and inter subject variations. Mefenamic acid (MFA) is an anthranilic acid derivatives (or fenamate) class of NSAID drugs and is used to treat mild to moderate pain, including menstrual pain, and is sometimes used to prevent migraines associated with menstruation. But it is sparingly soluble in water. Present study was aimed to improve solubility of MFA. Among many methods of improving solubilities, hydrotropic solubilisation method was used here. After extensive studies, from various hydrotropes, sodium citrate was shown most promising improvement on solubility. 0.5 M sodium citrate was optimized and its solid dispersion with mefenamic acid, dissolution studies had shown 62% increase in solubility of mefenamic acid as compare to pure drug.

**Keywords:** Mefenamic Acid, Solubility, Hydrotrop, Sodium Citrate.

## I. INTRODUCTION

Many techniques have been employed to enhance the aqueous solubility of poorly water-soluble drugs. Hydrotropic solubilization is one such method. Hydrotropes are a class of chemical compounds which affect an increased aqueous solubility by several folds to certain solutes which are sparingly soluble in water under normal conditions [1, 2]. Therapeutic efficacy of a drug depends upon its bioavailability and ultimately its solubility to achieve a desired concentration in systemic circulation. Because of their low aqueous solubility and high permeability, dissolution from delivery systems forms the rate limiting step in their absorption and systemic bioavailability [3].

Mefenamic acid is [2-[(2, 3 dimethyl phenyl) amino] benzoic acid, an anthranilic acid derivative, is a non-steroidal anti-inflammatory drug (NSAID) which is widely used to relief mild to moderate pain. It has low

water solubility but high permeability. The absolute bioavailability of this drug is about 90–100% [4]. Formulation and manufacture of solid oral dosage forms and tablets in particular, have undergone rapid change and development over the last several decades.

## II. Materials and Methods

UV/visible spectrophotometer (Model- V-530, Jasco) were employed for the spectral measurements. Mefenamic acid was purchased from Research lab Fine Chem. Ltd, Mumbai. All other chemicals and solvents used were of analytical grade.

## III. Experimental work and Results

**Preparation of Calibration Curve:** 10mg of mefenamic acid was dissolved in methanol to get 1mg/ml solution.



Then further dilutions were done to obtain 1 – 10 µg/ml solutions. Absorbance of all solutions was measured at 284nm, with UV-VIS spectrophotometer (Table 01).

Concentration of MFA (µg/ml)	Absorbance
1	0.0597
2	0.1213
4	0.2843
6	0.3721
8	0.4756
10	0.5877

Table 01-Calibration curve of mefenamic acid

The Graph of absorbance against the concentration was plotted and correlation Coefficient- was found to be 0.992 and equation of line was found to be  $y = 1.8571x - 1.3333$ .

**Solubility analysis with different hydrotopes :** Excess of mefenamic acid was added to 1M aqueous solution of urea, sodium citrate and potassium acetate separately. Flasks were shaken at 100 rpm for 24hrs. Solutions were filtered and examined by spectrophotometry at 284nm. The results (Table 02) clearly indicates that sodium citrate is a best hydrotropic agent.

Sr. No.	Hydrotropic agent	Absorbance	Concentration (µg/ml)
1	Potassium acetate	0.4766	6.0196
2	Urea	1.1163	12.3159
3	Sodium citrate	2.4146	25.0944

Table 02.Solubility analysis with different hydrotopes.

**Solubility analysis with variation in concentration of sodium citrate:**

Excess of Mefenamic acid was added in different aqueous solutions of sodium citrate(0.5M, 1M, 1.5M, and 2M). Flasks were shaken at 100 rpm for 24hrs. Solutions were filtered and examined by spectrophotometry at 284nm. Maximum solubility was observed with 0.5 M sodium citrate (Table 03).

Molarity of sodium citrate solution (M)	Absorbance	Concentration of MFA (µg/ml)
0.5M	1.7091	22.709
1.0 M	0.8045	9.2470
1.5M	0.2046	3.3425
2.0 M	0.0496	1.8169

Table No.03. Solubility analysis with variation in concentration of sodium citrate:

**Formulation of solid dispersion:** Mefenamic acid (1.2 mg) was dissolved in 1M sodium citrate (50ml) solution. Solution was heated at 80°C until semisolid consistency was attained then it was transferred to hot plate for complete drying. Dried mass was passed through 100 mesh sieve. Solid dispersion was found to be fine and free flowing.

**Assay:** 84.745 mg solid dispersion of mefenamic acid was weighed accurately and dissolved in 250 ml of distilled water. The absorbance of this solution was measured at 284 nm against blank. The drug content in solid dispersion of mefenamic acid was found to be 2.36 mg per 10 mg of solid dispersion. Thus ratio of drug to solid dispersion is 2.36:10.

**Dissolution study:** The dissolution study for the solid dispersion was carried out according to the Indian Pharmacopoeia, Apparatus Type II (basket) using phosphate buffer pH 7.4 as the dissolution medium [5]. The sample was withdrawn at 5minute interval. Fresh volume of the medium was replaced with the

withdrawn volume to maintain the sink conditions and constant volume throughout the experiment. Samples were suitably diluted with same dissolution medium and the amount of drug dissolved was estimated by UV-VIS spectrophotometer and analysed for the cumulative percentage of drug released. (Table 05).

In vitro release study revealed that there was marked enhancement in the dissolution rate of drug in solid dispersion when compared to pure drug. These may be because of solubilization of drug due to use of sodium citrate as a hydrotrope.

Time (min)	Average of conc. found		% of drug release	% of drug release
	Pure drug	Solid dispersion	Pure drug	Solid dispersion
5	1.450	5.0528	14.50%	50.52%
20	1.5436	5.9956	15.43%	59.95%
40	1.6702	6.9856	16.70%	69.85%
60	1.7256	7.9867	17.25%	79.86%
80	2.1546	9.895	21.54	98.95

Table 05: Dissolution profile of pure mefenamic acid and its solid dispersion.

#### IV. CONCLUSION

The method of hydrotropic solid dispersion is simple, cost-effective, environment friendly and safe (free from toxicity). So this simple methodology of such hydrotropic solid dispersion can be used to enhance the therapeutic efficacy of poorly water soluble drugs. Thus the research work overcomes the problem of poorly water soluble drugs.

#### V. REFERENCES

[1]. Shete AS, Yadav AV, Dabke AP and Sakhare SS. Formulation and evaluation of hydrotropic

solubilization based suspensions of Griseofulvin. *International Journal of PharmaSciences and Research* 2010; 1(1): 51–57.

- [2]. Abraham S. et al. Application of Hydrotropic Solubilization in Spectrophotometric Estimation of Lornoxicam from Tablets. *International Scholarly Research Notices* 2014; 14:4.
- [3]. Wang L, Cui FD, Hayse T and Sunada H. Preparation and evaluation of solid dispersion for nitrendipine-carbopol and nitrendipine HPMCP systems using twin screw extruder. *Chem. Pharm. Bull* 2005; 53(10):1240-1245.
- [4]. Martindale the Complete Drug Reference, 36th Edition, 2009: 80.
- [5]. The Indian Pharmacopeia 2010. Dissolution Test; 2: 189-192.

# Design of A Commercial Building (G+7) With Flat Slab Using Dynamic Analysis In Sap2000

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## ABSTRACT

With the increase in population and development of civilization, the demand for HOUSING is increasing at a peak rate. Especially in towns due to rapid industrialization, the demand is very high. Adapting the construction of Multi-storied Building not only matches with demand but also decreases the price of the single house. Hence an Engineer to be knowledgeable about the planning and designing of such Multi-storied Buildings. Advancements of computer packages have given many tools to the designer towards achieving the best and accuracy in their work. Flat-slab building structures possesses major advantages over traditional slab-beam-column structures because of the free design of space, shorter construction time, architectural –functional and economical aspects. Because of the absence of deep beams and shear walls, flat-slab structural system is significantly more flexible for lateral loads than traditional RC frame system and that make the system more vulnerable under seismic events. Modifications with additional construction elements improve small bearing capacity of the system and increase strength and stiffness, improving seismic behaviour of flat-slab construction system. The aim of our project is to design a G+7 building with flat slabs instead of conventional slab. Analysis & Design of the building with flat slab is done by using SAP2000 software.

**Keywords :** Architecture, Flat slab, SAP, Bearing capacity

## I. INTRODUCTION

Now days, there is an increase in housing requirement with increased population and urbanization. Therefore, building sector has gained increasing prominence. However, the fact that the suitable lands for building/construction- especially in the areas in which people live intensively- are limited and expensive shows that there is a necessity for optimal evaluation of these lands. Additionally, continuously increasing prices leads to increase in building costs; so, both dimensional and cost optimization becomes necessary and even indispensable. When a building is projected, geometrical dimensions of elements belonging to carrier system of the structure are

usually determined by using engineering capability and experiences gained over time. In sizing, the tensile forces to which the material to be subjected to should comply with the specifications. In the building design, the pre-sizing details provided are generally not changed much; sizes obtained in second or – at most third solution are taken as carrier system sizes. The basic aim in the engineering is to find a design having lowest cost, and ensuring predicted limitations.

### Flat Slab:

Flat slabs system of construction is one in which the beams used in the conventional methods of constructions are done away with. The slab

directly rests on the column and load from the slab is directly transferred to the columns and then to the foundation. To support heavy loads the thickness of slab near the support with the column is increased and these are called drops, or columns are generally provided with enlarged heads called column heads or capitals. Absence of beam gives a plain ceiling, thus giving better architectural appearance and also less vulnerability in case of fire than in usual cases where beams are used.

### Basic Definition of Flat Slab:

In general normal frame construction utilizes columns, slabs & Beams. However it may be possible to undertake construction without providing beams, in such a case the frame system would consist of slab and column without beams. These types of Slabs are called flat slab, since their behaviour resembles the bending of flat plates. A reinforced concrete slab supported directly by concrete columns without the use of beams.



Figure: Slabs with columns

### Components of Flat Slabs

- a. **Drops**: To resist the punching shear which is predominant at the contact of slab and column Support, the drop dimension should not be less than one-third of panel length in that direction.
- b. **Column Heads**: Certain amount of negative moment is transferred from the slab to the column at the support. To resist this negative moment the area at the support needs to be increased. This is facilitated by providing column capital/heads. Flat slabs are appropriate for most floor situations and also for

irregular column layouts, curved floor shapes, ramps etc. The benefits of choosing flat slabs include a minimum depth solution, speed of construction, flexibility in the plan layout (both in terms of the shape and column layout), a flat soffit (clean finishes and freedom of layout of services) and scope and space for the use of flying forms.

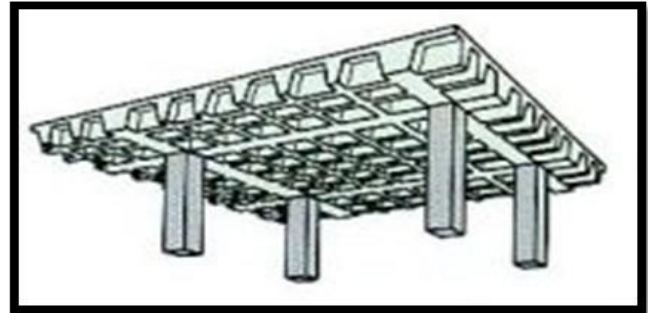


Fig: Solid Flat Slab

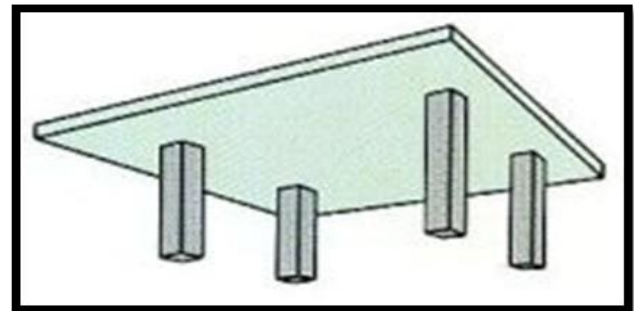


Fig: 1.3 Coffered Flat Slab

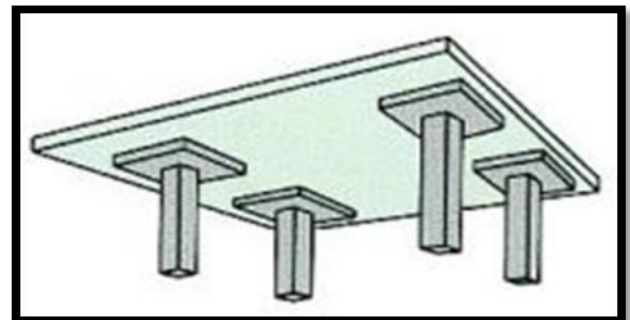


Fig: Solid Flat slab with Drop Panels

## II. METHODS OF DESIGN

Some of the popular design methods are:

- 2.4.1 Working Stress Method.
- 2.4.2 Ultimate Load Method.
- 2.4.3 Limit State Method.

### Working Stress Method:

This is also known as MODULAR RATIO METHOD, F.O.S. METHOD and ELASTIC METHOD.

In this method, analysis is based on the elastic theory assuming that both materials obey Hook's Law. It is a traditional method which is used for the design of reinforced concrete design where it is assumed that concrete and steel act together and are perfectly elastic at all stages and relationship between the loads and stresses is linear up to the collapse of the structure. It is based on the criteria that the actual stresses developed in the material under the action of the working loads is limited to a set of allowable values. Thus, the sections are designed in such a way that the stresses are within the permissible limits. This leads to un-economical sections, as the method doesn't utilize the full strength of the material resulting in heavier sections.

Design Loads = working /service loads. Design Stresses = characteristic values /F.O.S F.O.S For concrete =  
3 ---- for bending  
4 ---- for shear / compression  
F.O.S for Steel = 1.78 ---- for bending, shear & compression.

### Ultimate Load Method:

This is also known as LOAD FACTOR METHOD. In this method, inelastic behaviour of concrete is taken into account. At the failure the material tends to behave elastically, the strain increases many times beyond those in the elastic theory and stress distribution adjusts itself to enable member to develop maximum capacity. In this method, service loads are proportioning the section to carry up to the ultimate strength of the material.

Design Load = Working load \* load factor  
Design Stress = characteristic value / Load factor.  
Load Factor = 1.5 ----- Concrete  
= 1.15 ----- Steel. DEFECTS:

This method gives slender sections but larger deflections and larger cracks. Thus, in this method serviceability is not taken care off.

### Limit State Design:

It is an ideal method of design which takes into consideration not only ultimate strength but also serviceability and durability requirement. It includes merits of both elastic and ultimate theories. When a structure or apart of the structure becomes unfit for It is said to have reached its "LIMIT STATE". This method is to provide an acceptable probability that the structure will not reach any limit state during its services life time.

Design loads = working loads \* P.S.F.

Design stress = characteristic values/ P.S.F.

P.S.F. depends on the load combinations as per cl. 36.4.1, IS-456-2000. It consists of:

Limit state of collapse.

Limit state of serviceability. Limit state of collapse:

It is the limit state on attainment of which the structure is likely to collapse. It relates to strength and stability of the structures. Design to this limit ensures safety of structure against collapse

Limit state of collapse includes:

Bending

Shear Compression Torsion

Limit state of serviceability:

It relates to performance and behaviour of structure at working loads and is

based on causes affecting serviceability of the structure. It concerns with cracking and deflection of the structure.

Limit state of serviceability includes:

Deflections

Vibrations Cracking Durability

## III. MODELLING

### MODELLING OF RCC FRAMES

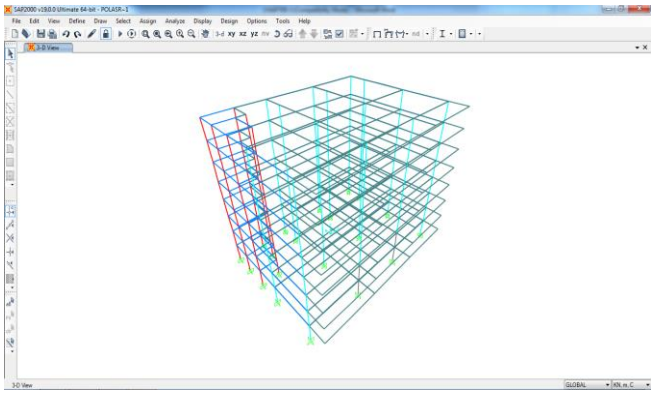


Fig. 3d view wire frame

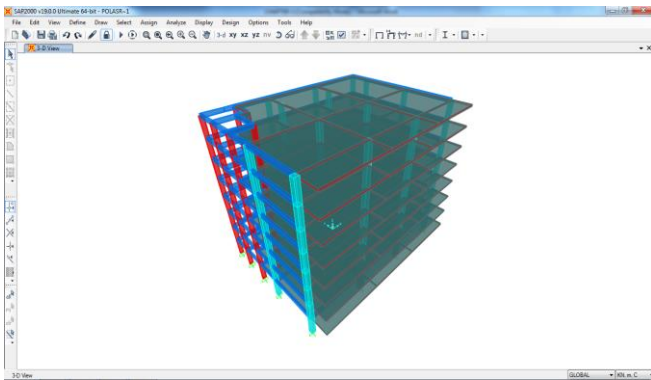


Fig : 3d view

- Column1 = 0.6\* 0.6 m
- Column2 = 0.75\* 0.75 m
- All beams = 0.3 \* 0.6 m
- All slabs = 0.3 m thick

**Materials for the structure:**

The materials for the structure were specified as concrete with their various constants as per standard IS code of practice

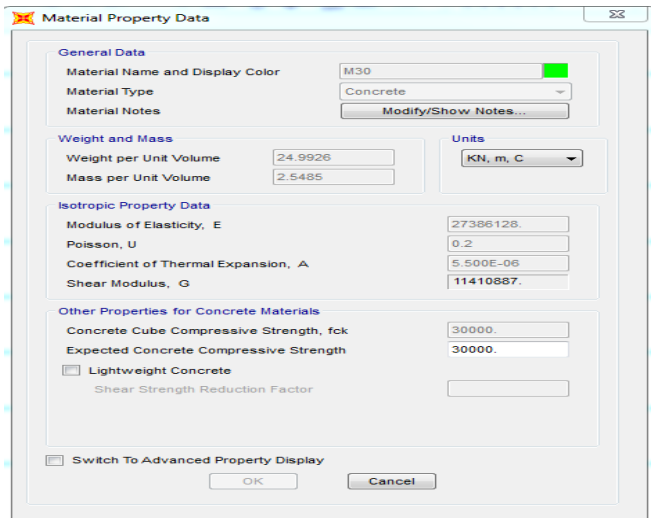
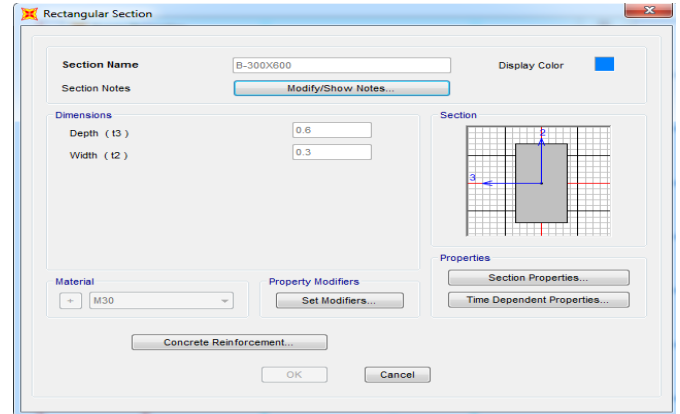


Fig : Generation of member property

**Generation of member property:**

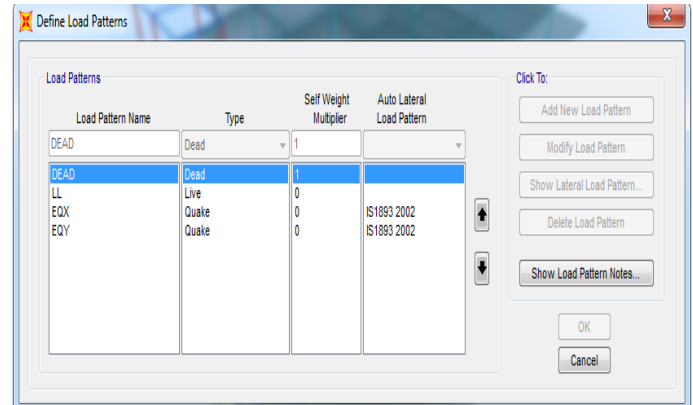
Generation of member property can be done in SAP2000 by using the window as shown above. The member section is selected and the dimensions have been specified. The beams are having a dimension of 0.3 \* 0.6 m and the columns having a dimension of 0.6\*0.6 m, 0.75\*0.75m.



**Loading:**

The loading cases were categorized as:

- Self-weight
- Dead load from slab
- Live load
- Load combinations



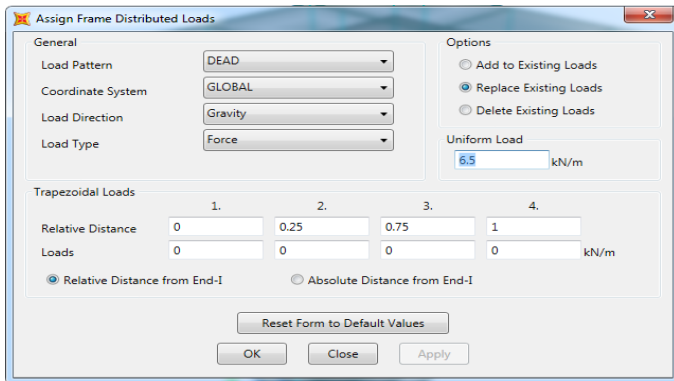
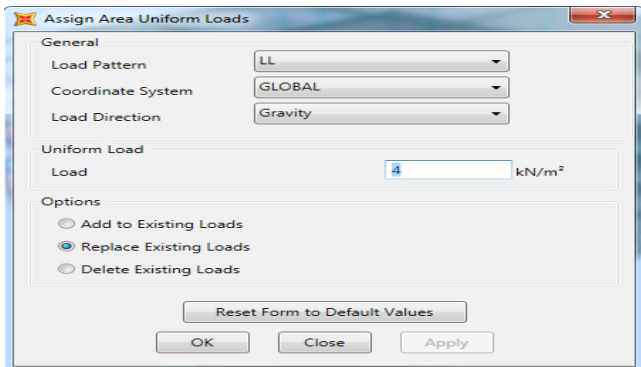


Fig : Frame load case

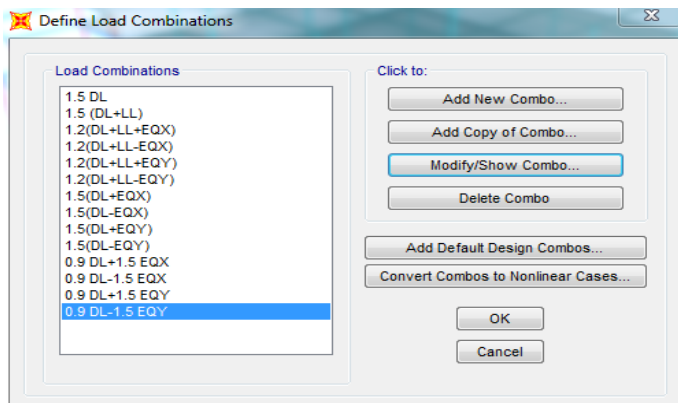
**Live load:**

The live load considered in each floor was 4.0 KN/sq m and for the terrace level it was considered to be 0.75 KN/sq m. The live loads were generated in a similar manner as done in the earlier case for dead load in each floor. This may be done from the member load button from the load case column.



**Load combination:**

The structure has been analyzed for load combinations considering all the previous loads in proper ratio. The combination of self-weight, dead load, live load and was taken in to consideration.



**IV. ANALYSIS AND DESIGN RESULTS**

**Analysis Results:**

The structure was designed for concrete in accordance with IS code. The parameters such as clear cover,  $F_y$ ,  $F_c$ , etc were specified. The window shown below is the input window for the design purpose.

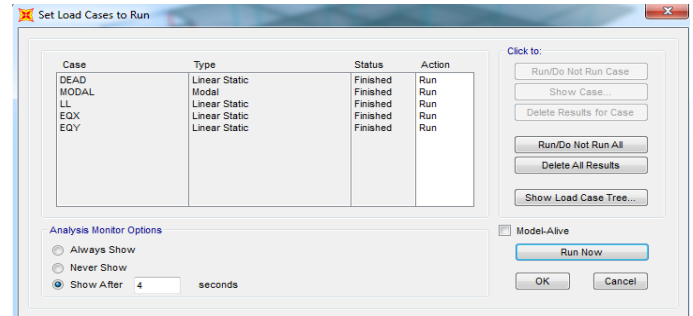


Fig. input window for Analysis.

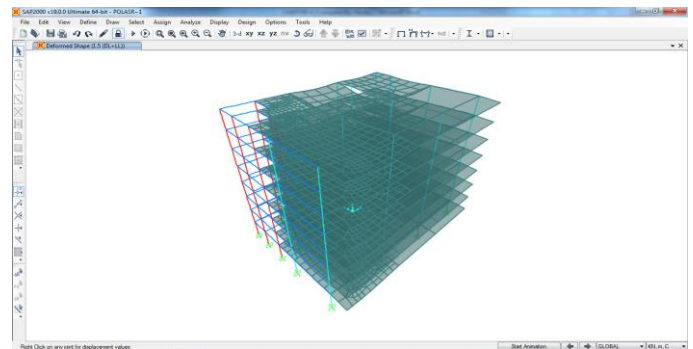


Fig. post processing mode

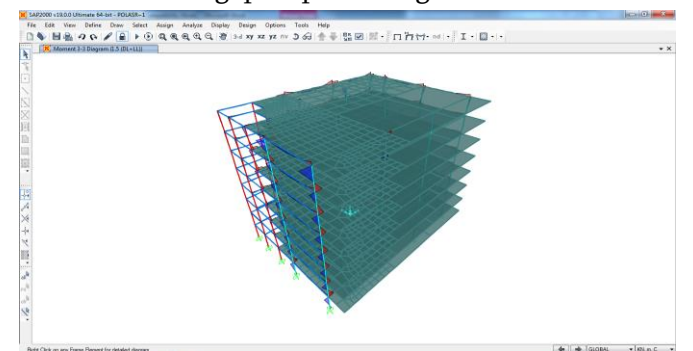


Fig. bending moment

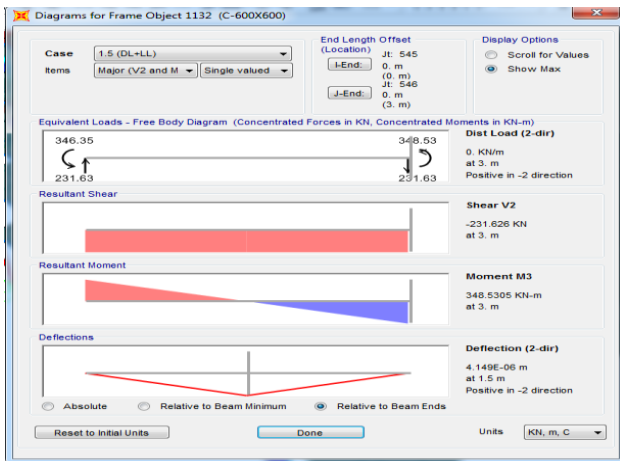


Fig. graph for shear force and bending moment for a column-1

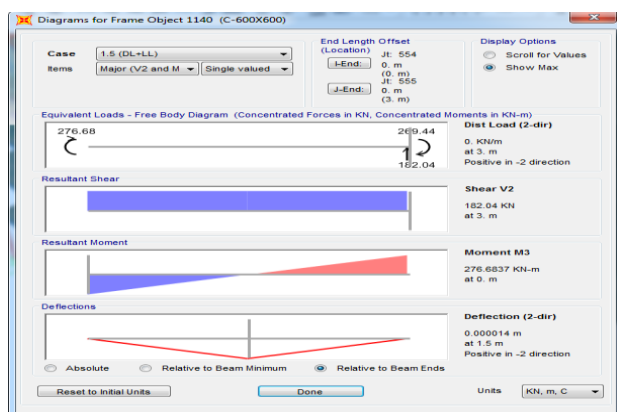


Fig. graph for shear force and bending moment for a column-2

## V. CONCLUSION

Flat-slab building structures possess major advantages over traditional slab-beam-column structures because of the free design of space, shorter construction time, architectural –functional and economical aspects. Because of the absence of deep beams and shear walls, flat-slab structural system is significantly more flexible for lateral loads than traditional RC frame system and that make the system more vulnerable under seismic events. The purely flat-slab RC structural system is considerably more flexible for horizontal loads than the traditional RC frame structures which contributes to the increase of its vulnerability to seismic effects. The critical moment in design of these systems is the slab-column connection, i.e., the penetration force in the slab at the connection, which should retain its bearing

capacity even at maximal displacements. The ductility of these structural systems is generally limited by the deformability capacity of the column-slab connection. To increase the bearing capacity of the flat-slab structure under horizontal loads, particularly when speaking about seismically prone areas and limitation of deformations, modifications of the system by adding structural elements are necessary.

## VI. REFERENCES

- [1]. IS: 875 (Part 1) – 1987 for Dead Loads, Indian Standard Code Of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures, Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
- [2]. IS: 875 (Part 2) – 1987 for Imposed Loads, Indian Standard Code Of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures, Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
- [3]. IS: 875 (Part 5) – 1987 for Special Loads and Combinations, Indian Standard Code Of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures, Bureau of Indian Standards, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
- [4]. IS 456-2000, Indian standard code of practice for plain and reinforced concrete (fourth revision), Bureau of Indian Standards, New Delhi, July 2000.
- [5]. SP: 16-1980, Design aids for reinforced concrete to IS: 456, Bureau of Indian standards, New Delhi, 1980.
- [6]. SP: 34-1987, Hand Book of Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi, 1987
- [7]. Jain, A.K. “Reinforced Concrete – Limit State Design”, Sixth edition, New Chand & Bros, Roorkee, 2002.



# Android Based Braille Tutor System for Visually Impaired People

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## ABSTRACT

Visually impaired students (VIS) are unable to get visual information, which has made their learning process complicated. This paper discusses the overall situation of VIS and identifies major challenges that they are facing in getting education. The Braille system is followed to educate blind students. However, lack of Braille based educational resources and technological solutions have made the learning process lengthy and complicated for VIS. As a developing country, most of the people cannot afford for the costly Braille related technological tools for VIS. Therefore, a mobile phone based Braille Tutor System, for Android platform is designed to provide an easy Braille learning technology for VIS. The main objective of the project is to create a low cost, economical presentation device and Braille tutor system based on Android for the blind. The project uses An Android Application which acts as a tutor at sender side and server side system which receives the data and converts to text to speech and even displays it in graphical manner at the Receiver Side. The Text can also covert into speech at the Receiver Side. Tutor App for visually impaired is a device that can be used by blind for two major purposes i.e. Note Taker, Electronic Braille Tutor System.

**Keywords :** Android platform, Braille Tutor System, Voice to Text Conversion, Braille Converter, Text-To-Speech Translator, Visual Impaired People Education for VIS.

## I. INTRODUCTION

In 2008, The World Health Organization (WHO) estimates that there are approximately 161 million people with severe vision loss worldwide. A generation ago 50 percent of blind school children used Braille. Now, it's less than 12 percent. Hence, in a vision to increase the percentage of Blind people studying Braille in a interactive way, this device is being developed

Braille is a tactile writing system used by people who are blind or visually impaired. It is traditionally written with embossed paper. Braille-users can read computer screens and other electronic supports thanks to refreshable braille displays. They can write braille with the original slate and stylus or type it on a braille writer, such as a portable braille

note-taker, or on a computer that prints with a braille embosser.

This paper is a very important need in today's world. It can be used to make examination experience easy for visually impaired people. This is better than many other options available till date for visually challenged people. Making use of Braille, Providing human support and giving extra time to complete the same task are some available methods to help visually impaired people to take the tests. This paper will help innovate a new way that will help blind and visually impaired people to take the test on their own without using anyone's help. The key focus of application is to provide students with an ability to interact with the system through speech. The application automates the examination process through reading out questions to the user and receiving their input orally. Technology of voice recognition will be used for solving the tests.

Hence this application will allow visually impaired people to appear for test in more convenient and efficient way.

## II. Research Motivations and Problem Definition About Braille and Proposed Research Methodology

Braille is writing system which enables blind and partially sighted people to read and write through touch. It was invented by Louis Braille (1809-1852), who was blind and became a teacher of the blind. It consists of patterns of raised dots arranged in cells of up to six dots in a 3 x 2 configuration. Each cell represents a letter, numeral or punctuation mark. Some frequently used words and letter combinations also have their own single cell patterns. Braille can be seen as the world's first binary encoding scheme for representing the characters of a writing system. The system as originally invented by Braille consists of two parts:

- i) A character encoding for mapping characters of the French language to tuples of six bits or dots.
- ii) A way of representing six-bit characters as raised dots in a Braille cell.

### Problem Statement:

The main aim of this paper is to propose a system that uses speech technology to provide students with access to information during exams. The key focus of application is to provide students with an ability to interact with the system through speech. The application automates the examination process through reading out questions to the user and receiving their input orally. Application also provides accessories for other requirements, like knowing the time remaining, during exams.

Use of this application shall benefit students with:

- Learning disabilities, including dyslexia and dysgraphia
- Poor or limited motor skills
- Vision impairments
- Physical disabilities
- Limited English Language
- The application will help the students with reading writing disabilities
- as well as sensory disabilities

## III. Proposed System and Methodology System Design and Architecture

The proposed project work is to create a low cost, economical Presentational device and Android Based Braille tutor system for the blind. The proposed system will involve 2 Major Module 1)An Android Based Tutor System. 2)A Java Server System.

**1.Android Tutor System:** It will be an android application which will have a login credentials and further 2 different modes of operations. Those are Auto Mode System and User Mode System. An **Auto Mode System** in which the Application will be sending each Alphanumeric Letters in a sequence to the Embedded Interpreter along with voice notifications further, the Receiver module will interpret the received Character in a Braille Pattern. An **User Mode System**, in which the tutor or the teacher will speak out a word say Good Luck, which will be synthesized from voice to text and each letter of the sentence spoken will be sent in sequence with some gap and the receiver Embedded system will present each letter sequence in the Braille Pattern along with the voice notification.

**2.A Java Server System :** It's Design using Java (Socket Server) having all interface and other components like Bluetooth required to complete the system. An Server System which acts as a receiver for the Tutor App

using Bluetooth as a medium and presents the Braille Matching sequence of each incoming word.

**System design and Architecture:**

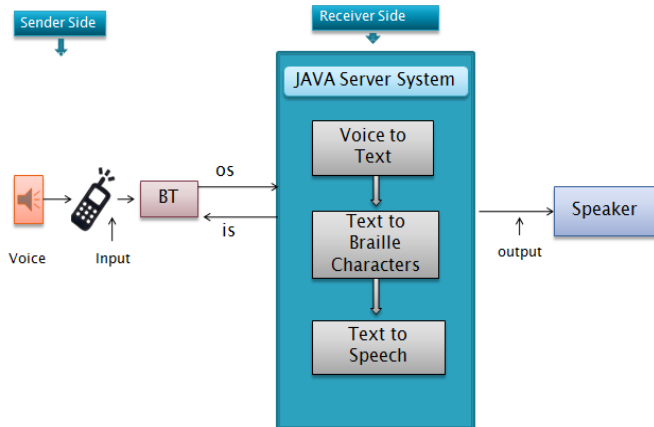


Fig.1. Block diagram of Braille Tutor System

The architecture of our proposed system is depicted in fig.1. The diagram shows major component of present system which are:

- Android Smart Phone.
- 512MB or 1GB RAM.
- GPRS, Bluetooth Supported.
- System with Minimum Pentium 4 Processor.
- Ram Minimum 4GB.
- Front-End:-Java, xml, Android Studio, Net-Beans IDE
- Back-End:-SqlServer, Sqlite.

In the Braille System architecture will give the conversion of text to Braille characters using Java. The user will send the data which is in the form of text. The text form will convert into Braille characters using Braille transcription. The transcription will fetch the data from the database. The transcription will convert the text to Braille characters & this converted data will be displayed on the window .The received data is again convert into speech at the Receiver Side.

**4.3 Flowchart**

The following flow chart will give the complete process of Proposed Tutor System

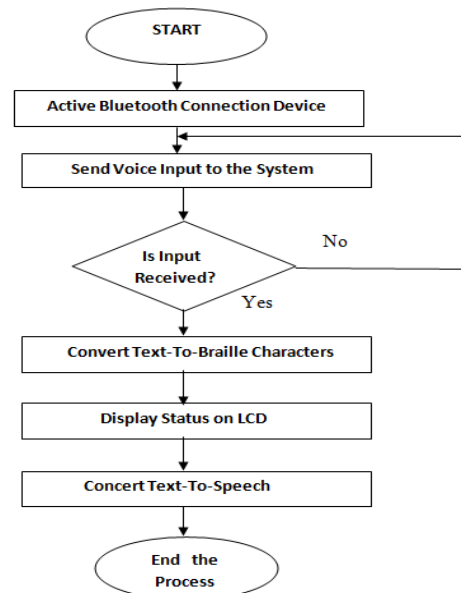


Fig.2. Flow chart of an Android based Braille Tutor System

Processing Steps of our proposed System:

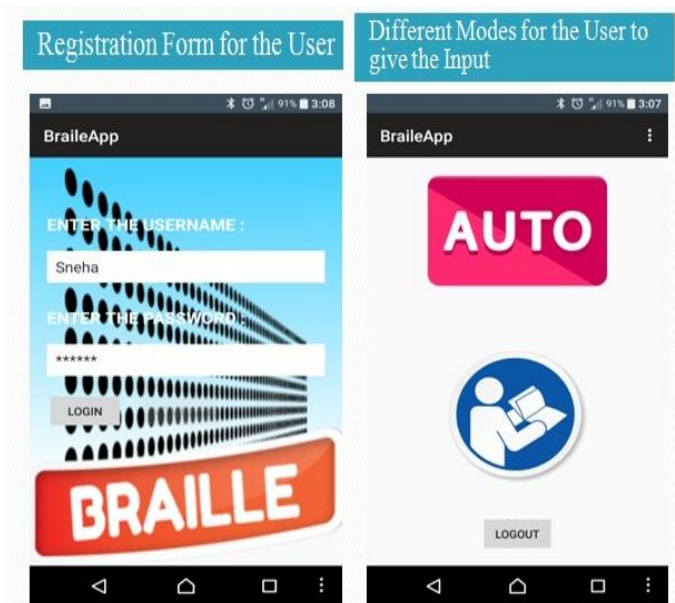
- The main process will start with an Android application . User need to send Voice as an input to the system through Bluetooth device.
- Activate the Bluetooth device while sending an input .
- Check the condition whether the input is received by the system or no.
- If the info is appropriately sent to the framework, at that point framework will get Instant message as information.
- The received Text message is get convert to Braille code in Braille Transcription.
- The Braille character will display on LCD.
- The Text message will again get convert into Voice Message using TTS(Text-To-Speech) synthesizer.

End user will get voice message as an output the process get stops.

**IV. Implementation**

**6.1 Outputs:**

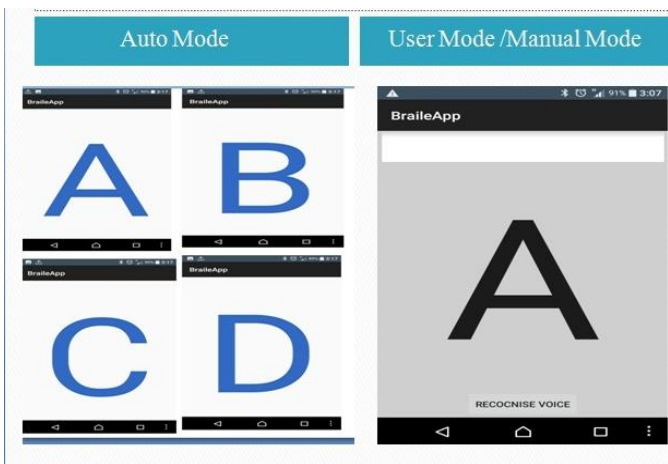
**6.2 An Android Based Tutor System:**



- Registration Form for the User: An Android application is created for the user to Enter the Login form to fill the details.
- Different Modes for the User to give the input:

Auto Mode and User Mode are the two different modes provided for the user to give input to the system.

1) Auto Mode and User Mode:



- Auto Mode: In which the Application will be sending each Alphanumeric Letters in a sequence to the Embedded Interpreter along with voice notifications further, the Receiver module will interpret the received Character in a Braille Pattern.

- User Mode: In which the tutor or the teacher will speak out a word say Good Luck, which will be synthesized from voice to text and each letter of the sentence spoken will be sent in sequence with some gap and the receiver Embedded system will present each letter sequence in the Braille Pattern along with the voice notification.

6.3 Voice Communicator Home Interface:

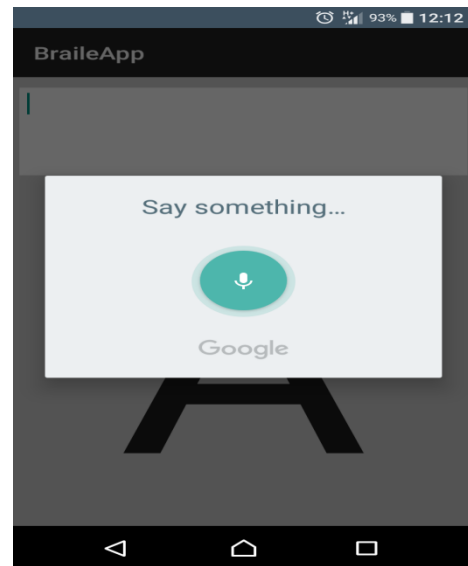


Figure 6. Voice Communicator Home Interface

In the first phase of the first setting of the user interface of the application, Voice Communicator’s activation will be of synchronous text display and voice command sounding. With different commands instructed to the user, the application will then recognize which user is using the said application. The voice command is designed for the blind person. The blind will just tap once for Voice Communicator’s recognition. In the user interface design communication process relies on the speaker sounding and normal messaging.

## 6.4 Voice Communicator Inbox Interface:

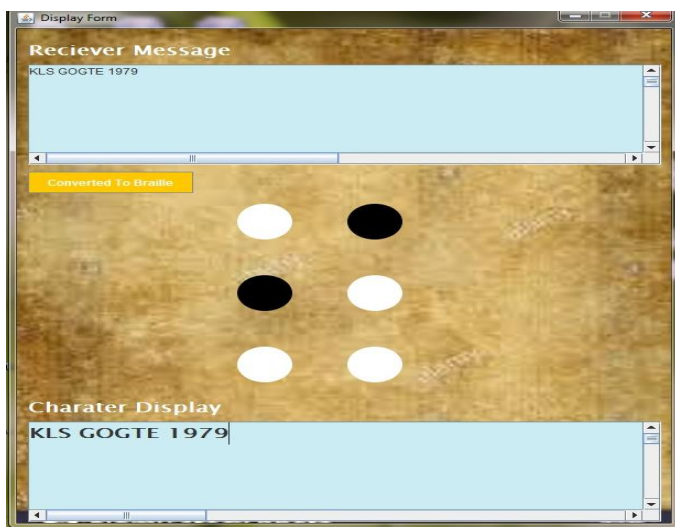


Figure 8. Screenshot of Voice Communicator's Inbox Interface

When the user gives his voice message to the android recognizer, the spelled words are get display on the Braille application interface. Here the user can check the validation for the input and user can understand whether the application is receiving the proper input or no.

## 6.6 Server System

**Out put : This output contains both Characters and Numbers**



Server System:

The System will receive the voice input from the user through the Bluetooth device. The voice message is get converts to text in the Server side system. The text in Braille Transaction using ASCII-BRAILLY encoding will convert into Braille Characters. This Braille Character will again convert to speech at the Receiver Side.

## V. Conclusion

Braille tutor helps the Visually Impaired Students to study and to attain knowledge in an easy manner and it also makes their life easier to gain the expertise over Braille script. The main advantage of this device is anyone can teach Braille, since there is no need of a teacher who knows Braille language. This enables blind to study Braille effectively since they can hear the actual pronunciation of letters and words, thereby enabling them to study by analyzing the patterns of Braille. The usability is very important to software; the results of this paper are also guideline for improving the usability and accessibility of smart phone application. This paper has analyzed two existing applications for visually challenged people and proposed a design for better application that can help blind users to carry out their routine tasks smoothly with the help of improved applications. In recent years, SMS messaging system for disability and handicapped communication aids has become widely deployed in large amount. Text to Speech is also finding new applications outside the disability market in future.

## VI. REFERENCES

- [1]. J Oliveira, T. Guerreiro, H. Nicolau, J. Jorge, D. Gonçalves: "Blind people and mobile touch-based text-entry: acknowledging the need for different flavors." In Proceedings of the 13th Int. ACM SIGACCESS Conf. on Computers and accessibility. ASSETS '11, ACM (2011).
- [2]. AR Fernandes, H. Paredes. "Exploring Alternative Devices for Blind Users." In Proceedings of The Sixth International Conference on Virtual Systems and Multimedia, 2000.
- [3]. Jie Li, Xiaoguang Yan and Dayong Zhang, "Optical Braille recognition with Haar wavelet features and Support-Vector Machine," 2010 International Conference on Computer, Mechatronics, Control

- and Electronic Engineering, Changchun, 2010, pp. 64-67. doi: 10.1109/CMCE.2010.5610062
- [4]. T Guerrero, H. Nicolau, J. Jorge, and D. Gonçalves. “Navtap: A long term study with excluded blind users.” In ASSETS’09, pages 99–106. ACM Press, 2009.
- [5]. SK. Kane, J.P. Bigham, and J.O. Wobbrock. “Slide Rule: Making mobile touch screens accessible to blind people using multitouch interaction techniques”, pp. 73-80, 2008. In Proc. ASSETS '08. New York: ACM Press.
- [6]. G Yfantidis, and G. Evreinov. “Adaptive Blind Interaction Technique for Touchscreens.” UAIS, 4, 328-337, 2006
- [7]. Aisha Mousa, Hazem Hiary, Raja Alomari, and Loai Alnemer, Smart Braille System Recognize, IJCSI International Journal of Computer Science Issues, Vol. 10, Issue 6, No I, November 2013 ISSN (Print): 1694-0814, ISSN (Online): 1694-0784 www.IJCSI.org
- [8]. M Bonner, J. Brudvik, G. Abowd, and K. Edwards. No-Look Notes: “Accessible Eyes-Free Multi-Touch Text Entry.” IEEE Pervasive Computing '10. Heidelberg: Springer, 2010, pp. 409-426.
- [9]. B Frey, C. Southern, and M. Romero. “BrailleTouch: mobile texting for the visually impaired.” Universal Access in Human-Computer Interaction. Context Diversity, 2011, pp. 19–25.
- [10]. J. Oliveira, T. Guerreiro, H. Nicolau, J. Jorge, and D. Gonçalves. “BrailleType: Unleashing Braille over Touch Screen Mobile Phones, in Human-Computer Interaction.” INTERACT 2011, P. Campos, et al., Editors, Springer Berlin / Heidelberg: Lisbon, Portugal, 2011, pp. 100-107

# Ergo-Human Optimum Sitting Position With Enhance the Biomechanics to Maintain the Natural Curvature of Spine Posture in Prominent Support and High Comfort of Backrest In Automobile Seating

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## ABSTRACT

Nowadays, customer's expectations for comfort in automobile seating rise continuously. The ultimate aim is to minimize fatigue and reduce the pressure, to provide an ergonomic feature in an optimum sitting posture, so that even longer journey do not lead to physical discomfort. Design objectives such as comfort, safety and health need to be satisfied simultaneously. Prolonged period of driving results in manifestation of physical problems such as Low Back Pain (LBP), and other Musculoskeletal Disorders (MSDs). Lumbar support is to prevent the muscular fatigue while vehicle occupant is sitting. Design the seating system is made to be ergonomic, user-friendly, comfortable and safe. Good sitting posture and relaxed position of driving is mainly focused on concentration and responsibilities. It's also a benefit to assess the ease of ingress/egress.

**Keywords:** Body posture, Biomechanics, Spine alignment, Neutral sitting posture, Ergonomics

## I. INTRODUCTION

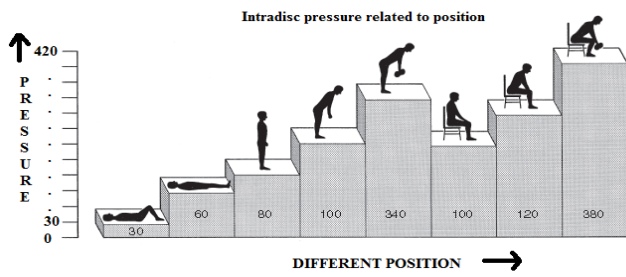
Normally, the human spine is a self-supporting system of skeleton, cartilage, ligaments and muscles. Overall shape of spine is naturally "S" shaped curve when viewed from lateral (side). The main function of the spinal column is to support the majority of body weight, shock absorption, protection of spinal cord and providing a stable structure to maintain an upright posture (1 & 5)

The human spine is one of the most important parts in the human body. With the strong and flexible structure, it provides support to the entire human body and enables the body movement. Back complaint is mainly caused by poor sitting posture (2).

The relative pressure changes in lumbar vertebrae disc on performing the various tasks and its position such as standing, sitting and lifting the weight. Postural changes have varying effects on lumbar disc pressure at various positions (3). It indicates that the highest pressure is placed on the disc of the lumbar spine occurs in the seated position and leaning forward, while bearing weight (Figure 1)

### A. Human Spine

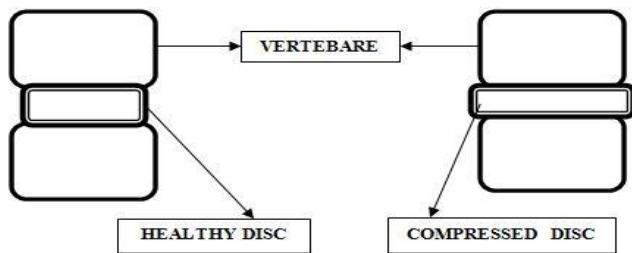
The spine is a crucial and complex structure in the human body. It offers main upright support for the human body and protection to the spinal cord and nerve roots. Meanwhile, it allows the body to perform different motions, such as bending, twisting and rotating.



**Figure 1.** Relative increases and decreases in Intra-disc pressure in relation to different body positions

**B. Functions of disc**

The primary function of the disc is to join the vertebrae and allow movement between them. The other functions are typical of the erect spine; a shock absorber and a load distributor. Supports each vertebral disc in the lumbar region, providing relief for the spinal column and relaxation of back muscles (7)



**Figure 2.** Vertebrae disc in normal and compress position

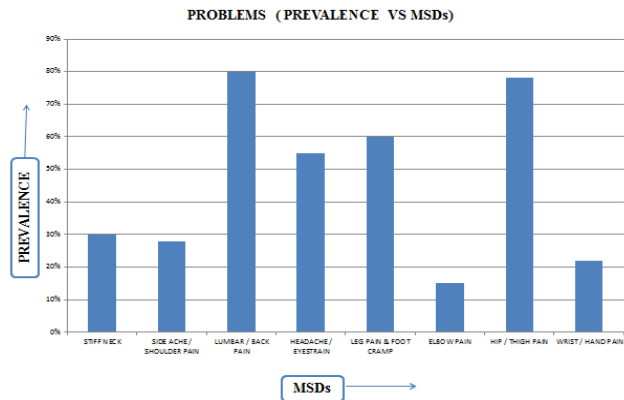
**II. IDENTIFICATION OF PROBLEM**

Improper sitting in the prolonged period of time is not good for the human body. Long-time driving is mainly results in Work –Related Musculoskeletal Disorders are mainly caused by poor posture, stress tension, position for extended period. Discomfort and Low Back Pain are frequent complaints from driver (4).

CTD- Cumulative Trauma Disorder is a collective term for syndromes characterized by discomfort,

disability or persistent pain in joints, tendons, discs muscles, ligaments and other soft tissues, with or without physical manifestations.

The correct sitting position is an important step towards a healthier back and correcting bad sitting habits. Unnatural curvature of the spine that often leads to lower back pain (6)



The figure 3 shows that the majority of the prevalence percentage occurs in lumbar and back region of the occupant. According to Survey, National Institute of Health Low Back Pain affects about eight out of ten.

**III. METHODOLOGY**

First of all, clearly list out what are major problems they are facing in prolonged period of driving. Then identify the root cause for serve problem. Collect the parameters relevant to the discomfort. To conduct experiment, an ergonomically comparison test sitting in various position for significant amount of time. Each of them sat for an hour in three sitting postures (i.e., upright, slumped, and forward leaning sitting postures).



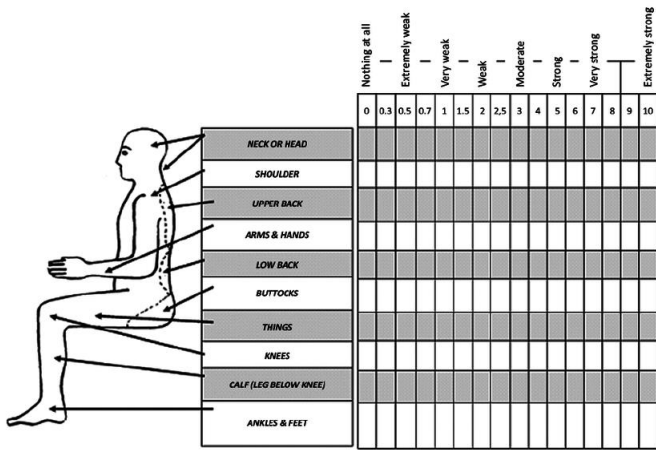


Figure 4. Borg's CR-10 Scale rating

Subjects rated perceived body part discomfort using Borg's CR-10 to indicate pain location in three sitting posture. An adapted Borg CR-10 scale was used to access the subjective discomfort on each body parts. A rating was given for each of 10 regions of the body parts including neck, shoulder, upper back, arm and hands, low back, buttocks, thighs, knees, calf and feet.

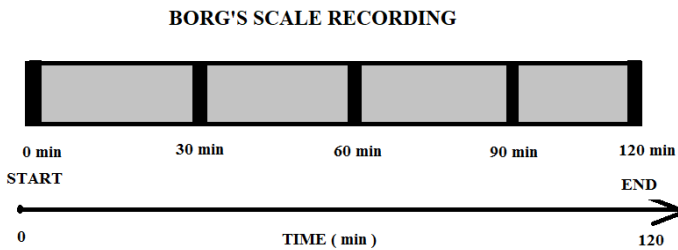


Figure 5. Borg's Scale reading with time

Ergonomic intervention has to play an important role to provide sitting comfort due to increased exposures to seated postures. Borg's scale recording with respect to certain time period and collect the feedback from each subjects discomfort rating in body parts.

Based on the results, the sitting posture with the highest low back discomfort after prolonged sitting was the forward leaning posture. Sitting in an upright posture is recommended because it increases muscle activation. Upright (good) posture is to prevent back slouch and strengthens the back muscles. Slouched

(bad) posture, spine in a 'crab' position with strain on back muscles



Figure 6. Different Siting position (Upright, Lean forward and Slouched sitting posture)

#### IV. COMFORT DRIVING POSITION

##### A. Driving and effects

A vehicle is in motion; the body is subject to different forces such as to accelerations and decelerations, to lateral swaying from side to side and to whole body up and down vibration. On driving, the feet are actively being used right front on the gas (acceleration) pedal, left on the brake and also used on the clutch to shift the gear. When the feet are active they can't be used to support and stabilize the lower body as normally sitting position in chair. This is major evidence factor that leads to increase the back problems



Figure 7. Correct & Bad driving posture

##### Lumbar region

In vertebral column, lumbar region is the largest portion in the spine anatomy. It supplies a number of important functions for the human body. This region

include functions such as structural support, movement and protection of certain body tissues. Proper lumbar support with optimum sitting posture is to ensure the spine alignment and relax the back muscles for hours of pain – free. Ensure the lumbar support and correct sitting posture together will give good ergonomic comfort Lumbar support is to aids the spine into anatomically correct position and provides added support for the lower back to ensure good sitting posture. Evenly distributing body weight and minimizing the pressure point under thighs to promote proper blood circulation. The prominently use of lumbar support has to reduce the intra-disc loads on the spine and retrieve the lordosis curve in spine.

### B. Sitting bones

Most of the people do not sit properly on their sitting bones; instead they sit on their tailbones. It mainly leads to problems such as low back-pain, additional forces on the spinal discs, ligaments and muscles. Ischial tuberosities (Sitting bones) is to rest automatically correct itself. Proper sitting posture is ideal pelvic tilt position with better comfort and keep the spine in a Neutral position – maintaining the natural curvature of spine.

Sitting is a body position in which weight of the body is transferred to a supporting area mainly by the Ischial tuberosities of the pelvis and lumbar surface. Pelvis is the foundation for sitting and strongly influences postural alignment of the entire skeleton. A neutral pelvic position is optimal for sitting .Both the Ischial Tuberosities should be equally utilize for weight bearing. Sitting is routinely performed in order to transfer the weight of the body to the supporting seat.

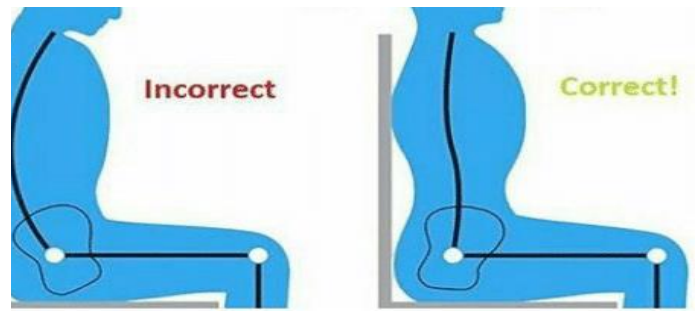
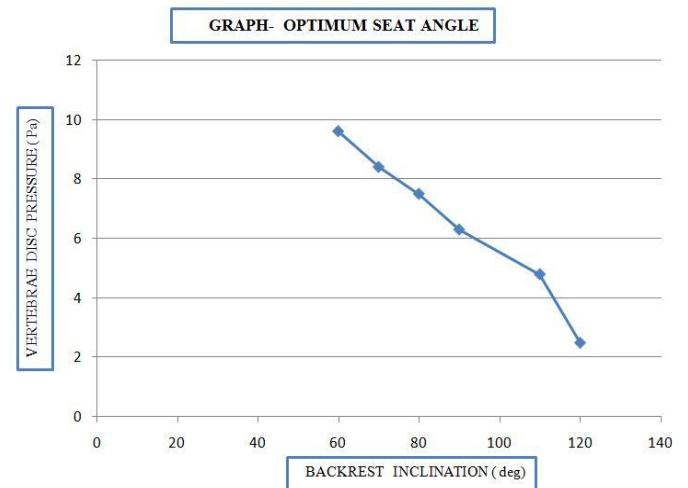


Figure 8. Proper Pelvic tilt position

### V. OPTIMUM SITTING ANGLE

Normally, sitting position leads to 40-60% more stress/strain on the back (disc pressure) than standing posture .Instead of most people sitting in awkward posture. Moreover, it further increases the back pain. Positive seat angle helps to maintain good contact with backrest.



The graph shows that vertebrae disc pressure should minimum in the backrest inclination optimum angle should be seems in the range of 90 -120 deg. Maintaining a good posture is an easy way to reduce the Lower Back-pain (LBP) .It indicates that take away the painful spine by keeping the natural curves in their normal position

#### A. Proper posture

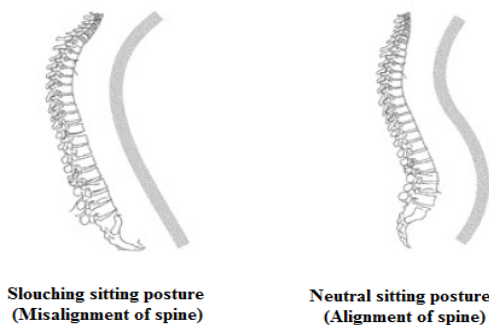
To sustain good posture (i.e.) neutral posture is the muscle of body must be imbalance to support an aligned spine .In a neutral spine there is optimum between the musculature right-to-left and front-to-back. When neutral posture, the body is in its

strongest and most balanced allowing for optimal efficiency and minimal stress on the joints. Best posture – imposes the least amount of stress and strain. Postural comfort is defined as the absence of an idea in sitting posture.

The secret of sitting correctly is to encourage the spine to its neutral ‘balanced’ position. The pelvis crest should tilt forwards allowing the spine to hold its natural ‘S’ shape. This means weight is evenly distributed across the inter-vertebral discs and there is a better balance in the supporting musculature.

### B. Alignment of spine

Maintaining the proper alignment can alleviate a significant amount of posture discomfort. Seat profile shape is already designed to ensure the perfect alignment to achieve the natural curves of the spine. Neutral posture is essential for optimal wellbeing and functioning of the body such as holding the weight of body, good breathing, musculoskeletal balance, proper functioning of internal parts, concentration, memory and cognitive ability and flow of energy throughout the body. Bad pain causes bad posture; it indicates that more correlation exists between posture and pain

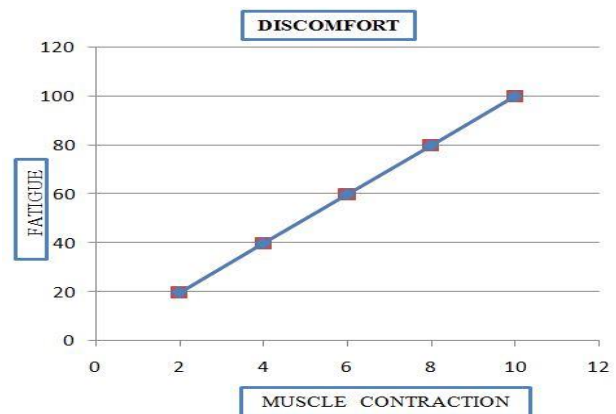


**Figure 9.** Alignment & Misalignment of spine

### C. Awkward Sitting Position

Improper posture is manifests that add more stress to the spine and tighten muscles in the shoulders and chest area. Flattens of the lumbar region leads to a

problem that is prone to shoulders pain, neck stiffness and back muscle tension. Poor posture and position can potentially cause/lead to musculoskeletal issues.



Bending this naturally elongated, "S" out of shape for long periods of time can often leads to muscle fatigue and back-pain. Poor sitting posture causes the unnecessary problems. Sitting flattens lumbar curve is to the change biomechanics of curve, increased the force on disc and also increases the muscle strain. The graph clearly indicates that increase the muscle contraction is drastically rises the fatigue of driver. Increased load on spinal vertebral column and it creates further discomfort.

## VI. COMFORTABLE SITTING POSTURE

### Recommendations

- 1) Ensure the seat back support to reclined position within the range of 90-120 degrees
- 2) Hold the steering wheel with both hands at the 9' clock and 3' clock positions
- 3) Back-rest should support the entire back from hips to shoulder
- 4) Natural "S" shape seat design is appropriately maintain the spine alignment and also proper back support is evenly distributing the weight
- 5) Knees should be slightly lower than hip position.

### **Eliminate pressure on the spine**

Neutral posture is to reduce the force of gravity acting on the spine and vertebral column. It also helps to reduce the pressure, back-pain and swelling and greatly improve the breathing, muscle relaxation, tension relief and relieve pain. Support the upper body, easing neck tension and offering relief for the vertebral disc. Eliminate pressure points on legs and disc is to improve the blood circulation, thus preventing numbness, leg pain and fatigue

### **Neutral Spine**

Natural curvature of human spine is also known as "Neutral spine". In the neutral posture, body muscles to be in strongest and more stable and hence it be injury – resistant position. Posture is important because it supports a vast range of daily function, in addition to supporting internal processes such as breathing, vision, digestion, circulation and temperature regulation

To keep correct alignment of spine in order to prevent injury and strain. Correct sitting position is the sitting upright with back straight and shoulders to be in the back. Body weight should be evenly distributed on both hip and gluteus should be touching the back of seat

Not aware of best sitting positions and sit in the wrong way, thereby abusing backs, necks and arms

- 1) Proper sitting position is the right angle or erect position
- 2) Sitting upright with aid of hips, knees and ankles all at right angles
- 3) 90 – Degree bending of the hip joint while preserving lordosis (concavity) of the back and that this equated to the best posture while sitting
- 4) Proper sitting posture is a more suitable position and allows the spine to carry the body weight in a more comfortable way
- 5) "Balanced seating" and "Best sitting position" is to ward off back-pain and stiffness

### **Neutral posture promote comfort**

Generally, the spine is in its most natural position with minimal bending or twisting. It limits stress on the parts of the spine and ensures neck & back muscles aren't being contracted / stretched. Neutral sitting posture is to superiorly equalize body pressure distribution and promote the correct lumbar posture, mitigating pressure points and significantly improving long trip comfort

### **Benefit for proper balance posture**

When the body is positioned correctly there is minimal strain on the muscles, ligaments, bones and joints, internal organs are not compressed, blood vessels are not pressed, nerves are not irritated. It's maintaining the skeletal alignment and to promoting the comfort and relaxation. Preventing the development of sores and decreasing the fatigue. Proper aligning and maintaining a natural S-curve is important for overall health and comfort.

## **VII. CONCLUSION**

Optimum sitting angles is to allow the better blood flow, which in turn increases oxygen and therefore a more sustainable position for natural and comfortable position. Increased blood flow enhances the brain function as results in greater alertness. A well-relaxed posture of driving stimulates more concentration.

90-90-90 posture (90 degrees at the hips, knees and ankles) is the ideal sitting posture. The backrest must provide good support for the entire lumbar region. It provides a foundation that minimizes fatigue and reduces the pressure points. A backrest that is able to maintain the spine's natural S-shape and distributes the pressure over the largest possible area, a reclined sitting position, about 90°-120° is the position that gives the best relief from stress

## VIII. REFERENCE

- [1]. Kieran O'Sullivan, Patrick O'Dea, Wim Dankaerts, Peter O'Sullivan, Amanda Clifford, Leonard O'Sullivan, Neutral lumbar spine sitting posture in pain-free subjects, vol. 15, pp. 557 - 561, 2010
- [2]. Lis A, Black K, Nordin M, Association between sitting and occupational LBP, vol. 16, pp. 283 - 298, 2007
- [3]. Richard Goossens, Biomechanics of Body support A study of load distribution, shear force, decubitus risk and form of the spine, 1994
- [4]. W. S. Marras, Occupational low back disorders causation and control, vol. 43, pp. 800 - 902, 2002
- [5]. M. H. Pope, K. L. Goh and M. L. Magnusson, Spine Ergonomics, vol. 4, pp. 49 - 68, 2002
- [6]. M Grujic, B Pandurangan, X Xie, A K Gramopadhye, Mozen, Musculoskeletal computational analysis of the influence of car-seat / adjustments on long - distance driving fatigue vol. 40, pp. 345 - 355, 2010
- [7]. Rani Lueder, CPE, Ergonomics of Seated Movement A review of the scientific literature, Humanics Ergo systems, 2004
- [8]. Huang Mengjie, Musculoskeletal Biomechanical computational analysis of sitting posture and seat design 2013
- [9]. Roland Zemp, William R. Taylor, Silvio Loren Zetti In vivo spinal posture during upright and reclined sitting in an office chair, 2013
- [10]. S. Hiemstra, Van Mastriegt, I. Kamp, S. A. T. Van Veen, P. Vink, T. Bosch, The influence of active seating on car passenger's perceived comfort and activity levels vol. 47, pp. 211 - 219, 2015
- [11]. Driving performance and driver discomfort in an elevated and standard driving position during a driving simulation, vol. 49, pp. 25 - 33, 2015
- [12]. Neil Mansfield, George Sammonds, Linh Nguyen, Driver discomfort in vehicle seats effect of changing road conditions and seat foam composition, vol. 50, pp. 153 - 159, 2015
- [13]. Kristina M. Gruevski, Michael W. R. Holmes, Chad E. Gooyers, Clark R. Dickerson, Jack P. Callaghan, Lumbar posture, seat interface pressures and discomfort responses to a novel thoracic support for police officers during prolonged simulated driving exposures, vol. 52, pp. 160 - 168, 2016
- [14]. M. J. M. Robb, N. J. Mansfield, Self-reported musculoskeletal problems amongst professional truck drivers, vol. 50, pp. 814 - 827, 2007
- [15]. M Miyamoto, S Konno, Y Gembun, X Liu, K Minami, H Ito, Epidemiological study of Low Back Pain and occupational risk factors among taxi drivers, vol. 46, pp. 112 - 117, 2007
- [16]. M. Kolich & S. M. Taboun Ergonomics modelling and evaluation of automobile seat comfort, vol. 47, pp. 841 - 863, 2007
- [17]. J. Mark Porter, Diana E. Gyi, Hilary A. Tait, Interface pressure data & the prediction of driver discomfort in road trials, vol. 34, pp. 207 - 214, 2003
- [18]. Satoshi Kitazaki, Michael J. Griffin, Resonance behaviour of the seat human body and effects of posture, vol. 31, pp. 143 - 149, 1998
- [19]. G. S. Paddan, N. J. Mansfield, C. I. Arrowsmith, A. N. Rimell, S. K. King, S. R. Holmes, The influence of seat backrest angle on perceived discomfort during exposure to vertical whole body vibration, vol. 55, pp. 923 - 936, 2012
- [20]. Irene Kamp The influences of car - seat design on its character experience, vol. 43, pp. 329 - 335, 2012
- [21]. Garfin S. R, Spinal Structure and Body Mechanics, 2012
- [22]. Combined effects of long-term sitting and whole body vibration on discomfort onset for vehicle occupants, 2014
- [23]. Neil J. Mansfield, Jamie Mackrill, Andrew N. Rimell, Siman J. Macmill The position and

Postural attitudes of driver occupants, seat position, Herbert M. Reynolds, Douglas Neal, Robert Kerr, 1996

[25]. Matthew P.Reed, Lawrence W. Schneider, Leda L. Richi, Survey of auto seat design recommendations for improved comfort , 1994

[26]. Jorgan Eklund ,Industrial seating and spinal loading , 1986

# FTIR Spectroscopic Analysis of Leaf Extract in Hexane in *Jasminum Azoricum* L.

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## ABSTRACT

The present study was aimed to identify the functional groups present in leaf extract in Hexane of *Jasminum azoricum* L., a critically endangered (CR) species, through Fourier Transform Infrared Spectroscopy (FTIR). The FTIR Spectroscopic studies revealed different characteristic peak values with various functional compounds such as alkanes, carboxylic acid, esters, amines, nitro, alkyl halide and aromatic compounds. The FTIR method was performed on a spectrophotometer system, which is used to detect the characteristic peak values and their functional groups.

**Keywords:** *Jasminum azoricum* L., FTIR, Spectroscopy, Functional groups

## I. INTRODUCTION

*Jasmine* belongs to the angiosperm family Oleaceae is an essential oil bearing plant. The representatives of the family have a worldwide distribution in tropical, sub-tropical and temperate regions<sup>[9]</sup>. *Jasminum* is the largest genus of the order Oleales comprises about 300<sup>[3]</sup> species or approximately 200 species<sup>[6]</sup>.

“Yasmyin” the Arabic word means fragrance from which the Jasmine is derived. Botanist Carl Von Linnaeus named the plants from the word “Yasmin”<sup>[10]</sup>. They are horticulturally and agriculturally important. *Jasminum* flowers are considered as spiritual flowers in India. The genus *Jasminum azoricum* L., is a strong growing woody vine which climbs up to 20 or more feet in height and produce a dense cover. The species is assessed as Critically Endangered (CR) for the IUCN European Red List<sup>[5]</sup>.

The use of IR spectroscopy for the analysis of biological samples was first suggested in 1940s, the technique was being successfully explored for the study of biological materials. IR spectroscopy has become an accepted tool for the characterization of

biomolecules<sup>[12]</sup>. FTIR spectroscopy is one of the most widely used methods to identify the chemical constituents and elucidate the compound structures to propose in medicinal purposes<sup>[2]</sup><sup>[13]</sup>. In the present investigation hexane extract of leaves of *J. azoricum* L., were analyzed. With this background the study was aimed to report the main functional components present in leaves.

## II. MATERIALS AND METHODS

### 2.1 Collection of plant materials

The materials were collected from Arpookara (9° 38' N: 76° 30' E) of Kottayam district, Kerala, India and was authenticated for the species *Jasminum azoricum* L., and the family Oleaceae. The voucher specimen was prepared and deposited in the herbarium of the Department of Botany, C. M. S. College, Kottayam.

### 2.2 Preparation of plant extract

The mature leaves were collected from the mother plant; leaves were detached and dried in shade at ambient temperature for a period of three weeks. The well dried samples were powdered separately by using

an electric blender. The powdered plant part (leaves) 1 gm was extracted in 10 ml of Hexane with continuous shaking on mechanical shaker for 24 hrs at room temperature. The extracts were then filtered through Whatmann No: 1 filter paper. The extracts were used for further analysis [14].

### 2.3 Preparation of sample for Infrared Spectrophotometer [FTIR] analysis

The extract was encapsulated separately in KBr pellet, to prepare translucent sample discs. The sample was loaded in FTIR spectroscope with scan range from 600 to 4000 cm<sup>-1</sup> (Shimadzu, Model No. IR- Prestige 21).

## III. RESULTS AND DISCUSSION

The FTIR spectrum was used to identify the functional groups of the active components in the plant sample based on the peak value in the region of Infrared radiation [7]. The leaf extract of *J. azoricum* in hexane gave the following characteristic absorption peaks (Figure-1 & Table-1).

The absorption spectra of *J. azoricum* L., exhibited a peak at 2960.73 represented the presence of alkane (C-H stretch) and carboxylic acid (O-H stretch). The peak at 1739.40 showed the presence of ester (C-O stretch) and aldehyde (C=O stretch). The peak at 1462.04 showed the presence of aromatic (C=C stretch). The peak at 1380.36 represented the presence of nitro (N-O stretch) and alkane (-C-H bending). The peak at 1022.12 represented the presence of amines (C-N stretch), esters (C-O stretch) and alkyl halide (C-F stretch). The peak at 769.59 exhibited the presence of esters (S-OR stretch), amines (N-H stretch), alkyl halide (C-Cl stretch) and alkene (=C-H bending).

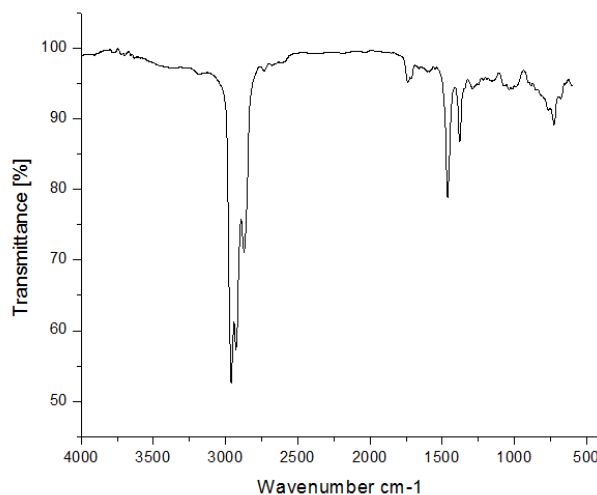


Figure 1: FTIR analysis of *Jasminum azoricum* L., leaves in hexane extract

Table-1: FTIR peak values and functional groups in hexane extract of *Jasminum azoricum* L., leaves.

SL. NO	Wavenumber (cm <sup>-1</sup> )	Frequency ranges (cm <sup>-1</sup> )	Functional Groups
1	2960.73	2500 – 3300	Alkane, carboxylic acid
2	1739.40	1720 – 1750	Ester, aldehyde
3	1462.04	1450 – 1600	Aromatic
4	1380.36	1345 – 1480	Nitro, alkane
5	1022.12	1000 – 1400	Amines, esters, alkyl halide
6	769.59	660 – 1000	Esters, amines, alkyl halide, alkene

The infrared spectrum with a frequency, ranges from 2850-3000 cm<sup>-1</sup>, 1735-1750 cm<sup>-1</sup>, 1450-1600 cm<sup>-1</sup>, 1345-1385 cm<sup>-1</sup>, 1000-1250 cm<sup>-1</sup> and 700-900 cm<sup>-1</sup>; the peaks are probably of alkane, esters, aromatic, nitro and amines.



The stretches such as C-H, C=O, C=C, N-O, C-N and S-OR with the nearest range representing the same functional groups reported by Hanson *et al.*, (2016) [8]; Adina *et al.*, (2012) [1], Donald *et al.*, (2001)[4] and IOCD[11].

#### IV. CONCLUSION

The results of the present study showed the presence of alkanes, amines, aldehydes, carboxylic acids, aromatic, nitro, esters, and alkyl halides in the leaves of *Jasminum azoricum* L., with their phytoconstituents and subjecting it to biological activity will definitely give fruitful results. So it is recommended for further spectroscopic studies to elucidate the structure, identification, bioactivity, toxicity profile, effect on the ecosystem and also agricultural products.

#### V. ACKNOWLEDGEMENT

The authors are thankful to C .M. S College Kottayam, Kerala and School of Environmental Science, M. G. University, Kottayam, Kerala, for providing the required facilities. We are thankful to Director, Higher Education Department, Government of Kerala for the financial support under Aspire Scholarship 2017- 18 used to carry out the work.

#### VI. REFERENCES

- [1]. Adina Elena Segneanu, Ioan Gozescu, Anamaria Dabici, Paula Sfirloaga and Zoltan Szabadai (2012). *Organic Compounds FT-IR Spectroscopy*, Macro To Nano Spectroscopy, Jamal Uddin (Ed.).
- [2]. Ashokkumar R. and Ramaswamy M. (2014). *Phytochemical screening by FTIR spectroscopic analysis of leaf extracts of selected Indian medicinal plants*. Int. J. Curr. Microbiol. Appl. Sci. 3 (1).
- [3]. Bhattacharjee S K. (1980). *Native jasmine of India*. Indian Perfumes. 24(3).
- [4]. Donald L. Pavia, Gary M. Lampman and George S. Kriz (2001). *Introduction To Spectroscopy*, 3<sup>rd</sup> edn. Thomson Learning, Inc.
- [5]. Florida Exotic Plant Council. (2001). *Jasminum fluminense Vell.* [www. Fleppec. Org/pdf/ Jasminum%20 fluminense . pdf](http://www.fleppec.org/pdf/Jasminum%20fluminense.pdf).2p.
- [6]. Green P S. (2004). *Oleaceae. In 'Flowering plants, Dicotyledons: Lamiales (except Acanthaceae including Avicenniaceae)*, JW Kadereit (Ed.).
- [7]. Gupta O P., Ali MM , Ray Ghatak BJ, Atal CK. (1977). *Some pharmacological investigations of embelin and its semisynthetic derivatives*. Indian J Physiol Pharmacol. 21(1).
- [8]. Hanson, Ronald K., Spearrin R. Mitchell and Goldenstein Christopher S. (2016). *Spectroscopy and Opitcal diagnostics for Gases*. Springer Cham Heidelberg, New York, Dordrecht London.
- [9]. Heywood DG. (1978). *Flowering plants of the world*. Mayflower Books. New York.
- [10]. Hyam R and R J Pankhurst. (1995). *Plants and Their Names: A Concise Dictionary*. Oxford University Press. U.S.A.
- [11]. International Organisation for Chemical Sciences in Development (IOCD). [http: / IR frequencies-files/ infrared spectroscopy](http://IR-frequencies-files/infrared-spectroscopy).
- [12]. Margarita P and Quinteiro R. (2000). *Fourier Transform Infrared (FT-IR)Technology for the Identification of Organisms*. Clinical Microbiology Newsletter. 8(22).
- [13]. Marimuthu M. and P. Gurusurthi (2013). *Phytochemical screening and FTIR studies on wild and common south Indian legumens*. Asian J Pharm Clin Res. 6(2).
- [14]. Vidya Kamble and Nikhil Gaikwad (2016). *Fourier Transform Infrared Spectroscopy Spectrometric Studies in Embelia ribes Burm. F: A Vulnerable medicinal Plant*. Asian J. of Pha. and Clinical Res. 9(3).

# Extractive Multi-Document Summarization using Neural Network

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## ABSTRACT

Natural language processing gives Text Summarization, which is the unmistakable application for information weight. Content diagram is a course of action of passing on a rundown by reducing the measure of outstanding document and relating essential information of champion report. There is rising a need to give grand chart in less time in light of the way that in exhibit time, the progress of data increments immensely on World Wide Web or on customer's work zones so Multi-Document once-completed is the best mechanical social affair to impact plot in less to time. This paper demonstrates an audit of existing techniques with the erraticism's including the need of sharp Multi-Document summarizer.

**Keywords:** Multi-Document Summarization; Clustering Based; Extractive and Abstractive approach; Ranked Based; LDA Based; Natural Language Processing

## I. INTRODUCTION

Natural language processing (NLP) is a field of programming arranging, robotized thinking and machine learning with the organized endeavors among PCs and human lingo. The usage of World Wide Web and diverse sources like Google, Yahoo! surfing what's more augmentations in light of this the issue of over-irritating information in like manner grows. There is goliath measure of data open in made and unstructured bundling and it is difficult to analyze all data or information. It is a need to get information inside less time. Along these lines, we require a structure that thusly recoups and pack the records as showed by customer require in time control. Record Summarizer is one of the achievable responses for this issue. Summarizer is a mechanical social affair, which serves a basic and gifted method for getting information. Summarizer is a strategy to isolate the huge substance from the documents. All around, the once-overs are delineated in two ways. They are Single Document Summarization and Multiple Document Summarization. The structure, which is evacuated and conveyed using single record is called as Single Document Summarization in any case, Multiple

Document Summarization is a changed framework for the extraction and change of information from different substance reports.

The fundamental inspiration driving once completed is to make remove which gives slightest accentuation, most exceptional vitality and co-referent demand of same subject of outline. In facilitate words, outline should cover all the essential parts of fascinating record without pointlessness while keeping up relationship between the sentences of framework. Appropriately, Extractive chart and Abstractive rundown approach is used. Extractive synopsis works by picking existing words, articulations or number of sentences from the essential substance to plot outline. It picks the most essential sentences or watchwords from the records while it in like path keeps up the low overabundance in the rundown. Abstractive summary technique, which makes an arrangement that, is closer to what a human may make. This kind of layout may contain words not explicitly show up in the crucial document build. It gives advice of champion record design in less word. This examination covers Cluster Based approach,

LDA Based approach and Ranking Based approach. The standard purpose behind Multi-story outline has been equivalently cleared up. The straggling scraps of the paper is showed up as takes after. Area II diagrams related work in the field of multi record rundown using Cluster Based approach, LDA Based approach and Ranking Based approach, Section III shows last conclusion.

## II. RELATED WORK

Multi-Document Summarization is a modified technique expected to expel and make the information from different substance records about a similar topic. The multi-file once-over is an incredibly complex errand to make a rundown. It is where one diagram ought to be focalized from various records. There are number of issues in multi record abstract that are not exactly the same as single report plot. It requires higher weight. The present utilization joins change of extractive and abstractive frameworks. A 10% blueprint may be satisfactory for one chronicle yet if we require it for different records then it is difficult to get an once-over from connect handle. In most if the investigation, the researcher manages area extraction or sentence extraction in light of the way that the social affair of watchwords contains a low measure of information while section or sentences can cover the particular thought of record. There are heaps of techniques, which address multi-record rundown, anyway in this paper we in a general sense focus on Cluster based, LDA based approach and Ranking based approach of multi-document diagram.

### A) Cluster Based Approach

Focal point of Cluster Based technique gives gathering computation, which is all the more intense, and it depends endless supply of the group. Gathering methodology generally incorporates only three errands as pre-taking care of, packing and once-over time. The going with procedure must be done before offering commitment to the gathering method by using pre-getting ready. Basically, pre-taking care of steps disengaged into taking after core interests

**Tokenization:** It breaks the substance into discrete lexical words that are separated by void area, comma, dash, bit et cetera [3] Stop words clearing: Stop words

like an, about, all, et cetera., or other zone subordinate words that must be removed.[3] Stemming: It ousts increases like "s", "ing" in this manner on from documents.[3]

After Pre-getting ready, gathering methodology is associated with deliver the rundown. A paper on data merging by Van Britsom et al. (2013) [1] proposed a strategy in perspective of usage of NEWSUM Algorithm. It is a kind of collection computation where disconnects a course of action of document into subsets and a short time later makes a diagram of referent works. It contains three phases: point recognizing verification, change and outline by using differing groups. Summary uses sentence extraction and sentence consultation. It is part the sources by their timestamps. It is apportioned into two sets as late articles and non-late articles. It relies upon score of sentence implies if information is more exact then it is incorporated framework. It addresses higher outcome for tremendous layout yet wide data uniting issue rises when endless data is open to consolidate.

This paper is on multi-document plot using sentence clustering by Virendra Kumar Gupta et al. (2012) [3] states that sentences from single record once-overs are assembled and best most sentences from each pack are used for influencing multi-to report layout. The model contains the methods as pre-getting ready, disturbance removal, tokenization, stop words, stemming, sentence part and feature extraction. Incorporate extraction incorporates taking after steps as-

**Precision:** It is defined as the fraction of retrieved docs that are relevant given as

$$\text{Relevant} = P(\text{relevant} | \text{retrieved}) [9]$$

$$P_n = m/Nn+1$$

**Recall:** Fraction of relevant docs that are retrieved given as Retrieved = P(retrieved | relevant) [9]

$$R_n = m/n$$

**TFIDF:**

$$\text{TF}(\text{term}, \text{document}) = \frac{\text{Frequency of term}}{\text{No of Document}}$$

$$\text{Term Frequency} = \frac{n_j}{\sum_k n_k}$$

**IDF (inverse document frequency):** It calculates whether the word is rare or common in all documents. IDF (term,

document) is obtained by dividing total number of Documents by the number of documents containing that term and taking log of that.

$$\text{IDF (term, document)} = \log \frac{\text{Total No of Document}}{\text{No of Doc containing term}}$$

**TF-IDF:** It is the multiple of the value of TF and IDF for a particular word. The value of TF-IDF increases with the number of occurrences within a doc and with rarity of the term across the corpus.

$$\text{TFIDF} = \text{TF} * \text{IDF}$$

In the wake of playing out these methods, basic sentences are removed from each gathering. Also, for this, there is two sorts of sentence batching used as syntactic comparability and semantic similarity. English National Corpus is used for finding out the repeat of words. It contains 100 million words. It gives best performing structure result on DUC 2002 dataset yet it isn't tackled DUC 2005 or DUC 2006 dataset.

A paper on Extracting Summary from Documents Using K-Mean Clustering Algorithm by Manjula K. S. et al. (2013) [7] proposed K-MEAN estimation and MMR (Maximal Marginal Relevance) technique which are used for request subordinate packing of center points in content document and finding question subordinate abstract, depends on upon the report sentences and tries to apply impediment on the record sentence to get the criticalness crucial sentence score by MMR known as nonspecific framework approach. Summary of file can be found by k-mean computation. This strategy used to set up the dataset by using a couple of gatherings and finds prior in the datasets. This finds likeness of each record and makes the layout of the report. In this work, n-gram, which is subtype of co-occasion association, is used. These strategies the data set through certain number of bundles and find the prior in the data sets anyway MMR depends on upon the chronicle sentences, and tries to apply confinement on the record sentence.

This paper is on Context Sensitive Text Summarization Using K Means Clustering Algorithm by Harshal J. Jain et al. (2012) [12] addresses K-MEAN computation. K-mean packing is used to social affair all the similar course of action of records together and detachment the chronicle into k-bunch where to find k centroids for each gathering. These centroids are not engineered truly so it gives various outcome. Thusly, we

put it really to gather the nearest centroid. Thusly we repeat this movement until the fulfillment of gathering to the entire record. After this we have to re-figure k new centroid by considering the point of convergence of past walk gatherings. These k new centroids make the new data set motivation behind nearest new centroid. Here circle is made and k-centroids change their place methodical until the point that any movements are happened. It finds question subordinate framework. Feasibility and time usage is the essential issues in this approach.

This paper is on Word Sequence Models for Single Text Summarization by Rene Arnulfo Garcia-Hernandez et al. (2009) [13] proposed the Extractive once-over procedure which gives a framework to the customer for equivalent substance chronicles. In this paper, here moreover uses the n-gram(non-syntactic) which includes gathering of n words inside a particular division in the substance and progressively appear in the substance. N-gram is used as a piece of a vector space appear in choosing the extractive substance plot. Exactly when plan of a couple of words is used then their probabilities are evaluated from a CORPUS which contains set of reports. At the last, the probabilities are joined to get from the prior probability of most conceivable explanation. In this work, n-gram is used as a part of a sentence in an unsupervised learning procedure. This system is used for batching the equivalent sentences and structures the gatherings where most illustrative sentences are chosen for delivering the once-over. The computation portrayed as takes after-

- Pre-taking care of First, take out stop words, oust noise and thereafter apply stemming process on it.
- Term decision must be taken what size of n-grams as feature is to be used to address the sentences. The repeat edge was 2 for MFS illustrate.
- Term weighting-decision must be taken that how every part is figured.
- Sentence gathering pick the commitment for the k-mean computation.
- Sentence decision: After finishing k-mean computation; pick the nearest sentence to each centroid for making the once-over.

It gives a blueprint to the customer for similar substance chronicles. It is critical to find from the prior technique

for choosing the best gram measure for content summation what isn't clear how to do.

### **B) Ranking Based Approach**

Situating Based Approach generally gives the higher situated sentences into the once-over. Situating estimations isolates the rank sentences and combinations the each and every rank sentence and create the framework. Essentially, it applies situating figuring, isolates rank sentences and create a layout.

This paper on *SRRank: Leveraging Semantic Roles for Extractive Multi-Document Summarization* by Su Yan and Xiaojun Wan (2014) [19] clear up a procedure that it positions sentences by using SR-Rank figuring on Extractive substance layout. SR-Rank computation is a kind of outline based count. Right off the bat, apportion the sentences and get the semantic parts, and thereafter apply a novel SR-Rank figuring. SR-Rank computation at the same time positions the sentences and semantic parts; it expels the most basic sentences from a record. A graph based SR-Rank estimation rank all sentences center points with the help of various sorts of centers in the heterogeneous chart. Here three sorts of outlines are cleared up as graph cluster, diagram yield and fundamental chart. So in this paper, three sorts of graphs are delivered as SR-Rank, SR-Rank-navigate and SR-Rank-gathering. Trial comes about are given on two DUC datasets which shows that SR-Rank estimation beats couple of baselines and semantic part information is endorsed which is extraordinarily helpful for multi-chronicle rundown.

Another paper *Document Summarization Method in light of Heterogeneous Graph* by Yang Wei (2012) [20] clears up the Ranking computation that applies on heterogeneous outline. Existing framework essentially uses genuine and semantic information to isolate the most basic sentences from different reports where they can't give the connection between different granularities (i.e., word, sentence, and point). The procedure in this paper is associated by building up a diagram which reflects connection between different granularity center points which have various size. At that point apply positioning calculation to ascertain score of hubs lastly most elevated score of sentences will be chosen in the document for producing synopsis. By utilizing

DUC2001 and DUC 2002, it shows the great exploratory outcome.

A paper on *A Novel Relational Learning-to-Rank Approach for Topic-Focused Multi-Document Summarization* by Yadong Zhu et al. (2013) [21] gives Optimization count and R-LTR (Learning-to-rank) approach. Social R-LTR framework is used rather than customary R-LTR luxuriously which avoids contrasts issue. Contrasts are a trying issue in extractive rundown methodology. The situating limit especially portray as the mix of ran sentences from chronicles and for this which is associated first then setback limit is associated on Plackett-Luce show which gives situating framework on customer sentences. Stochastic edge dive is then used to coordinate the learning system, and the summation is made by anticipating ravenous decision method. Quantitative and subjective approach can be given by test comes to fruition on TAC 2008 AND TAC 2009 which gives state of-craftsmanship procedures. To oblige the learning system which will use on other kind of dataset past the standard report.

Another paper on *Learning to Rank for Query-focused Multi-Document Summarization* by Chao Shen, Tao Li (2011) [22] explore how to use situating SVM to set up the segment weight for question focused multi-report rundown. As abstractive diagram gives not all around facilitated sentences from the records and human made once-over is abstractive so therefore situating SVM is proper here. In the first place, measure the sentence-to - sentence relationship by thinking about probability of sentence from the reports. Second, cost tricky adversity limit is made deduced planning data less fragile in the situating SVM's objective work. Trial result shows intense outcome of proposed strategy.

### **C) LDA Based Approach**

Idle Dirichlet Allocation (LDA), has been starting late introduced for delivering corpus focuses [22], and associated with sentence based multi-file rundown procedure. It isn't motivation to check focuses are of identical criticalness or relevance amassing of sentence or centrality subjects. A segment of the subjects can contain particular topic and pointlessness so for this LDA is used for topic appear.

The paper Mixture of Topic Model for Multi-record Summarization by Liu Na (2014) [15] considering Titled-LDA figuring which models title and substance of files at that point mixes them by disproportionate strategy. Here mix weights for focuses to be settled. Subject exhibits demonstrate an idea how records can be shown as probability scatterings over words in a report. Titled-LDA parceled into three errands: First, apportionment of point is done over the subject who is tried from Dirichlet spread. Second, a lone topic is picked by scattering for each word in the chronicle. Finally, every word is assessed from a polynomial spread over words which are portrayed in analyzed subject. Besides, get the title information and the substance information in fitting way which is helpful in execution of Summarization. The test occurs indicates incredible come to fruition by proposing another computation diverged from other figuring on DUC 2002 CORPUS.

### III. PROPOSED SYSTEM

The grouping of our thinking is on consolidating co-referent things. Co-referent things is a course of action of documents related to a comparable topic that one needs to pack which are set up to be met in the data solidifying issue. A record is rotted into a multi-set of thoughts. After crumbling of the reports into multi-set of thoughts a weighted perfect combination limit is associated. The multi-set of thoughts along these lines got is considered as a course of action of key thoughts. For plot period a fundamental change of the NEWSUM count is introduced. It is a summarization method that uses sentence extraction approach with a particular true objective to make summarizations.

The proposed system consisting of following modules as depicted in Fig.1:

- A. Pre-processor
  - Stemming
  - StopWord Removing
  - DocVector
- B. Clustering
  - K-Means Clustering
  - Bisect K-Means
- C. Merging
  - Fβ-Optimal Function
- 3.4 Summary generator

- NEWSUM
- Neural Network

#### [1] Preprocessor

In the first phase of pre-processor the given document, get divided into segments.

- Word Stemming: Stemmer mean produce the stem from the inflected form of words. It selects basic meaning of word, which is number of times present in paragraph.
- Clear StopWord: Clear StopWords after click this button clean all stop word they are is, the, it, are and etc. It reduces the length of text, which is necessary for summarization.
- DocVector: In a slide we have to calculate the average DocVector that is DocVector = No. of times term occurs in a doc /total no. of terms in a doc.

#### [2] Clustering:

Clustering is the way toward partitioning a group of data points into a little number of clusters. Here we are utilizing k-means clustering algorithm. Number of times a word happens in an archive (stop-words have been dispensed with before it and won't figure in this computation). Converse Document Frequency is the quantity of archives in the record set which contains that word.

#### [3] Merging:

It is the extraction of information from multiple texts written about the same topic. The resulting summary report allows individual users, such as professional information consumers, to quickly familiarize themselves with information contained in a large cluster of documents.

#### [4] Weighted optimal merge function:

$$\begin{aligned} \varpi^*(M) &= \arg \max_{\mathcal{S} \in \mathcal{M}(U)} f_{\beta}(\mathcal{S}|M) \\ &= \arg \max_{\mathcal{S} \in \mathcal{M}(U)} \left( \frac{(1 + \beta^2) \cdot p(\mathcal{S}|M) \cdot r(\mathcal{S}|M)}{\beta^2 \cdot p(\mathcal{S}|M) + r(\mathcal{S}|M)} \right) \end{aligned}$$

#### [5] Summary Generator:

At last the NEWSUM algorithm (a summarization technique) is applied on cluster document to generate the summarizations.

SUMMARIZER (Cluster, char \*K[])

```

{
while (size_of (K) != 0)
{
Rate all sentences in Cluster by key concepts K Select
sentence "s" with highest score and add to final
summary (S)
}
Return(S)
}

```

#### IV. CONCLUSION

It has been seen from the composed work audit that multi-report rundown consolidates making summation from various records which will be justifiable for client. The framework will make use of pre-processing systems like stop-word clearing and stemming and besides k-construes mean gathering, weighted flawless blend work and NEWSUM calculation to improve summation of value. The proposed structure can improve quality synopsis. Every so often there might be loss of fundamental data yet meanwhile our structure can give a speculative valuation for specific idea from the rundown.

#### V. REFERENCES

- [1] Van Britsom, Daan, Antoon Bronselaer, and Guy De Tre. "Using data merging techniques for generating multi-document summarizations." in IEEE trans. On fuzzy systems, pp 1 -17, 2013.
- [2] Bagalkotkar, A., Kandelwal, A., Pandey, S., &Kamath, S. S. (2013, August). A Novel Technique for Efficient Text Document Summarization as a Service.In *Advances in Computing and Communications (ICACC)*, 2013 Third International Conference on (pp. 50-53). IEEE.
- [3] Gupta, V. K., &Siddiqui, T. J. (2012, December). Multi-document summarization using sentence clustering. In *Intelligent Human Computer Interaction (IHCI)*, 2012 4th International Conference on (pp. 1-5).IEEE.
- [5] Ferreira, Rafael, Luciano de Souza Cabral, Rafael DueireLins, Gabriel Pereira e Silva, Fred Freitas, George DC Cavalcanti, Rinaldo Lima, Steven J. Simske, and Luciano Favaro. "Assessing sentence scoring techniques for extractive text summarization." *Expert systems with applications* 40, no. 14 (2013): 5755-5764.
- [6] Guran, A., N. G. Bayazit, and E. Bekar. "Automatic summarization of Turkish documents using non-negative matrix factorization." In *Innovations in Intelligent Systems and Applications (INISTA)*, 2011 International Symposium on, pp. 480-484.IEEE, 2011.
- [7] ShashiShekhar "A WEBIR Crawling Framework for Retrieving Highly Relevant Web Documents: Evaluation Based on Rank Aggregation and Result Merging Algorithms" in *Conf. on Computational Intelligence and Communication Systems*, pp 83-88 ,2011.
- [8] Manjula.K.S "Extracting Summary from Documents Using K-Mean Clustering Algorithm" in *IEEE IJARCC*, pp 3242-3246, 2013.
- [9] Gawali, Madhuri, MrunalBewoor, and SuhasPatil. "Review: Evaluating and Analyzer to Developing Optimized Text Summary Algorithm."
- [10] P.Sukumar, K.S.Gayathri "Semantic based Sentence Ordering Approach for Multi-Docment Summarization" in *IEEE IJRTE*, pp 71-76, 2014.
- [11] JinqiangBian "Research On Multi-document Summarization Based On LDA Topic Model" in *IEEE Conf. On Conference on Intelligent Human-Machine Systems and Cybernetics* ,pp 113-116 , 2014
- [12] Li, Yuhua, David McLean, Zuhair A. Bandar, James D. O'shea, and Keeley Crockett. "Sentence similarity based on semantic nets and corpus statistics." *Knowledge and Data Engineering, IEEE Transactions on* 18, no. 8 (2006): 1138-1150.
- [13] Harshad Jain et. al. "Context Sensitive Text Summarization Using K Means Clustering Algorithm" *IJSCE*, pp no 301-304, 2012.
- [14] García-Hernández, René Arnulfo, and YuliaLedeneva. "Word Sequence Models for Single Text Summarization."In *Advances in Computer-Human*
- [15] Ferreira, R., de Souza Cabral, L., Lins, R. D., Pereira e Silva, G., Freitas, F., Cavalcanti, G. D., ...&Favaro, L. (2013). Assessing sentence scoring techniques for extractive text summarization. *Expert systems with applications*, 40(14), 5755-5764.
- [16] Liu Na et al. "Mixture of Topic Model for Multi-document Summarization" In *2014 26th Chinese Control and Decision Conference (CCDC)*, IEEE, pp no 5168-5172.
- [17] RachitArora et al. "Latent Dirichlet Allocation and Singular Value Decomposition based Multi-Docment Summarization" In *2008 Eighth IEEE International Conference on Data Mining*, pp no 713-718.
- [18] HongyanLill et al. "Multi-document Summarization based on Hierarchical Topic Model" *HongyanLill*, pp no 88-91.
- [19] Liu, N., Tang, X. J., Lu, Y., Li, M. X., Wang, H. W., & Xiao, P. (2014, July). Topic-Sensitive Multi-document Summarization Algorithm. In *Parallel Architectures, Algorithms and Programming (PAAP)*, 2014 Sixth International Symposium on (pp. 69-74). IEEE.
- [20] Yan, Su, and Xiaojun Wan. "SRRank: Leveraging Semantic Roles for Extractive Multi-Docment Summarization."

# Design and Implementation of a Smart System for Assistance of Sleepy Driver Using ECG EEG and other Physiological Signals

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## ABSTRACT

In this paper we have designed a smart system for the assistances of driver who is in the nap during the driving of a vehicle and we will also determine the stage of sleep for the deciding whether the driver is again in the condition of driving or not because we have seen that these nap conditions has cost us 1000s of lives lots of people have lost their lives because of these nap like states of their driver. In our design the nap is detected by the analysis of ECG, EEG EOG,EMG and respiratory signals generated by driver`s body in the earlier researches many researchers also tried to detect these nap conditions only through EEG and EOG or any other combination of above signals but not all the signals were analyzed at the same time, in our design we have analyzed all the signals at the same time because in application which is going to be used in the real time situations like driving the accuracy of system should be the highest priority parameter above all other parameter like cost of the system complexity of the system etc. Because a little bit of wrong information sometime may cost too many lives. In this design we have setup a circuit that will perform the real time acquisition of ECG,EEG,EMG,EOG and respiratory signals and after that those signals are analyzed using MATLAB in order to detect the nap, using EOG signals we can calculate the duration of eye blink and if the eye blink duration is continuously keeps increasing and cross a certain value which is greater than normal it indicates that the driver may be in nap and the EMG signals will help in deciding the facial expressions like sleep ,at the same time EEG,ECG ,and respiratory signals are also analyzed and they will help us to determine the confirmation about sleep and the stage of the sleep also going to be determined ,once the driver`s condition is determined then on the basis of this a control signal will be generated and given to the GSM module and that will send a message with the information of location to the owner of the vehicle and also a alarm will ring in the vehicle.

**Keywords :** SREM, EEG, ECG, MATLAB, EOG, EMG.

## I. INTRODUCTION

In now days we can see that in all over world the traffic on roads is increasing drastically so it has become very important to have safe equipment for the safety on roads during the ride or travel most often we see that lots of road accidents are the result of some silly mistake made by driver for example we can consider a situation where a driver becomes little bit sleepy we call this condition as nap[3], this condition

is the transition of the states between the sleeping and active state, if a driver is in the nap during the driving the chances of accidents becomes more and more high because of the nap the reflexes of the driver becomes slow so he may lost the control over vehicle.

In many earlier researches people tried to detect these nap like conditions by applying many different algorithms Dong Qian[1] has analysed the EEG and applied the BCDC algorithm whereas Yash S. Desai[16]



has studied the findings of EEG and EOG for the detection of nap, also all these people have got the satisfactory results as we , but if we are designing an application for the real time situation like driving and suppose our system detects that the person is in the nap and we want to pass this information to owner of the vehicle then the accuracy of our system becomes very important because the impact of these information is directly going to affect the owners mood so a single set of wrong information can be panic for the owner hence in our design first we will monitor the alertness of driver with the analysis of EEG,EMG and EOG, once the nap is detected by these signal we will turn on the alarm in the vehicle and at the same time we have analysed the ECG and respiratory signal values of that time and if those values also indicates towards the condition like sleep then the nap is confirmed and the stage of sleep is also determined and now a message on owners mobile will be delivered with information of location of the vehicle and stage of the sleep.

In our design we have collected the EEG and EOG data by putting the EEG sensors on scalp [2], ECG and respiratory signals are captured by putting a chest strap and for analysing the facial expression we have put the EMG sensors on face of the driver now all these signal are given to the control and processing through data acquisition card and the control signals are generated accordingly.

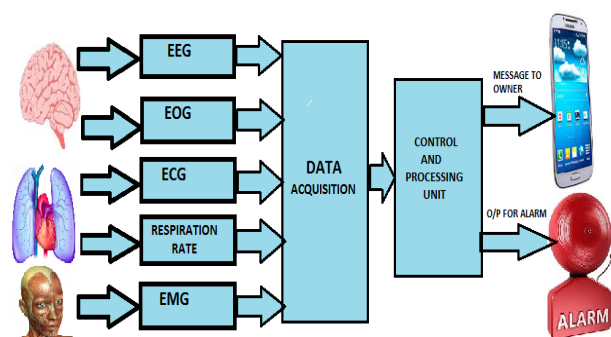


Fig. 1 Smart System Architecture

## II. NAP

In now a days the life style of peoples are becoming more and more busy and the result of these busy schedules can be seen on the daily life activities of the human beings and due to the increase pressure of very busy life style sometimes peoples do not get enough time for completing the sleep and the effect of this overnight can be seen on next day's activities of that person, person may feel the drowsiness all the time and some time he may get involved in to sleep and this short duration of sleep that is the transition period between active and sleep state is termed as the nap[4].

Suppose that person is driving a vehicle then these conditions may become dangerous so it becomes very important to detect this condition, if we are not able to detect these situations very soon the chances for the road accidents are increased with very high rate, in the following points we are discussing some stats related to the accidents which are caused by the un-alertness of the driver [5]

- The adults having the age between 18-29 are much more likely to drive during the nap or drowsiness.
- Men are more likely to have drowsiness or nap during drive in compare to women and they fall in sleep almost twice of women does.
- Shift workers are more likely to face this issue rather than regular workers.
- According to National highway traffic safety administration per year approximate 100,000 road accidents occurs due to the nap during the drive.
- Approximate 1550 deaths per year are the result of the driving during nap.
- Approximate 71000 people per year get injuries due to nap.
- An estimated total cost of \$ 1.25 billion is damaged due to these accidents.

### III. SYSTEM ARCHITECTURE

The architecture of the proposed system is shown in Fig. 1. The human brain is connected to EEG sensor and EEG Signals are captured by 14 EEG channels(0.05-200Hz) and are sampled at the rate of 1000Hz , the ECG and respiration rate data is collected through a Polar T 31 chest strap sensor[6] and we have sampled these ECG signals 500 Hz sampling frequency, for the facial expressions we have used MA 400-18 EMG sensor all these sensors read the signals from the human body and send these signals to control and processing unit via DAC where the MATLAB is used for the analysis of these signals and after this control unit will generate the control signals for the alarm and GSM module.[7]

#### A. Analysis of EEG signals during stage-1 sleep

EEG signals are the measurement of the electrical activity of the brain and each EEG wave form reflects the cortical electrical activity of brain, typically these signals are of low power and have the voltages in the range of micro volts, and these signals are characterized in to four different waves on the basis of the frequency.

Delta waves: these are the slowest waves and have the highest amplitude among all other waves, the frequency of these waves is around 3 Hz or below generally these wave appears in 3rd and 4th stage of sleep

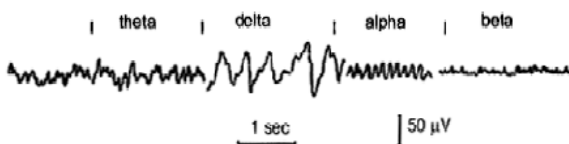


Fig. 2 Different types of waves produced by EEG.

Theta waves: These are the waves having the frequency range between 3-7.5 and have the

amplitude less than that of delta waves these waves appears during the “slow” activity phase of the person during the awake stage these waves becomes abnormal.

Alpha waves: These waves are of slightly higher frequencies if we compare with theta and delta waves the frequency range of these waves is between the 7.5-13 and these waves having the very low amplitude generally these appears during the relaxed state with closed eyes these waves disappears when we open the eyes or become alert by anyhow like we involve us in any thinking etc.

Beta wave: These waves in EEG are having the highest frequency and the range of frequency is 14 Hz or grater, the amplitude of these waves is minimum among all, generally these types of waves appears during the anxious Stages.

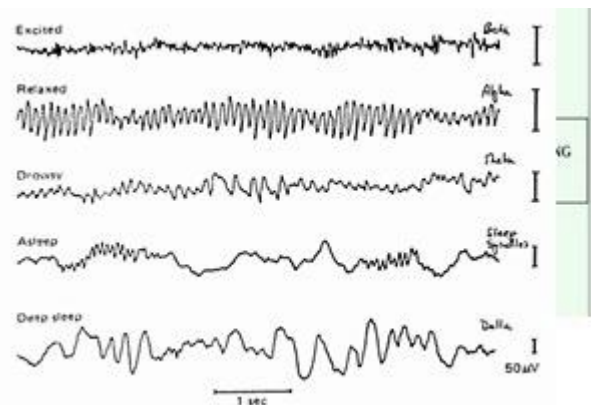


Fig. 3 Sleep Stages: Measures [9]

Since different waves present in the EEG can differentiate the various stages of a person as we have seen in above discussion so we can use these waveform as the indicator of the condition in which a person is feeling drowsiness or he is in the nap, if he or she is in the nap we can differentiate the various stages of the sleep on the basis of these signals, for detecting these conditions we have designed a algorithm in the MATLAB that will identify the current stages of the person with the help of these signals.

In the figure 2 we have differentiated various Stages of sleeps on the basis of EEG signals produced by their brain we have seen that if the person is in the deep sleep the waves produced by their brain are much slower and having the low amplitude in this state the alertness of the person is minimum as the alertness of the person is increase the frequency of the wave pattern produced by the human beings is keeps increasing and the amplitude is constantly keeps decreasing and finally it reaches the minimum at that time the pattern is having the maximum frequency and the stage of the person is determined as the excited state[8]

The state of nap which is the stage 1 of the sleep is the transition state between the alertness and sleep hence we have detected the time at which the attenuation in the frequency of alpha waves is appears[9] and these frequencies are trying to get closer towards the theta wave activity but the problem is that alpha waves indicates more than one physical condition hence only relying on the EEG could result in less accurate system hence we have designed a algorithm that includes other parameters also.

### B. Analysis of EOG signals

Electrooculography is a physiological signal used for the measurement of the electrical activity or the potential difference produced between the cornea and retina of the human eye, this potential dissimilarity is produced due to the occurrence of the nerves which are inside the retina and this is to be compared from the front side of the eye, eye movement will correspondingly produces a voltage ranges to  $16\mu\text{V}$  and  $14\mu\text{V}$  per  $1^\circ$  in horizontal and vertical way [10].

As we already know that eye blinking mechanism releases a little bit of water in the eye which generates moisture to the eye by the irrigation in form of tears and it works as lubricants for the eyes secrete. The upper part of our eye which is termed as eyelid in our eyes works for the suction all around the eyes which

covers the portion from the tear duct and spreads up to entire eyeball. It keeps out our eyes from drying. Blinking mechanism also help us in protecting the eye from irritations. Eyelashes which are the hairs attached from the upper and lower eyelids which generate the line, works against the dust and few other materials in the protection to eyes. Eyelashes are the main reason that why lots of irritants fails to reach our eyeball. The blinking procedure of our eye is controlled by the help of various muscles. The *teorbicularisoculi* and "*levatorpalpebraesuperioris*" muscles are the main muscles which controls the opening and closing of our eyes in upper eyelid. The muscle named as *orbicularis-oculi* acts in the eye the closing of eye, while in the contraction of our eyes the *levatorpalpebrae* muscle acts and opens the eye. The muscles which are responsible for the widening of the eye in the upper and 2- lower eyelids are Muller's, or the superior tarsal muscles. All these above discussed muscles are not only crucial in the blinking pattern, but these are also significant in many other works like winking and squinting. [11].

Four to five electrodes are required to detect the Eye movement all these EOG electrodes are going to act as transducers we have placed two electrode towards the outside of the eye and next two electrodes are placed below and above the eyes. Now we have placed a reference electrode. Generally every blink interval takes 2-10 second and we calculate the blink speed on the basis of that. This value may be different for every individual and we calculated the blink rate by averaging at-least 10 blinks. After this we have to calculate and monitor the blinking speed continuously when this blinking duration crosses a certain limit we detects that the driver is the nap.

### C. Analysis of EMG signals

Electromyography is a concern with the diagnosis procedure to evaluate the health of muscles and the nerves that control the signals. Machine neurons send electrical signals that results muscles to decrease or

increase in size. An EMG converts these signals into graphs, numerical or sound values that a specialist translates orally. EMG signal analysis is performed using an electromyogram [12]. EMG signals are used in this project because during sleep these signals should be weak and when sleep paralysis occurs these signals behaves as constant signal.

#### Analysis of ECG signals

ECG or Electrocardiography is a method used to monitor our cardio vascular system. During the each and every heartbeat our heart generates a small amount of voltage variation or say electrical signal. The produced electrical signal is the electrophysiological depolarization of our heart muscles. We measure this electrical activity of heart by placing some electrodes over the skin of our chest. Recently ECG is the main method used in the diagnosis of cardio vascular diseases for a long term

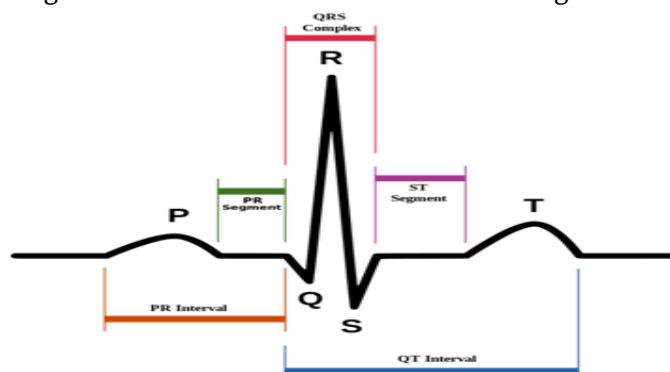


Fig. 4An ECG waveform with labeled segments

We have selected the NREM REM and waking state of human beings or the analysis of ECG signals in our study we have divided the ECG signals in various segments we have done this segmentation on the basis of polysomnographic criteria. Now we have calculated R-R interval in these signals further we have resample these signals at 2 Hz after performing the interpolation using MATLAB signal processing tool. After this we have calculated the HRV of all these ECG signals recorded for duration of 15 Minutes and

we identified the various state of sleep and waking state using this HRV.

#### D. Analysis of respiratory signals

In our study we have seen that during the sleep our breathing also shows significant changes. We have identified that whenever a person is in the waking state his breathing pattern continuously shows some variations since the breathing is disturbed by the various parameters like speech, emotions, movement etc. When the state of person changes from waking state to sleeping state simultaneously the respiration pattern also changes, during the nap the respiration becomes quite regular and an overall increase in the rate of respiration is also occurs [15].

### IV. NAP DETECTION ALGORITHM

Nap detection worked on the basis of comparison of all the signals which are received by placed electrodes on human body. It is working as the following:

These three signals (EEG, EOG, and EMG) are compared by data acquisition using MATLAB. on the basis of this a control signal is given to alarm and also if person is detected in the sleep again all the signals are going to be checked one more time with ECG and respiratory signal [17] and if person is confirmed in sleep a microcontroller based GPS system will send this message to owner of the car In this project the data should be read in real time so first the system must be aware about some specific values. Which includes that EEG signals during nap in various cases here the practical is implemented on some people so that we can analyse various cases of EEG waves during SREM (Slow Rolling Eye Movement) sleep.

EOG signals is for confirmation of SREM sleep because in some cases it was found that the data can be same as SREM sleep as the time when person is not in sleep condition. EMG signal given the final decision that whether the muscles of test body is moving or

not, if the muscles are not moving it shows that the person is in deep sleep. When all the data matches frequently just about 30-40 sec then the response sends as positive [18] all the analysis has been done on the basis of these algorithms and blow an alarm. Again check that weather the person is still in the sleep and this time it also check for the ECG and respiratory signal for the confirmation and hence if the person is detected in nap it will send a message to the owner of car and also blow the alarm.

**Algorithm Nap detection using Physiological signals**

- Place the electrodes for the detection of ECG EEG, EOG, EMG and respiratory signals.
- Compare the signals (EEG, EOG and EMG) by data acquisition system
- Sends the information to the control unit for positive response.
- Control unit transmits the information to receiver by using any communication medium.
- Again check if the alarm will off in a set delay then make a decision
- If yes then again check the ECG and respiration signals and sends information to the user by GSM using microcontroller.
- If no then again repeat the operation.

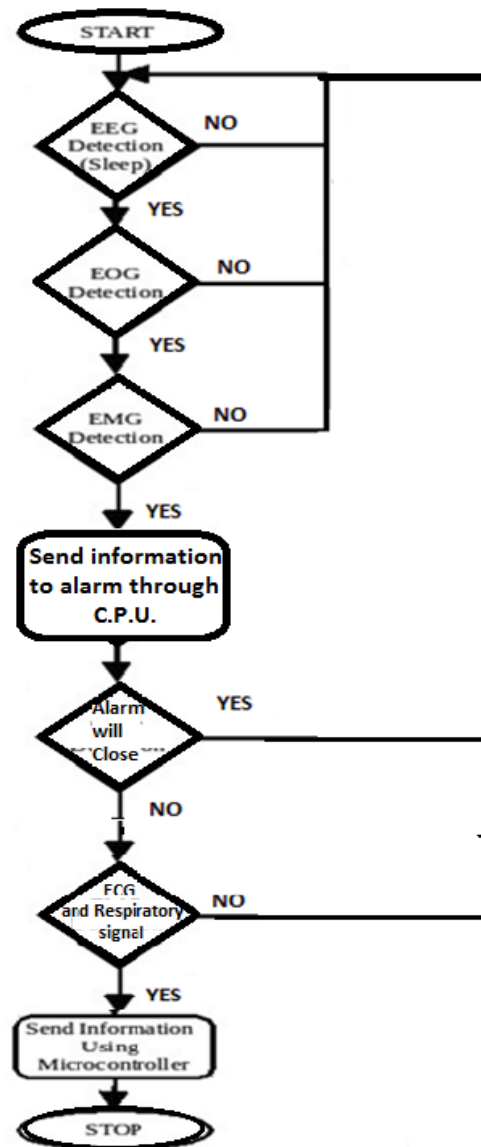


Fig. 5 Flowchart of Nap detection using Physiological signals

Nap Detection algorithm handles the condition of nap and also detects the stage of the paralysis if the condition is not true this will not respond.

Nap Detection flowchart is shown in Fig-5. If there is no nap detected, the program will not send any information to the given system. Otherwise if nap is detected, the current signal of detected nap will be processed by Nap Detection algorithm.

## V. EXPERIMENTS AND RESULTS

Here the screen-shot of the recorded EEG,EOG,EMG,ECG and respiratory waves during sleep of stage 1 that is nap, Fig-6 shows sensor position on scalp for EEG and for ECG and respiratory signals the sensor is placed on chest.

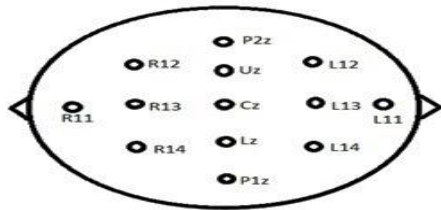


Fig. 6 Sensor Positions on the scalp for the Smart System.

## VI. SIMULATION RESULTS & DISCUSSIONS

Here the waveform recorded by electrodes shown in below screen-shots. Fig. 7 shows the electro-oculogram signals which represent the movements of eyeballs when the person is sleeping in SREM stage and struggling for opening his/her eyes. These waveforms are recorded during sleep when the person is feeling nap and at the same time the electromyogram recorded the signals of muscles movement which is shown in Fig. 8, shows that there is a constant waveform received in electromyogram which shows constant movement in person's muscles just like in that state.

In Fig. 9 shows the signals recorded by eight electrodes in which the person is in SREM (Slow Rolling Eye Movement) Sleep after the normal sleeping stages like stage1, stage2 sleep stages. These upper four signals are recorded by left portion of scalp and other four are from right portion of scalp.

In Fig. 10 and Fig. 11 shows how that how ECG and respiratory signal output indicates towards the nap or in the 1st stage of the sleep if the person is in the deep

sleep these signals will going to be more slower means as the persons sleep gets deeper the respiration rates increases and heart rate variability output gets slower.

When all the signals are recorded at the same time in the database the real-time system performs the analysis that the result that the value lies in the range of SREM sleep, at that time the signal received at the control unit and control unit sends the result to the receiver by any communication module or any indicator or alarm.

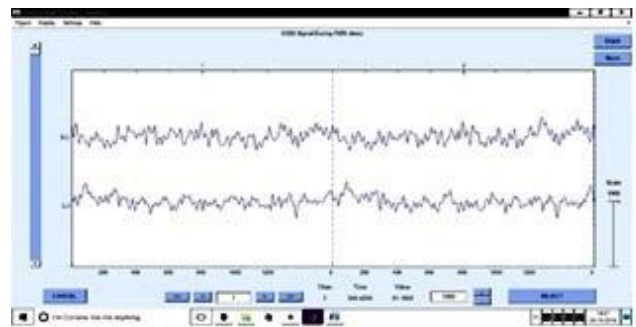


Fig. 7 EOG waveforms received by electrode R11 and L11

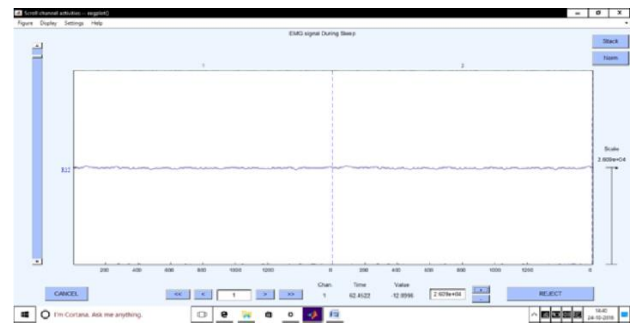


Fig. 8 EMG waveform received by electrode R12

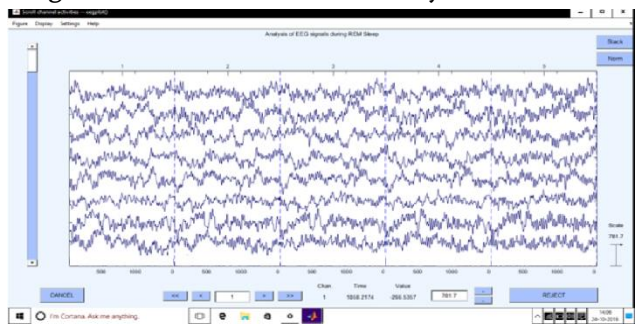


Fig. 9 EEG waveform received by eight electrodes, five of them placed on centre line, three are from left and right portion of head.

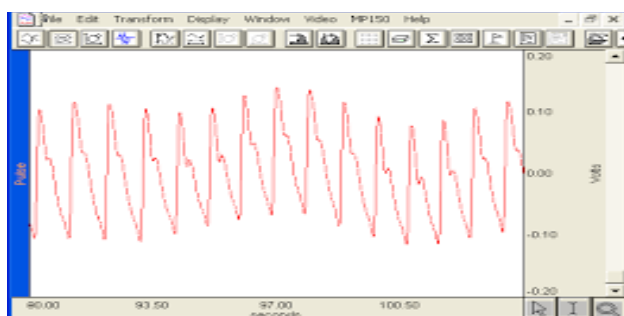


Fig.10 Respiratory rate during nap by chest strap sensor

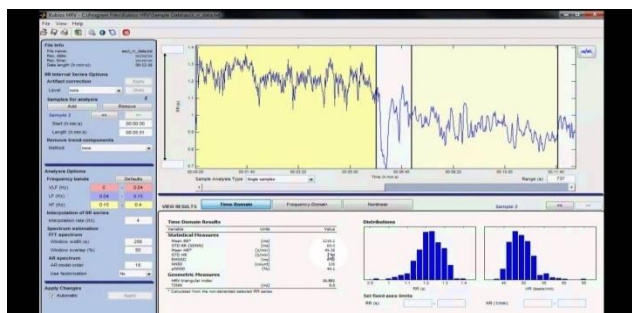


Fig.11 ECG waveform during the nap by polar T31 sensor

When all the data matches simultaneously the data acquisition system alerts the microcontroller or control unit that now the person is in sleep paralysis state and microcontroller alerts the person by using a communication medium like GSM communication, and send him/her a message that now the person who is in observation is in sleep paralysis.

## VII. CONCLUSION

An approach for the detection of nap is detection is developed and its solution is provided by sending the information to the owner of the car and to the driver so that the person can be out of his/her sleep or nap during drive and hence he or she can drive safely.

## VIII. ACKNOWLEDGEMENT

The authors are thankful to Hon'able C – VI, Dr. Aseem Chauhan (Additional President, RBEF and Chancellor AUR, Jaipur), Maj. General K. K. Ohri (AVSM, Retd.) Pro-VC Amity University, Uttar Pradesh Lucknow, Wg. Cdr. Dr. Anil Kumar,

Retd.(Director, ASET), Prof. S. T. H. Abidi (Professor Emeritus), Brig. U. K. Chopra, Retd.(Director AIIT), Prof O. P. Singh (HOD, Electrical & Electronics Engg.) Mr. Rajinder Tiwari (Asst. Prof. ASET) Amity University and Ms Ankita Tiwari (M.tech Embedded systems Technology) for their motivation, kind cooperation, and suggestions.

## IX. REFERENCES

- [1] 'Drowsiness Detection by Bayesian-Copula Discriminant Classifier Based on EEG Signals during Daytime Short Nap' Dong Qian, Bei Wang\*, Member, IEEE, Xiangyun Qing, Tao Zhang, Senior Member, IEEE, Yu Zhang, Member, IEEE, Xingyu Wang, and Masatoshi Nakamura, Senior Member, IEEE 0018-9294 (c) 2016 IEEE.
- [2] International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970) Volume-2 Number-4 Issue-7 December-2012 93 Driver's alertness detection for based on eye blink duration via EOG & EEG Yash S. Desai.
- [3] G. Borghini et al., "Measuring neurophysiological signals in aircraft pilots and car drivers for the assessment of mental workload, fatigue and drowsiness," *Neurosci. Biobehav. Rev.*, vol. 44, pp. 58–75, Jul. 2014
- [4] R. N. Khushaba et al., "Driver drowsiness classification using fuzzy wavelet-packet-based feature-extraction algorithm," *IEEE Trans. Biomed. Eng.*, vol. 58, no. 1, pp. 121–131, Jan. 2011.
- [5] C. M. Bishop, *Pattern Recognition and Machine Learning*, New York: Springer, 2006.
- [6] G. Klosch, B. Kemp, T. Penzel, A. Schlögl, P. Rappelsberger, E. Trenker, G. Gruber, J. Zeitlhofer, B. Saletu, W. Herrmann, S. Himanen, D. Kunz, M. Barbanoj, J. Roschke, A. Varri, and G. Dorffner, "The SIESTA Project Polygraphic and Clinical Database," IEEE

- Engineering in Medicine and Biology Magazine, vol. 20, no. 3, pp. 51–57, 2001.
- [7] A. Savitzky and M. J. E. Golay, “Smoothing and Differentiation of Data by Simplified Least Squares Procedures,” *Analytical Chemistry*, vol. 36, pp. 1627–1639, 1964.
- [8] F. Wilcoxon, “Individual Comparisons by Ranking Methods,” *Biometrics Bulletin*, vol. 1, no. 6, pp. 80–83, 1945.
- [9] H. Abdi, “Bonferroni and Sidak corrections for multiple comparisons,” in *Encyclopedia of Measurement and Statistics*, N. Salkind, Ed. Thousand Oaks (CA), 2007, pp. 103–107.
- [10] T. Young, M. Palta, J. Dempsey, J. Skatrud, S. Weber, and S. Badr, “The occurrence of sleep-disordered breathing among middle-aged adults,” *N Engl J Med*, vol. 328, pp. 1230–5, 1993.
- [11] B. Naegel, S. Launois, S. Mazza, C. Feuerstein, J. Ppin, and P. Lvy, “Which memory processes are affected in patients with obstructive sleep apnea? an evaluation of 3 types of memory,” *Sleep*, vol. 29(4), pp. 533–544, 2006.
- [12] J. Muthuswamy and N. Thakor, “Spectral analysis methods for neurological signals,” *J Neurosci Methods*, vol. 83, pp. 1–14, 1998.
- [13] C. Iber, S. Ancoli-Israel, A. Chesson, and S. Quan, “The aasm manual for the scoring of sleep and associated events: Rules, terminology and technical specifications,” *American Academy of Sleep Medicine*. Westchester, 2007.
- [14] P. Addison, J. Walker, and R. Guido, “Time-frequency analysis of biosignals: a wavelet transform overview,” *IEEE EMB Magazine*, vol. 28(5), pp. 14–29, 2009.
- [15] T. Ferree, “Spherical splines and average reference in scalp electroencephalography,” *Brain Topography*, vol. 19, pp. 43–52, 2006.
- [16] J. Walsleben, E. O’Malley, K. Bonnet, R. Norman, and D. Rapoport, “The utility of topographic eeg mapping in obstructive sleep apnea syndrome,” *Sleep*, vol. 16, pp. 76–78, 1993.
- [17] E. Verstraeten, “Neurocognitive effects of obstructive sleep apnea syndrome,” *Current Neurology and Neuroscience Reports*, vol. 7, pp. 161–166, 2007.
- [18] *Neurowinversion 6.8, user manual*, Nasan Medical Electronics Pvt. Ltd.



# Voice Based System in Desktop and Mobile Devices for Blind People

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## ABSTRACT

Voice mail architecture helps blind people to access e-mail and other multimedia functions of operating system (songs, text). Also in mobile application SMS can be read by system itself. Now a days the advancement made in computer technology opened platforms for visually impaired people across the world. It has been observed that nearly about 60% of total blind population across the world is present in INDIA. In this paper, I describe the voice mail architecture used by blind people to access E-mail and multimedia functions of operating system easily and efficiently. This architecture will also reduce cognitive load taken by blind to remember and type characters using keyboard. It also helps handicapped and illiterate people.

**Keywords :** Voice Mail, RSS (Real Simple Syndication), Microsoft Speech SDK.

## I. INTRODUCTION

Today in the information age computer has become a integral part of every body's life. We use a computer to hear songs, read something, accessing information from the internet. We use computer everywhere. But the information access and computer handling has to be done with the mouse and keyboard and by reading all the things present on the screen and then deciding what to do making it a visual process means we need eye sight to handle the information on the computer i.e. if we want to read news from the internet we have to first open a browser and then open a website to read news and then follow the links to read specific news. The decision making depends upon the eye sight and by reading everything that appears on the screen. So the computer and information age is not for the blind. The blind people cannot read the information and cannot view the mouse cursor to give command to the computer. They cannot access their mail and cannot send a mail. Thus the computer becomes a impractical thing for the blind people and information retrieval a tedious job. We are going to develop a information retrieval toolkit for the blind

and then transform the information into a Braille language for the blind people to read it and also keep a option of speech to read it. We are searching for a few things like how are we going to access the internet without a browser and how we are going to play the songs and read books without a mouse use.

The systems available now a day's uses screen readers which read information displayed on desktop or it prints information on Braille printer. ASR (Automatic speech recognizer) and TTS (text to speech) get used for converting speech to text and vice versa. Although these technologies are being improved continuously, some major problems still persist which make them unusable as a way of accessing email to a large segment of Blind people. These systems have following drawbacks.

1. With the help of screen readers it is difficult for blind person to access E-mail system and computer operating easily, because it has noisy audio Interface.
2. ASR is still in development stage. In case of noisy environment performance of ASR degrade.

3. Both ASR and TTS are highly language dependent. So the system developed for one language is not applicable to other.

4. Now a day's mobile is very common word it is known to almost all peoples even school goers also use mobile. Moreover, tools and technologies above for the blind users are unavailable for mobile devices.

5. These systems are not very much useful for small scale application for E-mail.

6. These available systems require use of keyboard which is very difficult for blind people to recognize and remember characters of keyboard.

Keeping in view all of these, goal of our project is to reduce limitations and problems mentioned above. Our system allows blind person to his/her voice instead of converting speech to text, the system directly sends recorded voice message to recipients mail address as an attachment. The system also provide option of desktop browser which helps to search contents in computer, Operate multimedia functions of computer such as audio, text, News on internet can be read by system. In this system we use Microsoft speech SDK which is a software development kit for building speech engine and application for Microsoft window. SDK contain SAPI i.e. you can use SDK run time to build application programming interface. This technique has following advantages:

1. Browser is used and done via a desktop application
2. The system provides an intuitive, interactive and easy to use GUI that can be easily used by a blind user even if they are not computer literate.
3. The system help not only for blind user to access Email, but it may also help other sighted people who can't type text due to illiteracy.

## II. LITERATURE REVIEW

There is bulk of information available on technological advances for visually impaired people. This includes development of text to Braille systems,

screen magnifiers and screen readers. Recently, attempts have been made in order to develop tools and technologies to help Blind people to access internet technologies. Among the early attempts, voice input and input for surfing was adopted for the Blind people. In IBM's Home page the web page is an easy-to-use interface and converts the text-to-speech having different gender voices for reading texts and links. However, the disadvantage of this is that the developer has to design a complex new interface for the complex graphical web pages to be browsed and for the screen reader to recognize.

Simple browsing solution, which divides a web page into two dimensions. This greatly simplifies a web page's structure and makes it easier to browse. Another web browser generated a tree structure from the HTML document through analyzing links. As it attempted to structure the pages that are linked together to enhance navigability, it did not prove very efficient for surfing. After, it did not handle needs regarding navigability and usability of current page itself. Another browser developed for the visually handicapped people was e-GuideDog which had an integrated TTS engine. This system applies some advanced text extraction algorithm to represent the page in a user-friendly manner. However, still it did not meet the required standards of commercial use.

There are a total number of 4.1 billion email accounts created until 2014 and an there will be estimated 5.2 billion accounts by end of 2018. this makes emails the most used form of communication. The most common mail services that we use in our day to day life cannot be used by visually challenged people. This is because they do not provide any facility so that the person in front can hear out the content of the screen. As they cannot visualize what is already present on screen they cannot make out where to click in order to perform the required operations.

For a visually challenged person using a computer for the first time is not that convenient as it is for a normal user even though it is user friendly. Although there are many screen readers available then also these people face some minor difficulties. Screen readers read out whatever content is there on the screen and to perform those actions the person will have to use keyboard shortcuts as mouse location cannot be traced by the screen readers. This means two things; one that the user cannot make use of mouse pointer as it is completely inconvenient if the pointer location cannot be traced and second that user should be well versed with the keyboard as to where each and every key is located. A user is new to computer can therefore not use this service as they are not aware of the key locations.

Another drawback that sets in is that screen readers read out the content in sequential manner and therefore user can make out the contents of the screen only if they are in basic HTML format. Thus the new advanced web pages which do not follow this paradigm in order to make the website more user-friendly only create extra hassles for these people.

All these are some drawbacks of the current system which we will overcome in the system we are developing.

Considering Indian scenario, ShrutiDrishti and Web-Browser for Blind are the two web browser framework that are used by Blind people to access the internet including the emails. Both the systems are integrated with Indian language ASR and TTS systems. But the available systems are not portable for small devices like mobile phones.

### III. PROPOSED METHODOLOGY

The architecture of our proposed system is depicted in fig.1, it shows major component of present system which are

1. G-mail System read messages on recipient mailbox.
2. RSS- Real simple syndication for news
3. Song- listen songs
4. Book reader-system read book
5. Drive browser- To search drives and folders

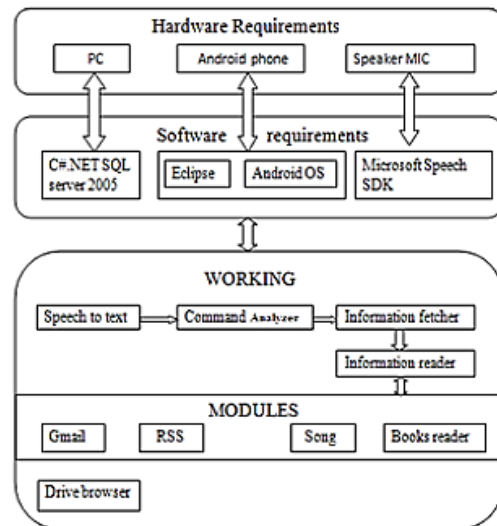


Fig. 1. Architecture of Proposed System

Concept of mailing the recorded The voice mailing system was built both for the desktop computers as well as for mobile devices. The system changes some of its configuration based on the selected devices. In the following subsections we will discuss working of the proposed system for both desktop as well as mobile platforms. Both the platform shares the same voice of the sender to the recipient. However, the GUI for both the platforms differs. In the following subsections we will discuss about each of these modules in detail.

## IV. VOICE BASED SYSTEM FOR DESKTOP

### A. Gmail:

#### 1. User Authentication System:

In user authentication module user has to give login information such as his/her username, password through voice command. for Blind users, all operation performed will get an voice based feedback.



Fig. 2. User Authentication System

There are options to save a particular users profile so that the user does not have to enter the same details again.

## 2. Options in Mailing:

**a. Sending Mail:** In send mail module the compose window will open; the user has option of either to record a voice message or to type text. In order to record a voice message a user can either click on the “Initialize Recording” button or can press the mouse right button anywhere on the screen. The GUI of the system has been designed in such a way that bluntly of the position of the mouse pointer, the mouse click operation will be registered and the system will work accordingly. In order to stop the recording, again the user can either click on the —End Recording! button or release the mouse right button anywhere on the screen i.e. the recording has been initialized by pressing the mouse right click button. Once the recording is finished, the system will ask the user to select the recipients mailing address. This is done by reading out all the mail ids of the sender alphabetically. Once the recipient mail id is entered, the system will prompt the user to send the mail or to cancel the operation. In order to send the mail the user can either press the “send mail” button or Left click on the mouse to send the mail. We will define all

the mouse click operations in details in the following sections.

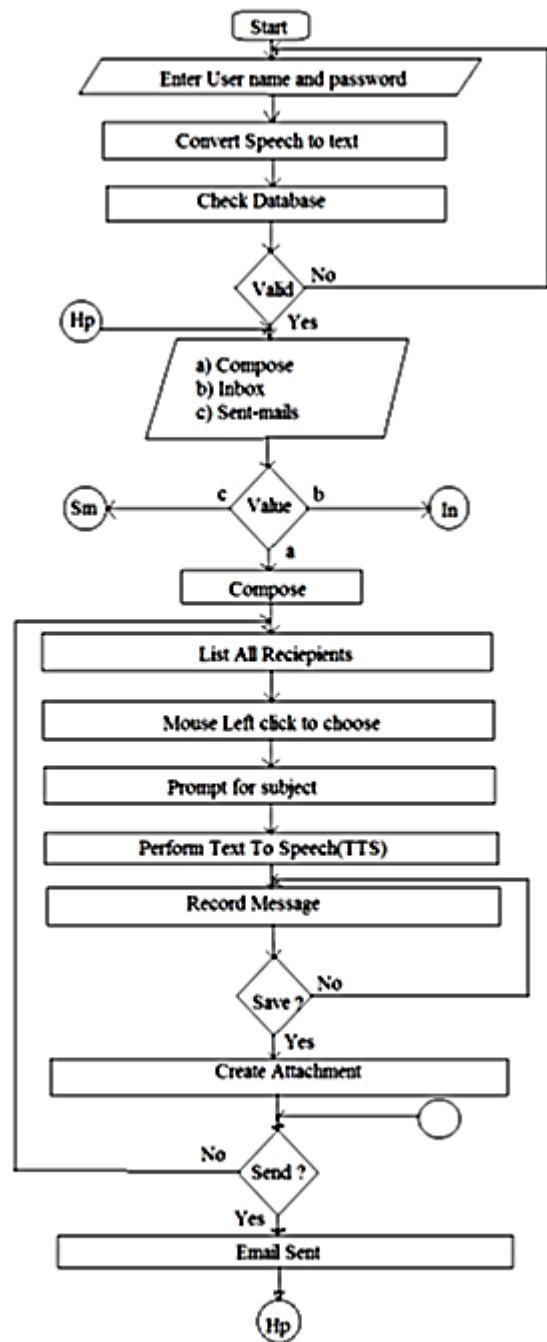


Fig. 3. Flow Chart for Composing Mail

**b. Check Inbox:** In the inbox module, the blind user can check the voice mail received in mailbox. Blind user can choose one of the two options first is checking the first ten mails and second option is check all the mail sequentially. After the user selects an option the system start to read email id given in list and then system ask to user whether the user want to

listen voice message or not, at that time system halt for a moment to receive the response. Then system performs corresponding action.

**3. GUI Accessing by Using Voice Command and Mouse Key Press:**

The GUI operation access by using voice command and mouse operation performed by the user instead of searching the short-cut key from the keyboard.

The user can apply the same keyboard command by performing different mouse operation and voice operation in our system each voice operation mapping to certain keyboard operation and also voice operation map with certain keyboard operation. This mouse operation can be change easily. Some example of mapping rules is shown in table I as below.

Mouse Click	Operation Performed	Voice Command
Right single	Compose Mail	Compose
Right double	Cancel Mail	Cancel
Right triple	NOP	NOP
Left single	Check Inbox	Open Inbox
Left double	Send Mail	Send
Left triple	NOP	NOP
Mouse Scroll Up	Select Next Mail	Next mail
Mouse Scroll Down	Previous Mail	Previous mail
Middle single	Attach Document	Attach
Middle double	Discard	Discard

**Table 1. Mouse Click and Voice Command Operations**

**B. RSS:**

RSS stands for "Really Simple Syndication". It is easy way to distribute a list of headlines, update notices and sometime content to an wide number of people. It is used by computer programs that organize those headlines and notices for easy understanding and reading.

**1. RSS Working:**

RSS works by having the website author maintain a list of notifications on their website in a standard way. This list of notifications is called as "RSS Feed". People who are interested in finding out the latest headlines or changes can check this list. Special computer programs called "RSS aggregators" have been developed that automatically access the RSS feeds of websites you care about on your behalf and organize the results for you.

RSS feeds and aggregators are sometimes called "RSS Channels" and "RSS Readers" respectively. Producing an RSS feed is very simple and hundreds of thousands of websites now provide this feature. Including major news organizations like the New York Times, The BBC and Reuters as well as many weblogs.

**C. Desktop Browser:**

Desktop browser provides voice feedback. In this system when user operate a particular drive then system inform the user by speaking out particular drive name "such as this is D drive" this help the user to confirm whether he/she in correct location or not.

**V. VOICE BASED SYSTEM FOR MOBILE**

Proposed system read messages on users mobile. As well as E-mail, other multimedia functions like (audio, text), news are handle same as discussed in voice based system for desktop. Thus, we created a version

of the same desktop application up and running on an Android based embedded platform. Roughly, the hardware requirements for our Android version of the application are as follows,

1. A touch screen device, preferably of size 4.0" x 4.0".
2. Android OS version 2.3.6 or higher.
3. CPU speed  $\geq$  400 MHz.
4. At least 30 MB of free phone memory, with support for SD card installation.
5. System requires at least 80 MB of secondary storage.

### VI. ADVANTAGES

1. The disabilities of visually impaired people are thrashed.
2. This system makes the disabled people feel like a normal user.
3. They can hear the recently received mails to the Inbox, as well as the IVR technology proves very effective for them in the terms of guidance.
4. The visually impaired people can advance from Desktop application to the web based application.

### VII. CONCLUSION

Voice mail architecture helps blind people to access e-mail and other multimedia functions of operating system (songs, text). Also in mobile application SMS can be read by system itself.

It has been observed that nearly about 60% of total blind population across the world is present in INDIA. This paper, describe the voice mail architecture used by blind people to access E-mail and multimedia functions of operating system easily and efficiently. This architecture will also reduce cognitive load taken by blind to remember and type characters using keyboard. It also helps handicapped and illiterate people.

### VIII. REFERENCES

1. Jagtap Nilesh, "Voice Based System in Desktop and Mobile Devices for Blind People", (February 2014), International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 2.
2. Pranjal Ingle, "Voice based e-mail System for Blinds", (2016), International Journal of Research Studies in Computer Science and Engineering (IJRSCSE), Volume 3, Issue 1.
3. T Shabanal, "Voice based email system for blind", (January 2015), International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 1.

# Route Discovery Process in Reactive Routing Protocol

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## ABSTRACT

A Mobile Ad-hoc network (MANET) is a self-organizing wireless network, which has no fixed infrastructure or central control station. A Major aspect of ad-hoc networks is that the nodes move randomly, which requires the routing protocols in ad-hoc network to quickly respond to the network topology change. In addition to that it should provide the various quality of services such as guaranteed delivery, security, reduced overhead etc. An efficient protocol must have the mechanism to maintain paths to other nodes and in most cases, if the routes are affected, it should be able to recover using an existing alternate path. In this, we focused the various methodologies used for route discovery, route maintenance and route recovery process adopted in Reactive routing protocol for MANETs. A Reactive (on-demand) routing strategy is a popular routing category for wireless ad hoc routing.

**Keywords** : Reactive Routing Protocol, Ad-Hoc - On Demand Distance Vector (AODV), Comparison of Reactive Routing Protocol.

## I. INTRODUCTION

Mobile Ad-hoc network is a collection of portable computing devices that form a self-organizing and self-administering wireless networks. Reactive protocols is also known as Source Initiated Protocols. It's not necessary to maintain the routing information or routing activity if there is no any communication. If one node wants to send a packet to the another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packets. The route maintenance procedure is used to maintain the routes. These protocols tend to use less bandwidth for maintaining the route tables at every node. However, the latency drastically increases, leading to long delays before a communication can start. This is because a route to the destination has to be acquired first.

To limit the impact of this delay, most protocols will use a route cache for once established routes. The routing mechanisms will vary in different protocols based on the factors like mobility of nodes, expected quality of services, area of application, resources availability etc. The data packets will be lost during path break which occurs due to node mobility. When the network traffic requires real time delivery (voice, for instance), dropping data packets at the intermediate nodes can be costly. Likewise, if the session is a best effort, TCP connection, packet drops may lead to slow start, timeout, and throughput degradation.

## II. REACTIVE ROUTING PROTOCOL

Reactive routing is a bandwidth efficient on-demand routing protocol for Mobile Ad-Hoc Networks. The protocols comprises of two main functions of Route

Discovery and Route Maintenance. In this protocol, a node initiates a route discovery process throughout the network, only when it wants to send packets to its destination. This process is completed once a route is determined or all possible permutations have been examined. Once a route has been established, it is maintained by a route maintenance process until either the destination becomes inaccessible along every path from the source or the route is no longer desired. A route search is needed for every unknown destination. Therefore, theoretically the communication overhead is reduced at expense of delay due to route search. Some reactive protocols are Ad hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR).[1 2]

### III. Ad-Hoc - On Demand Distance Vector (AODV)

Active on demand vector routing protocol uses mobile nodes to identify routes rapidly to reach new destinations and does not require nodes to maintain routes to destinations. It is loop-free and avoids "counting to infinity" problem. The operation of Active on demand vector comprises of two main processes i.e. route discovery and route maintenance.[2 3]

Nodes in the network is comprises with some of the information about the particular nodes. Each node in the network maintains a routing table with the routing information entries such as Destination IP Address, source IP address, Destination Sequence Number, Next Hop, IP Address Lifetime (expiration or deletion time of the route) Hop Count (number of hops to reach the destination) Network Interface other state and routing flags (e.g., valid, invalid).[4,5]

Each node in the network maintains a routing table with the routing information entries such as Destination IP Address, source IP address, Destination Sequence Number, Next Hop, IP Address Lifetime (expiration or deletion time of the route) Hop Count (number of hops to reach the destination) Network

Interface other state and routing flags (e.g., valid, invalid).

The route discovery process generates route request / route reply query cycle. When a node has a data to send then it broadcasts a route request (RREQ) packet across the network. The RREQ contains the following fields such as source-address, destination-address, destination-sequence number and hop-count. The nodes receiving this packet update their information for the source node and set up backwards pointers to the source node in the route tables.

A node receiving the route request (RREQ) may send a route reply (RREP) if it is either the destination or if it has a route to the destination with corresponding sequence number greater than or equal to that contained in the RREQ. The RREP contains the following fields such as Destination- address, Destination-sequence number and lifetime. Otherwise, it rebroadcasts the RREQ. Once the source node receives the RREP, it may begin to forward data packets to the destination.

If there are any link or node failures, then the node in the upstream of the break propagates a route error (RERR) message to the source node to inform it of the now unreachable destination(s). In order to enable this reporting mechanism, each node keeps a ``precursor list", containing the IP address for each its neighbours that are likely to use it as a next hop towards each destination. After receiving the RERR, if the source node still desires the route, it can reinitiate route discovery. On-demand routing protocol which is widely developed in ad- hoc networks because of its effectiveness and efficiency.

#### A. Route Discovery

When a node wants to establish a route with another node in the network then first it will check whether it have valid route to the destination or not. If it have a valid route in the routing table then it simply send the packets on that route. If it has not a valid route then it



start route discovery process. For this it will create a request packet RREQ (Route request). If they have a route to the destination then they simply send the reply otherwise forward the packets to their intermediate node and so on. At last it will reach to the destination and it simply Unicast the RREP (Route Reply) packet to the source. The source will enter the route in routing table with lifetime of the route. After discovering the efficient route the data packets will be forwarded through the discovered route from source to the destination.

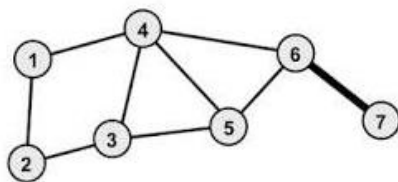
**B. Route Maintenance**

When a route failure occurs then the route maintenance process is initiated. The route failure occurs due to many reasons such as node mobility or power exhaustion. When a route failure occurs then the error message RERR is send to the source then the source will invalidate the route entry in the routing table and reinitiate the route discovery. The information or the data of the routes through the nodes are stored in the form of table to each of the nodes. Tables at each nodes maintains the information of each nodes present in the network.

There are some other control packets such as HELLO, RREP-ACK. HELLO messages are used to monitor the connectivity among neighbouring nodes.

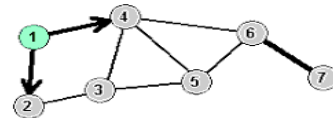
**Example of AODV for route discovery**

**AODV Example (1)**



Node 1 needs to send a data packet to Node 7  
 Assume Node 6 knows a current route to Node 7  
 Assume that no other route information exists in the network (related to Node 7)

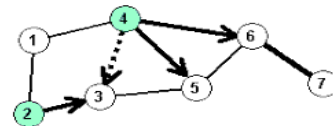
**AODV Example (2)**



- Node 1 sends a RREQ packet to its neighbors
  - source\_addr = 1
  - dest\_addr = 7
  - broadcast\_id = broadcast\_id + 1
  - source\_sequence\_# = source\_sequence\_# + 1
  - dest\_sequence\_# = last dest\_sequence\_# for Node 7

Mobile Networks : IP Routing and MANET Routing Algorithms

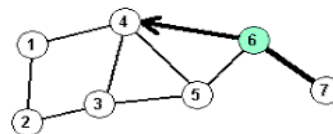
**AODV Example (3)**



- Nodes 2 and 4 verify that this is a new RREQ and that the source\_sequence\_# is not stale with respect to the reverse route to Node 1
- Nodes 2 and 4 forward the RREQ
  - Update source\_sequence\_# for Node 1
  - Increment hop\_cnt in the RREQ packet

Mobile Networks : IP Routing and MANET Routing Algorithms

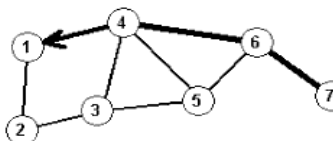
**AODV Example (5)**



- Node 6 knows a route to Node 7 and sends an RREP to Node 4
  - source\_addr = 1
  - dest\_addr = 7
  - dest\_sequence\_# = maximum(own sequence number, dest\_sequence\_# in RREQ)
  - hop\_cnt = 1

Mobile Networks : IP Routing and MANET Routing Algorithms

**AODV Example (6)**

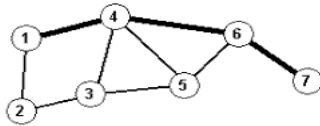


- Node 4 verifies that this is a new route reply (the case here) or one that has a lower hop count and, if so, propagates the RREP packet to Node 1
  - Increments hop\_cnt in the RREP packet

Mobile Networks : IP Routing and MANET Routing Algorithms

### AODV Example (7)

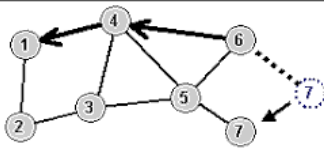
Dest	Next	Hops
7	4	3



- Node 1 now has a route to Node 7 in three hops and can use it immediately to send data packets
- Note that the first data packet that prompted path discovery has been delayed until the first RREP was returned

Mobile Networks I: IP Routing and MANET Routing Algorithms

### AODV Example (8)



- Assume that Node 7 moves and link 6-7 breaks
- Node 6 issues an RERR packet indicating the broken path
- The RERR propagates back to Node 1
- Node 1 can discover a new route

Mobile Networks I: IP Routing and MANET Routing Algorithms

The above figure is the example for finding the route from source to the destination through the nodes. It contains four frame types i.e. route finding, route frame, data frame, ACK. The route finding frame finds the possible route from source to the destination after finding the possible route the route frame gets back to the source from destination to send the data frame, when the data frame is sent successfully the destination needs to send the ACK frame to the source. So that source will come to know that data is successfully sent to the destination.

### IV. CONCLUSION

The task of finding and maintaining routes is nontrivial in mobile ad-hoc network. The mobility causes frequent unpredictable topological changes. A path that was considered to be optimal will not be optimal after a while. The factors that affect the routing process are link capacity, link and node capability, network density, etc. Also, the simulation

results show that there is no one protocol is having better performance. Each protocol is suitable for some applications. An efficient routing protocol should be selected that suits the desired task.

### V. REFERENCES

1. Ashok Kumar Sharma, Mr. Supratik Banerjee , Route Discovery Utilizing Power in AODV, Computer Science and Technology, Lovely Professional University Phagwara (Punjab), India 2013
2. ESivajothi, N.Vijayalakshmi, A.Swaminathan, Dr.P.Vivekanandan An Overview of Route Discovery Mechanisms of Multicast Routing Protocols for MANETs, Research Scholar, College of Engineering, Anna University, Chennai, India
3. Mr L Raja , Capt. Dr. S Santhosh Baboo Assistant Professor, Comparative study of reactive routing protocol (AODV, DSR, ABR and TORA) in MANET, Dept. of Computer Applications, P.G. Research Dept. of Computer Science 1Pachaiyappa's College, Chennai-30, 2D.G. Vaishnav College, Chennai-106
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# Study of Multicasting Routing Protocols

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## ABSTRACT

Sending various duplicates of bundle to various hubs is called Multicasting. Wired and foundation based remote systems are bolstered by numerous multicast directing conventions. In any case, applying this idea in Mobile Ad hoc remote systems (MANETs) is a major test. Issues in specially appointed systems are the shortage of data transfer capacity, short lifetime of the hubs because of energy imperatives and dynamic topology because of the portability of hubs. These issues put in power to plan a straightforward, versatile, hearty and vitality productive directing convention for multicast condition. In this paper we will examine distinctive multicasting directing conventions for versatile specially appointed systems and their sending issues.

**Keywords:** Multicasting, Mobile Ad- Hoc Networks (MANETs), Protocol, Routes.

## I. INTRODUCTION

Remote applications, similar to crisis hunts, salvages, and military war zones where sharing of data is obligatory, require fast deployable and speedy reconfigurable directing conventions, as a result of these reasons there are requirements for multicast steering conventions. There are numerous qualities and difficulties that ought to mull over when building up a multicast steering conventions, similar to: the dynamic of the system topology, the imperatives vitality, impediment of system adaptability, and the diverse attributes between remote connections and wired connections, for example, restricted data transfer capacity and poor security .For the most part there are two sorts of multicast directing conventions in remote systems. Tree-based multicast directing convention: in the tree-based multicasting, structure can be very unsteady in multicast specially appointed steering conventions, as it needs visit re-design in powerful systems, a case for these sort is Multicast

expansion for Impromptu On-Request Separation Vector (MAODV) and Versatile Request Driven Multicast Steering convention (ADMR). The second kind is work based multicast convention. Work based multicast directing conventions: It is in excess of one way may exist between a source recipient match, Center Helped Work Convention (CAMP) and On-Request Multicast Steering Convention (ODMRP) are a case for these sort of arrangement. It depicts related work on some multicast directing convention, tree-based multicast steering conventions like MAODV, work based multicast steering conventions like ODMRP and fix ODMRP, half and half multicast directing convention like AM Course.

In this, we will order the conventions that endeavored to posture general thoughts of how applying multicast idea in MANETs. The classification of these routing protocols will be mentioned under as shown in Figure 1.

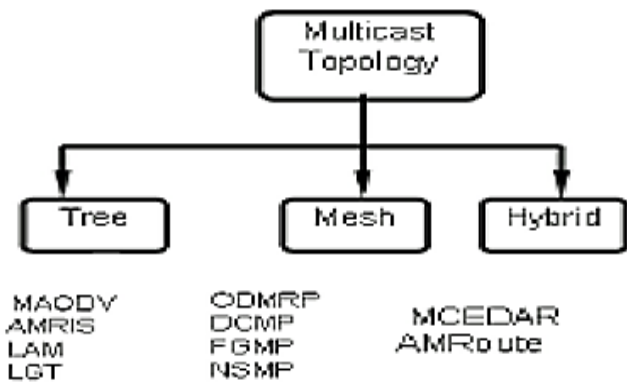


Figure 1: Multicast routing protocols in MANET

## II. PROTOCOLS CLASSIFICATION

Based on way dissemination Order of multicast directing conventions in remote system should be possible utilizing a thought of way dispersion among the gathering individuals. By utilizing this thought, in MANET multicast directing conventions are partitioned into following categories[1]:

- Tree based directing convention.
- Work based directing convention.
- Half and half steering convention.

### Tree Based Multicasting

A tree based chain of importance multicast steering convention builds up and keep up a mutual multicasting directing tree to deliver[2] information from a source to recipients of a multicast[1] groups. A surely understood case of tree based multicasting steering conventions are the Multicast Specially appointed On request Separation Vector steering conventions (MAODV). Tree based conventions gives the fast of information sending productivity and low strength. Tree based conventions are straightforward yet in MANET bundles are dropped until the point when tree is changed after the development of a hub.

Additionally tree progression based conventions are isolated into two sections:

- Source established tree multicast directing protocols[1].
- Rooted tree multicast directing protocols[3].

In a source established tree, based multicast conventions source hubs are underlying foundations of trees and executes the calculations for conveyance tree arrangement and maintenance[1]. Source must be known about topology data and addresses of all accepting nodes[3].

In center established tree, multicast steering convention center hubs are with particular capacities, for example, information partition and enrollment administration.

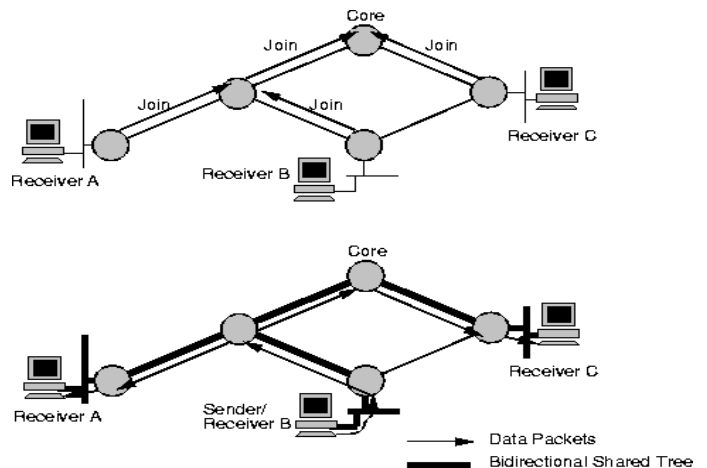


Figure 1: Tree Based Multicasting

### Multicast Specially appointed On-Request Separation Vector Directing Convention (MAODV)

The Specially appointed On-Request Separation Vector convention is both an on-request and a table-driven convention. The parcel measure in AODV is uniform dissimilar to DSR. Dissimilar to DSDV, there is no requirement for framework wide communicates because of neighborhood changes. AODV underpins multicasting and unicasting inside a uniform structure.

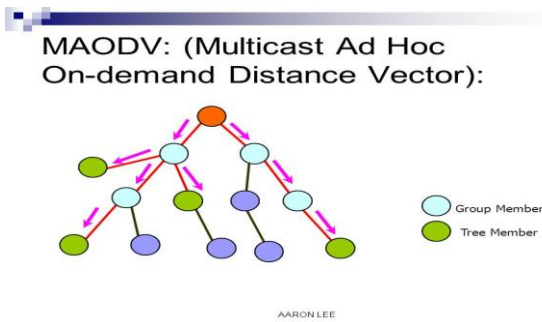


Figure 2: MAODV Diagram

### Work BASED MUTICASTING

A work based multicast steering convention get a work comprising of an associated segment of the system containing every one of the beneficiaries of a gathering. Case of work construct multicasting directing methodologies is With respect to Request Multicast Steering Convention (ODMRP). In work based multicast directing conventions, parcels are disseminated along the interconnected work structure. Work based conventions gives strong execution because of repetitive way accessibility.

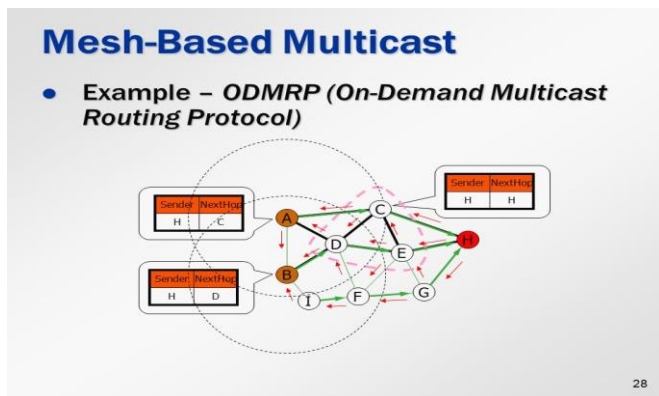


Figure 3: Mesh Based Multicast

### On-Demand Multicast Routing Protocol (ODMRP)

ODMRP, is an on-request work based, other than it is a multicast directing protocol[1], ODMRP convention can make utilization of unicast system to send multicast information bundle frame the sender hubs toward the recipients in the multicasting gathering. To convey multicast information by means of perused

flooding it utilizes sending bunch idea. The source, in ODMRP, builds up and keeps up assemble participation. On the off chance that source wishes to send bundle to a multicast gathering yet has course to that gathering, it essentially communicates JOIN\_DATA control parcel to the whole system. At the point when a middle of the road hub gets the JOIN\_DATA bundle it stores source address and succession number in its reserve to detect[1] copy. It performs important directing table updates for turn around way back to the source.

### HYBRID BASED MULTICASTING

It is the sort of conventions which have the blend of both tree-based and work based multicasting steering convention.

### Ad-Hoc Multicast Routing Protocol

AM Course in light of shared tree and has two faces: work and tree. AM Course distinguishes and assigned certain hub at legitimate center that are in charge of starting the flagging activity and keeping up the multicast tree to whatever remains of the gathering individuals. A non-center hub just reacts to messages. AM Course does not address organize flow and expect the fundamental unicast convention to deal with it. Utilizing the work joins, AM Course begins building multicast tree. On the off chance that there is any adjustment in the system, multicast tree in AM Course tries to keep the multicast conveyance tree unaltered. The primary impediment of this convention is that it might have transitory circles and may make non ideal trees with have versatility.

### III. Difference between Protocols

- PUMA and MAODV are both get arranged conventions. Be that as it may, Jaguar is a work based convention and give different courses from senders to collectors. MAODV, then again, is a

tree based convention and gives just a solitary course amongst senders and receivers[1].

- The primary distinction between a tree as developed in MAODV and a work as built in Panther is that a work gives different ways amongst senders and beneficiaries though a tree gives just a solitary way amongst senders and receivers[1].
- MAODV keeps up a common tree for each multicast gathering, comprising of just collectors and transfers. The Convention for Brought together Multicasting through Declarations (Panther) fabricates networks that interface all recipients together[1].
- PUMA does not require any unicast directing convention to work, or the pre-task centers to bunches as like MAODV[1].

#### IV. CONCLUSION

In this, introduces a general perspective of multicast steering conventions in specially appointed systems. Any multicast steering convention in MANETs tries to beat some troublesome issues which can be classified under essential issues or contemplations. All conventions have their own particular favorable circumstances and detriments. One builds multicast trees to decrease end-to-end idleness. Multicast tree-based steering conventions are effective and fulfill adaptability issue, they have a few disadvantages in specially appointed remote systems because of versatile nature of hubs that take an interest amid multicast session. In the work based conventions give more heartiness against versatility and spare the extensive size of control overhead utilized as a part of tree support. Most conventions of this compose depend on visit broadcasting, which may prompt an adaptability issue when the quantity of sources increments. Half and half multicast gives which are tree based and in addition work based and gives the upside of both types[1]. It is extremely hard to outline

a multicast directing convention considering all the previously mentioned issues. Still it is an open issue for scientists to build up a solitary convention which can fulfill however many objectives as could be allowed in the future[1].

#### V. REFERENCES

1. Tanu Preet Singh, Neha, Vikrant Das. "Multicast Routing Protocols in Manets", Volume 2, Issue 1 January 2012, Issn:2277128X, IJARCSSE.
2. E.Suresh Babu<sup>1</sup>, C.Nagaraju<sup>2</sup>, MHM Krishna Prasad<sup>3</sup>. A Comparative Study of Tree based Vs. Mesh based Multicast Routing Protocols in Mobile Ad hoc Networks. International Journal of Emerging Trends & Technology in Computer Science (IJETTCS) ,Volume 2, Issue 6, November – December 2013
3. <https://www.cisco.com/c/en/us/about/press/internet-protocol-journal/back-issues/table-contents-19/reliable-multicast.html>

# An implementation of Object Tracking using Modified Mean Shift Algorithm

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## ABSTRACT

Visual object tracking is a challenging problem in computer vision. To achieve the goal of object tracking we need to obtain a feature vector which is capable of identifying the object to be tracked despite of presence of translation in the view field, at the minimum. The change in scale of the object due to motion along the perpendicular to the line of sight adds to its complexity. In this work we have been able to implement an object tracking system using the MATLAB environment. The system uses the mean shift algorithm, which is based on color channel histogram analysis and the algorithm is modified that it includes the object texture information using the LBP operator. We have been able to enhance the object tracking capability of the system.

## I. INTRODUCTION

The real-time target tracking is a hot topic in computer vision application, which is widely used in the fields such as intelligent transportation, military surveillance, medical diagnosis, intelligent home, human-computer interaction and so on. The essence of target tracking is to determine the target position in image frames and then to associate front and rear frames for obtaining the target trajectory. The tracking algorithm should be able to adapt to a wide variety of complex environment, such as illumination changes, background interference and target occlusion. A popular algorithm in moving target tracking area is Mean Shift (MS) method [1], which receives the widespread attention with its low computational complexity and real-time performance.

Object detection is one of the most important tasks of computer vision and as such has received considerable attention from the research community. Typically object detectors identify one or more bounding boxes in the image containing an object and associate a category label to it. These detectors are specific for

each class of objects, and for certain domains exist a vast literature of specialized methods, such as face detection [9] and pedestrian detection [11]. In recent years the objectness measure, that quantifies how likely an image window is containing an object of any class [2], has become popular [3], [8]. The popularity of objectness proposal methods lies in the fact that they can be used as a pre-processing step for object detection to speed up specific object detectors.

The idea is to determine a subset of all possible windows in an image with a high probability of containing an object, and feed them to specific object detectors. Object proposal algorithms perform two main operations: generate a set of bounding boxes and assign an objectness score to each box. The window proposal step is typically much faster than the exhaustive evaluation of the object detector. Considering that a “sliding window” detector has typically to evaluate  $10^6$  windows, if it is possible to reduce this number to  $10^3$ – $10^4$ , evaluating only these proposals, then the overall speed is greatly improved. In this sense objectness proposal methods can be

related to cascade methods which perform a preliminary fast, although inaccurate, classification to discard the vast majority of unpromising proposals. Reducing the search space of object bounding boxes has also the advantage of reducing the false positive rate of the object detector.

The great majority of methods for objectness proposal have dealt with images, while approaches to video objectness proposal are oriented toward segmentation in supervoxels, deriving objectness measures from the “tubes” of superpixels that form them. This process is often computation-ally expensive and requires to process the whole video.

## II. LITERATURE REVIEW

**JI Xiaoyan, QU Shiru in their work “A Target Tracking Algorithm Based on Mean Shift with Feature Fusion”** have proposed an improved Mean Shift tracking algorithm based on texture and color feature fusion.. Experimental results show that the proposed algorithm is more robust and more adaptable than the classic Mean Shift and Particle Filter methods in complex environment, such as the similar background colors, rapid illumination changes and full occlusion.

**K. V sriharsha et al in their work “Dynamic scene analysis using Kalman filter and mean shift tracking algorithms”** have presented a work which is about locating a moving object (or multiple objects) over a time using a stationary camera and associating it in consecutive video frames. In this perspective, a video captured by digital camera is used for motion analysis. In the first stage of experiment background subtraction and frame differencing algorithms are used for object detection and its motion is estimated by associating the centroid of the moving object in each differenced frame. . In the second stage of experiment same algorithm is chosen for object detection but motion of each track is estimated by Kalman filter. However the

best estimate is made by combining the knowledge of prediction and correction mechanisms that were incorporated as part of Kalman filter design. The idea of combining Kalman filter theory and mean shift theory has given a direction in bringing out the efficient and reliable tracking results in case of partial occlusion.

### **Songmin Jia in his work titled as “Improved Target Tracking Based on Spatio-Temporal Learning**

has proposed a template- matching algorithm is an efficient and fast detection algorithm that find the maximum probability point in the image that similar to the template. In order to decrease the calculating time, the search region is not the whole image but the context region of STC tracking method. What’s more, after tracking and detecting we update the scale parameter to adapt the change of the target’s appearance. Finally, experimental results demonstrate that the tracking method has improved the robustness of tracking.

### **Jae Pil Hwang, Jeonghyun Baek, Baehoon Choi, and Euntai Kim in their work titled as “A Novel Part-based Approach to Mean-Shift Algorithm for Visual Tracking”** have presented

a novel method of visual tracking algorithm named part-based mean-shift (PBMS) algorithm is presented. In the proposed PBMS, unlike the standard mean-shift (MS), the target object is divided into multiple parts and the target is tracked by tracking each individual part and combining the results. For the part-based visual tracking, the objective function in the MS is modified such that the target object is represented as a combination of the parts and iterative optimization solution is presented. Further, the proposed PBMS provides a systematic and analytic way to determine the scale of the bounding box for the target from the perspective of the objective function optimization. Simulation is conducted with several benchmark problems and the result shows that the proposed PBMS outperforms the standard MS.



On the basis of literature review carried out we observe that Visual object tracking is a challenging problem in computer vision. A feature vector is required that identifies the object to be tracked such that the tracking system is able to track the object in the presence of translation in the view field, at the minimum. An added complexity to the problem is change in scale of the object due to motion along the perpendicular to the line of sight. A currently intractable problem with object tracking is rotation of the object perpendicular to the plane of the visual field, so our study will be limited to two dimensional visual fields.

The aim of their work is to implement an object tracking system using the MATLAB environment. The algorithm to be used is the mean shift algorithm, which is based on color channel histogram analysis. The mean shift algorithm is modified so as to include object texture information using the LBP operator. This will enhance the object tracking capability of the system. This will be accomplished in the following way:

1. Implementation of mean shift algorithm using MATLAB.
2. Implementation of local binary pattern algorithm using MATLAB.
3. Conversion of video feed to frames.
4. Determination of mean shift feature vector and LBP feature vector.
5. All the above will be combined into the final object tracking system.
6. Validation of the system using open source datasets available online.
7. Analysis of system performance and comparison with benchmarks available in the literature.

### III. PROPOSED METHODOLOGY

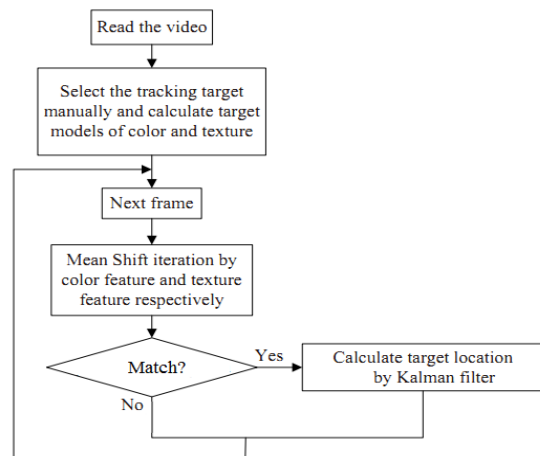


Figure 1. Overall Approach

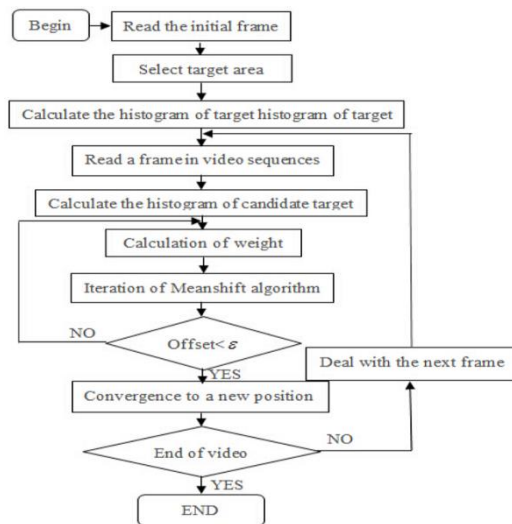


Figure 2. Detailed Flow Diagram

#### 3.1 Mean Shift Tracking

MS algorithm uses iterative method to find the maximum of probability density estimation in the neighborhood, i.e. the target position. Target region of the tracking algorithm is usually chosen by a rectangular or ellipsoidal region. The target is represented as feature histogram.

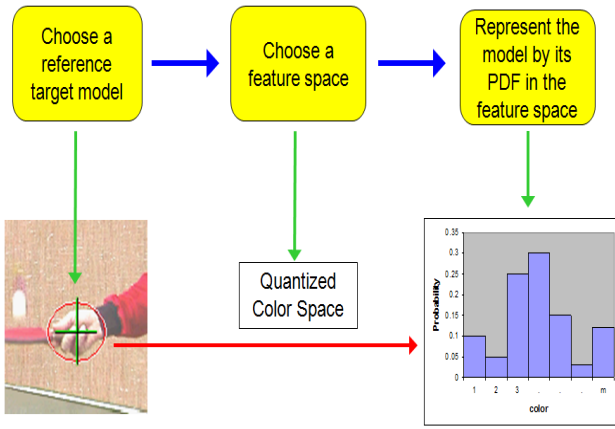


Figure 3. Feature Generation

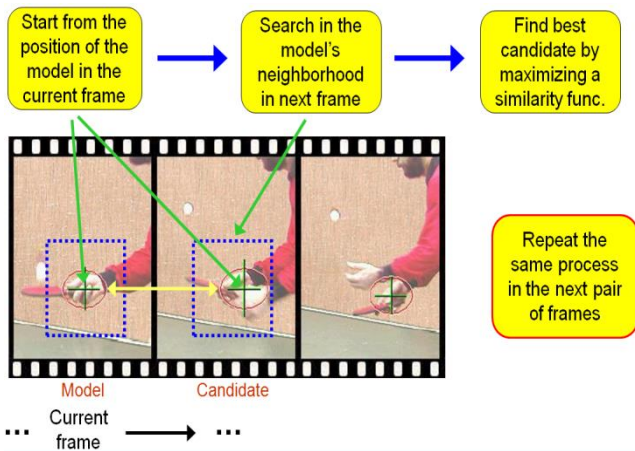


Figure 4. Mean Shift Action

3.2 LBP Texture Feature

Texture is a visual feature revealing homogeneous phenomenon in image, which reflects the spatial structure of the target with independent on the color or brightness, and has the characteristics of rotational invariance and strong noise immunity. Gray level co-occurrence matrix method and Gabor filtering method are more commonly used among various methods of target texture extraction, both of which have the disadvantages of high computational complexity and much redundant information of extracted texture features. In summary, the LBP operator is chosen to extract texture feature in their paper with fast computation, low complexity and gray-scale invariance.

LBP operator works by the means of thresholding pixels in the neighborhood of the pixel and considering the result as a binary number, then the LBP value is obtained with the binary number converted to a decimal number.

example			thresholded			weights		
6	5	2	1	0	0	1	2	4
7	6	1	1		0	128		8
9	8	7	1	1	1	64	32	16

Pattern=10001111  
 LBP=1+16+32+64+128=241

Figure 5. LBP Calculation

3.3 Target Occlusion

The target will be lost with classic MS tracking algorithm since Bhattacharyya coefficient dramatically reduces when the target is completely occluded. Kalman filter is used to solve this problem as the prediction compensation of occluded target. It is feasible to assume that the target is uniform motion during full occlusion since the acquisition time interval of video is very short. The moving parameters of the target can be predicted by Kalman filter. When the target appears again, MS tracking algorithm based on feature fusion works continuously.

Kalman filter is the most famous algorithm of tools for stochastic prediction estimation. In 1960, Kalman published his famous paper. In their paper, he solved the problem of discrete data linear filtering using recursive method [5].Kalman filter was named after Rudolph E.Kalman. Because of its simplicity and robustness, the Kalman filter to get the wide attention from researchers. Kalman filter

#### IV. RESULT AND DISCUSSION

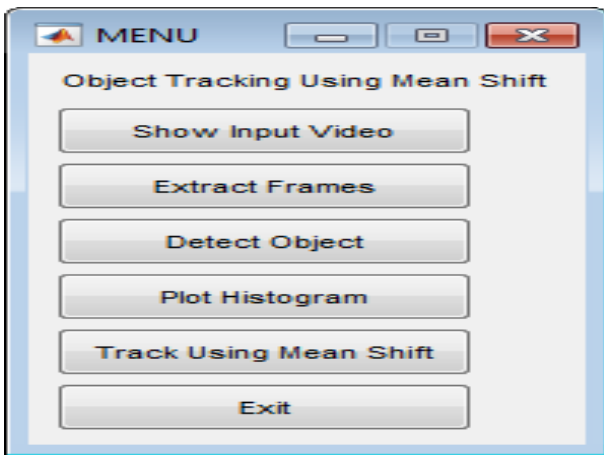


Figure 6. The overall execution flow

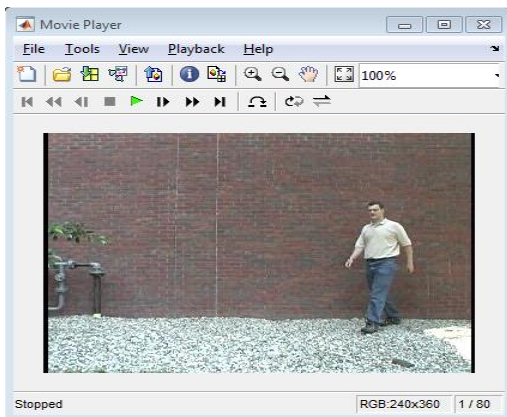


Figure 7. The input video

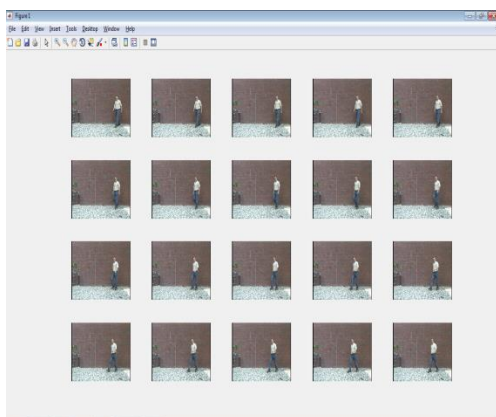


Figure 8. The Extracted frames from the input video

Object detection is the process of finding instances of real-world objects such as faces, bicycles, and buildings in images or videos. Object detection algorithms typically use extracted features and learning algorithms to recognize instances of an

object category. Figure 9 below gives the detected object. Plotting the histogram helps in finding the threshold for object detection and is shown in figure 10 below

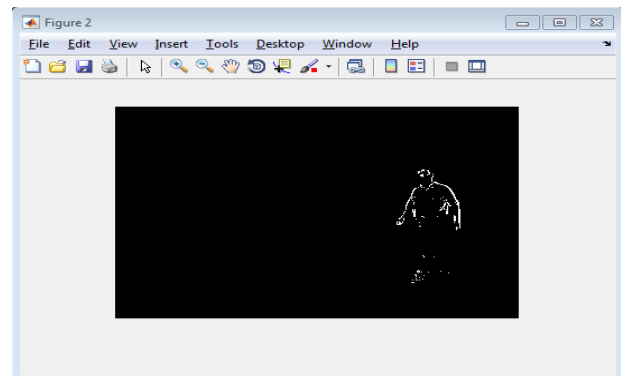


Figure 9. The object detection

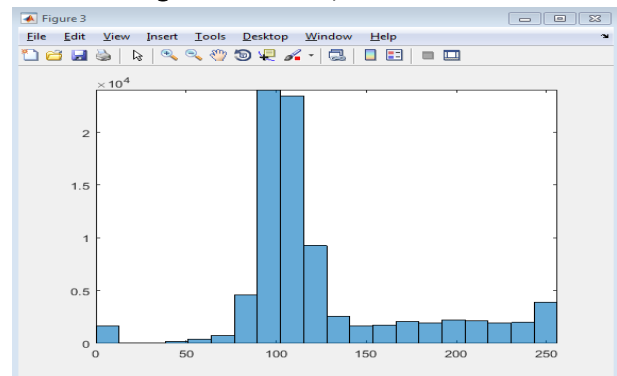


Figure 10. The plotted Histogram

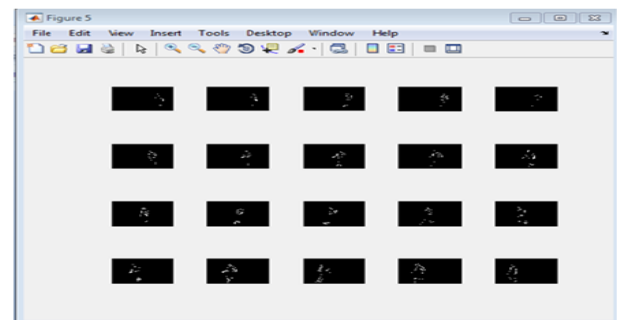


Figure 11. The object tracking using

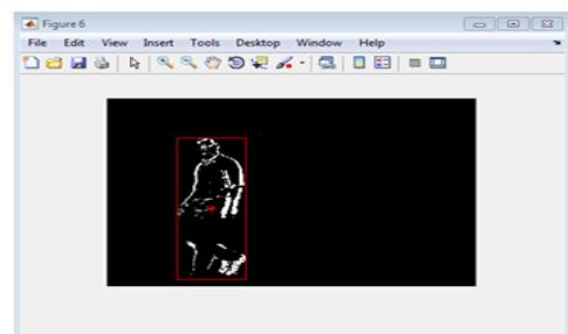


Figure 12. The tracked object tracking using Mean shift Algorithm Mean shift Algorithm

Motion estimation and tracking are key activities in many computer vision applications, including activity recognition, traffic monitoring, automotive safety, and surveillance Tracking is the process of locating a moving object or multiple objects over time in a video stream which is shown in figure 4.5 and the figure 4.5 shows the tracked object using mean shift algorithm

## V. CONCLUSION

We come to a conclusion that visual object tracking is a challenging problem in computer vision. To achieve the goal of object tracking they need to obtain a feature vector which is capable of identifying the object to be tracked despite of presence of translation in the view field, at the minimum.

We also observe that the change in scale of the object due to motion along the perpendicular to the line of sight adds to its complexity. In their work we have been able to implement an object tracking system using the MATLAB environment. The system uses the mean shift algorithm, which is based on color channel histogram analysis and the algorithm is modified that it includes the object texture information using the LBP operator. We have been able to enhance the object tracking capability of the system.

## VI. REFERENCES

- [1]. D Comaniciu, V Ramesh, P Meer, Kernel-based object tracking, *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, 2003, 25(5): 564-577.
- [2]. D Comaniciu, V Ramesh, P Meer, Real-time tracking of non-rigid objects using mean shift. *IEEE Conference on*, 2000:142-149.
- [3]. H Liu, Z Yu, H Zha, et al. Robust human tracking based on multi-cue integration and mean-shift. *Pattern Recognition Letters*, 2009, 30(9): 827-837.
- [4]. H Wang, C Liu, L Xu, et al. Multiple feature fusion for tracking of moving objects in video surveillance *Computational Intelligence and Security*, 2008. *CIS'08 International Conference on. IEEE*, 2008, 1: 554-559.
- [5]. R T Collins, Y Liu, M Leordeanu, Online selection of discriminative tracking features. *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, 2005, 27(10) 1631-1643.
- [6]. Y Dia, W Wei, Y Lin, An improved Mean-shift tracking algorithm based on color and texture feature. *Journal of Zhejiang University (Engineering Science)*, 2012, 46(2) 212-217.
- [7]. T Ojala, M Pietikäinen, D Harwood, A comparative study of texture measures with classification based on featured distributions. *Pattern recognition*, 1996, 29(1): 51-59.
- [8]. T Ojala, M Pietikainen, et al. Multiresolution gray-scale and rotation invariant texture classification with local binary patterns. *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, 2002,24(7): 971-987.
- [9]. G Bishop, G Welch, An introduction to the kalman filter *Proc of SIGGRAPH, Course*, 2001, 8(27599-23175): 41.
- [10]. Object Tracking Using Meanshift Algorithm Combined with Kalman Filter on Robotic Fish *International Symposium on Knowledge Acquisition and Modeling (KAM 2015)*
- [11]. Spatio-Temporal Closed-Loop Object Detection Leonardo Galteri, Lorenzo Seidenari, Marco Bertini, and Alberto Del Bimbo, Member, *IEEE TRANSACTIONS ON IMAGE PROCESSING 2017 ISBN 1057-7149*
- [12]. Improved Target Tracking Based on Spatio-Temporal Learning Songmin Jialet al *Proceedings of IEEE International Conference on Information and Automation China 2016*

# An Insight on RFID technology and Future challenges

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## ABSTRACT

With RFID it is possible to orient machines to recognize objects and communicate with them if needed. Progress in Wireless sensor technologies have made it possible for humans to interact with machines like never before. With nanotechnology making huge foray in technology more and more of power is being packed in lesser and lesser of space and has thus allowed development of RFID based system that connects and enables intelligent interaction between objects around the world. This paper tries to present an insight on RFID technology and its usage.

**Keywords:** RFID; Data Capture (AIDC), Enterprise Information Systems (EIS).

## I. INTRODUCTION

Radio Frequency Identification (RFID), a wireless Automatic Identification and Data Capture (AIDC) technology has caught up in the present times and has now become quite common. Logistics industry is quite open to the possibilities of RFID coming as a great benefactor as far as inventory management is concerned [1] [2] [3]. Explosion of sales from electronic commerce has added upto its requirement. Real-time tracking of items in the Supply Chain (SC), using RFID technology, is turning out to be of great benefit and has potential to be the game. In the near future, RFID technology is fast moving out to be a universal will be universal for tracking items, products, animals, shipments and even humans.

The RFID development community had perceived the idea of Internet of Things to refer to the possibility of discovering information about a tagged object by browsing an Internet address or database entry that corresponds to a particular RFID tag. RFID has fundamentally renovated the way information about products, equipment, animals and even people is collected and processed in real time, providing new business opportunities. RFID technology provides an

opportunity to the organization to reframe its business models so as to optimize the work process and improve efficiency and thus helping the company to reduce cost and accelerate production. Companies that implement the appropriate business processes to leverage the data collected by RFID and its conversion to information and intelligence will accelerate its benefits. RFID technology continues to evolve as it is applied to more processes especially in the day-to-day operation of things and thus, taking the notion of the IoT closer to reality. This paper is divided into 5 sections. Section I is the introduction. Section II provides a literature review of RFID IoT enabling technologies and applications. Section III will discuss the issues in RFID usage. Section IV deal with the research and development needed to move forward from RFID to IoT and concludes in. This paper will conclude in Section V by analysing current efforts and future roadmaps to make the Internet of Things a reality.

## II. LITERATURE REVIEW

In the present time the business houses, organization, industries are pushing it hard to survive in this competitive market and are always in search of

opportunities to keep themselves abreast of the current technologies and to exploit them for giving them a competitive edge. The internet has opened plethora of opportunities and with advances in sensor technologies, miniaturization and nanotechnology things have quickly moved to an area of embedded or artificial intelligence. These technologies have created opportunities for embedding intelligence in objects and have led to development of smart objects [7][8][9] that can autonomously communicate with each other. RFID has introduced a new way of doing business by converging computing, communications, and interactivity are available through a world of wireless, sensors, and network computing [11][12]. RFID can supplement machines with intelligence to identify objects, undermine their status and communicate with them as and when required in real time [13][14]. Identification technologies such as RFID, wireless sensor technologies allow objects to provide information about their environment and context, smart technologies have moved a notch up by allowing the everyday objects to “think and interact,” nanotechnology and energy-scavenging technologies are proving fuel to the notion of more processing power into less space [19]. These developments have heralded the idea of “Internet of Things” (IoT) that connects and enables intelligent interaction between objects around the world [15][16]. The present day researchers have coined the phrase “Internet of Things” referring to the general idea of a thing being connected and controlled through internet either by using RFID, wireless LAN, wide-area network, or other means [17]. Developments are being carried out at a very fast pace with embedding of short-range mobile transceivers into a wide array of additional gadgets and everyday items, enabling new forms of communication between people and things, and between things themselves creating new dimension having anytime connectivity with any thing.

RFID has allowed each object to have its own identifier that can be read at a distance allowing automatic, real time identification and tracking of individual objects [19]. Literature give evidence of lots of approach being followed to achieve the “Internet of Things” and RFID has a major bearing on it being named so. With the advent of electronic commerce the RFID has come as a solace for the logistical overload problem [21]. The passive RFID tag present itself as a cheap, small device having an infinite shelf life and capability to work efficiently in a wifi scenario without interferences making it readily convenient for business [22][23]. As businesses have achieved a global presence the RFID has matched to the requirement as was required and has become irreplaceable. The scope of RFID technology applications has also expanded to include not just manufacturing but also other industries like in retail industry as electronic article surveillance [24], cashless payment from credit cards (Smart cards) [25][26], transportation management [27], public transportation tickets (Smart cards) [28][29][30] and parking services (Smart cards) [31] to consumer devices (such as EZpass and Speedpass), healthcare (tracking items, drugs and patients) [32][33] and e-government (such as e-driver’s license and ePassport) [34]. As more and more everyday things are RFID tagged, the RFID object technology features - readable, recognizable, locatable, addressable, and/or controllable via the Internet – extend to these things. Researchers are focusing on arming the RFID tag with more memory and thus allowing more advanced artificial intelligence features can be embedded in the tag leading to more refined systems

### III. RFID USAGE ISSUES

As discussed above though the RFID has established itself an irreplaceable technology it does faces comes serious challenges. These challenges are in terms of its potential to generate large amount and the discrepancy in the collection of data of data. The management concern is to segregate, organize and

store the relevant data to prevent the system from overloading. In order that the system are streamlined the businesses should take efforts in integrating the RFID with the ERP application that are being used.

For RFID to be optimized there is need to exploit it in combination of the supply chain wherein it creates a conducive atmosphere for creating and sharing detailed RFID information. The IT system of the organization have to be buckled up to accommodate RFID by allowing process reengineering in three areas: package, business site and network [34]. One major threat to the RFID is the air interface .Host of researchers have discussed the potential problems being face by the RFID based systems [22][32][35][36]. With increased RFID integration with the business chain ,problem of the privacy have surfaced [37][38]. EPC global have presented certain guidelines which address to privacy concerns but have not been able to fully address it specifically – personal and location privacy. Options like : killing a tag (which can be executed with a 32-bit PIN) by disabling it at the point-of-sale counter, temporarily disabling a tag (putting a tag to sleep) then transmitting a PIN to awoken it, changing the tag identifier over time, relabeling tags, cryptographic approach , and interference prevention techniques are being put to use to address the privacy issues [36]. RFID should be able to support data sharing and transfer between different locations/organizations that are partners in the SC.

An RFID system will have several interacting entities: such as Objects – all EPC-tagged objects, such as cases, pallets and trucks; Readers – which are tagged with EPC code; Locations – used to represent where an object is and is also associated with a owner; and Transactions – business transaction in which EPC is involved e.g. check-out [40]. For the products moving from one place to another the dynamics provide a set of new challenges toward reading and tracking of data.

RFID management system deals ‘object tracking “ and “Object Monitoring” and has to keep track of missing objects too proving a new set of challenges and is quite complicated [40]. As RFID technology continues to evolve, more features will be added to the system. At the same time, more vulnerabilities/threats will be discovered; however, this will drive the RFID researchers to come up with enhanced designs to mitigate the security and privacy risks.

#### **IV. FROM RFID TO THE INTERNET OF THINGS**

The transition from the internet of computer to internet of things has changed the way things or objects were working and has resulted in fusion of the real physical world with the virtual world .Digital objects in a virtual world now represent physical things. Objects are now context-aware. They can sense, communicate and interact autonomously. The IoT is leading to a new arena of applications and services with higher productivity [43]. The key features of the IoT includes: ability to manage centralized or decentralized applications ; identity management of variety of identifiers ; context aware applications; mobility of people or things; different quality of service for different types of services and customized, personalized and user-friendly applications [44].

IoT has heralded a new trajectory of internet application and has opened opportunities for innovation in services relying on information related to the identity, status and location of the things (objects), and new societal services that will improve the quality of life [19]. RFID technology has a big big role to play as far as IoT is concerned subject to the air interface problem mitigation and the problem in discovering an object .Similarly there is need to standardize RFID systems related to physical objects (readers, tags, and sensors), communication infrastructures, spectrum for RFID use and security and privacy issues [45]. For the IoT, the futuristic

sensors and actuators will be intelligent and will modify the network like never before.[19]. The current EPCglobal infrastructure has not been fully tested yet and it need to chalk out plans and measures to cope of with the futuristic developments .

Development in RFID tags would be in two direction ,one for developing a cheap tag and other to develop a very sophisticated tag with lot of functionality being incorporated on it. There will be a need to develop protocols that are clever and use a minimal amount of power [19]. The future pervasiveness of the IPv6 protocol is expected to enhance the security of the object communication through the Internet. Thus, RFID technology is still some ways away from fulfilling its promise as a pivotal enabler of IoT.

## V. CURRENT EFFORTS AND FUTURE ROADMAPS

IoT has put to life the idea of anytime, anyplace and anything along with the RFID infrastructure and issues highlighted in the section above. Some challenges include: 1. Ability of network to cope with object explosion ? 2. Governance of global IoT? Data Control ? 3. Integration of inter-organizational? Data format? Data compression ? 4. Business models ? 5. Privacy concerns? 6. Interaction Mechanism ? 7. Object addressing ? How can objects discover services or applications?

Researchers have employed themselves in different area of concerns . The European Union is actively funding research through the Cluster of European Research Projects on the Internet of Things (CERP-IoT) including research in RFID technology (see [http://ec.europa.eu/information\\_society/policy/rfid/index\\_en.htm](http://ec.europa.eu/information_society/policy/rfid/index_en.htm) and <http://www.rfid-in-action.eu/cerp>) to address these issues. Researchers at the Auto-ID labs network (<http://www.autoidlabs.org>) are also working on some of these issues. Thus, for RFID

technology to meet the expectation it need to plug in the gaps as mentioned above and it has the capability to present itself as a technology which is able to find solutions or schemes that will bring benefits and yet protect the consumer's security and privacy.

## VI. REFERENCES

- [1]. Furness, V. "The RFID market outlook: New applications, best practice and future profit opportunities," Business Insight. Retrieved 16th November 2005 from [www.globalbusinessinsights.com/content/rbtc0077t.pdf](http://www.globalbusinessinsights.com/content/rbtc0077t.pdf)
- [2]. Ranky, P. "An introduction to radio frequency identification (RFID) methods and solutions," *Assembly Automation*, 26(1), 28-33, 2006.
- [3]. Wyld, D. "RFID 101: The next big thing in management," *Management Research News*, 29(4), 154-173, 2006.
- [4]. [www.idtechex.com/products/en/view.asp?productcategoryid=119](http://www.idtechex.com/products/en/view.asp?productcategoryid=119) Retrieved on July 6, 2010.
- [5]. Conner, Margery (May 27 2010). Sensors empower the "Internet of Things". pp. 32-38. ISSN 0012-7515.
- [6]. Sean Dodson (2003-10-09). "The internet of things". *The Guardian*. The Auto-ID Labs replaced the Auto-ID Center in October 2003. More precisely, EPCglobal was formed as the successor organization to the Auto-ID Center, while its sister organization Auto-ID Labs manages and funds research on the EPC technology.
- [7]. Gerd Kortuem, Fahim Kawsar, Vasughi Sundramoorthy, Daniel Fitton, Smart Objects as Building Blocks for the Internet of Things, *IEEE Internet Computing*, vol. 14, no. 1, pp. 44-51, Jan./Feb. 2010.
- [8]. Frank Siegemund. A Context-Aware Communication Platform for Smart Objects. In Alois Ferscha and Friedemann Mattern, editors, *Pervasive Computing*, Volume 3001 of Lecture



- Notes in Computer Science, pages 69-86, Vienna, Austria, April 2004.
- [9]. Friedemann Mattern. From Smart Devices to Smart Everyday Objects (Extended Abstract). Proceedings of sOc'2003 (Smart Objects Conference). pp. 15-16, Grenoble, France, May 2003.
- [10]. 2009 Horizon Project (<http://www.nmc.org/horizon>)
- [11]. Rolf Clauberg. RFID and Sensor Networks: From Sensor/Actuator to Business Application, RFID Workshop, University of St. Gallen, Switzerland, September 27, 2004.
- [12]. Buettner, M., Prasad, R., Sample, A., Yeager, D., Greenstein, B., Smith, J. R., and Wetherall, D. RFID sensor networks with the Intel WISP. In Proceedings of the 6th ACM Conference on Embedded Network Sensor Systems (Raleigh, NC, USA, November 05 - 07, 2008), pp 393-394.
- [13]. Welbourne, E., Battle, L., Cole, G., Gould, K., Rector, K., Raymer, S., Balazinska, M., and Borriello, G. Building the Internet of Things Using RFID: The RFID Ecosystem Experience. *IEEE Internet Computing*, Volume 13, Number 3, (May. 2009), pp 48-55.
- [14]. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Systems. Edited by Lu Yan, Yan Zhang, Laurence T. Yang, and Huansheng Ning. Auerbach Publications 2008. Print ISBN: 978-1-4200-5281-7. eBook ISBN: 978-1-4200-5282-4.
- [15]. awareIT: Internet of Things & Smart Objects (<http://awareit.blogspot.com/>) Retrieved on July 8, 2010. 16First International Workshop on the Web of Things (WoT 2010) Online papers at <http://www.webofthings.com/wot/2010/program.php>
- [16]. "APPENDIX F: THE INTERNET OF THINGS (BACKGROUND)". *Disruptive Technologies: Global Trends 2025*. SRI Consulting Business Intelligence. Retrieved 30 May 2010.
- [17]. Internet Reports 2005: The Internet of Things- Executive Summary, International Telecommunication Union ([http://www.itu.int/osg/spu/publications/internetofthings/InternetofThings\\_summary.pdf](http://www.itu.int/osg/spu/publications/internetofthings/InternetofThings_summary.pdf)) Retrieved June 30, 2010.
- [18]. Future networks and the internet: Early Challenges regarding the "Internet of Things," Commission Staff Working Document, Brussels, 29 September 2008, SEC(2008)2516.
- [19]. Cohen, M.A. "Supply Chain Research in the Age of eBusiness." Presentation at the 2000 NSF Design and Manufacturing Research Conference, January 4, 2000. 537
- [20]. Sheng QZ, Li X and Zeadally, S. Enabling Next Generation RFID Applications: Solutions and Challenges. *IEEE Computer*, September 2008.
- [21]. Pattabhiraman Krishna and David Husak, "RFID Infrastructure," *IEEE Applications & Practice*, June 2008.
- [22]. Fosso Wamba, S., Lefebvre, L.A. and Lefebvre, E. Integrating RFID Technology and EPC Network into a B2B Retail Supply Chain: A Step Toward Intelligent Business Processes, *J. Technol. Manag. Innov.* Volume 2, Issue 2, pp 114-124, 2007.
- [23]. Resatsch, F., Sandner, U., Leimeister, J. & Krcmar, H. Do Point of Sale RFID-Based Information Services Make a Difference? Analyzing Consumer Perceptions for Designing Smart Product Information Services in Retail Business. *Electronic Markets*, 18(3), 2008, pp 216- 231.
- [24]. Dr Klaus Finkenzeller, 2010 RFID Handbook: Fundamentals and Applications in Contactless Smart Cards, Radio Frequency Identification and Near-Field Communication, Third Edition, ISBN: 978-0-470-69506- 7, Published by John Wiley & Sons, Ltd, June 14, 2010. Dörte Müller (translator)
- [25]. Mohammed A. Qadeer, Nadeem Akhtar, Shalini Govil, Anuja Varshney, "A Novel Scheme for

- Mobile Payment Using RFID-Enabled Smart SIMcard," Proceedings of 2009 International Conference on Future Computer and Communication, pp. 339-343.
- [26]. Yunus A. Kathawala and Benjamin Tueck 2008 The use of RFID for traffic management, *International Journal of Technology, Policy and Management*, Volume 8, Number 2, 2008, pp 111 - 125
- 28MP Pelletier, M TrEpanier, C Morency, 2009. Smart Card Data in Public Transit Planning: A Review, *Transportation Research Center: Emerging Technologies Report*, 2009 (Interuniversity Research Center on Enterprise Networks, Logistics and Transportation, CIRRELT-2009-46, Nov 2009).
- [27]. HAO Xu, C Hai-bo, M Wardman 2004 A Review on the Development of Smartcards in Public Transport, *Journal of Transportation Systems Engineering and Information Technology*, Volume 4, No. 1, November 2004.
- [28]. Catherine Morency, Martin Trepanier, Bruno Agard, Measuring transit use variability with smart-card data, *Transport Policy*, Volume 14, Issue 3, May 2007, pp 193-203.
- [29]. Caroline Rodier, Susan A. Shaheen, and Tagan Blake. 2009 Smart Parking Pilot on the Coaster Commuter Rail Line in San Diego, California, Research Report, *Transportation Sustainability Research Center*, University of California, Berkeley, CA 94804.
- [30]. Gustavo H. P. Florentino , Heitor U. Bezerra , Helio B. De A. Júnior , Marcelo X. Araújo , Ricardo A , De M. Valentim , Antônio H. F. Morais , Ana M. G. Guerreiro , Gláucio B. Br , Carlos A. Paz De Araújo. 2008. Hospital Automation RFID-Based: Technology Stored In Smart Cards, *Proceedings of the World Congress on Engineering 2008*, Volume II, WCE 2008, July 2 - 4, 2008, London, U.K.
- [31]. Antonio Aguilar, W van der Putten, F Kirrane. Positive Patient Identification using RFID and Wireless Networks, *Proceedings of 11th Annual Healthcare Informatics Society of Ireland (HISI) Conference and Symposium*, 15-16 November 2006.
- [32]. Thangamuthu, Kumaravel. Issues with Supply Chain and RFID in the Retail Industry, Paper 353-2008, SAS Institute Inc., Middleton, MA
- [33]. Ari Juels. RFID Security and Privacy: A Research Survey. *IEEE Journal on Selected Areas in Communications*, 24(2):381-394, February 2006
- [34]. Pedro Peris-Lopez, Julio Cesar Hernandez-Castro, Juan EstevezTapiador, and Arturo Ribagorda. RFID Systems: A Survey on Security Threats and Proposed Solutions. In *11th IFIP International Conference on Personal Wireless Communications-PWC'06*, volume 4217 of *Lecture Notes in Computer Science*, pages 159-170, September 2006.
- [35]. StephenWeis, Sanjay Sarma, Ronald Rivest, and Daniel Engels, "Security and Privacy Aspects of Low-Cost Radio Frequency Identification Systems." In Dieter Hutter, Gunter Muller, Werner Stephan, and Markus Ullmann, editors, *International Conference on Security in Pervasive Computing-SPC 2003*, volume 2802 of *LectureNotes in Computer Science*, pages 454-469, Boppard, Germany, March 2003. 38Dirk Henrici and Paul Muller. Tackling Security and Privacy Issues in Radio Frequency Identification Devices. In Alois Ferscha and Friedemann Mattern, editors, *Pervasive Computing*, volume 3001 of *Lecture Notes in Computer Science*, pages 219-224, Vienna, Austria, April 2004.
- [36]. [http://www.epcglobalinc.org/public\\_policy/public\\_policy\\_guidelines.html](http://www.epcglobalinc.org/public_policy/public_policy_guidelines.html) Retrieved July 8, 2010.
- [37]. Wang, Fusheng and Liu, Peiya. Temporal Management of RFID Data, *Proceedings of the VLDB Conference*, Trondheim, Norway, 2005.
- [38]. Harrison, M. EPC Information Service - Data Model and Queries, Technical Report, Auto-ID Center, October 2003.

- [39]. The EPCglobal Network and The Global Data Synchronization Network (GDSN): Understanding the Information & the Information Networks.  
<http://www.epcglobalinc.org/news/positionpapers.html>, October 2004.
- [40]. [http://www.iot-visitthefuture.eu/fileadmin/documents/whatisrfid/Futint3-Internet-Of-Things\\_En.pdf](http://www.iot-visitthefuture.eu/fileadmin/documents/whatisrfid/Futint3-Internet-Of-Things_En.pdf) Retrieved on July 2, 2010.
- [41]. Presentation "Beyond RFID-The Internet of Things" at Joint EC/EPoSS Expert Workshop 2008, 11-12 February 2008.
- [42]. L. Atzori, et al. The Internet of Things: A Survey, *Computer Networks*, May 2010. 46  
Schmidt L., Milton N., Simplot-Ryl D. Towards Unified Tag Data Translation for the Internet of Things, *Proceedings Wireless VITAE 2009*.

# A Cross Layer Approach Network Evaluation of IEEE 802.15.4 for Mobile WSN

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## ABSTRACT

Mobility in wireless sensor networks (WSNs), can have profound effect on the network operation. This effect is diverse according to several parameters that include: application diversity, network topography (topology), network connectivity and deployed node(s) or sensed event(s) location estimation. One major finding is that these networks suffer from control packet overhead and delivery ratio degradation. This increases the network's energy consumption. This work introduces a cross-layer operation model that can improve the energy consumption and system throughput of IEEE 802.15.4 MWSNs. The proposed model integrates four layers in the network operation: 1) application (node location); 2) network (routing); 3) medium access control (MAC); and 4) physical layers. The model employs a mechanism to minimize the neighbor discovery broadcasts to the active routes only. Reducing control packet broadcasts between the nodes reduces the network's consumed energy. It also decreases the occupation period of the wireless channel. The model operation leads the network to consume less energy while maintaining the network packet delivery ratio. Simulations have been carried out to check the efficacy of the proposed operation model.

## I. INTRODUCTION

A mobile wireless sensor network (MWSN) can simply be defined as a wireless sensor network (WSN) in which the sensor nodes are mobile. Sensor node mobility can be divided into two categories: limited mobility where there are specific nodes that roam around the network to perform an exclusive task (e.g., mobile sink nodes) and random mobility where the nodes (sensor nodes) roam around the area of deployment to collect the data needed for the application. Mobility as a problem has either advantageous effects or disadvantageous ones.

Advantages of introducing mobility to the network can be listed as below:

1. Applications: Introducing mobility to the network can enlarge the scope of applications to implement WSNs. Applications such as social

activity monitoring, cattle monitoring, swarm bot actuated networks and more.

2. Topography and network connectivity: Since WSNs transfer their data in a multi-hop fashion, mobility can enhance the network operation by changing the location of the nodes leading to create different links to the destination required.
3. If mobility is limited to special nodes, e.g., sink node(s), the stationary nodes then can be relieved in terms of links generated to the destination node. The sink node(s) can roam around through stationary nodes and gather the information sensed by sensor nodes. Mobile sink nodes can also enhance the network connectivity by minimizing the congestion that can happen during network traffic flow.

Mobility can introduce a critical challenge to the operation of the deployed network:

1. If mobility is limited to special node(s), then those nodes can suffer from a bottleneck problem. A considerable plan and calculations are required to estimate the optimum number and paths for the special node(s) to cover the deployed network.
2. If mobility is random. i.e., sensor nodes are also mobile in the network, the effect is greater as the network topology changes become rapid and that affects the connectivity of the nodes. Topology changes have an effect on the routing operation as the links need to be rebuilt frequently; therefore, there is an increase energy consumption of the nodes. Mobility affects the MAC protocol operation because the connectivity can suffer from broken connections due to the transmission range of the wireless interface. The location of the sensor node(s) in random mobility is of importance because the sensed event is attached to the location of the sensor node. In a mobile scenario, a localization mechanism becomes a frequent operation leading to an increment in node(s) energy consumption.

The focus of this paper is the random mobility of the deployed sensor nodes and how it has effects on the networks operation in terms of the connectivity and location estimation of the nodes. The connectivity issue is dealt with by using routing protocols and MAC protocols as both layers are responsible of insuring an available connection between one hop and another. The location information is an application layer attachment; however, it requires a specific mechanism to estimate the location of the mobile node(s). This paper introduces a cross-layer operation model that can improve the energy consumption and system throughput of IEEE 802.15.4 MWSNs. The proposed model integrates four layers in the network operation: 1) application (node location); 2) network (routing); 3) medium access control (MAC); and 4) physical layers. The model employs a mechanism to

minimize the neighbor discovery broadcasts to the active routes only. The model operation leads the network to consume less energy while maintaining the network packet delivery ratio

## II. LITERATURE SURVEY

DD Chaudhary in his work "A new dynamic energy efficient latency improving protocol for wireless sensor networks" has explored the concept of distance metric based routing protocol approach for 'high energy efficiency' and 'shortest path selection' for latency improvement. The proposed new protocol is 'Dynamic Energy Efficient Latency Improving Protocol (DEELIP)'. The simulation results are compared with 'AODV' routing protocol. It is observed that in proposed protocol; the overhead of the network traffic is reduced, resulting in improvement of energy efficiency and latency than existing routing protocols.

G Anastasi et al in their work "A comprehensive analysis of the MAC unreliability problem in IEEE 802.15.4 wireless sensor networks" has focused on IEEE 802.15.4 WSNs and show that they can suffer from a serious unreliability problem. They have carried out an extensive analysis based on both simulation and experiments on a real WSN to investigate the fundamental reasons of this problem, and have found that it is caused by the contention-based MAC protocol used for channel access and its default parameter values. They also concluded that, with a more appropriate MAC parameters setting, it is possible to mitigate the problem and achieve a delivery ratio up to 100%, at least in the scenarios considered in this paper. However, this improvement in communication reliability is achieved at the cost of an increased latency, which may not be acceptable for industrial applications with stringent timing requirements.

L Karim et al in their work “Reliable location-aware routing protocol for mobile wireless sensor network” have proposed a location-aware and fault tolerant clustering protocol for mobile WSN (LFCP-MWSN) that is not only energy efficient but also reliable. LFCP-MWSN also incorporates a simple range free approach to localize sensor nodes during cluster formation and every time a sensor moves into another cluster. Simulation results show that LFCP-MWSN protocol has about 25-30% less energy consumptions and slightly less end-to-end data transmission delay than the existing LEACH-Mobile and LEACH-Mobile-Enhanced protocols.

On the basis of literature survey carried out we observe that these networks suffer from control packet overhead and delivery ratio degradation. This increases the network's energy consumption. Mobility can introduce a critical challenge to the operation of the deployed network. If mobility is limited to special node(s), then those nodes can suffer from a bottleneck problem. A considerable plan and calculations are required to estimate the optimum number and paths for the special node(s) to cover the deployed network. If mobility is random. i.e., sensor nodes are also mobile in the network, the effect is greater as the network topology changes become rapid and that affects the connectivity of the nodes. Topology changes have an effect on the routing operation as the links need to be rebuilt frequently; therefore, there is an increase energy consumption of the nodes. Mobility affects the MAC protocol operation because the connectivity can suffer from broken connections due to the transmission range of the wireless interface. The location of the sensor node(s) in random mobility is of importance because the sensed event is attached to the location of the sensor node. In a mobile scenario, a localization mechanism becomes a frequent operation leading to an increment in node(s) energy consumption.

In the existing systems a self-adaptive sleep/wake-up scheduling approach used, which takes both energy saving and packet delivery delay into account. This approach is an asynchronous one and it does not use the technique of duty cycling. Thus, the trade-off between energy saving and packet delivery delay can be avoided. In most existing duty cycling based sleep/wake-up scheduling approaches, the time axis is divided into periods, each of which consists of several time slots. In each period, nodes adjust their sleep and wake up time, i.e., adjusting the duty cycle, where each node keeps awake in some time slots while sleeps in other time slots.

The existing systems suffer from Data loss, reduced network life time, premature node failure

Thus the objective of our work is to improve the energy consumption and system throughput of IEEE 802.15.4 mobile wireless sensor network while minimizing the power utilized by the network. The focus is to reduce control packet broadcasts between the nodes for reducing the network's consumed energy and simultaneously decreasing the data transmission time resulting in high speed communication

### III. PROPOSED SYSTEM AND ITS METHODOLOGY

In the proposed algorithm, nodes instead of forwarding the packets to all the encountered neighboring nodes, select only the appropriate node and the selection of appropriate node is based on the distance and energy level. Firstly, only the neighboring nodes having distance less than neighbor discovery range are considered as neighboring nodes and the neighboring nodes are filtered by calculating the distance to destination. Nodes which have distance less than average distance are selected as neighboring nodes. Thus this method presents a routing mechanism which aims at reducing energy consumption in the network which is accomplished

by avoiding broadcasting of messages to all the neighboring nodes thus reducing the number of transmissions in the network. For proposed system Network life time will be high when compare with existing system with reduced energy consumption and low packet loss. At the same time the throughput is high with high packet delivery ratio and low delay .The overall system gets more secured and avoids dummy traffic.

establish a route to the destination node. The routing protocol utilized in the operation model utilizes a periodic neighbor maintenance message which is a hello packet. Hello packets are broadcast packets; therefore, it was possible to utilize the neighbor list from the network layer in the data-link layer. This eliminated the need for neighbor discovery messages to be sent by the MAC protocol.

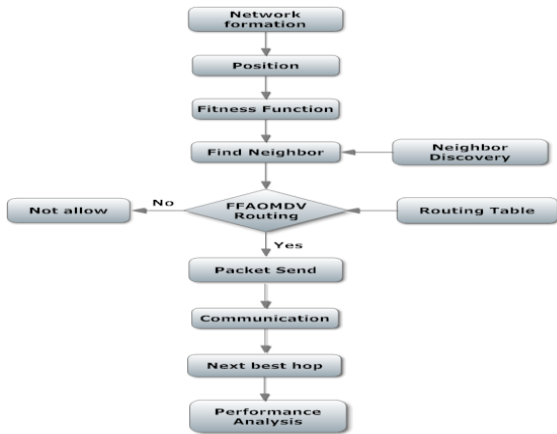


Figure 1. The flow diagram of the proposed system

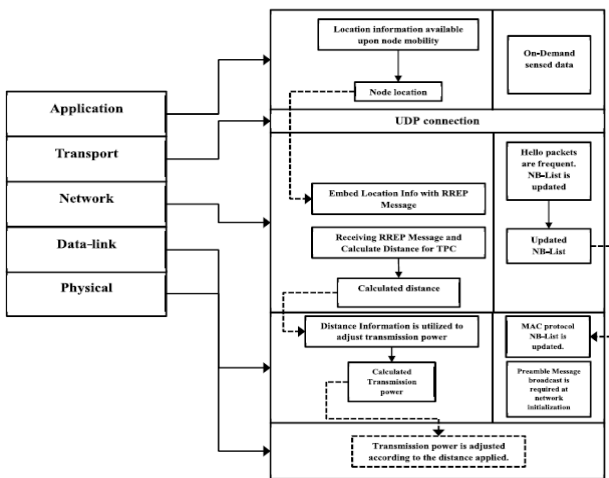


Fig. 1. Operational model detailed process diagram.

Figure 2. Operation model detailed process diagram

At network initialization, the mobile node started to broadcast a neighbor discovery message to initiate neighbor(s) information collection and store it in a neighbors' list (NB-List). After the initialization process, if a node in the network had data of interest to send, attached with this data was the location information of the mobile node. This node then started sending route request (RREQ) packets to

After the destination node received the RREQ packets, it replied by sending a unicast route reply (RREP) packet. The destination node embedded its own location information in the RREP message and sent it back to the next hop node in the reverse route. The next hop node in the reverse route calculated the distance between it and the destination node and exported this information to the data-link layer. The MAC protocol utilized the transmission power control-based on the distance information and calculated the required power to use when sending data packets back to the destination node. The transmission power and range is calculated by implementing the radio propagation model according to the distance calculated by the nodes. The distance between two nodes is calculated as the Euclidian distance between two points. This operation was repeated through all nodes until the source node.

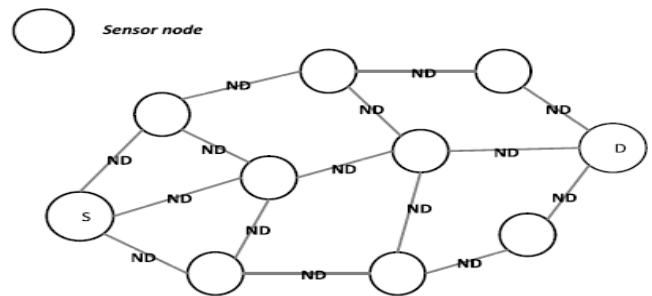


Figure 3. Network activity state at time stamp ts

#### IV. RESULT AND DISCUSSION

- The simulation work has been done with the Network Simulator ns-2, Version 2.34.

- Network formation is an aspect of creating nodes of network and transmit data.
- Network of 100 nodes is created using network simulator for wireless sensor network.

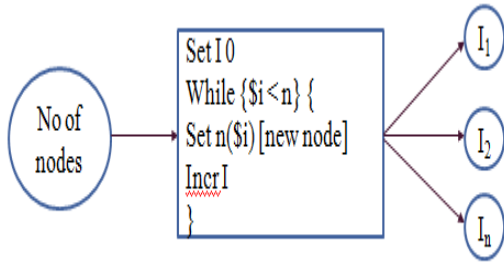


Figure 4. Method of Node formation

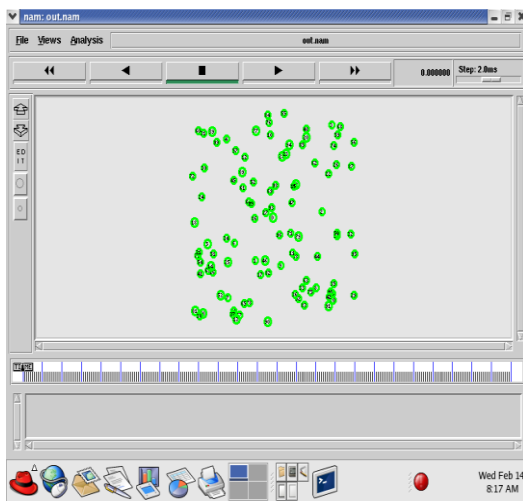


Figure 5. showing the created nodes

### NEIGHBOR DISCOVERY

- On-demand reactive routing protocol that uses routing tables with one entry per destination.
- When a source node needs to find a route to a destination, it starts a route discovery process, based on flooding, to locate the destination node.
- Upon receiving a route request (RREQ) packet, intermediate nodes update their routing tables for a reverse route to the source.
- Similarly, the forward route to the destination is updated upon reception of a route reply

(RREP) packet originated either by the destination itself or any other intermediate node that has a current route to the destination.

Node	Neighbor_node	X-Position	Y-Position	Distance
0	1	300	300	139.41703080383758
0	2	300	300	178.7357335054804
0	6	300	300	159.124820481121117
0	9	300	300	141.61607103905231
0	11	300	300	123.5307383217271
0	15	300	300	216.9302728696256
0	17	300	300	171.27165074571394
0	19	300	300	89.029411156093985
0	23	300	300	189.481394143441
0	27	300	300	31.840647904117262
0	28	300	300	179.66285681422639
0	34	300	300	179.8280360719678
0	44	300	300	195.21461374635427
0	45	300	300	179.68529431488329
0	46	300	300	128.4037275860527
0	47	300	300	99.444228250144883
0	52	300	300	123.92211981959886
0	61	300	300	140.492530304112683
0	64	300	300	80.044943138968762
0	69	300	300	76.430372215094749
0	71	300	300	78.0711487932761
0	79	300	300	107.29767977000149
0	80	300	300	125.52139056482054
0	82	300	300	163.328148260630728

Figure 6. showing created nodes the distances between them.

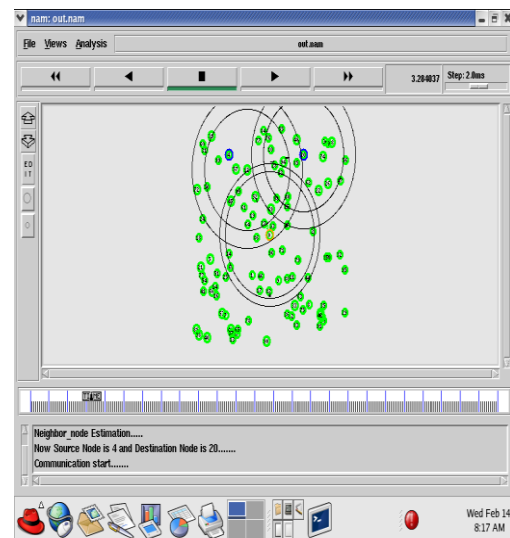


Figure 7. showing the neighbour discovery

```

Position of 47, X=189.415416, Y=525.998893, Z=0.000000
Velocity of 47, X=-1.428061, Y=-9.897507, Z=0.000000
Velocity of 47, Speed=10
at Time(1.201268), Position of 47 is X: 189.4154 and Y: 525.9989
at Time(1.201268): Updated Energy for a Node 47 is Energy 99.9991
Position of 98, X=205.031068, Y=449.430052, Z=0.000000
Velocity of 98, X=-7.827505, Y=6.223356, Z=0.000000
Velocity of 98, Speed=10
at Time(1.201268), Position of 98 is X: 205.0311 and Y: 443.4301
at Time(1.201268): Updated Energy for a Node 98 is Energy 99.9991
Position of 87, X=117.805847, Y=471.799130, Z=0.000000
Velocity of 87, X=2.597495, Y=-9.656760, Z=0.000000
Velocity of 87, Speed=10
at Time(1.201268), Position of 87 is X: 117.8056 and Y: 471.7991
at Time(1.201268): Updated Energy for a Node 87 is Energy 99.9991
Position of 94, X=107.161977, Y=485.496153, Z=0.000000
Velocity of 94, X=9.140485, Y=-4.056049, Z=0.000000
at Time(1.201268), Position of 94 is X: 107.1620 and Y: 485.4962
at Time(1.201268): Updated Energy for a Node 94 is Energy 99.9991
Position of 90, X=145.711263, Y=567.040853, Z=0.000000
Velocity of 90, X=0.474966, Y=-9.988714, Z=0.000000
Velocity of 90, Speed=10
at Time(1.201268), Position of 90 is X: 145.7113 and Y: 567.0409
at Time(1.201268): Updated Energy for a Node 90 is Energy 99.9991
    
```

Figure 8. showing the fitness function



**OPTIMAL PATH FINDING**

- Optimal Path Finder Algorithm is an optimization algorithm used in the proposed method for constructing an optimal path for transmitting the sensed data to the Destination.
- The node which has the data to transmit is called source node.
- Such node checks for the next best hop to transmit the sensed data towards the destination.
- For finding the next best hop, a *route\_request message* is sent to all the neighbors.
- Route request send to all intermediate nodes between source S and destination D.

**SCREENSHOT FOR OPTIMAL PATH FINDING**

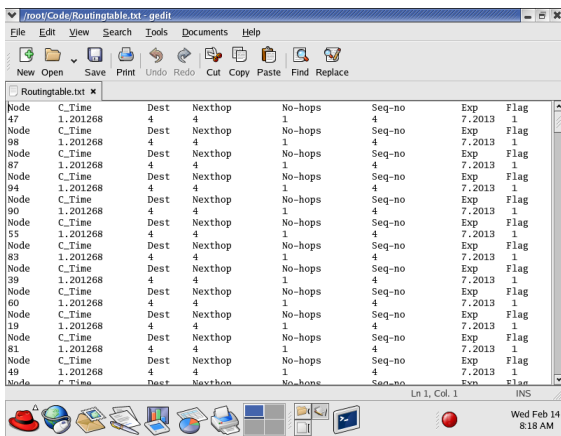


Figure 9. showing the optimal path finder in FFAOMDV Protocol in MANET.

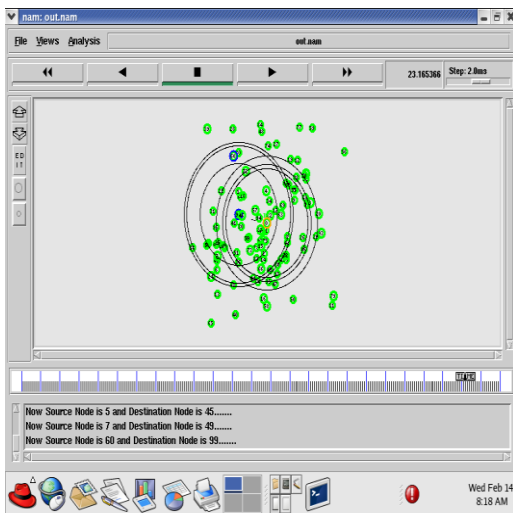


Figure 10. showing the communication in the FFAOMDV Protocol in MANET

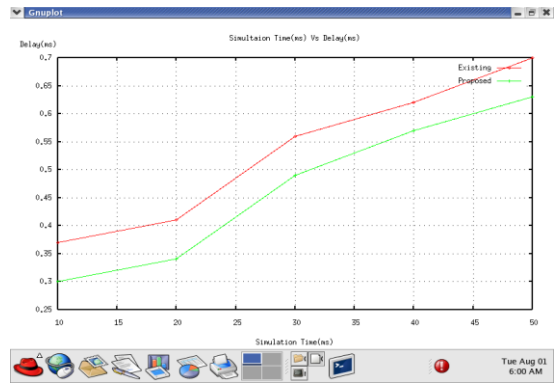


Figure 11. showing Delay by the nodes

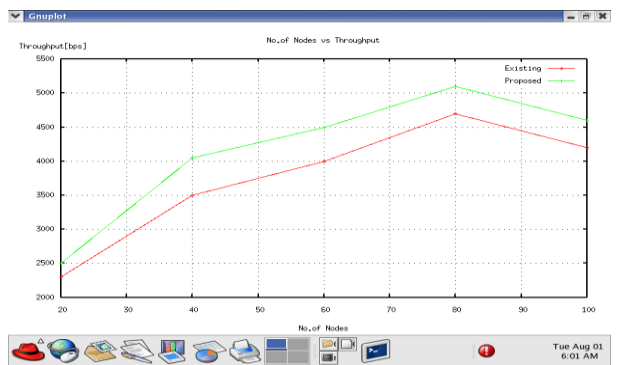


Figure 12. showing the Throughput carried in the network out by the nodes in network.

From figure 12 we can make an observation that the delay exhibited by the proposed system is around 0.62 ns as compared to the delay exhibited by the existing system which is around 7 ns .Thus the proposed system scores over the existing system. Similarly for figure 4.8 we observe that the throughput of the proposed system is around 4600 bps as compared to the throughput of the existing system which is around 4300.

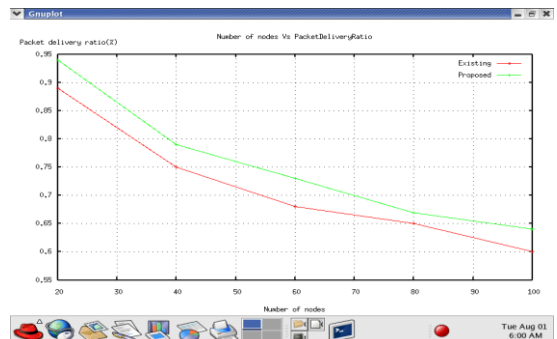


Figure 13. showing the ratio of Packet Delivery between nodes in the network.

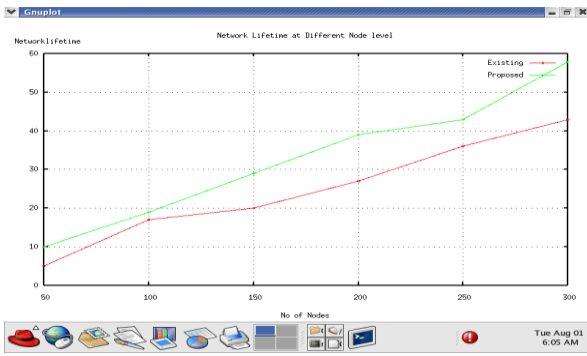


Figure 14. indicating Network Lifetime in the FFAOMDV protocol

From figure 4.9 we can make an observation that the packet delivery ratio for 100 nodes of the proposed system is around 95 % as compared to the packet delivery ratio for 100 nodes of the existing system which is around 87 %. Similarly for figure 4.10 we observe that the network lifetime at different node level for the proposed system is around 58 which is comparatively higher to the network lifetime at different node level of the existing system which is around 43.

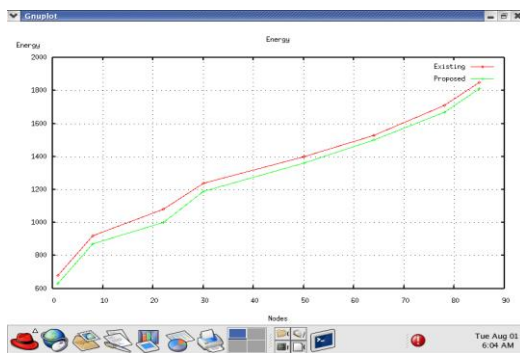


Figure 15. showing Energy consumption in the FFAOMDV protocol

From figure 15 we observe that the energy consumed by the existing system is higher as compared to the energy consumed by the proposed system.

## V. CONCLUSION

Thus we conclude that in this work we have been able to present a new energy efficient multipath routing algorithm called FF-AOMDV simulated using NS-2 under three different scenarios, varying node speed, and packet size and simulation time. These

performance metrics (Packet delivery ratio, Throughput, End-to-end-delay, Energy consumption and Network lifetime) and the Simulation results shows that the proposed FF-AOMDV algorithm has performed much better than both AOMR-LM and AOMDV in throughput, packet delivery ratio and end-to-end delay and It also performed well against AOMDV for conserving more energy and better network lifetime.

## VI. REFERENCES

- [1]. M. Cattani, S. Guna, and G. P. Picco, "Group monitoring in mobile wireless sensor networks," in Proc. Int. Conf. Distrib. Comput. SensorSyst. Workshops (DCOSS), Jun. 2011, pp. 1–8.
- [2]. K. Zen, D. Habibi, A. Rassau, and I. Ahmad, "Performance evaluation of IEEE 802.15.4 for mobile sensor networks," in Proc. 5th IFIP Int. Conf. Wireless Opt. Commun. Netw. (WOCN), 2008, pp. 1–5.
- [3]. X. Wang, X. Lin, Q. Wang, and W. Luan, "Mobility increases the connectivity of wireless networks," IEEE/ACM Trans. Netw., vol. 21, no. 2, pp. 440–454, Apr. 2013.
- [4]. S. A. B. Awwad, C. K. Ng, N. K. Noordin, and M. F. A. Rasid, "Cluster based routing protocol for mobile nodes in wireless sensor network," in Proc. Int. Symp. Collaborative Technol. Syst. (CTS), 2009, pp. 233–241.
- [5]. T. Yang, T. Oda, L. Barolli, J. Iwashige, A. Durrezi, and F. Xhafa, "Investigation of packet loss in mobile WSNs for AODV protocol and different radio models," in Proc. IEEE 26th Int. Conf. Adv. Inf. Netw. Appl. (AINA), Mar. 2012, pp. 709–715.
- [6]. T. Melodia, D. Pompili, and I. F. Akyldiz, "Handling mobility in wireless sensor and actor networks," IEEE Trans. Mobile Comput., vol. 9, no. 2, pp. 160–173, Feb. 2010.
- [7]. Y.-Y. Shih, W.-H. Chung, P.-C. Hsiu, and A.-C. Pang, "A mobility-aware node deployment and

- tree construction framework for ZigBee wireless networks," *IEEE Trans. Veh. Technol.*, vol. 62, no. 6, pp. 2763–2779, Jul. 2013.
- [8]. S. Deng, J. Li, and L. Shen, "Mobility-based clustering protocol for wireless sensor networks with mobile nodes," *IET Wireless Sensor Syst.*, vol. 1, no. 1, pp. 39–47, Mar. 2011.
- [9]. L. Karim and N. Nasser, "Reliable location-aware routing protocol for mobile wireless sensor network," *IET Commun.*, vol. 6, no. 14, pp. 2149–2158, Sep. 2012.
- [10]. D. D. Chaudhary and L. M. Waghmare, "A new dynamic energy efficient latency improving protocol for wireless sensor networks," *Wireless Pers. Commun.*, vol. 76, no. 3, pp. 351–362, 2014.
- [11]. G. Anastasi, M. Conti, and M. Di Francesco, "A comprehensive analysis of the MAC unreliability problem in IEEE 802.15.4 wireless sensor networks," *IEEE Trans. Ind. Informat.*, vol. 7, no. 1, pp. 52–65, Feb. 2011.

# Design of A Secure Scheme employing In-Packet Bloom Filter for Detecting Provenance Forgery and Packet Drop Attacks in WSN

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## ABSTRACT

Lots of application are inherently wireless sensor network based wherein they sense the desired parameter and forward the data to the base station to be aggregated and put forward to suitable use as and when desired. In such a case it is always a possibility that a malicious adversary may introduce additional nodes in the network or compromise existing ones. It is therefore highly crucial that high data trustworthiness is high so that correct decisions can be taken. Data provenance becomes critical in evaluating the trustworthiness of sensor data. Low energy and bandwidth consumption, efficient storage and secure transmission are several challenges required to be catered by provenance management. In this work we have been able to present a scheme to securely transmit provenance for sensor data. The scheme employs in packet bloom filter for providing provenance encoding. The provenance mechanism and reconstruction is taken care by the base station. The provenance scheme has been able to detect packet drop attacks staged by malicious data forwarding nodes.

## I. INTRODUCTION

Sensor networks have made their presence in lots of domains such as cyber physical infrastructure systems, environmental monitoring, power grids, etc. large amount of data is generated and forwarded towards the base station. Trustworthiness of data is a big issue as the data is being generated and forwarded from diverse sensor networks. Data provenance is an effective method to assess data trustworthiness, since it summarizes the history of ownership and the actions performed on the data. Recent research highlighted the key contribution of provenance in systems where the use of untrustworthy data may lead to catastrophic failures. Although provenance modeling, collection, and querying have been studied extensively for workflows and curate databases, provenance in sensor networks has not been properly addressed. We will investigate the problem of secure and efficient provenance transmission and processing

for sensor networks, and we will use provenance to detect packet loss attacks staged by malicious sensor nodes. In a multi-hop sensor network, data provenance allows the BS to trace the source and forwarding path of an individual data packet. Provenance must be recorded for each packet, but important challenges arise due to the tight storage, energy and bandwidth constraints of sensor nodes. Therefore, it is necessary to devise a light-weight provenance solution with low overhead. Furthermore, sensors often operate in an untrusted environment, where they may be subject to attacks. Hence, it is necessary to address security requirements such as confidentiality, integrity and freshness of provenance. Our goal is to design a provenance encoding and decoding mechanism that satisfies such security and performance needs. We will propose a provenance encoding strategy whereby each node on the path of a data packet securely embeds provenance information within a Bloom filter (BF) that is transmitted along

with the data. Upon receiving the packet, the BS extracts and verifies the provenance information. There is need to devise an extension of the provenance encoding scheme that allows the BS to detect if a packet drop attack was staged by a malicious node. As opposed to existing research that employs separate transmission channels for data and provenance, we only require a single channel for both. Furthermore, traditional provenance security solutions use intensively cryptography and digital signatures, and they employ append-based data structures to store provenance, leading to prohibitive costs. In contrast, we will use only fast message authentication code (MAC) schemes and Bloom filters, which are fixed-size data structures that compactly represent provenance. Bloom filters make efficient usage of bandwidth, and they yield low error rates in practice.

## II. LITERATURE SURVEY

Salmin Sultana, Gabriel Ghinita, Elisa Bertino, Mohamed Shehab in their work "A Lightweight Secure Scheme for Detecting Provenance Forgery and Packet Drop Attacks in Wireless sensor Networks" have proposed a novel lightweight scheme to securely transmit provenance for sensor data. The proposed technique relies on in-packet Bloom filters to encode provenance and it introduces efficient mechanisms for provenance verification and reconstruction at the base station. In addition, the scheme is armed with functionality to detect packet drop attacks staged by malicious data forwarding nodes.

Sankardas Roy, Mauro Conti, Sanjeev Setia, and Sushil Jajodia. In their work "Secure Data Aggregation in Wireless Sensor Networks" have presented a novel lightweight verification algorithm by which the base station can determine if the computed aggregate (predicate Count or Sum) includes any false contribution. Thorough theoretical analysis and

extensive simulation study show that our algorithm outperforms other existing approaches.

Fan Ye, Haiyun Luo, Songwu Lu, Lixia Zhang in their work "Statistical En-route Filtering of Injected False Data in Sensor Networks" have presented a Statistical En-route Filtering (SEF) mechanism that can detect and drop such false reports. SEF requires that each sensing report be validated by multiple keyed message authentication des (MACS), each generated by a node that detects the same event. As the report is forwarded, each node along the way verifies the correctness of the MACS and drops those with invalid macs at earliest points. The sink further filters out remaining false reports that escape the en-route filtering. SEF exploits the network scale to determine the truthfulness of each report through collective decision-making by multiple detecting nodes and collective false-report detection by multiple forwarding nodes. Their analysis and simulations show that, with an overhead of 14 bytes per report, SEF is able to dmp %90% injected false reports by a compromised node within 10 forwarding hops, and reduce energy consumption by 50% or more in many cases.

Salmin Sultana, Mohamed Shehab in their work "Secure Provenance Transmission for Streaming Data" have proposed a novel approach to securely transmit provenance for streaming data (focusing on sensor network) by embedding provenance into the inter packet timing domain while addressing the above mentioned issues. As provenance is hidden in another host-medium, our solution can be conceptualized as watermarking technique. However, unlike traditional watermarking approaches, we embed provenance over the inter packet delays (IPDs) rather than in the sensor data themselves, hence avoiding the problem of data degradation due to watermarking. Provenance is extracted by the data receiver utilizing an optimal threshold-based mechanism which minimizes the probability of provenance decoding errors. The

resiliency of the scheme against outside and inside attackers is established through an extensive security analysis. Experiments show that our technique can recover provenance up to a certain level against perturbations to inter-packet timing characteristics.

On the basis of literature survey carried out we observe that recent research highlighted the key contribution of provenance in systems where the use of untrustworthy data may lead to catastrophic failures. Although provenance modeling, collection, and querying have been studied extensively for workflows and curated databases, provenance in sensor networks has not been properly addressed.

Traditional provenance security solutions use intensively cryptography and digital signatures, and they employ append-based data structures to store provenance, leading to prohibitive costs.

Existing research employs separate transmission channels for data and provenance.

There is a need to design a provenance encoding and decoding mechanism that satisfies such security and performance needs. Similarly there is a need of a provenance encoding strategy whereby each node on the path of a data packet securely embeds provenance information within a Bloom filter (BF) that is transmitted along with the data. Upon receiving the packet, the BS extracts and verifies the provenance information.

### III. METHODOLOGY

#### 3.1 Light weight secure provenance scheme for wireless sensor network

This section tries to present the methodology for implementing provenance management for streaming data focusing on WSNs. We try to examine a mechanism which generates and transmits provenance in a distributed setting where a source node generates the data and the intermediate node(s)

towards the BS may process the in-transit data. A possible approach to the problem could be based on traditional security solutions like encryption, digital signature, and message authentication code (MAC). In a digital signature (or MAC) based mechanism, each party which is a stake holder in the data processing would affix its information to data and sign it to guarantee authenticity. Apart from this an approach base on encryption and incremental chained signature can be used for secure document provenance. This approach however brings in the difficulty of the provenance becoming larger than the data itself leading to inefficient usage of the transmission channel. Encryption/signature/MAC based mechanisms still are not capable to tackle this problem. Thus to address the above challenge we present two techniques - (i) a watermarking scheme for per-flow provenance encoding and decoding over the inter-packet delays (IPD), (ii) a per-packet provenance scheme using IBF. Different WSN applications may prefer one solution over the other depending on the network data rates.

#### 3.2 Background and System Model

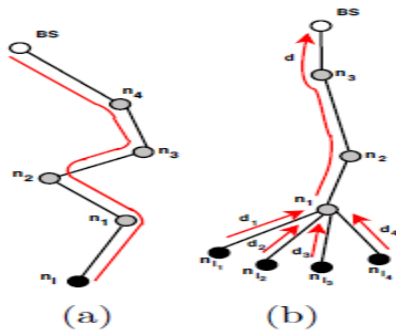
The system basically consists of the network, data and provenance models used. This section also deals with the details of the threat model and security requirements. Finally, it discusses the fundamental properties and operations of Bloom filters.

**3.2.1 Network Model.** We consider a multihop wireless sensor network, consisting of a number of sensor nodes and a base station (BS) that collects data from the network. The network is modeled as a graph  $G(N, L)$ , where  $N = \{n_i | 1 \leq i \leq |N|\}$  is the set of nodes, and  $L$  is the set of links, containing an element  $l_{ij}$  for each pair of nodes  $n_i$  and  $n_j$  that are communicating directly with each other.

**3.2.2 Data Model.** We assume a multiple-round process of data collection. Each sensor node generates data periodically, and individual values are routed and

aggregated towards the BS using any existing hierarchical (i.e., tree-based) dissemination scheme, e.g., [5]. A data path of  $p$  hops is represented as  $\langle n_1, n_1, n_2, \dots, n_p \rangle$ , where  $n_1$  is a leaf node representing the data source, and node  $n_i$  is  $i$  hops away from  $n_1$ . Each non-leaf node in the path aggregates the received data and provenance with its own locally-generated data and provenance.

Each data packet contains a unique packet sequence number, a data value, time stamp, and provenance. The sequence number is attached to the packet by the data source, and all nodes use the same sequence number for a given round [77].



Bloom Filters (BF). A Bloom filter is a space-efficient data structure for probabilistic representation of a set of items  $S = \{s_1, s_2, \dots, s_n\}$  using an array of  $m$  bits with  $k$  independent hash functions  $h_1, h_2, \dots, h_k$ . The output of each hash function  $h_i$  maps an item  $s$  uniformly to the range  $[0, m-1]$  and is interpreted as an index pointing to a bit in a  $m$ -bit array. Hence, the BF can be represented as  $\{b_0, \dots, b_{m-1}\}$ . Initially each of the  $m$  bits is set to 0.

To insert an element  $s \in S$  into a BF,  $s$  is hashed with all the  $k$  hash functions producing the values  $h_i(s) (1 \leq i \leq k)$ . The bits corresponding to these values are then set to 1 in the bit array. Figure 5.2 illustrates an example of BF insertion. To query the membership of an item  $s'$  within  $S$ , the bits at indices  $h_i(s') (1 \leq i \leq k)$  are checked. If any of them is 0, then certainly  $s' \notin S$ . Otherwise, if all of the bits are set to 1,  $s' \in S$  with high probability. There exists a possibility of error which arises due to hashing collision that makes the elements in  $S$  collectively causing indices  $h_i(s')$  being set to 1 even if  $s' \notin S$ . This is called a false positive. Note that, there is no false negative in the BF membership verification.

The cumulative nature of BF construction inherently supports the aggregation of BFs of a same kind, by performing bitwise-OR between the bitmaps.

### 3.2.4 Provenance Encoding

After generating a data packet, the source node marks it with the generation time and ensures the integrity of the timestamp with a MAC. The MAC is computed using the node specific secret key  $K_i$ . The next  $L_p$  data packets generated by the node, more specifically, the sequence of  $L_p$  IPDs is the medium where we hide the provenance of the packets. We denote the set of IPDs by  $DS = \{ [1], [2], \dots, [L_p] \}$ , where  $j[]$  represents the IPD between  $j$ -th and  $(j+1)$ -th data packet. The data source encodes a bit of its PN sequence over each IPD. Throughout the transmission of a packet towards the BS, each intermediate node also encodes 1-bit of

provenance information over the associated IPD. Hence, an IPD recorded at the BS carries the sum of 1-bit information from each node in the path. The process also uses the secret  $K_i$  and a locally generated random number  $\alpha_i$  (known as impact factor). The BS only knows the distribution of the  $\alpha_i$ 's. The process a node  $n_i$  follows to encode a bit of PN sequence over an IPD is summarized below:

- 1) Generation of Delay Perturbations:
- 2) Selection of a Delay Perturbation:
- 3) Provenance Embedding:
  - a) Simple Provenance Embedding
  - b) Aggregate Provenance Embedding

### 3.2.5 Provenance Decoding

The provenance retrieval algorithm recovers provenance using the secret parameters including the keys  $\{K_1, K_2, \dots, K_n\}$ , the PN length  $L_p$ , and the optimal threshold  $T^*$ . The threshold, corresponding to the network diameter and PN length, is calculated once after the deployment of the network.

## IV. RESULT AND DISCUSSION

### NETWORK FORMATION

The simulation work has been done with the Network Simulator ns-2, Version 2.34. Network formation is an aspect of creating nodes of network and transmit data. Network of 100 nodes is created using network simulator for wireless sensor network.

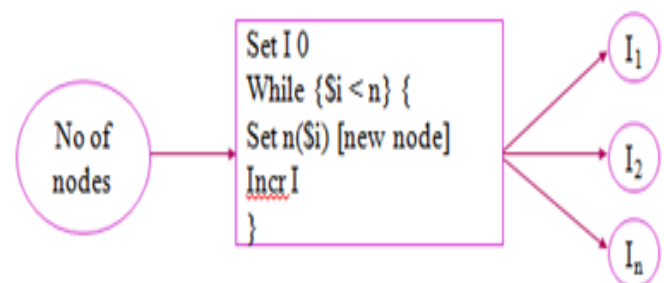


Figure 3. figure showing the method of network formation



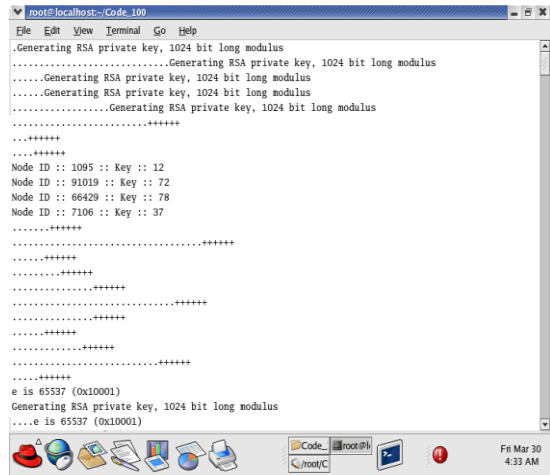
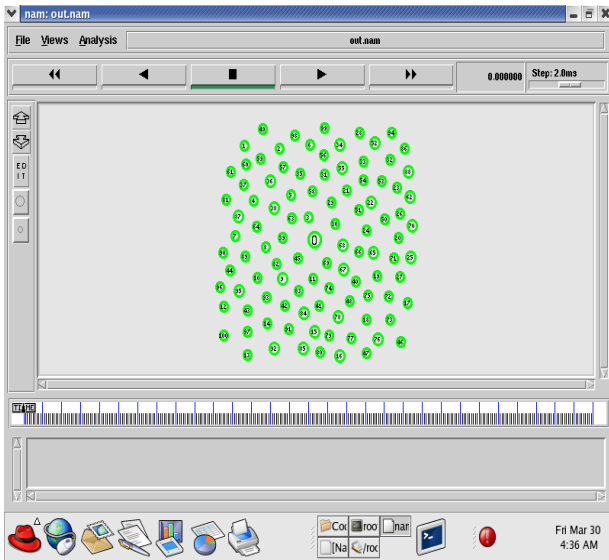


Figure 5. figure showing the security implementations

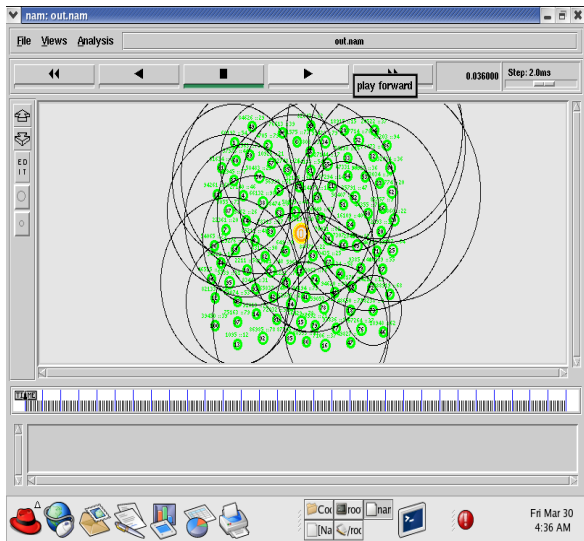


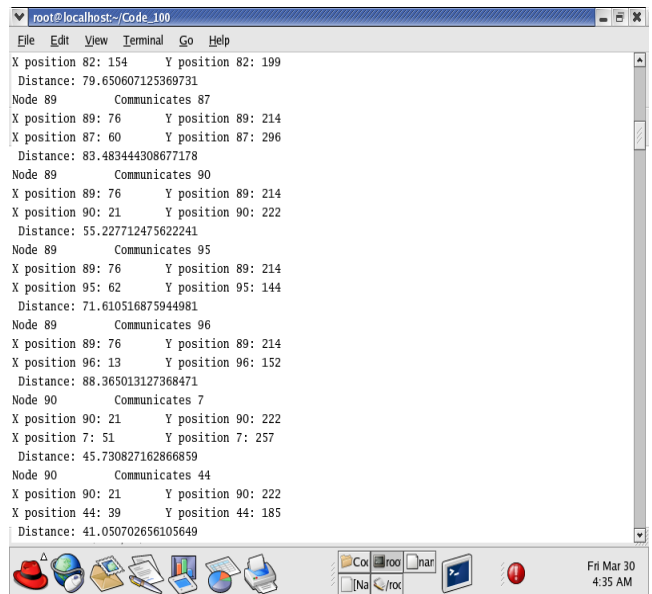
Figure 4. figure showing network formation

### SECURITY IMPLEMENTATION

Encryption decryption is done by SHA Algorithm. Detection of misbehavior nodes using Security Packet, then send communication between source to destination node. SHA is an algorithm used by modern computers to encrypt and decrypt messages. If the authentication is successful then it sends data packet through the Reliable routing path. SHA provides end-to-end confidentiality and hop-by-hop authentication.

### NEIGHBOR DISCOVERY

When a source node needs to find a route to a destination, it starts a route discovery process, based on flooding, to locate the destination node. Upon receiving a route request (RREQ) packet, intermediate nodes update their routing tables for a reverse route to the source. Similarly, the forward route to the destination is updated upon reception of a route reply (RREP) packet originated either by the destination itself or any other intermediate node that has a current route to the destination.



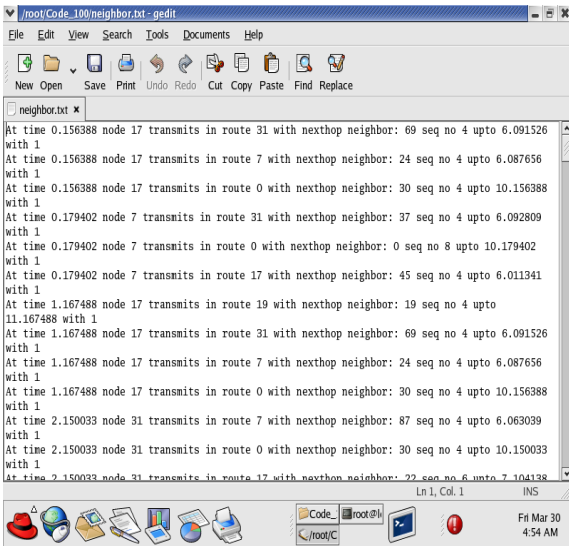


Figure 6. Screen shot showing neighbor discovery

**DATA FORWARDING**

Route request is sent to all the intermediate nodes between source and destination. Route discovery for shortest and fresh path is done .When a source node needs to find a route to a destination, it starts a route discovery process, based on flooding, to locate the destination node.

Upon receiving a route request (RREQ) packet, intermediate nodes update their routing tables for a reverse route to the source. After reaches the destination node- Sends Route reply packets to source node. The data is transmitted from source node to destination node through energy efficient intermediate nodes and in case of failure the route discovery is again initiated.

**Anomalous Behavior Detection**

Route request is sent to all intermediate nodes between source S and destination D. Route discovery for shortest and freshest path is carried out using Secure AODV Protocol. The neighbor list is checked so as to check anomalous behavior using security packets and then the communication is initiated between the source and the destination

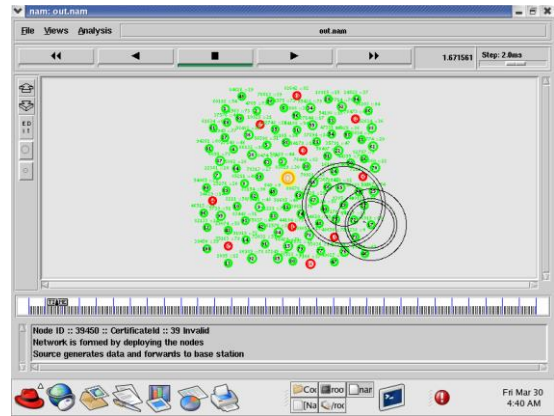


Figure 7. showing screen shot for data

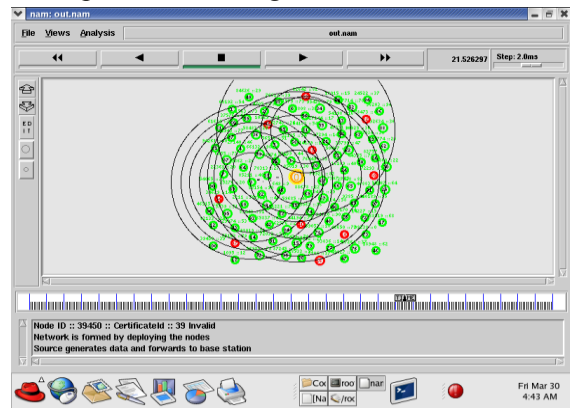


Figure 8. showing screen shot Anomalous forwarding Behavior detection

As seen in figure 5.5 we observe the network which is formed by deploying the nodes and the source generates the data and forwards to the base station .This figure show the behavior of the nodes while forwarding the data. In figure 5.6 we observe that nodes are transmitting the data and some node go on with anomalous behavior

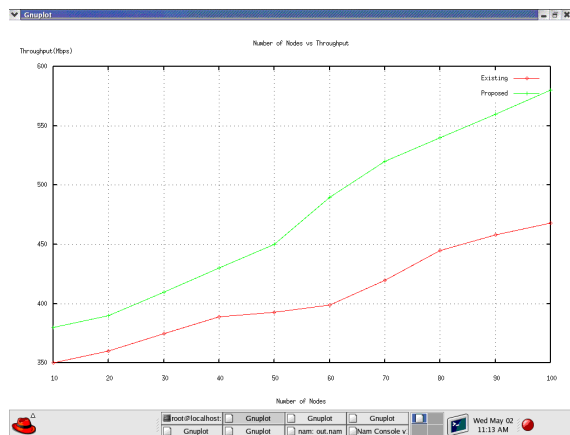


Figure 9. figure showing screenshot for throughput

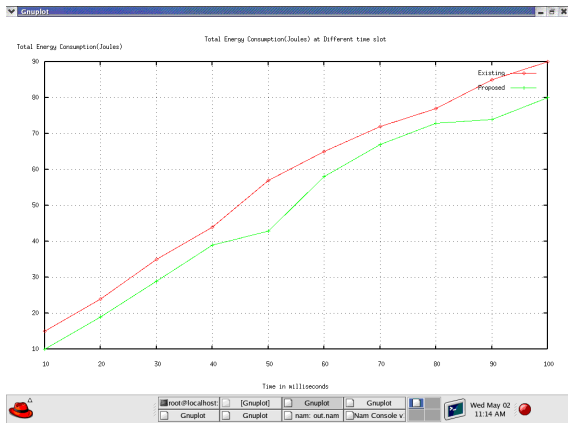


Figure 10. figure showing screenshot for Energy consumption

From figure 9 we can make an observation that the throughput of the proposed system is around 570 Mbps as compared to the throughput of the existing system which is around 460 Mbps. Thus the proposed system scores over the existing system. Similarly for figure 10 the energy consumed by the proposed system is around 80 Joules which is less as compared to the existing system having an energy consumption of around 90 Joules.

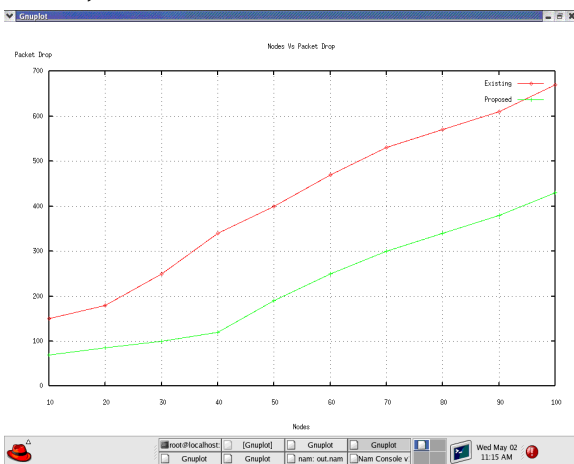


Figure 11. figure showing screenshot for

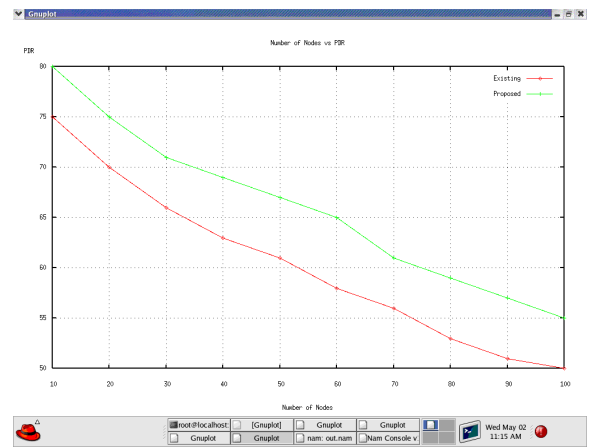


Figure 12. figure showing screenshot for packet drop delivery ratio

From figure 5.8 we can make an observation that the packet drop ratio for 100 nodes of the proposed system is around 420 as compared to the packet drop ratio for 100 nodes of the existing system which is around 680. Similarly for figure 5.9 we observe that the packet delivery ratio proposed system is around 80 which is comparatively higher to the packet delivery ratio of the existing system which is around 75.

## V. CONCLUSION

We conclude that lots of application are inherently wireless sensor network based wherein they sense the desired parameter and forward the data to the base station to be aggregated and put forward to suitable use as and when desired. In such a case it is always a possibility that a malicious adversary may introduce additional nodes in the network or compromise existing ones. It is therefore highly crucial that high data trustworthiness is high so that correct decisions can be taken. Data provenance becomes critical in evaluating the trustworthiness of sensor data. Low energy and bandwidth consumption, efficient storage and secure transmission are several challenges required to be catered by provenance management. We also conclude that we have been able to present a scheme to securely transmit provenance for sensor data. The scheme employs in packet bloom filter for providing provenance encoding. The provenance

mechanism and reconstruction is taken care by the base station . The provenance scheme has been able to detect packet drop attacks staged by malicious data forwarding nodes. And the proposed scheme scores over the existing schemes in terms of throughput , Energy consumption, the packet drop ratio and the packet delivery ratio.

## VI. REFERENCES

- [1]. S. Roy, M. Conti, S. Setia, and S. Jajodia, "Secure Data Aggregation in Wireless Sensor Networks," *IEEE Trans. Information Forensics and Security*, vol. 7, no. 3, pp. 1040-1052, June 2012.
- [2]. Salmin Sultana, Gabriel Ghinita, Member, IEEE , Elisa Bertino, Fellow, IEEE , and Mohamed Shehab, Member, IEEE Computer Society, " A Lightweight Secure Scheme for Detecting Provenance Forgery and Packet Drop Attacks in Wireless Sensor Networks", May-june 2015.
- [3]. Fan Ye, H. Luo, Songwu Lu, Lucia Zhang, "Statistical en-route filtering of injected false data in sensor networks", April 2005.
- [4]. Salmin Sultana, Mohamed Shehab, Elisa Bertino, "Secure provenance transmission for streaming data", August 2013.
- [5]. S. Madden, J. Franklin, J. Hellerstein, and W. Hong, "TAG: a tiny aggregation service for ad-hoc sensor networks," *SIGOPS Operating Systems Review*, Dec. 2002.
- [6]. H. Lim, Y. Moon, and E. Bertino, "Provenance-based trustworthiness assessment in sensor networks," in *Proc. of Data Management for Sensor Networks*, pp. 2–7, 2010.
- [7]. S. Sultana, E. Bertino, and M. Shehab, "A provenance based mechanism to identify malicious packet dropping adversaries in sensor networks," in *Proc. Of ICDCS Workshops*, pp. 332–338, 2011.

# Proposing A New Methodology For Weather Forecasting By Using Big Data Analytics

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## ABSTRACT

Big data has described an enormous quantity of data which needs new technologies to make potential to obtain value from it by analysis and capturing method. Data Analytics often includes scrutinizing past traditional data to research potential trends. Weather prognostication has been one of the most fascinating and exciting domain, and it performs an essential role in aerography. The weather situation is the state of the atmosphere at a given time regarding weather variables like wind direction, rainfall, cloud conditions, pressure, temperature, thunderstorm, etc. The Big data obtained by NCDC (National Climatic Data Center) has received over more than 116 weather locations and more than 1000 observations centers. The data produced by them is unstructured which grows a challenging job to explain it. In this paper, these enormous amounts of data have loaded onto the Apache Pig, Hadoop Distributed File System, Apache Hive is to process the data, which utilizes mappers and reducers to process the data. The above dataset has explained by using given methods and the final output of this project in the form of maximum, minimum and average temperature according to the given time and date.

**Keywords:** Big Data, Hadoop, HDFS, MapReduce, Mapper, Reducer, Min, Max, Average, NCDC.

## I. INTRODUCTION

Big Data is the method of analyzing large data sets comprising a class of data types [1]. The big data maintain a significant amount of data and process them. It is conventional data analysis which can handle the structured data, but not unstructured data. In big data, it can process both unstructured and structured data. Big data involves data sets typically with different dimensions beyond the ability of generally employed software tools to manage, capture, process and curate the data. Big data size varies from terabytes to several petabytes of data. Weather prognostication is the employment of technology to predict the behavior of the environment for a given area. It is essential for farmers, disasters, business agriculturist, etc. weather prediction is one of the

most exciting and fascinating domain and plays a significant role in aerography. There are numerous conditions in an excellent implementation of weather forecasting for example in data mining methods; it cannot forecast weather in short-term efficiently.

**MIN and MAX** temperature for each particular year, the graph is plotted for the visualization of the temperature. Based on the previous year data weather data of coming year is predicted.

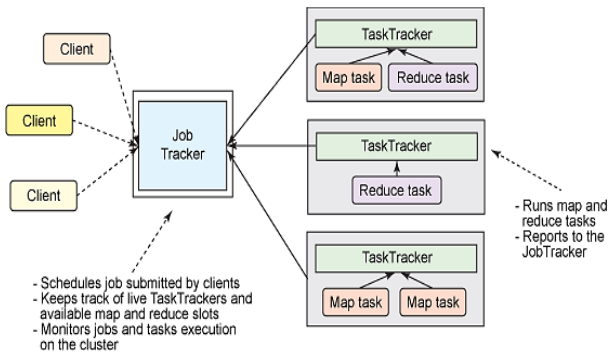


Figure 1

## II. MAPREDUCE PROGRAMMING

MapReduce application performs in three steps, namely map step, shuffle step, and reduce step. **Map stage:** The map or mapper's job is to process the input data. The input data is in the sort of file or directory and is collected in the Hadoop file system (HDFS) [4] [5]. The **Reduce task** takes the output from the Map as input and combines those data tuples (key-value pairs) into a smaller set of tuples.

## III. DESCRIPTION OF THE DATASET

A dataset is a collection of portraits of the items or data objects in a data model for the advantage of programmers and others who need to refer to them. The following table 1 depicts the data dictionary used in this Weather Prediction.

Table 1. Data Dictionary used in the proposed weather forecasting methodology

S. NO	COLUMN NAME	DATATYPE	CONSTRAINTS	DESCRIPTION
1	Country_id	Integer	Allow null	Get the country id
2	Country_name	Varchar	Allow null	Get the country name
3	State_id	Integer	Allow null	Get the state id

4	State_name	Varchar	Allow null	Get the state name
5	District_id	Integer	Allow null	Get the district id
6	District_name	Varchar	Allow null	Get the district name
7	Area_id	Integer	Allow null	Get the area id
8	Area_name	Varchar	Allow null	Get the area name
9	Date	Date	Allow null	Get the date
10	Time	Time value	Allow null	Required time
11	Seasons	Varchar	Allow null	Get the required seasons
12	Maximum temperature	Integer	Allow null	Get the max temp
13	Minimum temperature	Integer	Allow null	Get the mini temp
14	Average temperature	Integer	Allow null	Get the avg temp
15	Current temperature	Integer	Allow null	Get the cur temp
16	Passed temperature	Integer	Allow null	Required data
17	User_id	Integer	Allow null	Get the user id
18	User_name	Varchar	Allow null	Get the username

19	Email_id	Varchar	Allow null	Get the mail id
20	Phone_no	Integer	Allow null	Get the required phone no

CA_25-Jan-2014	00:12:345	15.7	01:19:345	23.1	02:34:542	12.3
03:12:187	16	04:00:093	-14	05:12:345	35.7	06:19:345
07:34:542	12.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	23.1	12:34:542	-22.3	13:12:187	16	14:00:093
15:12:345	15.7	16:19:345	23.1	19:34:542	12.3	20:12:187
22:00:093	-7					
CA_26-Jan-2014	00:54:245	15.7	01:19:345	23.1	02:34:542	12.3
03:12:187	16	04:00:093	-14	05:12:345	55.7	06:19:345
07:34:542	12.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	23.1	12:34:542	12.3	13:12:187	16	14:00:093
15:12:345	15.7	16:19:345	23.1	19:34:542	12.3	20:12:187
22:00:093	-7					
CA_27-Jan-2014	00:14:045	35.7	01:19:345	23.1	02:34:542	-22.3
03:12:187	16	04:00:093	-14	05:12:345	35.7	06:19:345
07:34:542	12.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	23.1	12:34:542	12.3	13:12:187	16	14:00:093
15:12:345	15.7	16:19:345	23.1	19:34:542	12.3	20:12:187
22:00:093	-7					
CA_28-Jan-2014	00:22:315	15.7	01:19:345	23.1	02:34:542	12.3
03:12:187	16	04:00:093	-14	05:12:345	35.7	06:19:345
07:34:542	12.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	-23.3	12:34:542	12.3	13:12:187	16	14:00:093
15:12:345	15.7	16:19:345	23.1	19:34:542	12.3	20:12:187
22:00:093	-7					
CA_29-Jan-2014	00:15:345	15.7	01:19:345	23.1	02:34:542	52.9
03:12:187	16	04:00:093	-14	05:12:345	45.0	06:19:345
07:34:542	-2.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	23.1	12:34:542	12.3	13:12:187	16	14:00:093
15:12:345	15.7	16:19:345	23.1	19:34:542	12.3	20:12:187
22:00:093	-7					
NJ_29-Jan-2014	00:15:345	15.7	01:19:345	23.1	02:34:542	52.9
03:12:187	16	04:00:093	-14	05:12:345	45.0	06:19:345
07:34:542	-2.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	23.1	12:34:542	12.3	13:12:187	16	14:00:093
15:12:345	15.7	16:19:345	23.1	19:34:542	12.3	20:12:187
22:00:093	-7					
CA_30-Jan-2014	00:22:445	15.7	01:19:345	23.1	02:34:542	12.3
03:12:187	56	04:00:093	-14	05:12:345	35.7	06:19:345
07:34:542	12.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	23.1	12:34:542	12.3	13:12:187	16	14:00:093
15:12:345	-15.7	16:19:345	23.1	19:34:542	12.3	20:12:187
22:00:093	-7					
CA_31-Jan-2014	00:42:245	15.7	01:19:345	23.1	02:34:542	12.3
03:12:187	16	04:00:093	-14	05:12:345	49.2	06:19:345
07:34:542	12.3	08:12:187	16	09:00:093	-7	10:12:345
11:19:345	23.1	12:34:542	12.3	13:12:187	16	14:00:093

Figure 2. Sample Weather Prediction Dataset

#### IV. PROPOSED METHODOLOGY FOR WEATHER FORECASTING BY USING BIG DATA ANALYTICS

The following figure 2 depicts the proposed methodology for weather forecasting by using Big Data Analytics.

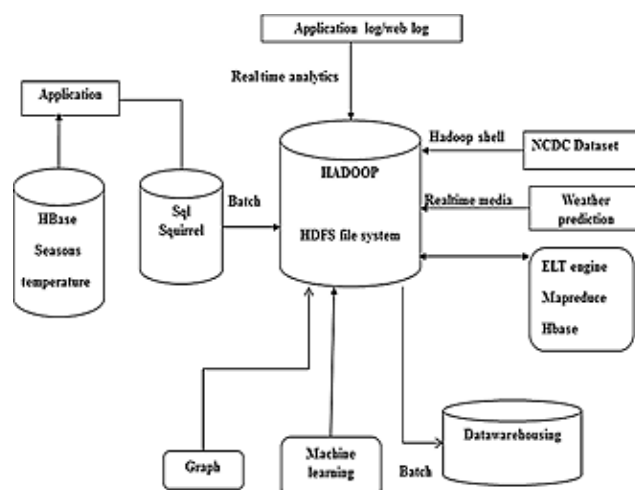


Figure 2. Proposed Methodology for Weather Forecasting by using Big Data Analytics

The forecast of the climate variance perpetually has shown very usefully and essential. In the United States of America (USA) there are typically many effects designed in different cities. These issues might involve the concerts, car racing, festivals, etc. As these are the open-air concerts, they experience a lot from the daily weather variations, which is rising because of global warming. To avoid these issues, they need to pre-plan and choose the data for their event in advance. It can work out only if they had any predictions of the climate data using the Hadoop and distributed system and map reduce. By using map-reduce and also calculate the maximum and the minimum temperature for the hot days and cold days. So, as a result, we can discover useful information about event planning, such as location, time and statistical data.

**Maximum, Minimum and Average:** In this step, to find out the maximum, minimum and average temperatures of the year, and able to predict the future weather forecast. Finally, to plot the graph for the obtained MAX, MIN and AVG temperature for each month of the particular year to visualize the temperature.

**Comparisons:** The overall accuracy percent is computed from the one to three years out accuracy

percentages for high temperature, low temperature, icon forecast precipitation and text forecast precipitation. Temperature accuracy is the percentage of estimates within three degrees. Precipitation accuracy is the percentage of correct forecasts. The forecasts have collected in the evening.

**Seasons:** This step used to Seasonal forecasting is the effort to present valuable information about the "weather climate" that has required in the following months. The periodical forecast is not a weather forecast. Weather can be examined as a snapshot of continually varying atmospheric situations, whereas climate has viewed as the statistical report of the weather phenomena happening in an assigned season.

**Prediction:** The forecast of the climate change perpetually has proven very important and useful. It can work out only if it had any estimates of the climate data using the Hadoop and distributed system and map reduce. By using map reduce and also calculate the maximum and the minimum temperature for the hot days and cold days. So, as a result, we can discover useful information about event planning, such as location, time and statistical data.

**Weather Reports:** This Module includes displaying the list of locations on the weather reports. It has visualized as a pictorial representation which has used to identify the past and current year of the temperature.

**Weather Format:** This Module includes Displaying the list of locations weather Forecast Details. It will be predicted based on the past minimum, maximum, average temperature of the particular year. A user can search specific location weather Forecast by giving the location name in this Module.

**Reports:** This application provides for generation of reports like total no of need (Min, Max and avg

temperature) available in the application weather forecast reports based on user requirements.

### Proposed Algorithm for Weather Forecasting using MapReduce Programming

**Input:** Cleans Dataset for particular region/City, Prediction Dates, Prediction Attribute

**Output:** Prediction for a specific range and specified attribute.

**Step1:** Select all data from noisy data source, and verify each.

While( $i \neq \emptyset$ )

If(verified(i)) Then weight(i) = 1

Else Weight(i) = 0

End While

Step1 Traverses the entire database and verifies the validity of each parameter if the parameter value is found noisy, zero weight has given to that record, and that record will not participate in the prediction process.

**Step2:**

PRED\_DATE = sequence to be predicted

BASE\_SEQ = (PRED\_DATE) – (NO\_OF\_DAYS)

The algorithm divides the whole data into equal chunks called sequences where every sequence is equal to the prediction time span, i.e., if the prediction is for 1 Month, the 12-year dataset has divided into monthly chunks. It has expected for the distance calculation in the dataset.

**Step 3:**

While days  $\neq \emptyset$

Selected\_days[ ] = DAY(day) of MONTH(month) (if Validated)

End While

Calculate Distance(Selected\_days[])

SORT(Selected\_days[], Distance)

This step performs the key operation of the algorithm. It selects the similar record from the whole dataset, i.e., if we need to predict the weather for the 1st week of Jan 2003, then this step will select all records of the 1st week of January from the whole dataset. Further it



calculates its distance, and finally, it sorts the results according to distance.

**Step4:** Find the K nearest neighbor and calculate mean. The last step extracts K nearest neighbors from the array and takes its mean as the predicted value for a specific day.

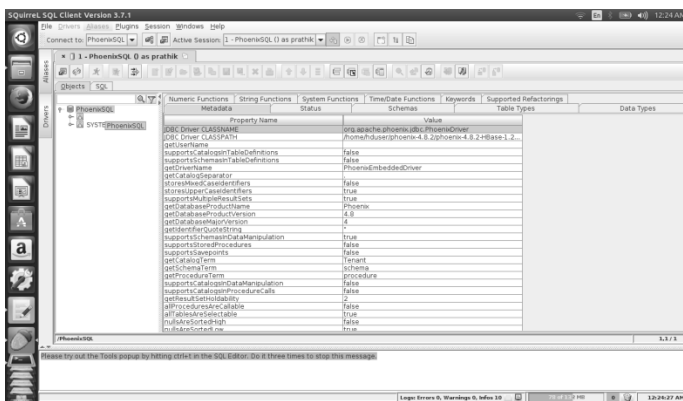
**Step5:** The process stopped when all data has examined.

### V. RESULT AND DISCUSSION

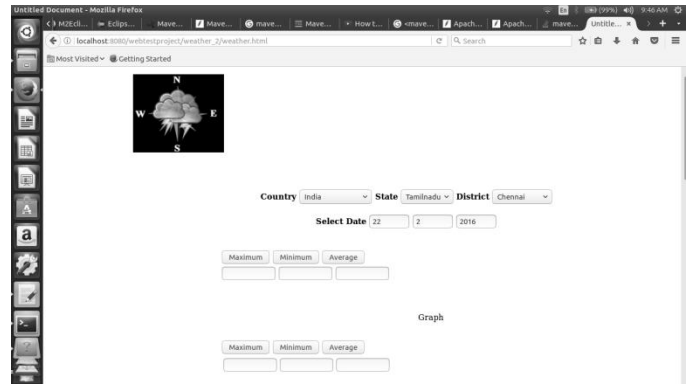
The following figure depicts the performance analysis of the k-nearest neighbor and fuzzy C-means in the weather forecasting. From the above table 2, the execution time of K-NN has reduced than the Fuzzy C-Means. The accuracy is increased by 92.86% in K-NN whereas in Fuzzy C -means it is only 57.14%.

**Table 2.** Comparison of the performance analysis of Fuzzy C-Means and K-Neared Neighbor in the Weather Forecasting

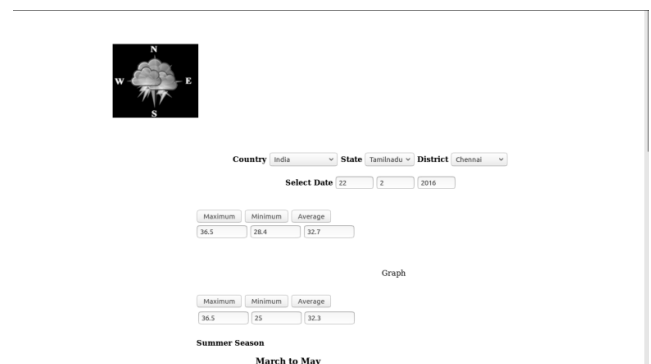
PARAMETERS	FUZZY MEANS ALGORITHM	C- NEAREST NEIGHBOR ALGORITHM
Accuracy	57.14%	92.86%
Execution Time	30 seconds	11seconds



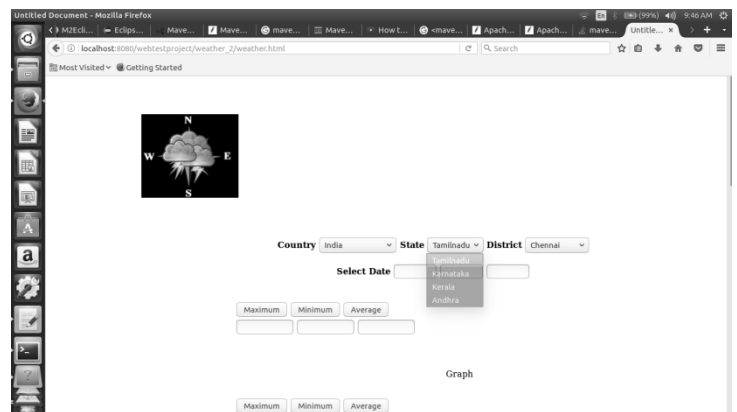
**Figure 3.** Description of the Dataset



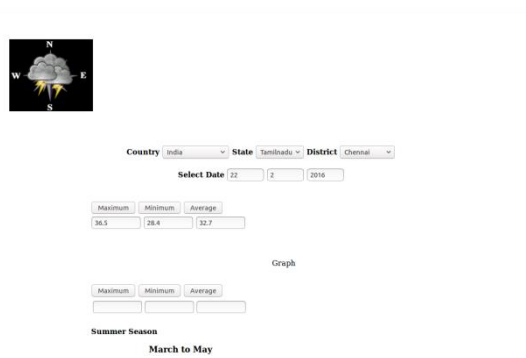
**Figure 4a.** Screenshot of the Home Page of the Weather Prediction



**Figure 4b.** Screenshot of the Select date for the weather prediction



**Figure 4c.** Selecting the state from the given option for the weather prediction



**Figure 4d.** Calculate the minimum, maximum and average temperature of the state for the selected date for the weather forecasting

## VI. CONCLUSION

The proposed methodology has analyzed from the past data and advanced weather prediction using big data environment. Hadoop with map reduces to analyze the sensor data, which has stored in the National Climatic Data Centre (NCDC) is an efficient solution. Map reduce is a framework for highly parallel and distributed systems across large dataset. By using map reduce with Hadoop helps in removing scalability bottleneck. This type of technology used to analyze large datasets has the potential for significant enhancement to the weather forecast. The query tools make the analytics much more comfortable by providing random access to Big Data. MapReduce is a framework for executing distributable algorithm across huge datasets are using a large number of computers. Using MapReduce with Hadoop, the weather data can be analyzed efficiently and also predict the future weather forecast, minimum and maximum temperature, hot days and cold days based on the data obtained from the NCDC. It helps for the people to preplanning for outdoor events based on the weather conditions.

## VII. REFERENCES

[1]. N.Padmaja, Prof. T.Sudha, "Big Data Analytics With Long Range Plan To Process Large Data Sets," *International Journal of Advanced Scientific*

*Technologies, Engineering and Management Sciences*, pp.87-90.

- [2]. Harshawardhan S. Bhosale, Prof. Devendra P. Gadekar, "A Review Paper on Big Data and Hadoop," *International Journal of Scientific and Research Publications*, Volume 4, Issue 10, October 2014, pp.1-7.
- [3]. National Climatic Data Center Data Documentation for Data Set 3260 (DSI-3260). <ftp://ftp.ncdc.noaa.gov/pub/data/noaa/dsi3260.pdf>.
- [4]. Pooja S.Honnutagi, "The Hadoop distributed file system," *International Journal of Computer Science and Information Technologies*, Vol. 5 (5), 2014, 6238-6243.
- [5]. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce," This is the pre-production manuscript of a book in the Morgan & Claypool Synthesis Lectures on Human Language Technologies. Anticipated publication date is mid-2010.

# Studies on Biosorption of Alizarin Red Dye onto Borassus Powder and Optimization Through Central Composite Design

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## ABSTRACT

This work presents an alternative methodology for removal of a dyestuff Alizarin Red from aqueous solutions by using a new biosorbent, Borassus powder in a batch biosorption technique. The characterization of the biosorbent was performed by using FTIR and XRD techniques. The parameters investigated includes, agitation time, biosorbent size, pH, initial concentration of dye, dosage of biosorbent and temperature. The Kinetic study incorporated Lagergren first order and pseudo second order models. The study also included thermodynamics and isotherms like Langmuir, Freundlich and Temkin. The experimental data was correlated for regression analysis and the data was very well fitted.

**Keywords:** Alizarine red dye, Borassus, RSM, CCD, kinetics.

## I. INTRODUCTION

Effluents emanating from many industries contain dissolved heavy metals. If these effluents are discharged without treatment, they will have adverse effects on the environment. Numerous techniques have been proposed by various researchers for the treatment of heavy metal-bearing effluents. These include ion-exchange [1], chemical precipitation [2], electrochemical methods [3] and membrane technology [4]. Another method, which has gained momentum in recent years, is biosorption. The inherent advantages and applications of biosorption have been extensively reviewed by several investigators [5–7]. Several theoretical models were tested in order to fit the experimental data and to understand the possible physicochemical interactions involved in the sorption phenomenon between the biomass surface and the dye molecules. [8]

In the last decades, biomasses were widely used in waste liquid treatment. The usage of inactive

microorganisms for the removal of heavy metals [9–10] and organics including dyes [11, 12], phenolics [13,14] and pesticides [15] from wastewaters have been widely studied. The special surface properties of bacteria, yeasts, fungi and algae enable them to adsorb different kinds of pollutants from solutions. The passive uptake of pollutants by inactive/dead biological materials is termed as biosorption [16]. In the concept of biosorption, several physical or chemical processes may be involved such as physical and/or chemical adsorption, ion exchange, coordination, complexation, chelation and microprecipitation. Biomass cell walls offer many functional groups which can bind metal ions and organics such as carboxyl, hydroxyl, sulphate, phosphonate and amino groups. In addition, biosorption processes offer the advantages of low operating costs, high selectivity and efficiency, good removal performance and regeneration ability. For FGD process, activated carbon and sewage sludge [17–19] were used to SO<sub>2</sub> adsorption at low temperature.

## II. METHODS AND MATERIAL

The present experimentation is carried out both batch-wise and column, on biosorption of Alizarine red dye from aqueous solutions on the biosorbent – Borassus powder.

The experimental procedure consists of the following steps:

- 2.1 Preparation of the bisorbent
- 2.2 Characterization of biosorbent
- 2.3 Preparation of the stock solutions
- 2.3 Studies on Equilibrium Biosorption Process

### 2.1. Preparation of the bisorbent

Borassus leaves were collected from Jodugulla palem beach, near tenneti park, Visakhapatnam. The collected biosorbent was washed with water several times until the dirt particles are removed and finally washed with distilled water. The biosorbent was dried in sun light for fifteen days, cut into small pieces, powdered and sieved. In the present study, the obtained powder was used as biosorbent without any pretreatment.

### 2.2 Characterization of biosorbent

Biosorption of Alizarine red dye using Borassus powder has many affecting factors which include characterization (FTIR, XRD, SEM), Biosorbents were characterized by FTIR spectrometry using Spectrum GX of Perkin Elmer, XRD patterns were recorded from 10 to 700 For SEM studies, the dried powders and the corresponding loaded powders were first coated with ultra-thin film of gold by an ion sputter JFC-1100 and then were exposed under a Japanese make electron microscope (JEOL, JXA-8100) equilibrium studies (agitation time, biosorbent size, pH, initial concentration, biosorbent dosage, temperature), Isotherms (Langmuir, Freundlich, Temkin), Kinetics (Lagergren First Order, Pseudo Second Order), Thermodynamics (Entropy, Enthalpy and Gibb's Free Energy) and Optimization using

Central Composite Design. XRD patterns were recorded from 10 to 700.

### 2.3 Preparation of stock solution:

The standard stock solution of Alizarin Red dye (1000 mg/L) was prepared by dissolving 1.0 g of 99.9 % analytical grade Alizarin Red dye in 1000 mL of distilled water. The concentration of dye in the aqueous solution was varied from 20 to 200 mg/L by diluting the stock solutions with required quantity of deionized water. The pH of the working solution was adjusted using either 0.1 N HCl or 0.1N NaOH.

### 2.3 Studies on Equilibrium Biosorption Process:

The biosorption was carried out in a batch process by adding a pre-weighed amount of the Borassus powder to a known volume of aqueous solution for a predetermined time interval in an orbital shaker. The procedures adopted to evaluate the effects of various parameters via. Agitation time, biosorbent size, pH, initial concentration, biosorbent dosage and temperature of the aqueous solution on the biosorption of Indigo carmine dye were evaluated using single step optimization process

**Table 1** Experimental conditions for biosorption of Alizarin Red dye

S.N o.	Parameter	Values Investigated
1	Agitation time, t, min	5, 10, 15, 20, 25, 30, 30, 50, 60, 90, 120, 150 and 180
2	pH of the aqueous solution	2, 3, 3, 5, 6, 7 and 8
3	Initial dye concentration, Co, mg/L	20, 50, 100, 150 and 200
3	Initial Biosorbent dosage, w, g/L	10, 20, 25, 30, 35, 30, 50, 60 and 80
5	Temperature, K	283, 293, 303, 313 and 323

### III. RESULTS AND DISCUSSION

#### 3.1 Effect of agitation time

Duration of equilibrium biosorption is defined as a time required for dye concentration to reach a constant value during biosorption. The fig 3.1 shows the equilibrium agitation time which is determined by plotting the % biosorption of AR dye against agitation for the interaction time intervals between 1 to 180 minutes. In the first five minutes, 25% of AR dye is biosorbed for the 53  $\mu\text{m}$  size of 10 gm/L biosorbent dosage. By reaching 58%, the % biosorption is increased briskly upto 25 minutes. The equilibrium conditions of attainment indicate the constant % biosorption beyond 25 minutes. In 50 ml of aqueous solution ( $C_0=20\text{mg/L}$ ), the maximum biosorption of 58% is attained for 25 minutes of agitation with 10 gms/L of 53 $\mu\text{m}$  size biosorbent is mixed. In the initial stages the rate of biosorption is fast because adequate surface area of the biosorbent is available for the biosorption of AR dye. Due to vanderwall forces of attraction the time increases, more amount of AR dye gets biosorbed on to the surface of biosorbent and resulted in decrease of available surface area. Over the surface the biosorbate normally, forms a thin single molecule thick layer over the surface. The biosorption capacity is exhausted when this mono molecular layer covers the surfaces. At 40 minutes the maximum 69 % of biosorption. Therefore, all other experiments are conducted at this optimum agitation time. [20-24]

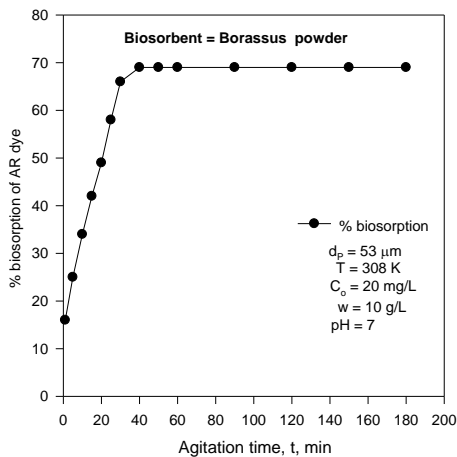


Figure 3.1. Effect of time on % biosorption of AR dye

#### 3.2 Effect of biosorbent size

From the aqueous solution the variation in % biosorption of AR dye with biosorbent size are obtained. The figure 3.2 shows the results which are drawn with % biosorption of AR dye is a function of biosorbent size and it decreases from 53 to 152 $\mu\text{m}$  and increases from 69 to 45%. This is expected to phenomenon, as the size of the particle decreases there by the number of active and freely available sites on the biosorbent also enhances with the surface area of the biosorbent enhances. [25-29]

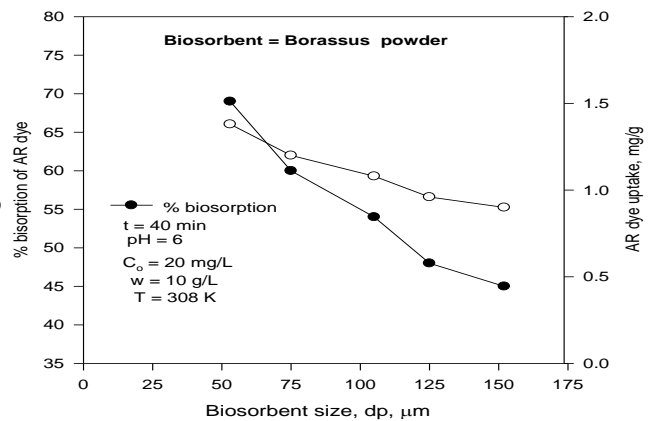


Figure 3.2. Effect of size on % biosorption of AR dye

#### 3.3 Effect of pH

pH controls the degree of ionization and species of the biosorbate, biosorption by influencing the surface change of biosorbent. Using 10gm/L of 53  $\mu\text{m}$  size biosorbent of the aqueous solution, AR dye biosorption data are obtained in the pH range of 2 to 8 in the present investigation made. The figure 3.3 shows the effect of pH of aqueous solution on % biosorption of AR dye. Beyond the pH value of 6 it increased slowly and the margin is very less. For appropriate sites on the biosorbent surface the low pH depresses biosorption due to competition. The AR dye replace  $\text{H}^+$  ions bound to the biosorbent and with increasing pH, this competition weakens. [30-34]

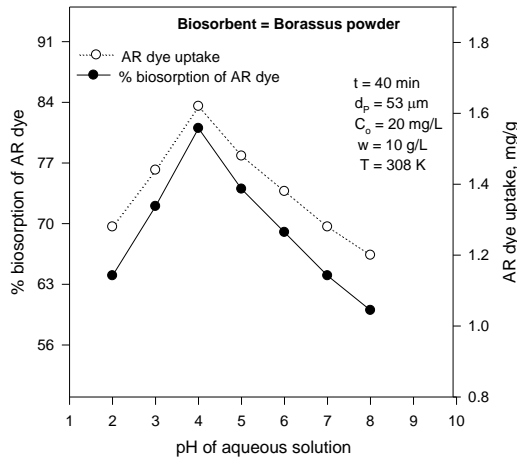


Figure 3.3. Effect of pH on % biosorption of AR dye

### 3.4 Effect of initial concentration of AR dye

The percentage of biosorption of AR dye shows in the figure 3.4 and its effect of initial concentration of AR dye in the aqueous solution. The present biosorption of AR dye is increased in  $C_0$  from 20 to 200mg/L (66-673) and decrease from 81 to 60%. The constant number of available active sites on the biosorbent and this behavior can be attributed to increase in the total amount of biosorbate. [35-39]

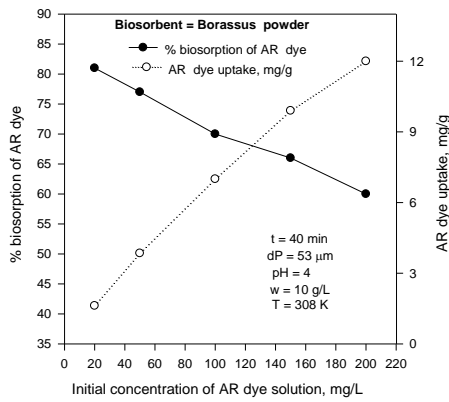


Figure 3.4. Effect of initial concentration on % biosorption of AR dye

### 3.5 Effect of biosorbent dosage

This figure 3.5 shows the percentage biosorption of AR dye which is drawn against the biosorbent dosage for 53 μm size biosorbent with an increase in the biosorbent dosage from 0.5 to 4 gm/L and the biosorption of AR dye increased from 81 to 95%. The number of active sites available for AR dye biosorption would be more and this behavior is

obvious because of the increase in biosorbent dosage. When dosage is increased from 40 to 70 gm/L the change in the biosorbent of AR dye is marginal from 92 to 95%. Hence all other experiments are conducted at 40 gm/L dosage. [40-44]

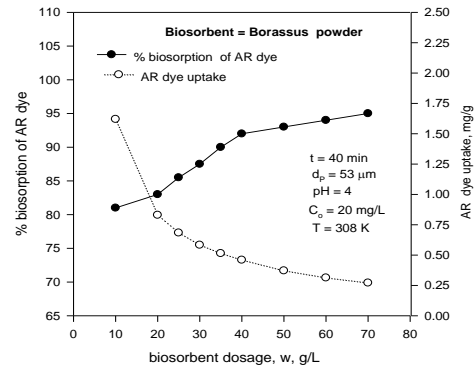


Figure 3.5. Effect of dosage on % biosorption of AR dye

### 3.6 Effect of temperature

Experiment is done varying temperature from 283 to 323K. On the equilibrium dye uptake the effect of temperature was significant. The figure 3.6 shows the effect of changes in the temperature on AR dye uptake. In the internal porous structure of surface high temperature favors the diffusion of dye molecules. [45-49]

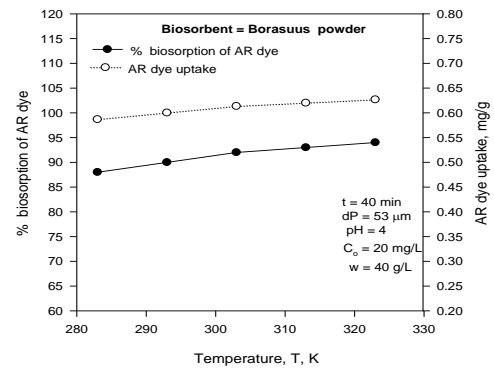


Figure 3.6. Effect of temperature on % biosorption of AR dye

### 3.7 Isotherms:

#### 3.7.1 Langmuir isotherm:

Irving Langmuir developed an isotherm named Langmuir isotherm. It is the most widely used simple two-parameter equation. This simple isotherm is based on following assumptions:

Biosorbates are chemically biosorbed at a fixed number of well-defined sites

Each site can hold only one biosorbate specie  
 All sites are energetically equivalent  
 There are no interaction between the biosorbate species

The Langmuir relationship is hyperbolic and the equation is:

$$q_e/q_m = bC_e / (1+bC_e) \quad \dots\dots (3.20)$$

Equation (6.1) can be rearranged as

$$(C_e/q_e) = 1/(bq_m) + C_e/q_m \quad \dots\dots (5.20)$$

From the plots between  $(C_e/q_e)$  and  $C_e$ , the slope  $\{1/(bq_m)\}$  and the intercept  $(1/b)$  are calculated. Further analysis of Langmuir equation is made on the basis of separation factor, ( $R_L$ ) defined as  $R_L = 1/ (1+bC_e)$

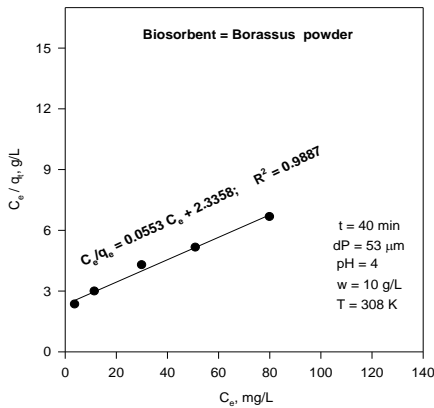
$0 < R_L < 1$  indicates favorable adsorption

$R_L > 1$  indicates unfavorable adsorption

$R_L = 1$  indicates linear adsorption

$R_L = 0$  indicates irrepressible adsorption

Langmuir isotherm is drawn for the present data and shown in Figure 3.7. The equation obtained is:  $C_e/q_e = 0.0553C_e + 2.3358$  with a good linearity (correlation coefficient,  $R^2 \sim 0.9887$ ) indicating strong binding of AR dye to the surface of Borassuspowder.



**Figure 3.7** Langmuir isotherm for % biosorption of AR dye

**3.7.2 Freundlich isotherm:**

Freundlich presented an empirical biosorption isotherm equation that can be applied in case of low and intermediate concentration ranges. It is easier to handle mathematically in more complex calculations.

The Freundlich isotherm is given by

$$q_e = K_f C_e^n \quad \dots\dots (3.21)$$

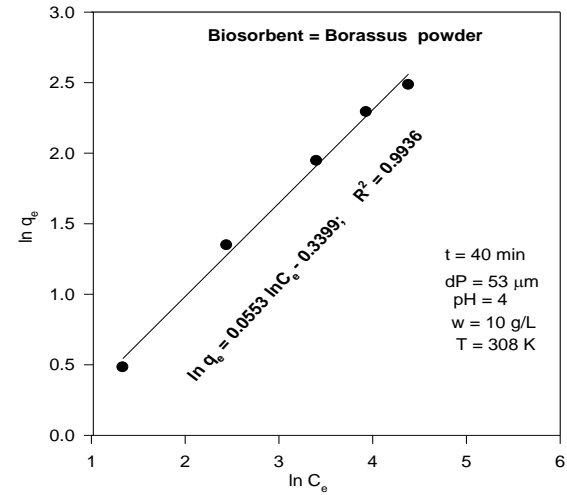
Where  $K_f$  (mg) represents the biosorption capacity when dye equilibrium concentration and  $n$  represents the degree of dependence of biosorption with equilibrium concentration Taking LN on both sides, we get

$$\ln q_e = \ln K_f + n \ln C_e \quad \dots\dots (3.22)$$

Freundlich isotherm is drawn between  $\ln C_e$  and  $\ln q_e$  and is shown in Figure 3.8 for the present data. The resulting equation has a correlation coefficient of 0.9936.

$$\ln q_e = 0.0553 \ln C_e - 0.3399 \quad \dots (3.23)$$

The ‘n’ value in the above equation ( $n=0.6618$ ) satisfies the condition of  $0 < n < 1$  indicating favorable biosorption.



**Figure 3.8.** Freundlich isotherm for % biosorption AR dye

**3.7.3 Temkin isotherm:**

Temkin and Pyzhev isotherm equation describes the behavior of many biosorption systems on the heterogeneous surface and it is based on the following equation

$$q_e = RT \ln(A_T C_e) / b_T \quad \dots\dots (5.24)$$

The linear form of Temkin isotherm can be expressed as

$$q_e = (RT / b_T) \ln(A_T) + (RT/b_T) \ln(C_e) \quad \dots\dots (3.25)$$

Where

$$A_T = \exp [b(0) \times b(1) / RT]$$

$b(1) = RT / b_T$  is the slope

$b(0) = (RT / b_T) \ln (A_T)$  is the intercept and

$$b = RT/b \quad (1)$$

The present data are analysed according to the linear form of Temkin isotherm and the linear plot is shown in Figure 3.9. The equation obtained for AR dye biosorption is:  $q_e = 3.4129 \ln C_e - 3.7009$  with a correlation coefficient 0.9834. The best fit model is determined based on the linear regression correlation coefficient (R). From the Figs 3.7, 3.8&3.9, it is found that biosorption data are well represented by Freundlich isotherm with higher correlation coefficient of 0.9936, followed by Temkin and Langmuir isotherms with correlation coefficients of 0.9638 and 0.9887[50-59] respectively.

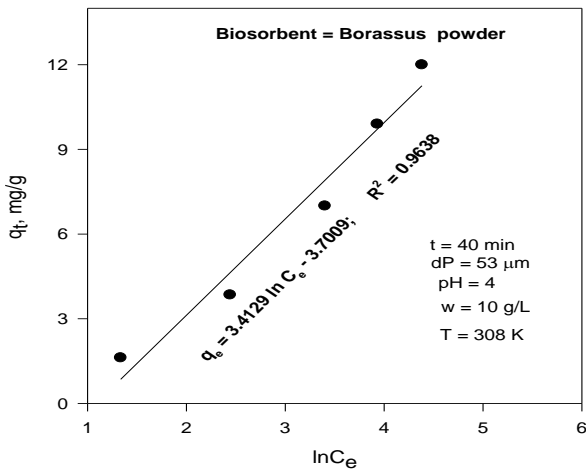


Figure 3.9. Temkin isotherm for % biosorption of AR dye

Table 1. Isotherm constants (linear method)

Langmuir isotherm	Freundlich isotherm	Temkin isotherm
$q_m = 18.07011$ mg/g	$K_f = 0.71184$ mg/g	$A_T = 0.33811$ L/mg
$K_L = 0.02369$	$n = 0.6618$	$b_T = 738.117$
$R^2 = 0.9887$	$R^2 = 0.9936$	$R^2 = 0.9638$

### 3.8 Kinetics of biosorption

#### 3.8.1 Lagergren First order Kinetics

The order of biosorbate – biosorbent interactions have been described using kinetic model. Traditionally, the first order model of Lagergren finds wide

application. In the case of biosorption preceded by diffusion through a boundary, the kinetics in most cases follows the first order rate equation of Lagrangen:

$$(dq_t/dt) = K_{ad} (q_e - q_t) \quad \dots\dots\dots (3.26)$$

where  $q_e$  and  $q_t$  are the amounts adsorbed at  $t$ , min and equilibrium time and  $K_{ad}$  is the rate constant of the pseudo first order biosorption.

The above equation can be presented as

$$\int (dq_t / (q_e - q_t)) = \int K_{ad} dt \quad \dots\dots\dots (3.27)$$

Applying the initial condition  $q_t = 0$  at  $t = 0$ , we get

$$\log (q_e - q_t) = \log q_e - (K_{ad}/2.303) t \quad \dots\dots\dots (3.28)$$

In the present study, the kinetics are investigated with 50 mL of aqueous solution ( $C_0 = 20$  mg/L) at 303 K with the interaction time intervals of 1 min to 180 min. Lagragen plots of  $\log (q_e - q_t)$  versus agitation time ( $t$ ) for biosorption of AR dye the biosorbent size (53  $\mu$ m) of Borassus powder in the interaction time intervals of 1 to 180 min are drawn in Figure 3.10.  $\log (q_e - q_t) = -0.0380 t + 0.1862$ ,  $R^2 = 0.8686$   $\dots\dots\dots (3.29)$

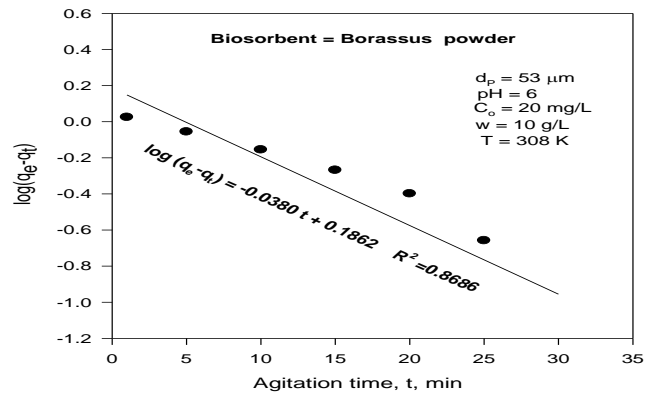


Figure 3.10. first order kinetics for % biosorption of AR dye

#### 3.8.2 Pseudo Second order Kinetics

Plot of  $\log (q_e - q_t)$  versus 't' gives a straight line for first order kinetics, facilitating the computation of adsorption rate constant ( $K_{ad}$ ). If the experimental results do not follow the above equation, they differ in two important aspects:



- i)  $K_{ad} (q_e - q_t)$  does not represent the number of available biosorption sites and
- ii)  $\log q_e$  is not equal to the intercept.

In such cases, pseudo second order kinetic equation:  $(dq_t/dt) = K (q_e - q_t)^2$  ..... (3.30)

is applicable,

where 'K' is the second order rate constant.

The other form of the above equation is:  $(dq_t / (q_e - q_t)^2) = K dt$  ..... (3.31)

let  $q_e - q_t = x$

$dq_t = dx$

$$1/x = K x + C \quad \text{..... (3.31)}$$

$$C = 1/q_e \text{ at } t = 0 \text{ and } x = q_e$$

Substituting these values in above equation, we obtain:

$$1/(q_e - q_t) = Kt + (1/q_e) \quad \text{..... (5.32)}$$

Rearranging the terms, we get the linear form as:

$$(t/q_t) = (1/Kq_e^2) + (1/q_e) t \quad \text{..... (3.33)}$$

The pseudo second order model based on above equation, considers the rate limiting step as the formation of chemisorptive bond involving sharing or exchange of electrons between the biosorbate and biosorbent. If the pseudo second order kinetics is applicable, the plot of  $(t/q_t)$  versus 't' gives a linear relationship that allows computation of  $q_e$  and K.

$$t/q_t = 0.6341 t + 6.165, \quad R^2=0.8936 \quad \text{..... (3.34)}$$

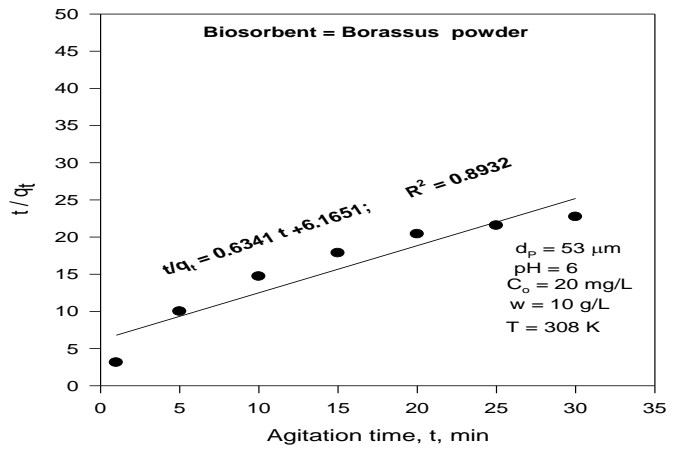


Figure 3.11. second order kinetics for % biosorption of AR dye

In the present study, the kinetics are investigated with 50 mL of aqueous solution ( $C_o = 20$  mg/L) at 303 K with the interaction time intervals of 1 min to 180 min. Pseudo second order plot of  $t$  vs  $t/q_t$  for biosorption of AR dye with the biosorbent size ( $53 \mu m$ ) of Borassus powder in the interaction time intervals of 1 to 180 min is drawn in Figure 3.11[60-64].

Table 2. Equations and rate constants

Order	Equation	Rate constant	R <sup>2</sup>
Lagergren first order	$\log (q_e - q_t) = -0.0380 t + 0.1862$	$0.087514 \text{ min}^{-1}$	0.8686
Pseudo Second order	$t/q_t = 0.6341 t + 6.1651$	$0.065219 \text{ g/(mg-min)}$	0.8932

### 3.8.3 Thermodynamics of biosorption:

Biosorption is temperature dependant. In general, the temperature dependence is associated with three thermodynamic parameters namely change in enthalpy of biosorption ( $\Delta H$ ), change in entropy of biosorption ( $\Delta S$ ) and change in Gibbs free energy ( $\Delta G$ ).

Enthalpy is the most commonly used thermodynamic function due to its practical significance. The negative value of  $\Delta H$  will indicate the exothermic/endothermic nature of biosorption and the physical/chemical in

nature of sorption. It can be easily reversed by supplying the heat equal to calculated  $\Delta H$ .

The  $\Delta H$  is related to  $\Delta G$  and  $\Delta S$  as

$$\Delta G = \Delta H - T \Delta S \quad \dots\dots (3.35)$$

$\Delta S < 1$  indicates that biosorption is impossible whereas  $\Delta S > 1$  indicates that the biosorption is possible.  $\Delta G < 1$  indicates the feasibility of sorption.

The Vant Hoff's equation is

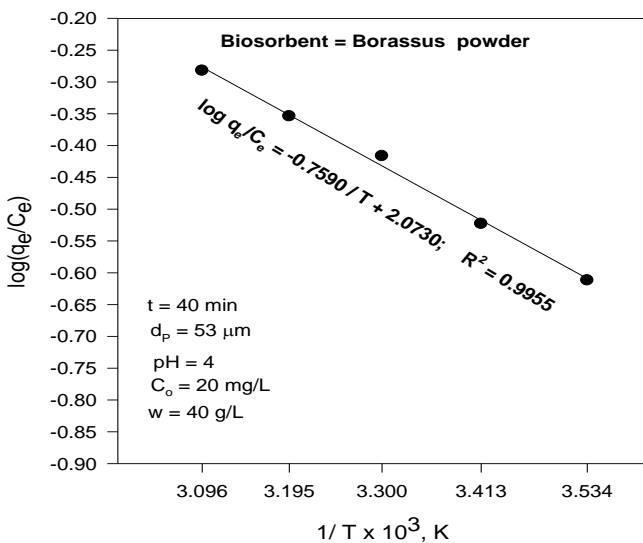
$$\log (q_e / C_e) = \Delta H / (2.303 RT) + (\Delta S / 2.303 R) \dots (3.36)$$

$$\log (q_e / C_e) = - 0.7590 (1 / T) + 2.0730 \dots (3.37)$$

Where  $(q_e/C_e)$  is called the biosorption affinity.

If the value of  $\Delta S$  is less than zero, it indicates that the process is highly reversible. If  $\Delta S$  is more than or equal to zero, it indicates the reversibility of process. The negative value for  $\Delta G$  indicates the spontaneity of biosorption. Whereas the positive value indicates is non spontaneity of sorption.

Experiments are conducted to understand the biosorption behavior varying the temperature from 283 to 323 K. The plot indicating the effect of temperature on biosorption of AR dye for different initial AR dye concentrations is shown in Figure 3.12. The values are  $\Delta G = -12012.6$ ,  $\Delta H = 14.5326$  and  $\Delta S = 39.6935$ [65-69].



**Figure 3.12.** Vantoff's plot for % biosorption of AR dye

**3.9. Optimization using Response Surface Methodology (RSM):**

**3.9.1 Optimization of biosorption conditions using CCD**

The effects of four independent variables (pH, initial concentration of AR dye in aqueous solution, biosorbent dosage and temperature) on AR dye biosorption are analyzed using Central Composite Design (CCD) [65-69]. The optimum conditions for the four independent variables on the extent of AR dye biosorption are formed within the quadratic model. Levels of different process variables for percentage biosorption are shown in table-3.3.

**Table 3.** Levels of different process variables in coded and un-coded form for % biosorption of AR dye using Borassus powder

Variable	Name	Range and levels				
		-2	-1	0	1	2
X <sub>1</sub>	pH of aqueous solution	2	3	4	5	6
X <sub>2</sub>	Initial concentration, C <sub>o</sub> , mg/L	10	15	20	25	30
X <sub>3</sub>	Biosorbent dosage, w, g/L	30	35	40	45	50
X <sub>4</sub>	Temperature, T, K	28	29	30	31	32

Regression equation for the optimization of biosorption is:

% biosorption of AR dye is function of pH of aqueous solution ( $X_1$ ), initial concentration ( $X_2$ ), dosage ( $X_3$ ), and Temperature of aqueous solution ( $X_4$ ).

The multiple regression analysis of the experimental data has yield the following equation:

$$Y = -1518.84 + 18.36 X_1 + 6.52 X_2 + 6.12 X_3 + 9.13 X_4 - 3.18 X_1^2 - 0.11X_2^2 - 0.08X_3^2 - 0.01X_4^2 - 0.24 X_1X_2 + 0.30 X_1X_3 + 0.00 X_1X_4 + 0.02 X_2X_3 - 0.01 X_2X_4 - 0.00X_3X_4 \text{--- (5.38)}$$

Table-5.22 represents the results obtained in CCD. The response obtained in the form of analysis of variance (ANOVA) from regression eq.3.38 is put together in table-3.4. Fischer’s ‘F-statistics’ value is defined as  $MS_{model}/MS_{error}$ , where MS is mean square. Fischer’s ‘F-statistics’ value, having a low probability ‘p’ value, indicates high significance.

**Table 4.** Results from CCD for AR dye biosorption by borassuspowder

Run No.	$X_1$ , pH	$X_2$ , Co	$X_3$ , w	$X_4$ , T	% biosorption of AR	
					Experim ental	Predicted
1	5	15	20	293	85.58000	85.58833
2	5	15	20	313	87.02000	86.97167
3	5	15	30	293	84.38000	84.39500
4	5	15	30	313	84.90000	84.90833
5	5	25	20	293	87.62000	87.61500
6	5	25	20	313	87.68000	87.70833
7	5	25	30	293	88.92000	88.87167
8	5	25	30	313	88.12000	88.09500
9	7	15	20	293	85.68000	85.68167
10	7	15	20	313	87.08000	87.12500
11	7	15	30	293	90.46000	90.42833
12	7	15	30	313	91.02000	91.00167
13	7	25	20	293	82.82000	82.80833
14	7	25	20	313	83.00000	82.96167
15	7	25	30	293	89.98000	90.00500
16	7	25	30	313	89.30000	89.28833
17	4	20	25	303	83.12000	83.14000
18	8	20	25	303	84.42000	84.42667
19	6	10	25	303	84.98000	84.97667

20	6	30	25	303	85.26000	85.29000
21	6	20	15	303	86.18000	86.17667
22	6	20	35	303	91.28000	91.31000
23	6	20	25	283	90.36000	90.37000
24	6	20	25	323	91.02000	91.03667
25	6	20	25	303	96.52000	96.52000
26	6	20	25	303	96.52000	96.52000
27	6	20	25	303	96.52000	96.52000
28	6	20	25	303	96.52000	96.52000
29	6	20	25	303	96.52000	96.52000
30	6	20	25	303	96.52000	96.52000

Experimental conditions [Coded Values] and observed response values of central composite design with  $2^4$  factorial runs, 6- central points and 8- axial points. Agitation time fixed at 40 min and biosorbent size at 53  $\mu$ m

**Table 5.** ANOVA of AR dye biosorption for entire quadratic model

Source of variation	SS	df	Mean square(MS)	F-value	P> F
Model	598.41	1	42.7438	4317	0.0000
Error	32	4	8.0000	5	0
Total	0.0149	1	0.00099		
	598.42	5			
	81				

Df- degree of freedom; SS- sum of squares; F- factor F; P- probability.

$$R^2=0.99996; R^2 (adj):0.99992$$

**Table 6.** Estimated regression coefficients for the AR dye biosorption onto Borassus powder

Terms	Regressi on coefficient	Standar d error of the coefficient	t-value	P-value
Mean/Int	-	6.09245	-249.299	0.0000

ercept	1518.84	3	0	0.0000
Dosage, w, g/L (L)	18.36	0.25333 8	72.474	0
Dosage, w, g/L (Q)	-3.18	0.00601 1	-529.708	0.0000
Conc, Co, mg/L (L)	6.52	0.05066 8	128.774	0.0000
Conc, Co, mg/L (Q)	-0.11	0.00024 0	-473.562	0.0000
pH (L)	6.12	0.05220 9	117.184	0.0000
pH (Q)	-0.08	0.00024 0	-323.425	0.0000
Temperat ure, T, K (L)	9.13	0.03724 1	245.053	0.0000
Temperat ure, T, K (Q)	-0.01	0.00006 0	-241.910	0.0000
1L by 2L	-0.24	0.00157 4	-155.645	0.0000
1L by 3L	0.30	0.00157 4	188.680	0.0000
1L by 4L	0.00	0.00078 7	1.906	0.0760
2L by 3L	0.02	0.00031 5	77.822	0.0000
2L by 4L	-0.01	0.00015 7	-40.976	0.0000
3L by 4L	-0.00	0.00015 7	-27.635	0.0000

\*insignificant ( $P \geq 0.05$ )

The ANOVA of the regression model is sufficiently great, as proven from the Fisher's  $F$ -test and has a very low probability value ( $P_{\text{model}} > F = 0.000000$ ). Besides, the computed  $F$ -value is much higher compared to  $F$ -value ( $F_{0.05 (14,15)} \text{ tabulars} = 2.42$ ) at 5% level, suggesting that the treatment differences are sufficiently great. Student's  $t$ -test can implicate regression coefficient of the parameter, while pattern of interactions amidst all the factors can be entailed by 'p' values. It is noted

from table-5.24 that more significant corresponding coefficient term can be possessed by having high 't' value and low 'P' value. By analyzing 't' and 'p' values from table-5.24, all the variables have high importance to explain the individual and interaction effects of independent variables on biosorption of AR dye to anticipate the response. The model is reduced to the following form by excluding undistinguished terms in eq.3.39.

$$Y = -1518.84 + 18.36 X_1 + 6.52 X_2 + 6.12 X_3 + 9.13 X_4 - 3.18 X_1^2 - 0.11 X_2^2 - 0.08 X_3^2 - 0.01 X_4^2 - 0.24 X_1 X_2 + 0.30 X_1 X_3 + 0.00 X_1 X_4 + 0.02 X_2 X_3 - 0.01 X_2 X_4 - 0.00 X_3 X_4 \text{--- (3.39)}$$

A positive sign of the coefficient represents an interactive effect i.e., response (% biosorption of AR dye) steps up with increase in effect, whereas a negative sign implies an incompatible effect that means response lowers with an increase in effect.

Measure of the model's variability to the responses indicated is presented by correlation coefficient ( $R^2$ ). As  $R^2 \rightarrow 1$ , model is inviolable and the response is estimated better. In our study,  $R^2 = 0.99996$  suggests that 0.004 % of the total variations are not adequately explained by the model. Statistical relevance of the ratio of mean due to regression and mean square due to residual error is tested with the help of ANOVA.  $F$ -values implicate that % biosorption can be sufficiently explained by the model equation. If 'P' value is lower than 0.05, the model is considered to be statistically significant at the 95 % confidence level.

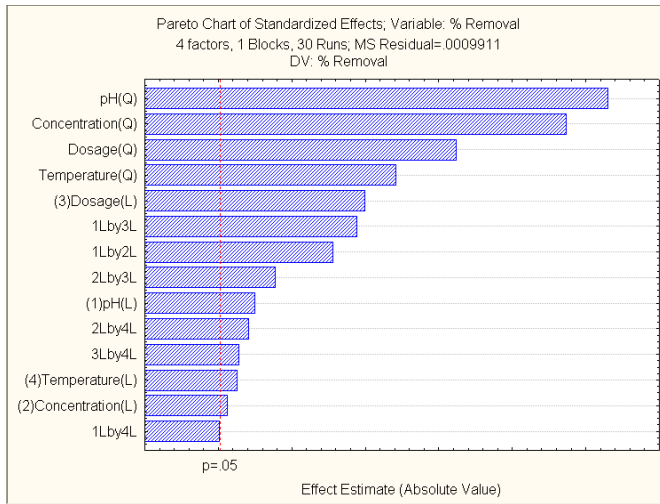


Figure 3.13. Pareto Chart

The optimal set of conditions for maximum percentage biosorption of AR dye is pH = 4.1354, initial AR dye concentration = 20.1222 mg/L, biosorbent dosage = 41.9207 g/L, and temperature = 303.2657 K. The extent of biosorption of AR dye at these optimum conditions was 96.79145%. It is evident that experimental values of % biosorption are in close agreement with that of predicted by Central Composite Design. Experiments are conducted in triplicate with the above predicted optimal set of conditions and the % biosorption of AR dye is 93 %, which is closer to the predicted % biosorption.[70-74]

**3.9.2 Interpretation of residual graphs:**

Normal probability plot (NPP) is a graphical technique used for analyzing whether or not a data set is normally distributed to greater extent. The difference between the observed and predicted values from the regression is termed as residual. Figure 3.14 exhibits normal probability plot for the present data. It is evident that the experimental data are reasonably aligned implying normal distribution.

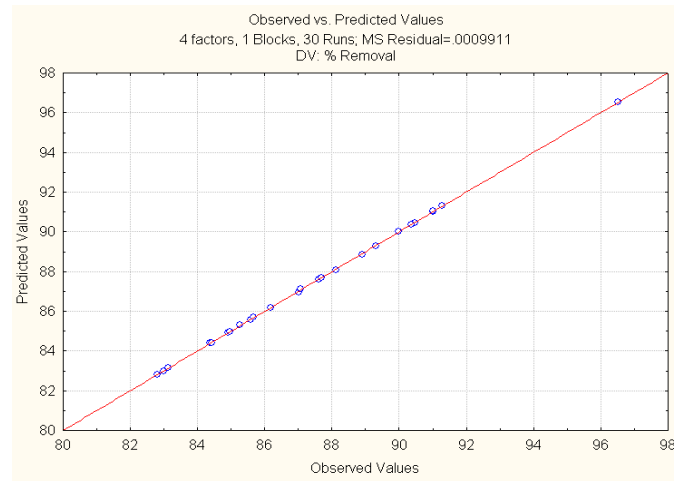


Figure 3.14. Normal probability plot for % biosorption of AR dye

**3.9.3 Interaction effects of biosorption variables:**

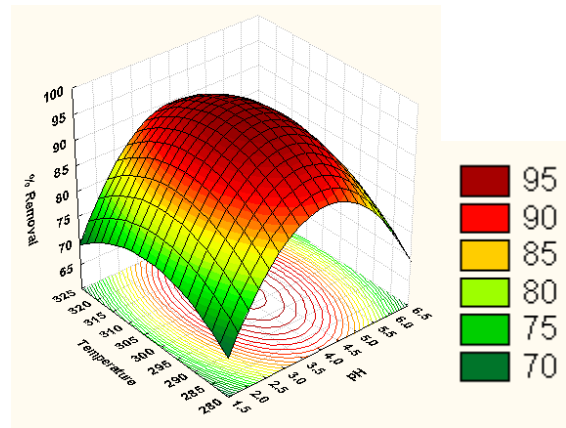
Three-dimensional view of response surface contour plots [Fig3.15 (a) to 3.15 (f)] exhibit % biosorption of the AR dye using borassus powder for different combinations of dependent variables. All the plots are delineated as a function of two factors at a time, imposing other factors fixed at zero level. It is evident from response surface contour plots that the % biosorption is minimal at low and high levels of the variables. This behavior confirms that there is a presence of optimum for the input variables in order to maximize % biosorption. The role played by all the variables is so vital in % biosorption of AR dye and seen clearly from the plots. The predicted optimal set of conditions for maximum % biosorption of AR dye is:

pH of aqueous solution	=	4.1354
Initial AR dye concentration	=	20.1222 mg/L
Biosorbent dosage	=	41.9207 g/L
Temperature	=	303.2657 K
% biosorption of AR dye	=	96.79145

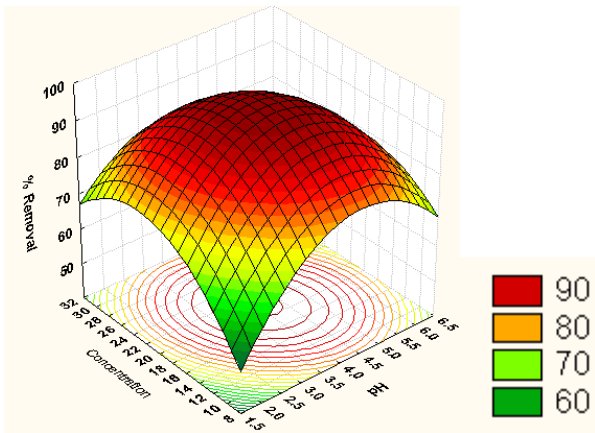
The experimental optimum values are compared with those predicted by CCD in table-3.7. The experimental values are in close agreement with those from CCD.

**Table 7.** Comparison between optimum values from CCD and experimentation

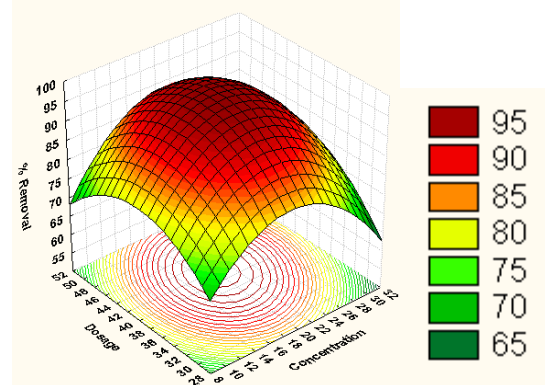
Variable	CCD	Experimental
pH of aqueous solution	4.1354	4.0
Initial AR concentration, mg/L	20.1222	20
Biosorbent dosage, w, g/L	41.9207	40
Temperature, K	303.2657	303
% biosorption	96.79145	90



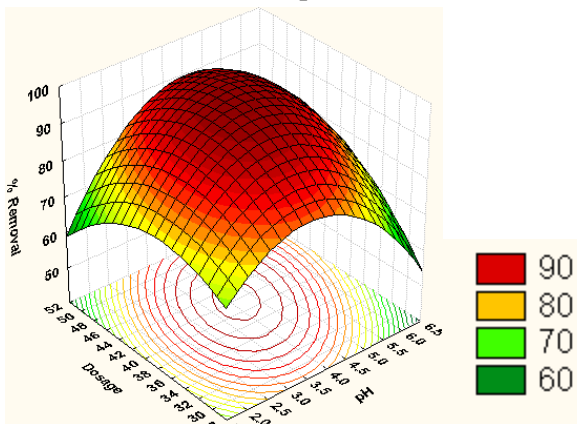
**Figure 3.15 (c)** Surface contour plot for the effects of pH and temperature of AR dye in aqueous solution on the % biosorption



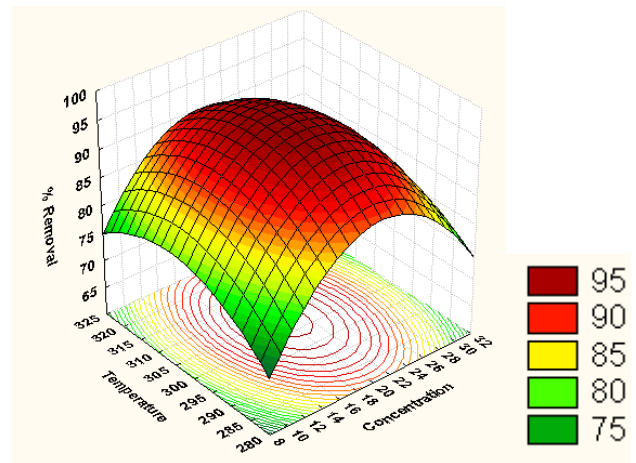
**Figure 3.15. (a)** Surface contour plot for the effects of pH and initial concentration of AR dye on % biosorption



**Figure 3.15. (d)** Surface contour plot for the effects of concentration and dosage on % biosorption of AR dye



**Figure 3.15. (b)** Surface contour plot for the effects of pH and Dosage of AR dye in aqueous solution on % biosorption



**Figure 3.15. (e)** Surface contour plot for the effects of concentration and temperature on % biosorption of AR dye

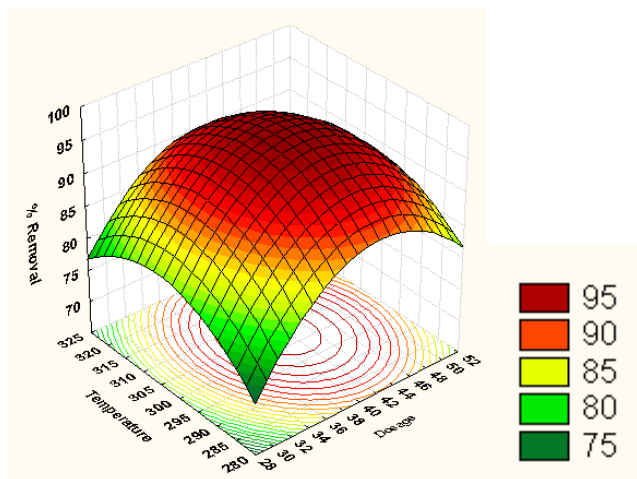


Figure 3.15. (f) Surface contour plot for the effects of Dosage and temperature on % biosorption of AR dye

### 3.10 Characterization of borassuspowder

#### 3.10.1 FTIR spectrum

##### 3.10.1 (a) FTIR spectrum of untreated Borassuspowder

FTIR measurements presented in Figure 3.16 (a) show the broad band at 3359.09 cm<sup>-1</sup> is due to -OH stretching or -NH<sub>2</sub> stretching. The band at 2926.24 cm<sup>-1</sup> denote the presence of CH<sub>2</sub> stretching vibrations. The band at 1733.52 cm<sup>-1</sup> suggests the presence of Assymetric stretching vibration of C = O. The band at 1645.93 cm<sup>-1</sup> is may be due to the Oleifinic C = C and Carbonyl C = O stretching. Amide N-H bending vibrations of C=O is due at 1515.30 cm<sup>-1</sup> band.

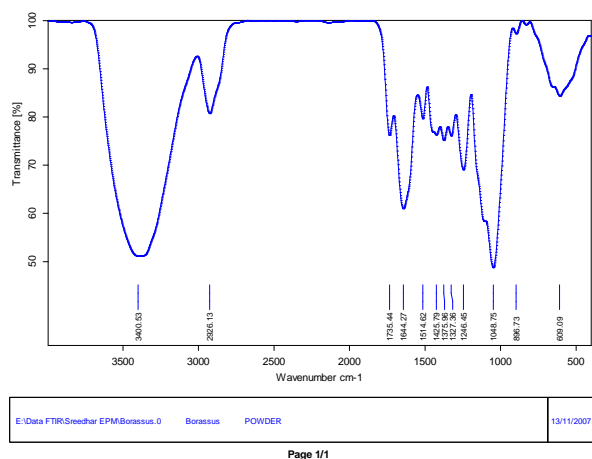


Figure 3.16. (a) FTIR spectrum of untreated Borassus powder

##### 3.10.1(b) FTIR spectrum of treated Borassus powder

FTIR spectrum for treated powder is shown in fig 3.16(b). Broad band at 3359.17 cm<sup>-1</sup> suggests -OH

stretching or -NH<sub>2</sub> stretching. The band at 2925.14 cm<sup>-1</sup> due to the presence of CH<sub>2</sub> stretching vibrations. The band at 1737.91 cm<sup>-1</sup> indicates the presence of Assymmetric stretching vibration of C = O arising from group such as lactone, quinine and carboxylic acids. The Oleifinic C = C and Carbonyl C = O stretching, respectively appear at 1648.17 cm<sup>-1</sup> band. The vibration at 1511.83 cm<sup>-1</sup> be attributed to Amide N-H bending vibrations. Comparing IR spectra of Borassus before & after biosorption, the biosorption bands shifted to higher values. These shifts may be attributed to the changes in counter ions associated with carboxylate and hydroxyate anions. This indicates that the main contributors in dye uptake are may be acidic groups, carboxyl and hydroxyl groups [75-79].

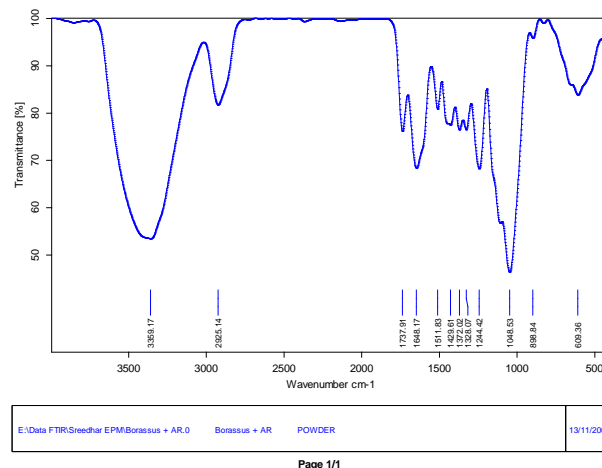


Figure 3.16 (b) FTIR spectrum of treated Borassus powder

Table 9. Shift of FTIR peaks for untreated and Borassus powder treated AR dye

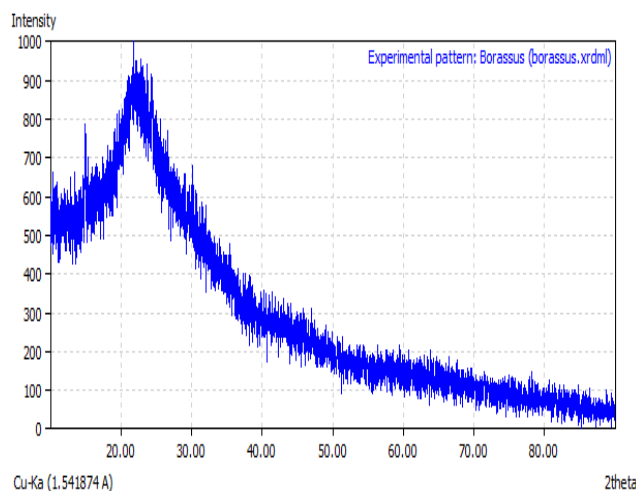
S. No.	Peaks in untreated powder, cm <sup>-1</sup>	Peaks in treated powder, cm <sup>-1</sup>	Description
1	---	609.36	2,4 benzene deformation out of phase
2	609.57	---	2,4 benzene deformation out of phase
3	---	898.84	S = O and C-S-O

			bands from ester sulphonate		---	3359.17	-OH stretching or -NH <sub>2</sub> stretching
4	---	1048.53	C-H bending vibrations				
5	1049.60	---	C-H bending vibrations				
6	---	1244.42	-SO <sub>3</sub> stretching				
7	1244.85	---	-SO <sub>3</sub> stretching				
8	1328.07	1328.07	-CH <sub>2</sub> bending vibrations				
9	---	1372.02	-CH <sub>2</sub> bending vibrations				
10	1374.49	---	-CH <sub>2</sub> bending vibrations				
11	1426.39	---	C-N stretching				
12	---	1429.61	C-N stretching				
13	---	1511.83	Amide N-H bending vibrations				
14	1515.30	---	Amide N-H bending vibrations				
15	1645.93	---	Olefinic C = C and Carbonyl C = O stretching				
16	---	1648.17	Olefinic C = C and Carbonyl C = O stretching				
17	1733.52	---	Assymmetric stretching vibration of C = O				
18	---	1737.91	Assymmetric stretching vibration of C = O				
19	---	2925.14	CH <sub>2</sub> stretching vibrations				
20	2926.24	---	CH <sub>2</sub> stretching vibrations				
21	3359.09	---	-OH stretching or -NH <sub>2</sub> stretching				

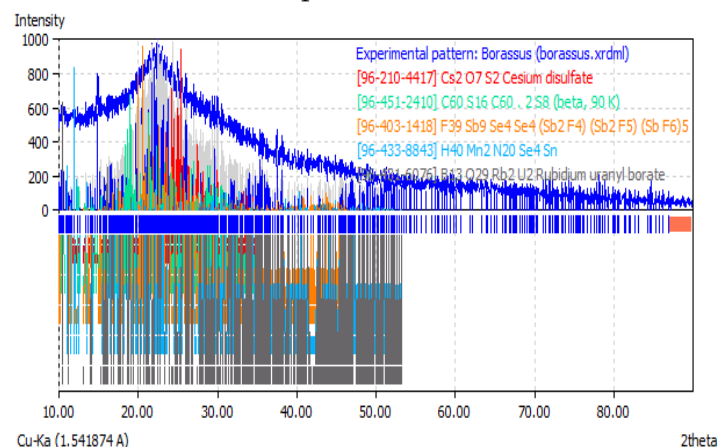
**3.10.2 XRD patterns**

**3.10.2 (a) X-Ray Diffraction for untreated Borassus powder**

XRD patterns shown in fig 3.17 (a) & (b) for untreated powder do not show very acute or keen and discrete peaks and exhibits minimum amorphous nature. The peaks at 2θ values of 0.3845, 0.6273, 0.5076, 0.6547 and 0.4937 corroborate the presence of NP<sub>3</sub>O<sub>13</sub>Se<sub>3</sub>, O<sub>2</sub>Si, Rb<sub>12</sub>Si<sub>17</sub>, AuCs and Al<sub>1.65</sub>Na<sub>1.65</sub>O<sub>4</sub>Si<sub>0.35</sub>. Their corresponding d-values are 4.1049, 4.2516, 3.8633, 3.0189 and 2.5648 [80-84].



**Figure 3.17. (a)** XRD pattern of untreated Borassus powder

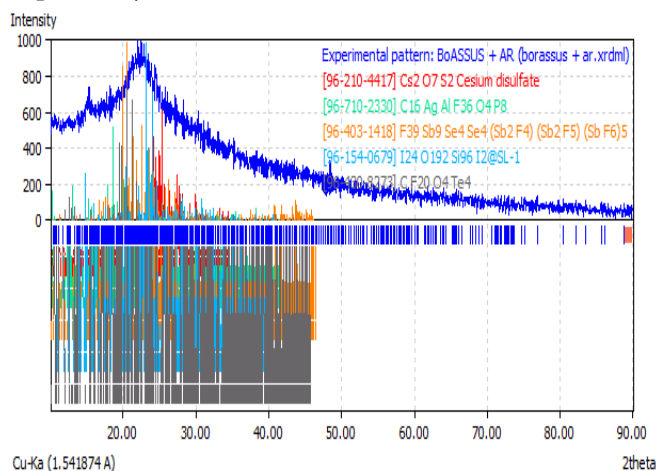


**Figure 3.17. (b)** XRD pattern of AR dye untreated Borassus powder with matching compounds



### 3.10.2 (b) X-Ray Diffraction for treated Borassus powder

XRD patterns of treated AR dye, shown in figs 3.17(c), show very spiky and clear peaks and exhibit absolutely amorphous nature. The peaks at  $2\theta$  values of 0.4584, 0.6664, 0.5909, 0.6593 and 0.6948 corroborate the presence of  $\text{Ni}(\text{HN}_2\text{S}_2)_2$ ,  $\text{O}_2\text{Si}$ ,  $\text{CCaO}_3$ ,  $\text{Cs}_{23}\text{O}_{14.15}$  and C (graphite). Their corresponding d-values are 1.8171, 2.2843, 3.0168, 2.9714 and 2.1314 respectively.



**Figure 3.17. (c)** XRD pattern of AR dye treated Borassus powder with matching compounds

### IV. CONCLUSION

1. The equilibrium agitation time for biosorption of AR dye is 40 min.
  2. The optimum dosage is 40 g/L
  3. % biosorption is increased upto pH = 4.
  4. The RSM optimized values are:  $w = 41.9207$  g/L,  $\text{pH} = 4.1354$ ,  $C_0 = 20.1222$  mg/L,  $T = 303.2657$  K and extent of biosorption = 96.79145%.
  5. The experimental data are well represented by Langmuir ( $R^2 = 0.9887$ ) and Temkin ( $R^2 = 0.9638$ ) isotherms.
  6. The kinetic studies show that the biosorption of AR dye is described by both first order ( $R^2 = 0.8686$ ) and pseudo second order kinetics ( $R^2 = 0.8932$ ).
- The thermodynamic investigation reveal the spontaneity of the process  $-\Delta G$  is negative (-

1202.6J/mole), irreversibility  $-\Delta S$  is positive (39.69356J/mole) and endothermic nature of biosorption  $-\Delta H$  is positive (14.5326J/mole).

### V. ACKNOWLEDGEMENT

The Author expresses his deep sense of gratitude to Andhra University and Department of Chemical Engineering for providing chemicals, equipment and laboratory facilities.

### VI. REFERENCES

- [1]. J.A.S. Tenorio, D.C.R. Espinosa, Treatment of chromium plating process effluents with ion exchange resins, *Waste Manage.* 21 (2001) 637–642.
- [2]. M.M. Matlock, B.S. Howerton, D.A. Atwood, Chemical precipitation of heavy metals from acid mine drainage, *Water Res.* 36 (2002) 4757–4764.
- [3]. L. Koene, L.J.J. Janssen, Removal of nickel from industrial process liquids, *Electrochem. Acta* 47 (2001) 695–703.
- [4]. Y. Benito, M.L. Ruiz, Reverse osmosis applied to metal finishing wastewater, *Desalination* 142 (2002) 229–234.
- [5]. B. Volesky, Z.R. Holan, Biosorption of heavy metals, *Biotechnol. Prog.* 11 (1995) 235–250.
- [6]. A. Kapoor, T. Viraraghavan, Fungal biosorption—an alternative treatment option for heavy metal bearing wastewaters: a review, *Bioresource Technol.* 53 (1995) 195–206.
- [7]. F. Veglio, F. Beolchini, Removal of metals by biosorption: a review, *Hydrometallurgy* 44 (1997) 301–316.
- [8]. S. Altenor, M.C. Ncibi, E. Emmanuel, S. Gaspard, "Textural characteristics, physiochemical properties and adsorption efficiencies of Caribbean alga *Turbinaria turbinata* and its derived carbonaceous materials for water treatment application", *Biochemical Engineering Journal* 67 (2012) 35–44

- [9]. Simeonova A, Godjevargova T, Ivanova D. Biosorption of heavy metals by dead *Streptomyces fradiae*. *Environ Eng Sci* 2008; 25:627–34.
- [10]. Han R, Li H, Li Y. Biosorption of copper and lead ions by waste beer yeast. *J Hazard Mater* 2006; 137:1569–76.
- [11]. Fu Y, Viraraghavan T. Dye biosorption sites in *Aspergillus niger*. *Bioresour Technol* 2002; 82:139–45.
- [12]. Asku Z, Donmez G. A comparative study on the biosorption characteristics of some yeast for Remazol Blue reactive dye. *Chemosphere* 2003; 50:1075–83.
- [13]. Calace N, Nardi E, Petronio BM. Adsorption of phenols by papermill sludges. *Environ Pollut* 2002; 118:315–9.
- [14]. Daughney CJ, Fein JB. Sorption of 2,4,6-trichlorophenol by *Bacillus subtilis*, *Environ Sci Technol* 1998;32:749–52.
- [15]. Lievreumont D, Seigle-murandi FB, Benoit-guyod JL. Removal of PCNB from aqueous solution by a fungal adsorption process. *Water Res* 1998; 32:3601–6.
- [16]. Vijayaraghavan K, Yun Y. Bacterial biosorbents and biosorption. *Biotechnol Adv* 2008; 26:266–91.
- [17]. Chattopadhyaya G, Macdonald DG, Bakhshi NN, Mohammadzadeh JSS, Dalai AK. Adsorptive removal of sulfur dioxide by saskatchewan lignite and its derivatives. *Fuel* 2006; 85:1803–10.
- [18]. Bashkova S, Bagreev A, Locke DC, Bandosz TJ. Adsorption of SO<sub>2</sub> on sewage sludge-derived materials. *Environ Sci Technol* 2001; 35:3263–9.
- [19]. Xu L, Guo J, Jin F, Zeng H. Removal of SO<sub>2</sub> from O<sub>2</sub>-containing flue gas by activated carbon fiber (ACF) impregnated with NH<sub>3</sub>. *Chemosphere* 2006;62: 823–6.
- [20]. Mangun CL, Debarr JA, Economy J. Adsorption of sulfur dioxide on ammoniatreated activated carbon fibers. *Carbon* 2001; 39:1689–96.
- [21]. Gaur V, Asthana R, Verma N. Removal of SO<sub>2</sub> by activated carbon fibers in the presence of O<sub>2</sub> and H<sub>2</sub>O. *Carbon* 2006; 44:46–60.
- [22]. Hameed, B. H., A. A. Ahmad, and N. Aziz. "Isotherms, kinetics and thermodynamics of acid dye adsorption on activated palm ash." *Chemical Engineering Journal* 133, no. 1-3 (2007): 195-203.
- [23]. Chuah, T. G., A. Jumariah, I. Azni, S. Katayon, and SY Thomas Choong. "Rice husk as a potentially low-cost biosorbent for heavy metal and dye removal: an overview." *Desalination* 175, no. 3 (2005): 305-316.
- [24]. Hameed, B. H., and A. A. Ahmad. "Batch adsorption of methylene blue from aqueous solution by garlic peel, an agricultural waste biomass." *Journal of hazardous materials* 164, no. 2-3 (2009): 870-875.
- [25]. Lorenc-Grabowska, Ewa, and Grazyna Gryglewicz. "Adsorption characteristics of Congo Red on coal-based mesoporous activated carbon." *Dyes and pigments* 74, no. 1 (2007): 34-40.
- [26]. Ahmad, Rais, and Rajeev Kumar. "Adsorption studies of hazardous malachite green onto treated ginger waste." *Journal of environmental management* 91, no. 4 (2010): 1032-1038.
- [27]. Mall, Indra Deo, Vimal Chandra Srivastava, Nitin Kumar Agarwal, and Indra Mani Mishra. "Adsorptive removal of malachite green dye from aqueous solution by bagasse fly ash and activated carbon-kinetic study and equilibrium isotherm analyses." *Colloids and Surfaces A: Physicochemical and Engineering Aspects* 264, no. 1-3 (2005): 17-28.
- [28]. Ofomaja, Augustine E. "Kinetic study and sorption mechanism of methylene blue and methyl violet onto mansonia (*Mansonia altissima*) wood sawdust." *Chemical Engineering Journal* 143, no. 1-3 (2008): 85-95.
- [29]. Mckay, Gordon, M. El Geundi, and M. M. Nassar. "Equilibrium studies during the removal

- of dyestuffs from aqueous solutions using bagasse pith." *Water research* 21, no. 12 (1987): 1513-1520.
- [30]. Vogel, R., P. Hoyer, and H. Weller. "Quantum-sized PbS, CdS, Ag<sub>2</sub>S, Sb<sub>2</sub>S<sub>3</sub>, and Bi<sub>2</sub>S<sub>3</sub> particles as sensitizers for various nanoporous wide-bandgap semiconductors." *The Journal of Physical Chemistry* 98, no. 12 (1994): 3183-3188.
- [31]. Annadurai, G., and M. R. V. Krishnan. "Adsorption of acid dye from aqueous solution by chitin: Equilibrium studies." (1997).
- [32]. Li, Yanhui, Qiju Du, Tonghao Liu, Xianjia Peng, Junjie Wang, Jiankun Sun, Yonghao Wang et al. "Comparative study of methylene blue dye adsorption onto activated carbon, graphene oxide, and carbon nanotubes." *Chemical Engineering Research and Design* 91, no. 2 (2013): 361-368.
- [33]. Mittal, Alok, Jyoti Mittal, Arti Malviya, Dipika Kaur, and V. K. Gupta. "Decoloration treatment of a hazardous triarylmethane dye, Light Green SF (Yellowish) by waste material adsorbents." *Journal of Colloid and Interface Science* 342, no. 2 (2010): 518-527.
- [34]. Alpat, Sibel Kılınç, ozge ozbayrak, Şenol Alpat, and Husamettin Akçay. "The adsorption kinetics and removal of cationic dye, Toluidine Blue O, from aqueous solution with Turkish zeolite." *Journal of hazardous materials* 151, no. 1 (2008): 213-220.
- [35]. Demirbas, E., M. Kobya, and M. T. Sulak. "Adsorption kinetics of a basic dye from aqueous solutions onto apricot stone activated carbon." *Bioresource technology* 99, no. 13 (2008): 5368-5373.
- [36]. Mittal, Atul K., and S. K. Gupta. "Biosorption of cationic dyes by dead macro fungus *Fomitopsis carnea*: batch studies." *Water science and technology* 34, no. 10 (1996): 81-87.
- [37]. Gulnaz, Osman, Aysenur Kaya, and Sadik Dincer. "The reuse of dried activated sludge for adsorption of reactive dye." *Journal of Hazardous Materials* 134, no. 1-3 (2006): 190-196.
- [38]. Aksu, Zumriye, and Gonul Donmez. "A comparative study on the biosorption characteristics of some yeasts for Remazol Blue reactive dye." *Chemosphere* 50, no. 8 (2003): 1075-1083.
- [39]. Lian, Lili, Liping Guo, and Chunjing Guo. "Adsorption of Congo red from aqueous solutions onto Ca-bentonite." *Journal of Hazardous Materials* 161, no. 1 (2009): 126-131.
- [40]. Mohammadi, Nourali, Hadi Khani, Vinod Kumar Gupta, Ehsanollah Amereh, and Shilpi Agarwal. "Adsorption process of methyl orange dye onto mesoporous carbon material—kinetic and thermodynamic studies." *Journal of colloid and interface science* 362, no. 2 (2011): 457-462.
- [41]. Daneshvar, N., H\_ Ashassi-Sorkhabi, and A. Tizpar. "Decolorization of orange II by electrocoagulation method." *Separation and purification Technology* 31, no. 2 (2003): 153-162.
- [42]. Oladoja, N. A., C. O. Aboluwoye, Y. B. Oladimeji, A. O. Ashogbon, and I. O. Otemuyiwa. "Studies on castor seed shell as a sorbent in basic dye contaminated wastewater remediation." *Desalination* 227, no. 1-3 (2008): 190-203.
- [43]. Yasin, Yamin, Mohd Zobir Hussein, and Faujan Hj Ahmad. "Adsorption of methylene blue onto treated activated carbon." *Malaysian Journal of analytical sciences* 11, no. 2 (2007): 400-406.
- [44]. ALzaydien, Atef S. "Adsorption of methylene blue from aqueous solution onto a low-cost natural Jordanian Tripoli." *American Journal of Applied Sciences* 6, no. 6 (2009): 1047.
- [45]. Hameed, B. H. "Removal of cationic dye from aqueous solution using jackfruit peel as non-conventional low-cost adsorbent." *Journal of hazardous materials* 162, no. 1 (2009): 344-350.

- [46]. Wang, Qi, Zhaokun Luan, Ning Wei, Jin Li, and Chengxi Liu. "The color removal of dye wastewater by magnesium chloride/red mud (MRM) from aqueous solution." *Journal of hazardous materials* 170, no. 2-3 (2009): 690-698.
- [47]. Lian, Lili, Liping Guo, and Chunjing Guo. "Adsorption of Congo red from aqueous solutions onto Ca-bentonite." *Journal of Hazardous Materials* 161, no. 1 (2009): 126-131.
- [48]. Mohammadi, Nourali, Hadi Khani, Vinod Kumar Gupta, Ehsanollah Amereh, and Shilpi Agarwal. "Adsorption process of methyl orange dye onto mesoporous carbon material—kinetic and thermodynamic studies." *Journal of colloid and interface science* 362, no. 2 (2011): 457-462.
- [49]. Ho, Yuh-Shan, Chun-Chiao Chiang, and Yung-Chien Hsu. "Sorption kinetics for dye removal from aqueous solution using activated clay." *Separation Science and Technology* 36, no. 11 (2001): 2473-2488.
- [50]. Alkan, Mahir, ozkan Demirbaş, Sermet Celikcapa, and Mehmet Dogan. "Sorption of acid red 57 from aqueous solution onto sepiolite." *Journal of Hazardous Materials* 116, no. 1-2 (2004): 135-145.
- [51]. McKay, Gordon. "Adsorption of dyestuffs from aqueous solutions with activated carbon I: Equilibrium and batch contact-time studies." *Journal of chemical technology and biotechnology* 32, no. 7-12 (1982): 759-772.
- [52]. Gimbert, Frédéric, Nadia Morin-Crini, François Renault, Pierre-Marie Badot, and Grégorio Crini. "Adsorption isotherm models for dye removal by cationized starch-based material in a single component system: error analysis." *Journal of Hazardous Materials* 157, no. 1 (2008): 34-46.
- [53]. Xue, Yongjie, Haobo Hou, and Shujing Zhu. "Adsorption removal of reactive dyes from aqueous solution by modified basic oxygen furnace slag: isotherm and kinetic study." *Chemical Engineering Journal* 147, no. 2-3 (2009): 272-279.
- [54]. Ho, Y. S., and C. C. Wang. "Pseudo-isotherms for the sorption of cadmium ion onto tree fern." *Process Biochemistry* 39, no. 6 (2004): 761-765.
- [55]. Porter, J. F., G. McKay, and K. H. Choy. "The prediction of sorption from a binary mixture of acidic dyes using single-and mixed-isotherm variants of the ideal adsorbed solute theory." *Chemical Engineering Science* 54, no. 24 (1999): 5863-5885.
- [56]. Sivaraj, Rajeshwari, C. Namasivayam, and K. Kadirvelu. "Orange peel as an adsorbent in the removal of acid violet 17 (acid dye) from aqueous solutions." *Waste management* 21, no. 1 (2001): 105-110.
- [57]. Walker, G. M., L. Hansen, J-A. Hanna, and S. J. Allen. "Kinetics of a reactive dye adsorption onto dolomitic sorbents." *Water Research* 37, no. 9 (2003): 2081-2089.
- [58]. Tan, I. A. W., B. H. Hameed, and A. L. Ahmad. "Equilibrium and kinetic studies on basic dye adsorption by oil palm fibre activated carbon." *Chemical Engineering Journal* 127, no. 1-3 (2007): 111-119.
- [59]. Al-Ghouti, M., M. A. M. Khraisheh, M. N. M. Ahmad, and S. Allen. "Thermodynamic behaviour and the effect of temperature on the removal of dyes from aqueous solution using modified diatomite: a kinetic study." *Journal of Colloid and Interface Science* 287, no. 1 (2005): 6-13.
- [60]. Hameed, B. H., A. A. Ahmad, and N. Aziz. "Isotherms, kinetics and thermodynamics of acid dye adsorption on activated palm ash." *Chemical Engineering Journal* 133, no. 1-3 (2007): 195-203.
- [61]. Wang, Li, Jian Zhang, Ran Zhao, Cong Li, Ye Li, and Chenglu Zhang. "Adsorption of basic dyes on activated carbon prepared from *Polygonum orientale* Linn: equilibrium, kinetic and

- thermodynamic studies." *Desalination* 254, no. 1-3 (2010): 68-74.
- [62]. Kyzas, George Z., Nikolaos K. Lazaridis, and Athanassios Ch Mitropoulos. "Removal of dyes from aqueous solutions with untreated coffee residues as potential low-cost adsorbents: Equilibrium, reuse and thermodynamic approach." *Chemical engineering journal* 189 (2012): 148-159.
- [63]. Wang, Lianggui. "Application of activated carbon derived from 'waste'bamboo culms for the adsorption of azo disperse dye: Kinetic, equilibrium and thermodynamic studies." *Journal of Environmental Management* 102 (2012): 79-87.
- [64]. Boparai, Hardiljeet K., Meera Joseph, and Denis M. O'Carroll. "Kinetics and thermodynamics of cadmium ion removal by adsorption onto nano zerovalent iron particles." *Journal of hazardous materials* 186, no. 1 (2011): 458-465.
- [65]. El-Latif, MM Abd, Amal M. Ibrahim, and M. F. El-Kady. "Adsorption equilibrium, kinetics and thermodynamics of methylene blue from aqueous solutions using biopolymer oak sawdust composite." *J. Am. Sci* 6, no. 6 (2010): 267-283.
- [66]. Kayranli, Birol. "Adsorption of textile dyes onto iron based waterworks sludge from aqueous solution; isotherm, kinetic and thermodynamic study." *Chemical Engineering Journal* 173, no. 3 (2011): 782-791.
- [67]. Alslaibi, Tamer M., Ismail Abustan, Mohd Azmier Ahmad, and Ahmad Abu Foul. "Application of response surface methodology (RSM) for optimization of Cu<sup>2+</sup>, Cd<sup>2+</sup>, Ni<sup>2+</sup>, Pb<sup>2+</sup>, Fe<sup>2+</sup>, and Zn<sup>2+</sup> removal from aqueous solution using microwaved olive stone activated carbon." *Journal of Chemical Technology and Biotechnology* 88, no. 12 (2013): 2141-2151.
- [68]. Kafshgari, Leila Asadi, Mohsen Ghorbani, Asghar Azizi, Shilpi Agarwal, and Vinod Kumar Gupta. "Modeling and optimization of Direct Red 16 adsorption from aqueous solutions using nanocomposite of MnFe<sub>2</sub>O<sub>4</sub>/MWCNTs: RSM-CCRD model." *Journal of Molecular Liquids* 233 (2017): 370-377.
- [69]. Pi, Ke-Wu, Qu Xiao, Hui-Qin Zhang, Min Xia, and Andrea R. Gerson. "Decolorization of synthetic methyl orange wastewater by electrocoagulation with periodic reversal of electrodes and optimization by RSM." *Process safety and environmental protection* 92, no. 6 (2014): 796-806.
- [70]. Remenarova, Lucia, Martin Pipiska, Eva Florkova, Miroslav Hornik, Marian Rozložnik, and Jozef Augustin. "Zeolites from coal fly ash as efficient sorbents for cadmium ions." *Clean Technologies and Environmental Policy* 16, no. 8 (2014): 1551-1564.
- [71]. Ahmady-Asbchin, Salman, Reza Tabaraki, Naser Jafari, Abdollah Allahverdi, and Ashkan Azhdehakoshpour. "Study of nickel and copper biosorption on brown algae *Sargassum angustifolium*: application of response surface methodology (RSM)." *Environmental technology* 34, no. 16 (2013): 2423-2431.
- [72]. Khatri, Rajesh A., Steven SC Chuang, Yee Soong, and McMahan Gray. "Carbon dioxide capture by diamine-grafted SBA-15: A combined Fourier transform infrared and mass spectrometry study." *Industrial & Engineering Chemistry Research* 44, no. 10 (2005): 3702-3708.
- [73]. Bhargava, Rohit. "Towards a practical Fourier transform infrared chemical imaging protocol for cancer histopathology." *Analytical and bioanalytical chemistry* 389, no. 4 (2007): 1155-1169.
- [74]. Wahab, Mohamed Ali, Salah Jellali, and Naceur Jedidi. "Ammonium biosorption onto sawdust: FTIR analysis, kinetics and adsorption isotherms modeling." *Bioresource Technology* 101, no. 14 (2010): 5070-5075.
- [75]. Thistlethwaite, P. J., and M. S. Hook. "Diffuse reflectances Fourier transform infrared study of

- the adsorption of oleate/oleic acid onto titania." *Langmuir* 16, no. 11 (2000): 4993-4998.
- [76]. Wang, Yan, Koichi Murayama, Yoshiki Myojo, Roumiana Tsenkova, Nobuyuki Hayashi, and Yukihiro Ozaki. "Two-dimensional Fourier transform near-infrared spectroscopy study of heat denaturation of ovalbumin in aqueous solutions." *The Journal of Physical Chemistry B* 102, no. 34 (1998): 6655-6662.
- [77]. Qu, Lianhua, and Xiaogang Peng. "Control of photoluminescence properties of CdSe nanocrystals in growth." *Journal of the American Chemical Society* 124, no. 9 (2002): 2049-2055.
- [78]. Huang, Chih-Hung, Kai-Ping Chang, Hong-De Ou, Yu-Chun Chiang, E-E. Chang, and Chu-Fang Wang. "Characterization and application of Ti-containing mesoporous silica for dye removal with synergistic effect of coupled adsorption and photocatalytic oxidation." *Journal of hazardous materials* 186, no. 2-3 (2011): 1174-1182.
- [79]. Wang, Guoxiu, Juan Yang, Jinsoo Park, Xinglong Gou, Bei Wang, Hao Liu, and Jane Yao. "Facile synthesis and characterization of graphene nanosheets." *The Journal of Physical Chemistry C* 112, no. 22 (2008): 8192-8195.
- [80]. Liu, Wen, Ting Wang, Alistair GL Borthwick, Yanqi Wang, Xiaochen Yin, Xuezhao Li, and Jinren Ni. "Adsorption of Pb<sup>2+</sup>, Cd<sup>2+</sup>, Cu<sup>2+</sup> and Cr<sup>3+</sup> onto titanate nanotubes: Competition and effect of inorganic ions." *Science of the Total Environment* 456 (2013): 171-180.
- [81]. Zhang, Xi, Lizhi Zhang, Tengfeng Xie, and Dejun Wang. "Low-temperature synthesis and high visible-light-induced photocatalytic activity of BiOI/TiO<sub>2</sub> heterostructures." *The Journal of Physical Chemistry C* 113, no. 17 (2009): 7371-7378.
- [82]. Liang Lva, Jing Hea, Min Weia, D.G. Evansa, Xue Duan, "Uptake of chloride ion from aqueous solution by calcined layered double hydroxides: equilibrium and kinetic studies", *Water Research*, 40:4, 2006, 735-743.
- [83]. Gupta V.K and Rastogi A, "Biosorption of SCB dye from aqueous solutions by green algae spirogyra species: Kinetics and equilibrium studies", *Journal of Hazardous Materials*, 152: 2008, 407-414.
- [84]. Flavio A. Pavan, Ana C. Mazzocato, Rosangela A. Jacques, Silvio L.P. Dias, "Ponkan peel A potential biosorbent for removal of Pb(II) ions from aqueous solution", *Biochemical Engineering Journal*, 40: 2008, 357-362.

# Diagnosis of X-Ray Using Gabor Wavelet Transform

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## ABSTRACT

The bone fracture is common problem in human beings due to accident or other causes like bone cancer etc. The fracture can occur in any bone of our body like wrist, heel, ankle, hip, rib, leg, chest etc. It is not possible to view fractures by naked eyes, so X-ray/CT images are used to detect it. But sometimes these images lack sufficient details needed to diagnose. Now a day's image processing is playing an important role in bone fracture detection. Image processing is important in modern data storage and data transmission especially in progressive transmission of images, video coding (teleconferencing), digital libraries, image database, and remote sensing. This paper presents a study of image processing techniques for bone fracture detection. This paper will help user to study different methods for bone fracture detection using image processing and to design new techniques to improve accuracy of fracture detection. Wavelets have been widely used in signal and image processing. Wavelet transforms have been successfully applied to many topics including tomography reconstruction, image compression, noise reduction, image enhancement, texture analysis, segmentation, multiscale registration. This paper also presents technologies used to implement image processing based system for fracture detection with pros and cons.

**Keywords:** X-rays, CT Images, Tomography.

## I. INTRODUCTION

The fracture can be defined as crack in bone or break in a bone. Proteins, fibres and minerals form a bone of our body. Number of bones are joined together to form a skeleton of the body. Support to the body shape, protection to the organ of body is provided by skeleton. Bones helped to produce red blood cells. With help of bones we can run, jump, kneel, and lift. Bones also protect our internal organs from the damage. Various shape, size and structure of bone occur in human body. Femur bones are the largest bones and auditory bones are the smallest bones. Different types of bone occurs as oblique, compound, spiral, greenstick and important. X-rays and detection combined to walk, seat, fractures transverse. To identify such a different types bone fractures different medical imaging tools are used such as X-rays, CT

(computed tomography) images, MRI (Magnetic Resonance Imaging), ultrasonic, etc. Most commonly used technique are X images in fracture detection. These techniques provide easiest way to diagnosis. For existence and location of fracture, doctors usually use X-rays, broken bones are very common.

In X-rays, there are three types of different intensities can be occur such as background, bones, and fractured region in region we can identified the fracture region using pixel classifications. In this section we can determine the actual length of the fracture. The calculated result will be applied with fuzzy logics. To apply fuzzy logics there are different fuzzy rules by which we can calculate the actual result. The obtained result will be analysed with the previous observations. In this way we can obtain the different result for different images as input taken into considerations.

Wavelet transforms and other multi-scale analysis functions have been used for compact signal and image representations in de-noising, compression and feature detection processing problems for about twenty years. Numerous research works have proven that space-frequency and space-scale expansions with this family of analysis functions provided a very efficient framework for signal or image data. The wavelet transform itself offers great design flexibility. We will introduce the wavelet multi-scale analysis framework and summarize related research work in this area and describe recent state-of-the-art techniques.

## II. PROPOSED SYSTEM

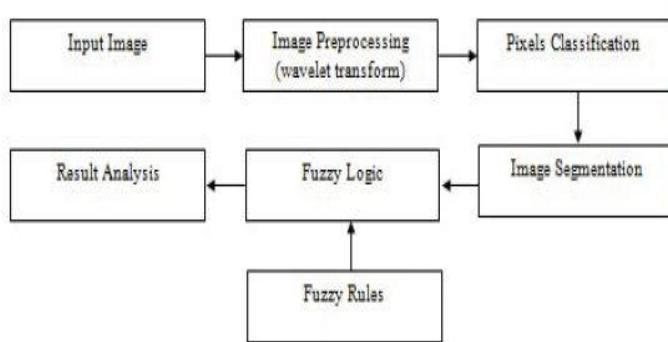


Figure 1. Block diagram

The X-Rays /CT images are obtained from the hospital that contains normal as well as fractured bone images. In the first step applying pre-processing techniques such as RGB to gray scale conversion. The image enhancement can be obtained by removing noise from the image. Then image classification can be done so as to separate background, ROI (region of interest) and infected pixels. Then infected pixels get marked. Then this images will be compared with the given data base and result is calculated by applying fuzzy logic to it.

Image pre- processing usually consists of an application-dependent technique for enhancing preselected features or for removing irrelevant detail. Most image processing techniques which have been applied to biomedical situations have been found to be very application dependent.. The pre-processing

techniques are designed to enhance selected features and eliminate irrelevant data. The feature extraction techniques are designed to extract specified, application-dependent information from a digitalized radiographic image. In this paper for pre-processing Gabor wavelet transform is used. The detail of Gabor wavelet transform is given as follows.

### Fundamentals of Gabor wavelet transform:

The Fourier transform has been the most commonly used tool for analyzing frequency properties of a given signal, while after transformation, the information about time is lost and it's hard to tell where a certain frequency occurs. To solve this problem, we can use kinds of time-frequency analysis techniques learned from the course [3] to represent a 1-D signal in time and frequency simultaneously. There is always uncertainty between the time and the frequency resolution of the window function used in this analysis since it is well know that when the time duration get larger, the bandwidth becomes smaller. Several ways have been proposed to find the uncertainty bound, and the most common one is the multiple of the standard deviations on time and frequency domain:

$$\sigma_t^2 = \int t^2 |x(t)|^2 dt / \int |x(t)|^2 dt, \sigma_f^2 = \int f^2 |X(f)|^2 df / \int |X(f)|^2 df \quad (1)$$

$$\sigma_t \times \sigma_f \geq 14\pi \quad (2)$$

Among all kinds of window functions, the Gabor function is proved to achieve the lower bound and performs the best analytical resolution in the joint domain [4]. This function is a Gaussian modulated by a sinusoidal signal and shown below:

$$\varphi(t) = \exp\left[-\frac{\alpha^2}{2} t^2\right] \exp\left[j2\pi f_0 t\right] \quad (3)$$

$$\Phi(f) = \pi \alpha^2 \exp\left[-\frac{\pi^2}{2\alpha^2} (f - f_0)^2\right] \quad (4)$$

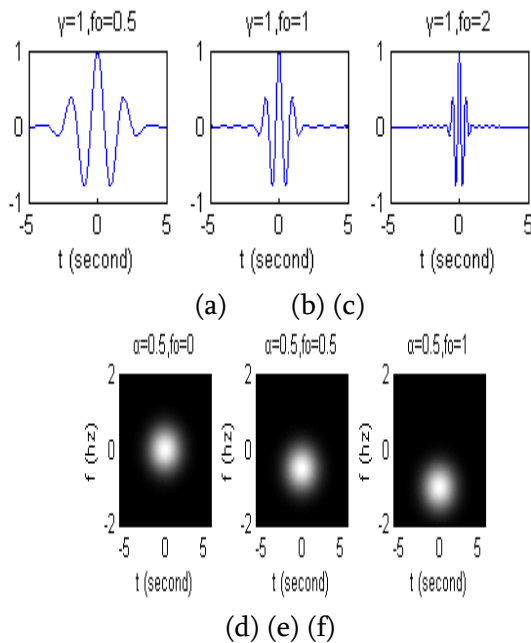
Where  $\alpha$  determines the sharpness and  $f_0$  the is modulated center frequency of , and  $\Phi f$  is its Fourier transform. Fig.1 shows the example of  $\varphi(t)$  with three different  $f_0$  but the same  $\alpha$  and their time-frequency



analysis by Gabor transform. These three distributions have the same area but don't meet the multi-resolution requirement: the window size should depend on the center frequency. To achieve this requirement, we substitute  $a$  with  $f_0/\gamma$ , where  $\gamma$  is an self-defined constant, and make the time duration of  $\varphi t$  dependent on the central frequency  $f_0$ . The generalized  $\varphi t$  with normalization of the maximum response in frequency domain is now defined as:

$$\varphi t = |f_0| \gamma \pi \exp\left\{i\pi(f_0 \gamma^2 t^2)\right\} \exp\left\{i\pi(j 2 \pi f_0 t)\right\} \quad (5)$$

Fig.2 shows the example of this new-defined  $\varphi t$  with three different  $f_0$  but the same  $\alpha$  and their time-frequency analysis by Gabor transform.



**Figure 2.** Example of  $\varphi t$  with three different  $f_0=0,0.5,$ and  $1$  but the same  $\alpha=0.5$  and their time-frequency analysis by Gabor transform, where (a)-(c) show the real part of  $\varphi t$  and (d)-(f) show the magnitude of the Gabor transform of  $\varphi t$  .

This 1-D Gabor function could be extended into 2-D form and also achieve the lower bound of uncertainty principle [5]. This 2-D Gabor function is defined as [2]:

$$\varphi x, = f 2 \pi \gamma \eta \exp\left\{i\pi\left(-\left(f^2 \gamma^2 x r^2 + f^2 \eta^2 y r^2\right)\right)\right\} \exp\left\{i\pi\left(j 2 \pi f x r\right)\right\} \quad (6)$$

$$x r = x \cos \theta + y \sin \theta, y r = -x \sin \theta + y \cos \theta$$

where  $f$  is the frequency of the modulating sinusoidal plane wave and  $\theta$  is the orientation of the major axis of the elliptical Gaussian. The 2-D Fourier transform of  $\varphi x$ , is shown below:

$$\Phi u, = \exp\left\{i\pi\left(-\pi^2\left(\gamma^2 f^2 u r - f^2 + \eta^2 f^2 v r\right)\right)\right\} \quad (7)$$

$$u r = u \cos \theta + v \sin \theta, v r = -u \sin \theta + v \cos \theta$$

In practical cases, the Gabor wavelet is used as the discrete wavelet transform with either continuous or discrete input signal, while there is an intrinsic disadvantage of the Gabor wavelets which makes this discrete case beyond the discrete wavelet constraints: the 1-D and 2-D Gabor wavelets do not have orthonormal bases. If a set of wavelets has orthonormal bases, the inverse transform could be easily reconstructed by a linear superposition, and we say this wavelet transform provides a complete representation. The nonorthonormal wavelets could

$$MSE = \frac{\sum_{i=1}^M \sum_{j=1}^N (x(i, j) - y(i, j))^2}{MN}$$

provide a complete representation only when they form a frame [1]. The concepts of the frame is beyond the scope of this report because it's too theoretical, while in most of the applications, we don't really care about these nonorthonormal properties if the Gabor wavelets are used for feature extractions. When extracting features for pattern recognition, retrieval, or computer vision purpose, the transformed coefficients are used for distance measure or compressed representation but not for reconstruction, so the orthogonal constraint could be omitted.

$$NC = \frac{\sum_{i=1}^M \sum_{j=1}^N (x(i, j) * y(i, j))}{\sum_{i=1}^M \sum_{j=1}^N (x(i, j))^2}$$

### III. ANALYSIS

#### A. Analysis with respect to PSNR value, MSE, NC and Time Constraint

$$AD = \frac{1}{MN} \sum_{i=1}^M \sum_{j=1}^N (x(i, j) - y(i, j))$$

**Peak signal-to-noise ratio (PSNR):** It is an expression for the ratio between the maximum possible value (power) of a signal and the power of distorting noise that affects the quality of its representation. Because many signals have a very wide dynamic range, (ratio between the largest and smallest possible values of a changeable quantity) the PSNR is usually expressed in terms of the logarithmic decibel scale. PSNR is most commonly used to measure the quality of reconstruction of lossy compression codecs. The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codecs, PSNR is an approximation to human perception of reconstruction quality. Although a higher PSNR generally indicates that the reconstruction is of higher quality, in some cases it may not be. One has to be extremely careful with the range of validity of this image; it is only conclusively valid when it is used to compare results from the same codec (or codec type) and same content PSNR can be calculated as,  $PSNR=10 \log 255^2$

**Mean Square Error (MSE):** It measures the average of the square of the error. The error is the amount by which the pixel value of original image differs from the pixel value of decrypted image.

**Normalized Correlation (NC):** It measures the similarity representation between the original image and decrypted image.

**B. Analysis with respect to AD value, MD, NAE and SC:**

**Average Difference (AD):** Average Difference is measurement of differences between two images. Here we calculated the average difference by the formula given. As we know that large value of maximum difference means that image is poor in quality.

**Maximum Difference (MD):** Difference between any two pixels such that the larger pixel appears after the smallest pixel. As we know that large value of

maximum difference means that image is poor in quality. MD is defined as.

$$MD = \text{MAX } |x(i, j) - y(I, j)|$$

$$NAE = \frac{\sum_{m=1}^M \sum_{n=1}^N |x(m, n) - y(m, n)|}{\sum_{m=1}^M \sum_{n=1}^N |x(m, n)|}$$

**Normalized Absolute Error (NAE):** The large value of normalized absolute error means that image is poor quality. NAE is defined as

**Structural Content (SC):** The structural content measure used to compare two images in a number of small image patches the images have in common. The patches to be compared are chosen using 2D continuous wavelet which acts as a low level corner detector. As we know that large value of structural content SC means that image is poor quality. SC is defined as,

$$SC = \frac{\sum_{i=1}^M \sum_{j=1}^N (y(i, j))^2}{\sum_{i=1}^M \sum_{j=1}^N (x(i, j))^2}$$

**IV. RESULT**

The graphical user interface will be appearing as shown in fig a. It consist of various blocks such as menu, infected region and analysis section. The input image will be displayed as shown in fig b. This input image need to pre-process so as to remove the noise and enhance the features of image. The pre-process image will be appearing as shown in fig c. The region of interest will be found by applying different algorithm to it and then fractured area will crop as shown in fig e. If the pattern of fracture image is not same then it will be added to the database. The result analysis will be obtained as shown in figure f.

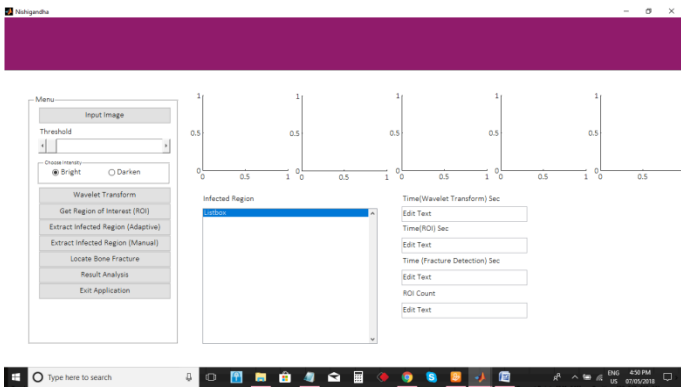


Figure 3a. Graphical User Interface

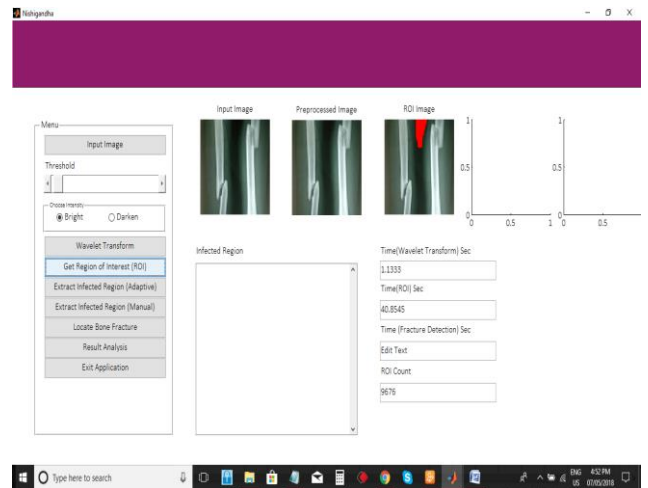


Figure 3d. ROI Image

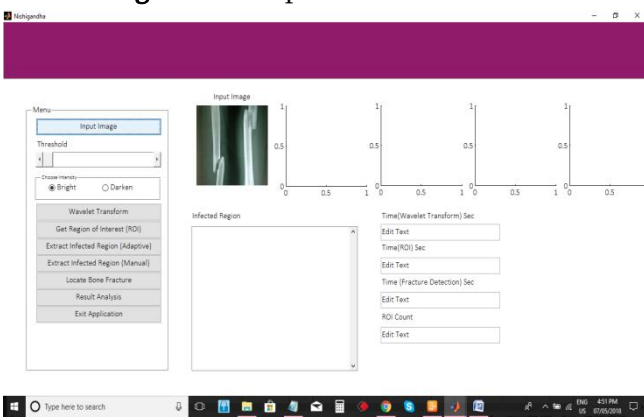


Figure 3b. Input Image

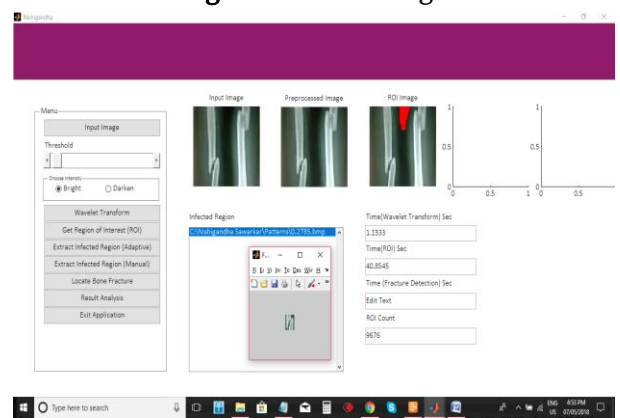


Figure 3e. Infected Region Crop

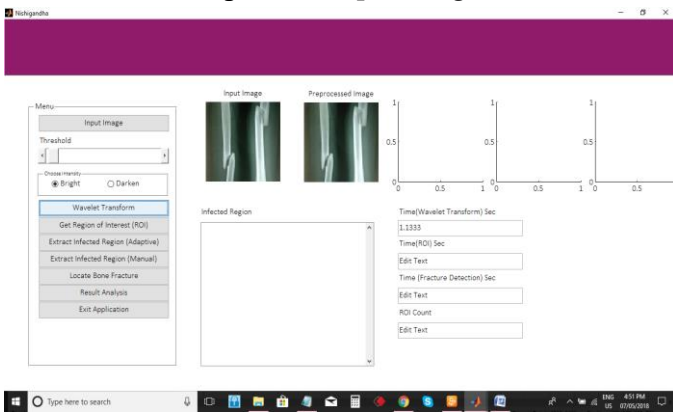


Figure 3c. Image Pre-Processing Using Gabor Wavelet Transform.

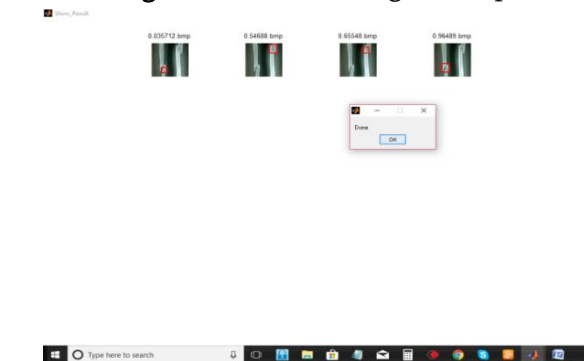


Figure 3f. Bone Fracture Detection

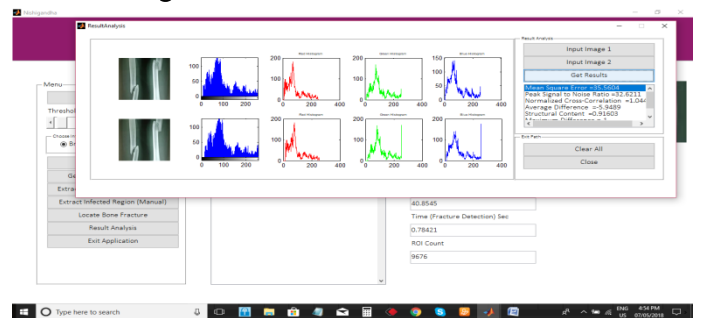


Figure 3g. Result Analysis

## V. CONCLUSION

A computer based analysis techniques for the detection of bone fracture using X-ray images has been presented in this work. It starts from the pre-processing to remove the noise and enhancing brightness of the image by using the Gabor wavelet transform the pixelization of the image is done. Segmentation will be done and we get the expected outcomes. This system also can be used for eye image diagnosis and MRI images too.

## VI. REFERENCES

- [1]. Chan, K.-P., Fu, A. W.-C. (1999). Efficient time series matching by wavelets. Data Engineering. In: Proceedings, 15th International Conference on, p. 126– 133. IEEE.
- [2]. Lim, S. E., Xing, Y., Chen, Y., Leow, W. K., Howe, T. S., Png, M. A. (2004). Detection of femur and radius fractures in x-ray images. In: Proc. 2nd Int. Conf. on Advances in Medical Signal and Info. Proc.
- [3]. Yap, D. W.-H., Chen, Y., Leow, W. K., Howe, T. S., Png, M. A. (2004). Detecting femur fractures by texture analysis of trabeculae. In Pattern Recognition. ICPR. In: Proceedings of the 17th International Conference on, 3, p. 730–733. IEEE.
- [4]. Lum, V. L. F., Leow, W. K., Chen, Y., Howe, T. S., Png, M. A. (2005). Combining classifiers for bone fracture detection in x-ray images. In: Image Processing. ICIP. IEEE International Conference on, 1, p. I-1149. IEEE.
- [5]. Al-Khaffaf, H., Talib, A. Z., Salam, R. A. (2008). Removing salt-and-pepper noise from binary images of engineering drawings. In: Pattern Recognition. ICPR. 19th International Conference on, p. 1–4. IEEE.
- [6]. Aishwariya, R., Geetha, M.Kalaiselvi. and Archana, M. “Computer- Aided Fracture Detection Of X-Ray Image”,
- [7]. Vijaykumar, V., Vanathi, P., Kanagasabapathy, P. (2010). Fast and efficient algorithm to remove gaussian noise in digital images. IAENG International Journal of Computer Science, 37(1).
- [8]. Chai, H. Y., Wee, L. K., Swee, T. T., Hussain, S. (2011). Glcm based adaptive crossed reconstructed (acr) k-mean clustering hand bone segmentation. p. 192–197.
- [9]. S.K.Mahendran, S.Santhosh Baboo. An Enhanced Tibia Fracture Detection Tool Using Image Processing and Classification Fusion Techniques in X-Ray Images. In Global Journal of Computer Science and Technology Volume 11 Issue 14 Version 1.0 August 2011
- [10]. Anu T C, Mallikarjunaswamy M.S Rajesh Raman.(2012) Detection of Bone Fracture using Image Processing Methods. In International Journal of Computer Applications (0975 – 8887)
- [11]. Sachin R.Mahajan, P.H.Zope,S.R.Suralkar. Review of An Enhance Fracture Detection Algorithm Design Using XRays Image Processing. International Journal of Innovative Research in Science, Engineering and Technology, Vol. 1, Issue 2, December 2012.
- [12]. Hao, S., Han, Y., Zhang, J., Ji, Z. (2013). Automatic isolation of carpal-bone in hand x-ray medical image. In Informatics and Management Science I, p. 657–662. Springer
- [13]. Mahmoud Al-Ayyoub, Ismail Hmeidi, Haya Rababah. Detecting Hand Bone Fractures in X-Ray Images. Journal of Multimedia Processing and Technologies Volume 4 Number 3 September 2013.
- [14]. Swathika.B1, Anandhanarayanan.K, Baskaran.B, and Govindaraj.R.Radius Bone Fracture Detection Using Morphological Gradient Based Image Segmentation Technique.
- [15]. Chokkalingam, SP. and Komathy, K. (2014). —Intelligent Assistive Methods for Diagnosis of Rheumatoid Arthritis Using Histogram Smoothing and Feature Extraction of Bone

Images. World Academy of Science, Engineering and Technology International Journal of Computer Information Systems and Control Engineering, Vol. 8, Issue .5, pp.834-843.

- [16]. Rathode, Hs. and Ali, Wahid. (2015), —MRI Brain Image Quantification Using artificial neural networks – A Review Report, ISOI Journal of Engineering and Computer science, Vol. 1, Issue No. 1, pp. 48-55. (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (2) , 2015, 1616-1619 .
- [17]. Tanudeep Kaur , Anupam Garg.(2016) Bone Fraction Detection using Image Segmentation. International Journal of Engineering Trends and Technology (IJETT) – Volume 36 Number 2- June 2016.

# A Passenger Bus Alert and Accident System for Blind Person Navigational

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## ABSTRACT

In today's environment when everything is Travel Bus information is a vital component of many intelligent transportation systems (ITS) applications. In recent years, the number of vehicles in India has increased tremendously, leading to severe traffic congestion and pollution in urban areas, particularly during peak periods. A desirable strategy to deal with such issues is to shift more people from personal vehicles to public transport by providing better service (comfort, convenience and so on). The scope of this proposed system is to use speech recognition system for user selected destination entry, and voice module for making announcements about the arrival details. The performance of the proposed system is found to be promising and expected to be valuable in the development of advanced public transportation systems (APTS) in India. The main advantage of this device is to provide bus alerting system for easy navigation i.e. the user gets the voices which pronounce the bus details along with destination alerts. The system also supports with another protection feature for blind, when any sudden accidents occur which is detected using MEMS accelerometer sensor and sends location global positioning system based alerts to the predefined concern person in the form of SMS messages. As Speech is the primary and most convenient means of communication between humans it aims to provide a review based on the design of a new voice based alerting system for the blind based on Speech recognition system and voice circuit for voice based announcements.

**Keywords:** GPS, Blind navigation, GSM, Wireless Communication XBee.

## I. INTRODUCTION

Each visually impaired faces its own daily challenges. Since they have difficulty to sense what happens around them, this compromises a series of activities such as learning, and especially locomotion. If they need to use public transportation, the challenge becomes even greater. In addition, they depend on the good will of other people around them to locate the public transport vehicle. Most of time they don't even know if they are on a bus stop. To give more comfort and quality of life for these people to use public transportation, it is necessary to research and develop systems that might help them to localize and use the

public transport service independently, like ordinary person.



Figure 1

## II. BACKGROUND OVERVIEW

### A. Existing System

Conventional solutions that can be used by people with visual impairment are the use of cane, personal guide and guide dog. In the public transport, only the last 2 solutions help the blind person to get around more safely. However, both have high costs. The WHO estimates that 90% of people with visual disabilities live in low-income situation. So, the systems and solutions must be low cost, accessible to all people in this group, with easy operation. Several systems have been proposed over the years.

### B. Drawbacks of Existing System

- Manual operation
- Monitoring depends on driver
- Less Alert system
- Unsafe for others
- Short range
- Less accuracy

### C. Aim & Objective

Many of them involve electronic systems using Wireless Sensor Networks and/or communication via GPS for localization. The main aim of the project is to design a voice based alerting system for the blind based on Speech recognition system and voice circuit for voice based announcements.

### D. Proposed System

The proposed system consists of two sections.

- (i) Passenger section
- (ii) Bus section

This system which is with passenger or physically disabled person consists of PIC microcontroller which is interfaced with speech recognition module, GPS receiver, GSM modem, APR voice circuit, LCD, buzzer and zigbee module, MEMS accelerometer sensor.

Initially the user needs to gives his/her destination details through voice recognition module as input. The microcontroller takes responsibility to display the

destination related bus numbers onto the LCD and also announces the bus numbers to the blind person using APR33A3 voice circuit. Secondly the controller also sends the information about the user destination details to the bus section using wireless zigbee module. When the bus reaches the bus stop then the system automatically announces the arrival of bus along with bus number details using voice circuit.

The user section also has another protection feature like usage of MEMS accelerometer sensor. Whenever any accident is detected using the sensor then the system automatically alerts through buzzer alarm and also sends the alerting messages to the concerned person about his location using GSM modem in the form of SMS messages.

The bus section consists of Zigbee module, LCD, buzzer interfaced with ARM-7 LPC2148 microcontroller. When the zigbee module receives the input given from user section it continuously sends the signal about its approach using wireless zigbee communication and when it once reaches the required destination it alerts through buzzer alarm.

The same information is sent to the user section for enabling other units like displaying the bus details on LCD, Voice based bus approach alerts, and also using GSM module it can send the bus details to the concerned person predefined number.

## I. BLOCK DIAGRAM

### A. Transmitter Unit

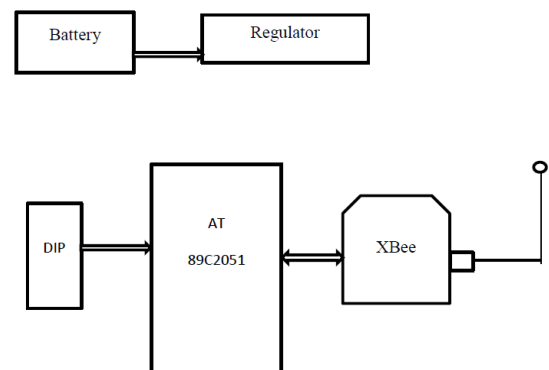


Figure 2

## B. Receiver Unit

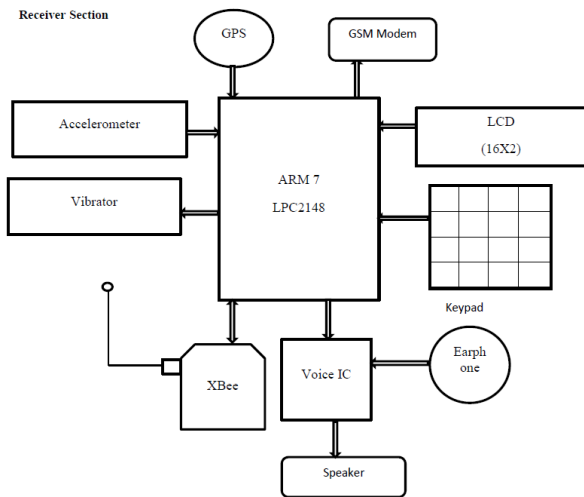


Figure 3

## II. THE PROPOSED SYSTEM

### A. Introduction

This system is specially designed for blind person, so he/ she can travel easily, safely and independently. This system divided into two parts. One is transmitter and another is receiver. Transmitter side will be placed in the bus and blind person have the receiver side. Transmitter part contains XBee module and DIP. XBee module will continuously transmit its unique ID which is generated by DIP. Receiver part contains XBee module, which receive the ID and have keypad to store destination ID in system. It's also have accelerometer which gives location of system.

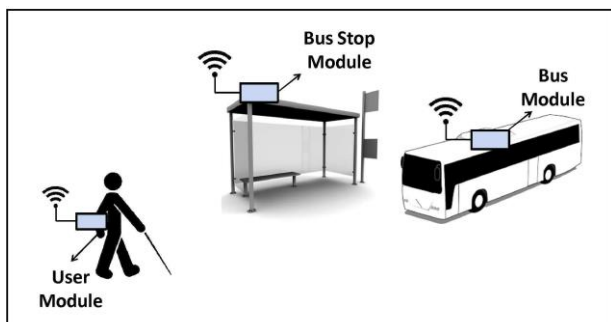


Figure 4

### B. The Working Flow

Let's see how the system will work; as we read in above paragraph, Blind person will have Receiver part. Every bus stop will have its unique id. If a blind person wants to travel from one destination to another by bus, He/she will store the unique id of destination bus stop, with a help of the keypad provided in system. After giving destination ID, receiver will start and continuously searching for Id which match destination Id. In transmitter side which placed in buses, its continuously transmit the bus stops id to nearest bus stops. As soon as the transmitter id of bus and systems destination id matches, system will activate the vibrator motor and sound will generated to give alert for blind person that he/she can board in bus for journey.

As the journey started, system will again waiting for the transmitter id which matched with destination id. As destination stop arrived the system will again give vibration with help of the vibration motor and sound with help of Voice IC to alert a blind person that stop arrived he/she can get down from bus.

There is another mechanism in this system. This mechanism is specially designed for safety of blind person. If accident of blind person is occurred the accelerometer is activated which is placed in system and GSM 800 modules, which generate message which contains the location of blind person. This Message will send to the relative's number of blind person, which is already stored in system. This helps the relatives to find the blind person and it gives more safety to that person.

## III. ALGORITHM

### A. Transmitter Side

- Step1: Start.
- Step2: System variables initialize.
- Step3: System peripherals initialize.
- Step4: Monitor ID from DIP switch.
- Step5: Generate packet of ID.
- Step6: Send to XBee.
- Step7: Monitor for ID from DIP switch.



## B. Receiver Side

- Step1: Start.
- Step2: System variables initialize.
- Step3: System peripherals initialize.
- Step4: Get destination ID from User.
- Step5: Monitor for wireless Bus ID.
- Step6: Check ID matched with User ID.
- Step7: ID does not match? Go back to Step 5.
- Step8: Generate voice alert
- Step9: Start vibrator motor.
- Step10: Monitor live GPS location
- Step11: Check for User's Bus stop location.
- Step12: Location does not match? Go back to step 10.
- Step13: Generate voice alert.
- Step14: Start vibrate motor
- Step15: Stop.

## IV. RESULT & DISCUSSION

When the person reaches the bus station, he can find the buses that pass through a particular location with the help of voice recognition system and voice synthesizer. When the bus approaches the bus station, there is an indication in the bus by the beep sound of a buzzer that there is a blind person available in the bus station.

This is achieved with the help of XBee unit both in the bus unit and blind unit. Finally when the bus reaches the station the bus number is announced to the blind through headphones.

There are currently available systems for the outdoor navigation but they will not assist in travelling to unfamiliar areas. Some systems use PDA which is not so economic and cannot be afforded by all. In most of the systems RFID tags are used which are required in 1000s of numbers for tracking of route. Also it provides only one way communication. The system we use is a mobile unit, weightless and economically feasible.

## C. Advantage

- User-friendly interaction with the user.
- Reliable for blind people.
- Easy to operate.
- Visual alerts through LCD
- Audible alerts through Voice module and also buzzer alarm.
- Speech based input for destination
- Wireless data transmission using zigbee.
- MEMS based accident detection
- Location based alerts using GPS receiver module
- User-friendly interaction with the user.
- Highly sensitive.
- Reliable for blind physically challenged people.
- SMS based alerting system using GSM in case of emergencies.
- Highly efficient and low cost design with portability

## D. Disadvantages

- Easy to operate.
- Visual alerts through LCD
- Audible alerts through Voice module and also buzzer alarm.

## V. CONCLUSION

Primarily, the blind person in the bus station is identified with RF communication. The blind informs the location he needs through the microphone which is given to the voice recognition system which produces the output of bus numbers in the voice synthesizer unit which is heard in headset.

Then this location is transmitted to the transceiver in the bus. If the names in the transceiver in the bus matches with that of the name send by the blind, then there is an alarm in the bus unit alerting the presence of blind and a voice to the user's headset that the particular bus has arrived. With the help of GPS

tracker connected with audio output the destination chosen by the blind is intimated when the bus reaches the correct location. PDA's can be used for GPS tracking but it is not cost effective.

The accessibility of public transport for people with visual impairment is an issue that needs to be fairly debated. Nowadays, the use of public transportation is growing fast. There is expansion of the existing networks, capacity and the number of lines. But there are few, or any, strategies aimed for integrating people with visual impairments in a manner to facilitate their lives. The work proposed in this paper seeks to create a low-cost solution, low power consumption and an affordable system.

To reach these characteristics, it uses various electronic devices and widespread technologies, such as smartphone, application and embedded system. This helps to lower the costs of the system, and facilitates its maintenance. With preliminary tests, for distances adjusted to real situation, the system showed satisfactory results.

The communication link between the modules was successfully performed, where could be confirmed via HyperTerminal. However, the system needs to be tested in others situations, like using more than one Module, to analyse the behaviour when more users are connected to the network. This will require a management of the information to attend all the users at the right time.

## VI. ENHANCEMENTS

### A. Future Modifications

- The project can be extended using GPRS module using which the bus details can be monitored directly from predefined web link.
- This approach eliminates the problem of blind pedestrians. We designed an assistive device for the Blind based on adapted GSM, fusion of GPS and vision based positioning.

- The assistive device improve user positioning, the estimated position would compatible with assisted navigation for the blind positioning.
- The future work enhances autonomous robots or vehicles localization. This project can be extended using GPRS module using which the live tracking of the physically disabled can be plotted in the Google maps.
- The system can be extended by using Android technology for plotting location tracking in Google maps.
- The project can be extended using wireless Wi-Fi network using which the destination can be provide as input using voice application and also touch application from android mobile.
- As future work, the user application for smartphone will be developed. It will contain already all public transport routes, and work with Talkback system.
- The prototypes modules will be developed to small and easy to transport. Final tests will be performed with people with visually impairment, to get a feedback about the system and improve it even more.

## III. REFERENCES

- [1]. G.Lavanya ME., Preethy. W1, Shameem.A 1, Sushmitha.R1 (2013) , "Passenger BUS Alert System for Easy Navigation of Blind " , International Conference on Circuits, Power and Computing Technologies IEEE ICCPCT-2013] , 798-202.
- [2]. Shantanu Agrawal , Anuja Anwane , Prasad Bulankar, Dhiraj K. Thote , (April 2014 ) , "Bus Recognition System For Visually Impaired Persons (VIPs) Using RF Module " , International Conference on Industrial Automation and Computing (ICIAC- 12-13th April 2014)
- [3]. G.Raja , D. NaveenKumar ,G.Dhanateja , G.V.Karthik Y, Vijay kumar ,( Apr-2014 ) , "Bus

- Position Monitoring System To Facilitate The Passengers " , IJESAT] International Journal of Engineering Science & Advanced Technology] Volume-3, Issue-3, 132-135
- [4]. Ravi Mishra and Sornnath Koley, (2012), 'Voice Operated Outdoor Navigation System For Visually Impaired Persons', International Journal of Engineering and Technology, Vol 3, Issue 2, pp.153-157
- [5]. Lamya El alamy, Sara Lhaddad, Soukaina Maalal, Yasmine Taybi, Yassine Salih-Alj , (2012), "Bus Identification System for Visually Impaired Person " , IEEE Sixth International Conference on Next Generation Mobile Applications, Services and Technologies
- [6]. Rishabh Gulati (2011), 'GPS Based Voice Alert System for the Blind', International Journal of Scientific and Engineering Research, Volume 2, Issue 1, pp 1-5
- [7]. Hyn Kwan Lee , Ki Hwan Eom , Min Chul Kim and Trung Pham Quoc, (2010), 'Wireless Sensor Network Apply for the Blind U-bus System', International Journal of u- and eservice, Science and Technology, Vol.3, No.3, pp.13-24
- [8]. Brendan D Perry, Sean Morris and Stephanie Carcieri,, (2009), 'RFID Technology to Aid in Navigation and Organization for the Blind and Partially Sighted', pp. 1-52
- [9]. World Health Organization. (2009). 10 facts about blindness and visual impairment Online]. Available: [www.who.int/features/factfiles/blindness/blindness\\_facts/en/index.html](http://www.who.int/features/factfiles/blindness/blindness_facts/en/index.html)
- [10]. Advance Data Reports from the National Health Interview Survey (2008). Online]. Available: [http://www.cdc.gov/nchs/nhis/nhis\\_ad.htm](http://www.cdc.gov/nchs/nhis/nhis_ad.htm)
- [11]. International Workshop on Camera-Based Document Analysis and Recognition (CBDAR 2005, 2007, 2009, 2011). Online]. Available: <http://www.m.cs.osakafu-u.ac.jp/cbdar2011/>
- [12]. X. Chen and A. L. Yuille, "Detecting and reading text in natural scenes," in Proc. Comput. Vision Pattern Recognit., 2004, vol. 2, pp. II-366–II-373.
- [13]. X. Chen, J. Yang, J. Zhang, and A. Waibel, "Automatic detection and recognition of signs from natural scenes," IEEE Trans. Image Process., vol. 13, no. 1, pp. 87–99, Jan. 2004.
- [14]. D. Dakopoulos and N. G. Bourbakis, "Wearable obstacle avoidance electronic travel aids for blind: A survey," IEEE Trans. Syst., Man, Cybern., vol. 40, no. 1, pp. 25–35, Jan. 2010.
- [15]. B. Epshtein, E. Ofek, and Y. Wexler, "Detecting text in natural scenes with stroke width transform," in Proc. Comput. Vision Pattern Recognit., 2010, pp. 2963–2970.
- [16]. Y. Freund and R. Schapire, "Experiments with a new boosting algorithm," in Proc. Int. Conf. Machine Learning, 1996, pp. 148–156.
- [17]. N. Giudice and G. Legge, "Blind navigation and the role of technology," in The Engineering Handbook of Smart Technology for Aging, Disability, and Independence, A. A. Helal, M. Mokhtari, and B. Abdulrazak, Eds. Hoboken, NJ, USA: Wiley, 2008.
- [18]. K. Kim, K. Jung, and J. Kim, "Texture-based approach for text detection in images using support vector machines and continuously adaptive mean shift algorithm," IEEE Trans. Pattern Anal. Mach. Intell., vol. 25, no. 12, pp. 1631–1639, Dec. 2003.
- [19]. KReader Mobile User Guide, knfb Reading Technology Inc. (2008). Online]. Available: <http://www.knfbReading.com>
- [20]. S. Kumar, R. Gupta, N. Khanna, S. Chaudhury, and S. D. Joshi, "Text extraction and document image segmentation using matched wavelets and MRF model," IEEE Trans Image Process., vol. 16, no. 8, pp. 2117–2128, Aug. 2007.
- [21]. Joonyoung Jung<sup>1</sup> , Kiryong Hal, Jeonwoo Lee<sup>1</sup>, Youngsung Kim<sup>2</sup> and Daeyoung Kim<sup>3</sup>. Wireless Body Area Network in a Ubiquitous Healthcare System for Physiological Signal Monitoring and Health Consulting.

- International Journal of Signal Processing].Image Processing and Pattern Recognition.2008,pp47-54(2008)
- [22]. Pei Zhi-jie, Ding Xiao-di. Development of Wireless Remote Medical Monitoring System J]. Computer & Digital Engineering, 2008,12, 55-58
- [23]. Li Wen-zhong, Duan Chao-yu,et al. The Introduction and Actual Combat of Zigbee Wireless Network TechnologyM].Bei Jing: Aerospace University Press, 2007.4
- [24]. Guo Shi-fu, Ma Shu-yuan, Wu Ping-dong, Chen Zhilong. Pulse Wave Measurement System Based on ZigBee Wireless Sensor NetworkJ]. Application Research of Computers, 2007.4,258-260
- [25]. Shahab, F. Shafait, and A. Dengel, "ICDAR 2011 robust reading competition: ICDAR Robust Reading Competition Challenge 2: Reading text in scene images," in Proc. Int. Conf. Document Anal. Recognit., 2011, pp. 1491–1496.

# Studies on Character association for yield and yield attributing components in Sunflower (*Helianthus annuus* L.) germplasms in coastal saline belts of West Bengal

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## ABSTRACT

A study on genetic variability was made with different quantitative and yield attributing characters in sunflower (*Helianthus annuus* L.). One hundred and twenty five inbred lines of sunflower were selected for studying the character association both direct and indirect to assess the relationship among seed yield and its components. The trial was conducted in the Instructional Farm of Ramkrishna Ashram Krishi Vigyan Kendra, Nimpith on rabi-summer season of 2011-12. The analysis of variance revealed significant differences among the genotypes for all the characters under study. Observations were recorded on twelve different quantitative and yield attributing traits viz., days to 50% flowering, days to maturity, no. of leaves per plant, plant height (cm), head diameter (cm), 100-seed weight (g), no. of seeds per head, seed filling %, hull content (%), volume weight per 100 ml (g), oil content (%) and seed yield per plant (g) and (g). Hence simultaneous selection of these characters would contribute for the improvement of seed yield and oil yield per plant. The maximum positive association in relation to seed yield per plant were found with no. of seed per head, 100seed weight, head diameter and percentage of seed filling. The genetic influence of all the said four characters were more than 80% which signifies the importance of all these four characters in improving the seed yield in case of open pollinated population development as well as hybrid variety development programme.

**Keywords:** Sunflower, Yield, Character association, Selection indices.

## I. INTRODUCTION

India is facing a shortage of edible oil in recent years. During 2009-10 India imported almost 8 million tonnes of vegetable oil which is almost 45 per cent of country's needs spending almost 25000 crores. Sunflower has maximum potential for bridging the gap in the demand and production of edible oil in the country. Its seeds contain high oil content ranging from 35 to 40% with some types yielding upto 50% (Skoric and Marinkovic, 1986). Oil yield is influenced by many plant traits like days to 50 %flowering, plant height, 100-seed weight, volume weight per 100 ml and oil content. Earlier Fick et al. (1974), Green (1980) and Joksimovic et al.

(1999) used simple correlation analysis to study the relationships between oil yield on one side and the other sunflower plant traits on the other side. In the present investigation, simple correlation between oil yield and its component characters was studied to identify the selection indices.

In the present investigation, 78 hybrids derived from crossing between 78 inbred lines and one CMS line 234 A by top cross fashion in sunflower (*Helianthus annuus* L.) were studied. They were raised in a randomized block design with two replication in the Oil seeds Farm, Centre for Plant Breeding and Nimpith during Summer 2010-11. In each replication, each entry was raised in 12.6 m<sup>2</sup> plot

adopting a spacing of 60 cm between the rows and 30 cm between plant to plant. Established agronomic practices were followed under irrigated condition. The data were recorded on ten randomly selected plants for the yield and yield contributing traits viz, days to 50% flowering, plant height, head diameter, 100-seed weight, volume weight per 100ml, oil content, seed yield per plant, oil yield per plant. The data collected were statistically analyzed for simple correlation.

Simple correlation coefficients among the oil yield and its component characters in sunflower are presented in Table 1. Oil yield was highly significant and positively correlated with seed yield per plant(0.97), plant height (0.49), head diameter (0.61), volume weight (0.29), 100-seed weight (0.49) and oil content (0.39). Similar results were reported by Chikkadeviah et al. (2002), and Ramasubrahmanyam et al. (2002). The character days to 50% flowering had non-significant and positive association with oil yield. Association among yield components days to 50 per cent flowering had positive and significant correlation with plant height. Similar results were reported by Teklewold et al. (2000) and Vidhyavathi et al. (2005). Plant height had positive and significant correlated with head diameter, seed yield per plant. Similar reports were also made by Lakshminarayana et al., (2004) and Vidhyavathi et al. (2005). Head diameter had positive and significant per plant. Similar reports were also made by Moorthy (2004) and Manivannan et al. (2005). Volume weight had positive significant correlation with oil content and seed yield per plant. Similar results were reported by Vidhyavathi et al. (2005) and Manivannan et al. (2005). The character 100-seed weight had shown positively significant correlation with oil content and seed yield per plant.

The non significant association between days to 50% flowering and oil yield indicates that a breeder can

develop high oil yielding hybrids/varieties in early or late maturity group.

Hence considering the correlation analysis, characters namely plant height, head diameter, volume weight/100 ml, 100-seed weight, oil content and seed yield per plant are considered as important selection indices for oil yield improvement.

## II. REFERENCES

- [1]. Chikkadevaiah, Sujatha, H.L. and Nandini. 2002. Correlation and path analysis in sunflower. *Helia*,25: 109–118.
- [2]. Fick, G.N., Zimmer, D.C.and Zimmerman, D.C.1974. Correlation of seed oil content in sunflower with other plant and seed characteristics.*Crop Sci.*,14: 755–7.
- [3]. Green, V.E, 1980.Correlation and path analysis of the components of yield in sunflower cultivars:(*Helianthus annuus L.*).In: Proc.of the 9th Int. Sunflower Conf., pp: 12–21.June, 8-13, 1980.Terremolinos-Malage, Spain.
- [4]. Joksimovic, J., J. Atlagic.and D. Skoric,1999.Pathcoefficient analysis of some oil yield components in sunflower (*Helianthus annuus L.*).*Helia*, 22:35–42.
- [5]. Lakshminarayana, N., Sreedhar, N.and Prabhakar A.J.2004.Correlation and path analysis in sunflower (*Helianthus annuus L.*). *Andhra Agric. J.*, 51 (3 and 4): 342-344
- [6]. Manivannan, N., Vidyavathi, P.and Muralidharan, V., 2005.Diallel analysis in Sunflower.*Indian J.Agric. Res.*, 39 (4): 281-385.
- [7]. Moorthy,J. 2004. Combining ability,heterosis and association studies in confectionery sunflower Tamil Nadu Agricultural University, Coimbatore.

- [8]. Ramasubrahmanyam, S.V., Ranganatha A.R.G. and S.Sudeer Kumar. 2002. Genetic variability for seed yield and seed parameters in sunflower. J. Oilseeds Res., 19: 171-174.
- [9]. Skoric, D. and Marinkovic, R. 1986. Most recent results in sunflower breeding. Int. Symposium on sunflower, Budapest, Hungary, pp: 118-9.
- [10]. Teklewold, A., Jayaramaiah, H. and Jagadeesh, B.N. 2000. Correlations and path analysis of physico-morphological character of sunflower (*Helianthus annuus* L.) as related to breeding method. *Helia*, 23: 105-114.
- [11]. Vidhyavathi, R., Mahalakshmi, P., Manivannan, N. and Muralidharan, V. 2005. Correlation and path analysis in sunflower (*Helianthus annuus* L.). *Agric. Sci. Digest*, 25 (1): 6-10.

**Table 1**

Characters	Plant height (cm)	Hd. Dia. (cm)	Vol. Wt 100 ml (g)	100-seed weight (g)	Oil content(%)	Seed yield/plant(g)	Oil Yield /pl (g)
<b>Days to 50% flowering</b>	0.51**	0.12	0.19	0.21	-0.04	0.11	0.09
<b>Plant height (cm)</b>		0.54**	0.39	0.12	0.15	0.49**	0.49**
<b>Head diameter (cm)</b>			0.21	0.50**	0.26*	0.59**	0.61**
<b>Volume weight/100 ml(g)</b>				0.20	0.35**	0.25*	0.29**
<b>100-seed weight (g)</b>					0.29**	0.46**	0.49**
<b>Oil content ( % )</b>						0.21	0.39**
<b>Seed yield/plant (g)</b>							<b>0.97**</b>

\*, \*\* are significant at 5 and 1 per cent respectively

**Genotypic Correlation Co-efficient of different Yield attributing traits on seed Yield of sunflower**

**Table 2**

Character	Days to 50% Flowering	Days to Maturity	No of leaves/pl	Hd.Dia(cm)	Pl.Ht. (cm)	100 seed wt (g)	No of seeds/hd	Seed filling %	oil%	Hull%	Vol.Wt (g/100cc)
<b>Days to Maturity</b>	0.874**										
<b>No of leaves/pl</b>	-0.253	-0.061									
<b>Hd.Dia(cm)</b>	0.326	0.575**	0.198								
<b>Pl.Ht.(cm)</b>	0.093	0.243	0.899**	0.247							
<b>100 seed wt (g)</b>	0.121	0.516**	0.432*	1.057**	0.334						
<b>No of seeds /hd</b>	0.255	0.453**	0.419*	0.975**	0.388*	0.959**					
<b>Seed filling %</b>	0.235	0.404*	0.587**	0.849**	0.651**	0.886**	0.911**				
<b>oil%</b>	0.418*	0.408*	-0.241	-0.253	0.107	-0.293	-0.206	-0.259			
<b>Hull%</b>	-0.304	-0.288	-0.199	0.123	-0.459**	0.101	0.043	-0.025	-0.753**		
<b>Vol. Wt (g/100cc)</b>	-0.045	-0.117	0.443**	-0.473**	0.447**	-0.351	-0.186	-0.057	0.212	-0.271	
<b>Seed yield/pl(g)</b>	0.272	0.448**	0.288	0.932**	0.314	0.957**	0.998**	0.851**	0.244	0.014	-0.204

\*, \*\* are significant at 5 and 1 per cent respectively

## Phenotypic Corelation Co-efficient of different Yield attributing traits on seed Yield of sunflower germplasm

Table 3

Characte RS	Days to 50% Flowering	Days to Maturity	No of leaves/pl	Hd.Dia(cm)	Pl.Ht. (cm)	100 seed wt (g)	No of seeds/hd	Seed filling %	oil%	Hull%	Vol.Wt (g/100cc)
Days to Maturity	0.820**										
No of leaves/pl	-0.225	0.089									
Hd.Dia(cm)	0.307	0.496**	0.180								
Pl.Ht.(cm)	0.099	0.281	0.738**	0.205							
100 seed wt (g)	0.092	0.390*	0.296	0.752**	0.326						
No of seeds /hd	0.235	0.431*	0.314	0.767**	0.380*	0.943**					
Seed filling %	0.189	0.261	0.543**	0.615**	0.562**	0.670**	0.708**				
oil%	0.401	0.370*	-0.238	-0.206	0.100	-0.274	-0.201	-0.217			
Hull%	-0.284	-0.264	-0.131	-0.110	-0.421*	0.102	-0.029	0.209	-0.720**		
Vol. Wt (g/100cc)	-0.049	-0.093	0.281	-0.452**	0.419*	-0.210	-0.119	0.013	0.206	-0.247	
Seed yield/ pl(g)	0.261	0.419*	0.249	0.826**	0.295	0.867**	0.965**	0.674**	-0.237	0.019	0.204

\*, \*\* are significant at 5 and 1 per cent respectively

## Direct and indirect effects of different Yield attributing traits on seed Yield of sunflower

Table 4

Characte RS	Days to 50% Flowering	Days to Maturity	No of leaves/pl	Hd. Dia.(cm)	Pl.Ht. (cm)	100 seed wt (g)	No of seeds/h d	Seed filling %	oil%	Hull%	Vol. Wt (g/100cc)	Seed Yield/PL ( <b>r</b> )
Days to 50% Flowering	-0.574	-0.502	0.146	-0.187	-0.054	-0.070	-0.147	-0.135	-0.240	0.175	-0.026	0.2728
Days to Maturity	0.394	0.451	-0.028	0.260	0.110	0.188	0.205	0.182	0.284	-0.130	-0.053	0.4489**
No of leaves/pl	0.085	0.021	-0.338	-0.06	-302	-0.145	-0.138	-0.197	0.081	-0.067	-0.149	0.2887
Hd. Dia(cm)	0.025	0.045	0.015	0.078	-0.019	0.082	0.076	0.066	0.020	0.010	-0.037	0.9321**
Pl. Ht.(cm)	0.013	0.035	0.128	0.035	0.142	0.047	0.055	0.093	0.015	-0.065	0.064	0.3148
100 seed wt (g)	-0.137	-0.473	-0.491	-1.200	0.378	-1.136	-1.081	-1.006	0.333	-0.116	0.399	0.9574**
No of seeds /head	0.457	0.811	0.737	1.742	0.694	1.714	1.787	1.028	-0.368	-0.078	-0.333	0.9989**
Seed filling %	0.071	0.121	0.176	0.255	0.195	0.266	0.273	0.800	-0.078	-0.075	-0.017	0.8517**
Oil%	0.019	0.018	-0.011	-0.011	0.005	-0.013	-0.009	-0.012	1.045	0.034	0.010	-0.2444
Hull%	-0.080	-0.076	-0.053	0.033	-0.121	-0.027	-0.012	-0.066	-0.198	0.863	-0.071	0.0141
Vol. Wt (g/100cc)	0.000	-0.001	0.004	-0.004	0.004	0.003	-0.002	-0.001	0.002	-0.002	0.009	-0.2045

## Data on Yield attributes of sunflower germplasm-2011-12&2012-13

Table 5

Name of the Germplasm	Plant Ht.(cm) at Harvest	Head dia.(cm )	Seed yield(g /pl)	100 seed wt.(g)	Seed Filing (%)	Kernel wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% Flowering	Days to maturity
GMU-454	76.1	7.1	12	7.07	86	4.69	2.38	33.66	40.3	62	93
GMU-321	84.8	12.8	12	8.89	70	6.32	2.57	28.91	35.3	68	100
GMU-321	88.6	14.5	14	7.72	90	5.45	2.27	29.40	51.5	69	101
GMU-488	102.6	9.35	15	6.28	75	4.70	1.58	25.16	38.2	63	94
GMU-442	112.2	16.65	26	6.07	70	3.47	2.60	42.83	50.3	71	102
GMU-488	103.7	8.95	14	6.60	75	4.83	1.77	26.82	40.4	70	102
GMU-389	137.2	19.5	40	7.32	90	3.87	3.45	47.13	44.0	73	107
GMU-442	80.1	16.0	20	5.34	80	3.72	1.62	30.33	48.6	68	102



GMU-2-2	77.8	15.1	20	9.34	78	5.85	3.49	37.37	38.2	63	95
GMU-351	147.0	18.55	24	3.66	15	2.51	1.15	31.42	23.4	72	106
GMU-2-2	100.0	15.3	14	9.87	60	6.58	3.29	33.33	40.1	64	96
GMU-1119	128.9	14.5	10	5.31	80	2.47	2.84	53.49	41.2	66	99
GMU-389	151.8	21.5	30	10.4	25	6.99	4.43	38.79	38.2	71	104
GMU-488	103.3	10.4	14	6.72	92	4.32	2.35	35.23	46.9	64	96
GMU-1147-4-2	140.1	15.3	30	6.35	79	3.84	2.52	39.62	39.4	72	105
GMU-1034	82.8	16.4	20	4.67	78	3.12	1.48	32.18	42.0	70	103
GMU-312	135.6	15.5	15	4.55	71	3.02	1.53	33.63	39.0	68	100
GMU-423	106.4	9.1	17	5.38	94	2.98	2.49	45.52	35.8	71	104
GMU-301	163.8	13.5	12.5	3.22	81	1.28	1.94	60.25	44.1	66	98
GMU-592	87.9	9.5	11	4.24	93	2.50	1.74	41.03	42.3	63	95
GMU-566	134.6	13.6	13	5.49	92	3.80	1.69	30.78	38.5	67	99
GMU-1023	129.6	12.9	6.2	2.49	70	1.60	0.89	35.74	31.4	67	100
GMU-1099	135.6	14.7	7.0	3.61	96	2.50	1.10	30.55	42.4	68	101
GMU-539	110	14.45	14	7.99	70	5.19	2.80	35.04	45.2	64	98
GMU-559	125.6	13.5	12	7.85	70	5.41	2.44	31.08	41.1	65	98
GMU-420	121.0	12.6	8	5.44	95	4.21	1.23	22.61	42.2	62	95
GMU-400	93.0	10.5	22	8.46	95	4.70	3.76	44.44	42.0	67	101
GMU-539	115.2	17.6	8	5.33	85	3.87	1.46	27.39	41.5	65	96
GMU-454	87.6	9.75	10	5.63	55	4.03	1.60	28.42	39.8	61	95
GMU-420	121.0	12.6	8	5.86	91	4.323	1.54	26.26	42.0	64	96
GMU-431	105.0	13.6	10	7.97	79	5.24	2.73	34.25	46.1	63	97
GMU-376	87.0	6.80	10	4.77	91	3.36	1.41	29.56	44.6	65	98
GMU1147	125.1	11.9	15	7.05	33	4.73	2.32	32.90	40.2	66	99
GMU-376	109.6	8.6	30	5.6	91	3.51	2.09	37.33	44.2	75	107
GMU-349	112.6	10.5	12	5.03	75	3.59	1.44	28.62	41.6	72	102
GMU-359	121.2	12.6	13	8.69	90	6.49	2.20	25.31	43.2	64	96
GMU-349	115.6	13.2	18	7.08	89	4.21	2.87	40.54	39.2	68	100
GMU-347	112.9	12.9	20	3.97	75	2.88	1.09	27.45	46.3	70	102
GMU-389	163.4	19.7	32	8.76	50	5.12	3.64	41.55	45.1	74	106
GMU-1034	118.1	17.8	30	10.16	46	5.90	4.26	41.92	36.0	71	103
<b>Mean</b>	113.82	13.45	16.70	6.42	75.0	4.16	2.25	35.07	41.37	67.90	98.92
<b>Range</b>	76.1-163.8	7.1-21.5	6.2-40	3.61-10.16	15-96	1.28-6.58	0.89-4.43	25.10-60.25	23.4-51.5	61-75	93-107

Table 6

Name of the Germplasm	Pl. Ht.(cm)	Head dia.(cm)	Seed yield(g/pl)	100 seed wt.(g)	Seed Filing(%)	Kerne l wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% flowering	Days to maturity
AKSFI-197	102.1	15.3	25	4.79	94	2.94	1.85	38.62	38.1	66	98
AKSFI-71	170.6	18.6	50	5.57	91	3.37	2.21	39.60	40.6	73	105
AKSFI-58-3	125.0	14.6	10	6.46	67	4.75	1.71	26.47	48.6	64	96
AKSFI-190	141.6	15.2	24	5.78	65	3.94	1.84	31.84	41.0	66	98
AKSFI-52-1	110.6	13.6	10	6.75	92	4.52	2.23	33.04	39.2	65	97
AKSFI-186	106.8	16.6	21.0	9.15	66	6.42	2.73	29.84	38.1	69	102
AKSFI-7	124.6	15.2	25	7.26	68	3.42	3.84	52.90	41.1	62	94
AKSFI-52-4	129.8	14.3	17	6.66	73	4.05	2.61	39.19	44.5	67	100
<b>Mean</b>	<b>126.38</b>	<b>15.42</b>	<b>22.75</b>	<b>6.55</b>	<b>77.0</b>	<b>4.18</b>	<b>2.37</b>	<b>36.44</b>	<b>41.4</b>	<b>66.5</b>	<b>98.75</b>
<b>Range</b>	102-129.8	14.6-18.6	10-50	4.8-9.1	66-94	2.92-6.42	1.71-3.84	26.47-52.90	38.1-48.6	62-73	94-105

Table 7

Name of the Germplasm	Pl. Ht.(cm)	Head dia.(cm)	Seed yield(g/pl)	100 seed wt.(g)	Seed. Fil(%)	Kerne l wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% flowering	Days to maturity
ID-5022	78.0	13.5	20.0	5.47	95	4.05	1.43	26.09	32.0	68	98
ID-5022	88.0	15.39	22.0	7.62	85	5.07	2.55	33.47	48.4	71	102
ID-60	102.0	16.2	14.0	6.33	60	3.04	3.29	51.97	33.6	65	96
ID-5204	88.2	17.6	16.0	7.73	70	5.01	2.72	35.19	32.1	66	97
ID-63	110	16.6	20.0	3.75	90	2.50	1.25	33.34	43.1	70	102
ID-4036	130.5	16.35	22.0	8.53	50	5.51	3.02	35.41	44.1	71	103
ID-60	102.0	16.2	20.0	4.89	73	3.51	1.38	28.23	35.8	70	103
ID-4036	122.0	20.33	50.0	7.47	71	4.36	3.11	41.64	44.1	74	106
<b>Mean</b>	<b>102.6</b>	<b>16.52</b>	<b>23.0</b>	<b>6.48</b>	<b>74.2</b>	<b>4.13</b>	<b>2.34</b>	<b>35.66</b>	<b>39.15</b>	<b>69.37</b>	<b>100.87</b>
<b>Range</b>	78-130	13.5-20.3	14.0-50.0	3.75-7.73	60-95	2.50-5.51	1.43-3.29	26.09-51.97	32.0-48.4	65-74	97-106

Table 8

Name of the Germplasm	Pl. Ht.(cm)	Head dia.(cm)	Seed yield(g/pl)	100 seed wt.(g)	Seed. Fil.(%)	Kerne l wt(g)	Husk Wt(g)	Husk%	Vol .Wt. (g/100cc)	Days to 50% Flw	Days to maturity
GP R-1-1	97.4	9.3	16	4.5	95	2.95	1.55	34.45	40.1	66	98
GP-5082	132.7	16.5	21.0	4.75	90	3.45	1.30	27.37	43.0	69	101
GP-5082	138.4	15.7	19.0	4.77	94	3.11	1.66	34.81	45.2	68	101
GP-1019	126	12.6	10	4.52	73	2.92	1.60	35.40	36.4	72	103
GP-475	64.0	7.2	10	4.37	76	3.37	1.00	22.88	40.0	64	94
GP-150	93.4	11.3	12	4.35	85	2.70	1.65	37.93	41.6	69	100
GP-113	73.9	11.2	10	5.45	61	3.94	1.51	27.70	33.6	70	100
GP-450	85.1	9.35	10	9.99	96	6.72	3.27	32.73	47.3	66	96
GP-39	92.7	12.65	14	5.38	79	3.61	1.77	32.90	38.2	74	105
GP-450	91.5	11.3	11.0	6.90	80	4.50	2.40	34.78	42.8	60	92
GP-175	116.5	10.9	12.0	4.98	47	3.26	1.75	34.93	44.9	70	102
GP-475	122.8	11.5	22.0	7.84	89	5.55	2.29	29.21	39.8	74	105
GNPL-109	99.6	14.6	26	5.26	93	3.64	1.62	30.79	44.1	68	101
GNPL-109	92.8	16.4	30.	9.63	90	6.39	3.24	33.65	46.5	72	103
DRSF-113	158.6	16.45	70	8.09	95	5.38	2.39	30.76	46.1	63	94
DRSF-108	168.4	13.1	30.0	5.62	81	5.23	2.27	30.27	45.0	65	95
LSF-11	84.0	10.5	24.0	8.36	80	5.82	2.54	30.39	36.8	67	99
LSF-8	78.2	9.2	34.0	6.83	91	4.73	2.10	30.75	46.8	72	102
LSF-8	124.8	14.7	12.0	9.314	87	6.49	2.64	28.92	48.0	69	101
LSFH-35	144.0	19.2	34.0	4.62	91	2.59	2.03	43.94	45.1	72	106
LSF-11	76.0	9.5	15.0	6.4	85	4.42	4.98	52.98	40.1	61	91
PLVSF-9	138.6	16.0	16.0	5.71	75	3.49	2.22	38.88	32.0	67	98
PKVSF-22	122.6	14.2	16.8	6.33	92	4.16	2.17	34.28	47.8	68	99
<b>Mean</b>	<b>111.39</b>	<b>12.75</b>	<b>20.64</b>	<b>6.26</b>	<b>83.7</b>	<b>4.28</b>	<b>2.17</b>	<b>33.50</b>	<b>42.22</b>	<b>68.34</b>	<b>99.65</b>
<b>Range</b>	<b>64-168.4</b>	<b>7.2-19.2</b>	<b>10-34</b>	<b>4.5-9.99</b>	<b>47-96</b>	<b>2.6-6.7</b>	<b>1.0-4.98</b>	<b>27.37-52.98</b>	<b>36.4-48</b>	<b>61-74</b>	<b>91-105</b>

# Digitized Meter and Invoice Generation

Swati Kasbe<sup>1</sup>, Kundan Khairnar<sup>1</sup>, Monika Mahale<sup>1</sup>, Prathamesh Pardeshi<sup>1</sup>, Prof. Bajirao Shirole<sup>2</sup>

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<sup>2</sup>Professor, Department of Computer Engineering, SCOE Nashik, Maharashtra, India

## ABSTRACT

The representative of electricity board monthly come and visits every residential and corporate zone and manually collects the readings from electricity meter. The data is recorded on a piece of paper along with a snap shot of the meter. There after the officials reads the snap shot and readings of the meter and then feed it to the local software for bill calculations. Finally the bills are sent. We as a consumer then make the payment for the received bill. Such a tedious process is this. Man made mistakes can be in huge numbers. Human resources are wasted and many other problems do occur. We finally thought of building a system that will do the above process automatically. The advancing mobile communication technology and the decrease in costs make it possible to combine mobile technology into electricity board automation systems. We propose a system that collects the consuming energy from residential and corporate zones and send it directly to the central-Server. The traditional approach for collection of energy consumption data is that the representatives of electricity board monthly comes and visit every residential and corporate and manually reads the consumption data from the meter. The data is recorded on a piece of paper along with a snap shot of the meter and finally submitted to the local electricity board office. There after the officials reads the snap shot and readings of the meter and then feed it to the local software for Invoice. Finally the bills are dispatched. We as a consumer then make the payment for the received bill. Such a hectic process is this. Man made mistakes can be countless. Human resources wasted and many other problems do occur. We finally thought of building a system that will do the above process automatically. Every Energy consumption meter will be attached to a microcontroller unit that will scan the meter reading after every one month. The meter reading will transmitted wirelessly to the local server along with the meter number. This data will be processed by the server and generates the bill automatically. Once the bill is generated an SMS alert will be send to the owner's mobile number. According to the market need of Electric Meter. Now the system will use wireless controller. It is used since application don't need high speed data rate, need to be low powered as well as low cost.

**Keywords:** Energy Meter, Microcontroller LPC 2148 , Mobile, Server, Buzzer, crystal oscillator.

## I. INTRODUCTION

The usual metering systems has many disadvantages as manual reading has faults such as errors in taking reading mistake, external conditions affecting readings ,delayed work. These ways of doing things also needs huge manpower. Smart meter reading system is one way to avoid these faults. Due to this

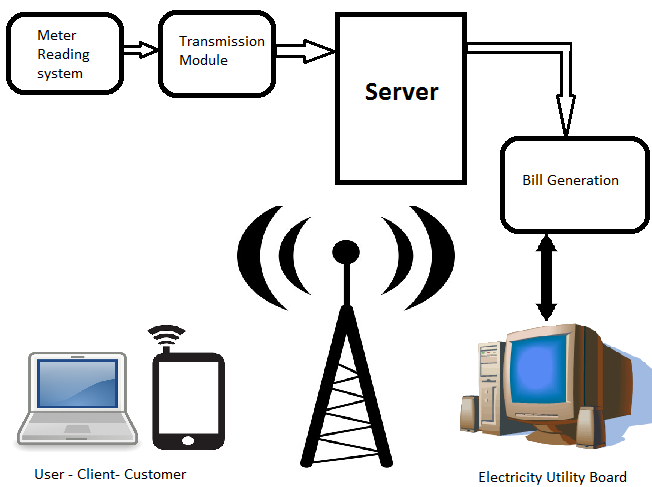
system, incorrect bills were delivered and huge economic loss of consumers.

There are three key elements in an smart meter reading (SMR) system: consumption measurement, meter reading, transmission of measured data, and data processing and billing. An SMR system has to be Cost-effective while providing robust and reliable

performance. Smart meter reading enables utility companies to communicate remotely with residential utility meters using communications. electricity board can now set up two-way data communications between the utility's data center and the meters. More detailed customer information can serve to offer enhanced services such as time-of-use pricing, management of demand, and load profiles.

Every Energy consumption meter will be attached to a microcontroller unit that will scan the meter reading after every one month. meter reading will transmitted wirelessly to the local server along with the meter number. This data will be processed by the server and generates the bill automatically. Once the bill is generated an SMS alert will be send to the owner's mobile number.

**II. SYSTEM ARCHITECTURE**



**Figure 1**

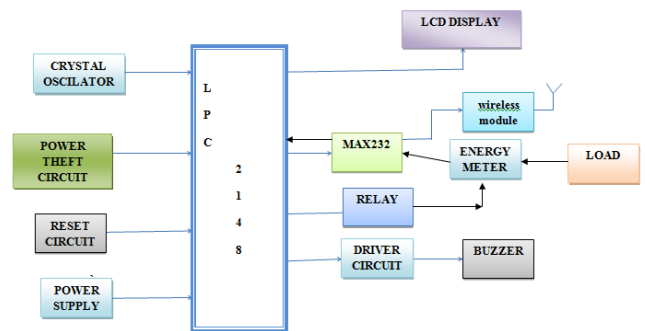
Here the Meter reading system is the actually a meter which is going to take reading at customers end. The meter is embedded with several hardware to achieve the communication between the meter and server which is placed at electricity board office. The meter is attached with transmission module, here this module is used for communication between meter and

server. We are using wireless module for communication purpose and no need of any human efforts to take meter reading manually.

After receiving the reading at server side there will back office processing and calculation of bill and after calculation the bill will be generated and sent to customer via SMS.

The payment method used by us is very innovative and easy to use by any category of customers as here are two broad options for paying bill. One can pay bill manually by using payment gateway on our website. And another newly came option of payment is automatic deduction from bank account here the client or customer just need to add his account details and enable the automatic deduction option. The amount of bill will be automatically deducted from his/her account and SMS of that transaction will be received by customer.

This is how our system will work. We can also deactivate the meter by sitting in office and in one click if customer has not payed bill within certain period of time.



**Figure 2. Block Diagram**

The whole system can be divided into three sections. First is a energy meter with micro controllers that measures real-time power consumption. Second part is the data transmission, where the meter reading can be sent through a wireless Module based network to a server. The third part is the improved data

management system based on user friendly software with two separate access support – one for consumer and another for the electricity authority.

We are using ,

**LPC 2148:** ARM is a family of instruction set architectures for computer processors based on a reduced instruction set computing (RISC) architecture developed by British company ARM Holdings.

LPC-P2148 is prototype board for LPC2148 ARM7TDMI-S microcontroller with USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM up to 40 kB, produced by NXP Semiconductors. With LPC-P2148 you can explore the features of LPC21XX family on budget, the board has everything necessary to build simple applications.

**Crystal Oscillator:** A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a precise frequency. This frequency is commonly used to keep track of time, as in quartz wristwatches to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits.

**MAX 232:** The MAX232 is a dual transmitter / dual receiver that typically is used to convert the RX, TX, CTS, RTS signals. The drivers provide TIA-232 voltage level outputs (about  $\pm 7.5$  volts) from a single 5-volt supply by on-chip charge pumps and external capacitors.

**Buzzer:** It is an audio signalling device If electricity theft is detected or any misuse of meter is detected, then buzzer rings.

**Invoice Generation:** Here the calculation is done of meter readings and the bill amount is sent to customer via SMS. Along with SMS we will also send link for bill payment and here we have two payment methods. First method is tradition online payment method and another one is auto deduction from bank account.

This project explores the development of wireless controller Based electricity bill. The purpose of this project is to build a digital electricity bill, which could be controlled using wireless controller.

**Relay:** the microcontroller sends a signal to the relay driver which in turn switches off the relay, such that the main supply to the load is switched off

**LCD:** LCD display is attached to engery meter and used to show the units consumed by customer.

**Wireless Module:** The wireless module is used to transfer reading of units and other details to our server.

Mainly, it is used for transferring data from hardware to server.

### III. RESULTS

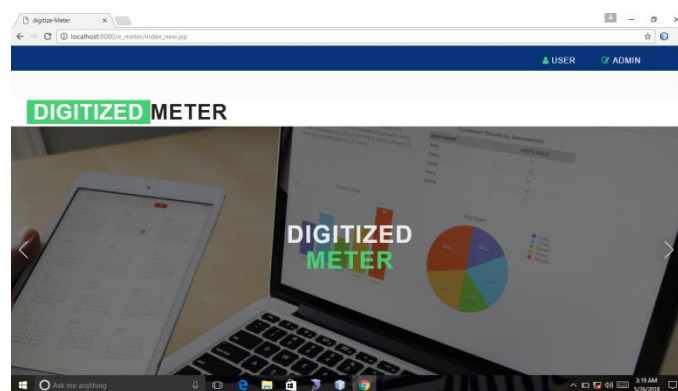


Figure 3. Home Page.

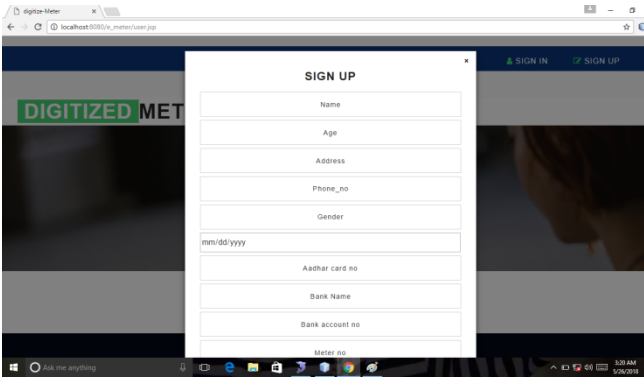


Figure 4. User Signup.

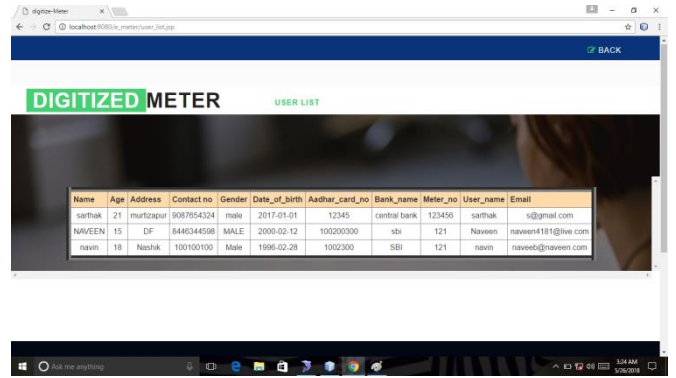


Figure 8. User List.

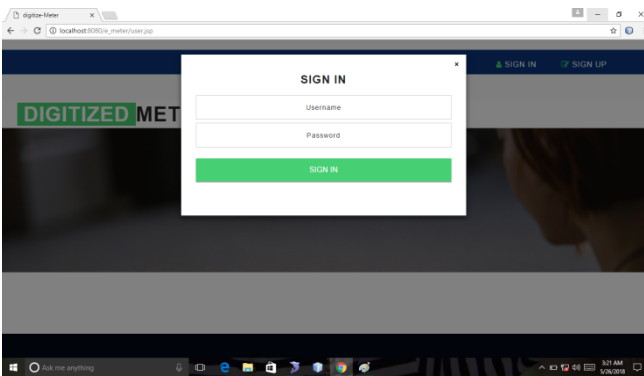


Figure 5. User Login.

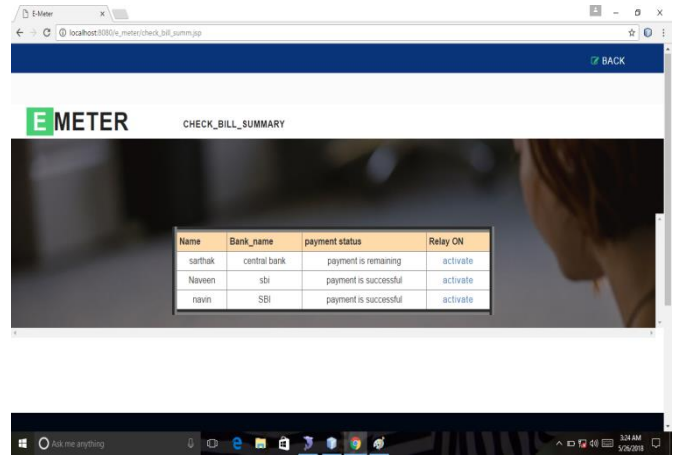


Figure 9. Bill Summary.

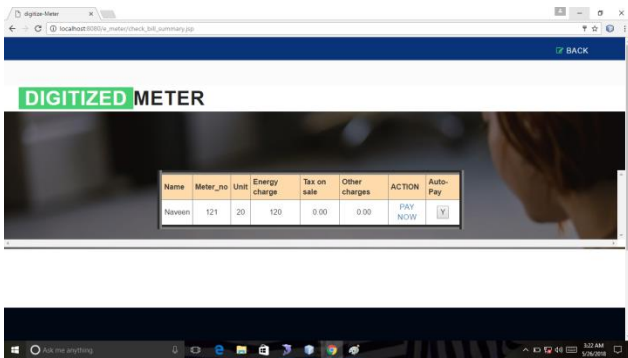


Figure 6. User Homepage.

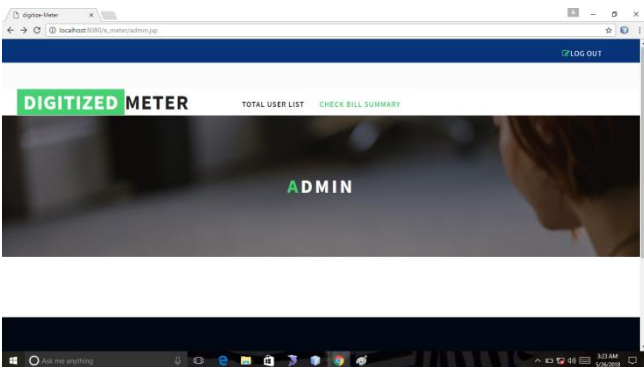


Figure 7. Admin Homepage.

#### IV. CHARTS

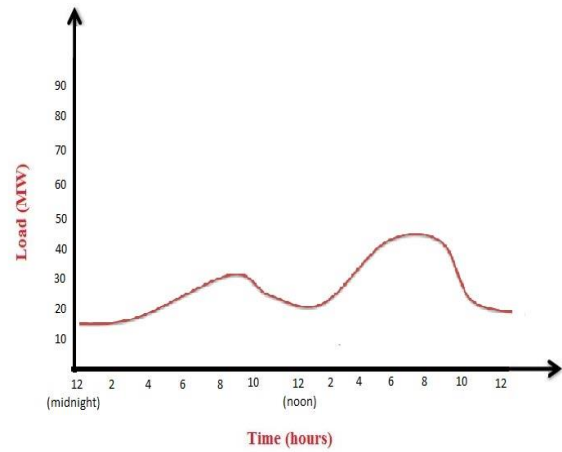
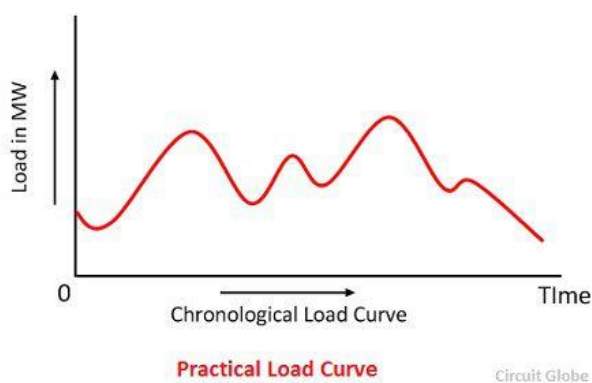


Figure: A typical daily load curve

Figure 10. Graphical Representation Of Energy Consumed.



**Figure 11.** Graphical Representation Of Energy Consumed.

We are going to show the graphical representation of energy consumed. These graphs will be shown in the admin area to get idea of load and energy consumption. If the admin finds any suspicious activity then he/she can take appropriate action on it.

## V. CONCLUSION

This system gives an efficient knowledge about security, Communication System of Meter Reading and payment problems. Since all the vulnerabilities are closed to avoid any possible fraud, lose of electricity problem would be solved. The expense for meter reading and human efforts will be reduced, when the Digitized Energy Meter is introduced. The secure transmission will stop the fraud and theft of energy. The innovative and newly introduced payment method will give great ease of bill payment. And no one ever needs to stand in queue for hours to pay bill. The payment of bill is just one click far. So its very efficient and time saving. The security of this system can further be modified and according to improve the efficiency of the system.

## VI. REFERENCES

[1]. Pradip W Kulkarni, Manisha V Shinde, Automation of Electricity Billing Process, IEEE 2014.

- [2]. Automatic Electric Meter Reading Monitoring System Using GSM International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 03 Issue: 05 — May-2016
- [3]. International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 4, April 2013)
- [4]. Satellite Conference ICSTSD 2016 International Conference on Science and Technology for Sustainable Development, Kuala Lumpur, MALAYSIA, May 24-26, 2016 ISSN: 2348
- [5]. IJSRD - International Journal for Scientific Research Development— Vol. 3, Issue 03, 2015— ISSN (online): 2321-0613; Wireless Prepaid Energy Metering using RF and Arduino Technology
- [6]. International Journal of Innovative Research in Computer and Communication Engineering Vol. 3, Issue 3, March 2015; Prepaid Energy Meter with GSM Technology.

## VII. BIOGRAPHIES

- [7]. "Ms. Swati R. Kasbe, She is studying in Sanghavi College Of Engineering, Nashik, MH, India. She is student of Computer Engineering "
- [8]. "Mr. Kundan A. Khairnar, He is studying in Sanghavi College Of Engineering, Nashik, MH, India. He is student of Computer Engineering"
- [9]. "Ms. Monika S. Mahale, She is studying in Sanghavi College Of Engineering, Nashik, MH, India. She is student of Computer Engineerig Department. "
- [10]. "Mr. Prathamesh N. Pardeshi, He is studying in Sanghavi College Of Engineering, And working as Server administrator at MIPIT Technologies, Nashik, MH, India. "



# IoT Based Smart Irrigation Using Water Flow Sensors

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## ABSTRACT

India is a horticulture based country. It is important to enhance the efficiency and nature of agro based items. The proposed configuration is a programmed framework that guides the client in water system handle. It continues informing the rancher through an on-board LCD show and messages that is sent to the User PC. This proposed design is moreover valuable for the Users who are standing up to control frustration issues to keep up a uniform water supply as a result of vitality disillusionment or inadequate and non-uniform water supply. The customized water framework structure in like manner keeps the Users to revived with all the establishment practices through a GPRS Module that sends messages on the PC. This contraption can be a vital turning point for our overall population. The contraption is easily direct by the Users of the country. This proposed arrangement is valuable for decreasing the human work. This is a low spending framework with a fundamental social application.

**Keywords:** Arduino, IR sensors, MAX-232.

## I. INTRODUCTION

Agribusiness makes utilization of eighty five% of to be had freshwater assets worldwide, and this percent will keep on being overwhelming in water allow because of populace increment and duplicated nourishment request. There is a squeezing need to make systems construct absolutely with respect to innovation and innovation for maintainable utilization of water, comprehensive of specialized, agronomic, administrative, and institutional updates. There are numerous frameworks to procure water investment funds in differing plants, from central ones to additional mechanically propelled ones. For instance, in a solitary gadget plant water notoriety changed into checked and water system planned in light of shade temperature dispersion of the plant, which end up noticeably gotten with warm imaging .moreover, unique structures have been advanced to time table water system of yields and streamline water use by utilizing a harvest water strain file (CWSI). This contraption utilizes sensors like stickiness, soil

dampness. These sensors send qualities to small scale controller. Microcontroller sends qualities to PC utilizing serial discussion. As indicated by constant sensors esteems relentless diagram is show on PC and Android Based portable utilizing Internet and Android application. Here edge expense is keep, if sensor esteems pass the edge charge at that point Drip Irrigation segments can be control mechanically through microcontroller.

## II. EXISTING SYSTEM

In some of the water system contraption water system booking is done by means of following soil, water prevalence with tension meters underneath trickle water system through the computerization controller device in sandy soil. It is exceptionally vital for the rancher to save the substance inside the subject. It is extremely hard to gauge the substance material of the division. Presently a days there is no framework like this to quantify.

### III. PROPOSED SYSTEM

The proposed gadget has exceptional sensors, a small scale controller, GPRS and quality assets. A few WSUs might be conveyed in-zone to design a dispensed sensor group for the programmed water system gadget. Every unit relies upon on the miniaturized scale controller that controls the radio modem GPRS and tactics statistics from the dirt dampness sensor, temperature sensor and water degree sensor. In this remote sensor unit or transmission unit the sensor information from various sensors (Soil dampness, temperature, moistness and water degree) are amassed within the primary controller. This facts is shown on transmission section LCD. Arduino controller is changed to some restrict estimations of temperature and soil dampness.

#### Block diagram:

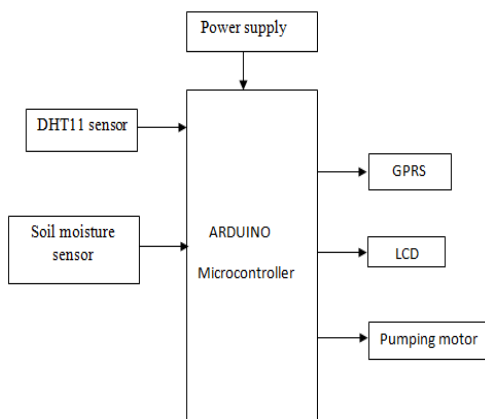


Figure 1

#### Hardware requirement:

##### Arduino:

The Arduino Micro Controller is a open source platform which has 6 analog pins ,14 digital pins, one serial port,one power jack and one usb jack for code dumping

##### ATMEGA328P FEATURES:

- Elite steadiness, Low Power utilization with 8-Bit Microcontroller.

- Progressed Reduced Instruction Set Computer (RISC) Architecture which has the accompanying components as takes after
  - ❖ It has 131 Strong Instructions.
  - ❖ Most executable instruction is single clock cycle.
  - ❖ 32 sticks each with eight universally useful working registers
  - ❖ It accompanies completely static operation
  - ❖ At 20 MHz it has the throughput up to 20 Million Instructions Per Second (MIPS)
  - ❖ It has two cycles of multiplier on chip
- It has senior non-fickle Memory Segments
  - ❖ It has 32 Kilo Bytes of In-scheme self-designed Flash program memory
  - ❖ It has 1K Bytes EEPROM
  - ❖ It has 2K Bytes Intramural static RAM (SRAM)
  - ❖ It has compose/eradicate cycles of 10,000 glimmer/100,000 EEPROM
  - ❖ The aggregate information maintenance capacity of around 20 years at 85°C/100 years at 25°C
  - ❖ facultative boot code area with self-determining bolt bits which has both In-System designed by on-chip boot loader program and genuine read while compose operation
  - ❖ The program can be bolted with the assistance of the product security
- A portion of the fringe elements are as per the following
  - ❖ There are two 8-bit clocks/counters with independent re-scale and think about mode
  - ❖ There are two 8-bit clocks/counters with independent re-scale and think about mode
  - ❖ It has constant counter with isolated oscillator work
  - ❖ It has six PWM channels
  - ❖ It has 10-bit ADC in TQFP and QFN

- ❖ An arrangement of 10-bit ADC in PDIP
- ❖ A USART for serial communication
- ❖ There are two-master slave SPI linkup's
- ❖ Designed guard dog clock with isolated on-chip oscillator
- Special features of the  $\mu$ c are detailed:
  - ❖ It will get reset when power on.
  - ❖ It also has the internal Oscillator
  - ❖ Two separate sources are available.
  - ❖ An extra 6 sleep modes are available, stand-by mode is also available
- The I/O and Babbage are
  - ❖ It has 28- I/O lines
  - ❖ 28-pin in PDIP, 32-lead in TQFP, 28-pad in QFN/MLF and 32-pad in QFN/MLF
- Executing voltage are as follows
  - 1.8 - 5.5V for Atmega328P
- Temperature range is
  - ❖  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$
- Speed grade is
  - ❖ 0 - 20 MHz at 1.8 - 5.5V
- Low Power utilization at 1 MHz, 1.8V,  $25^{\circ}\text{C}$  for ATmega328P:
  - ❖ Active Mode: 0.2 mA
  - ❖ Power-down Mode: 0.1  $\mu\text{A}$
  - ❖ Power-save Mode: 0.75  $\mu\text{A}$  (Including 32 kHz RTC)

#### IV. PIN ARRANGEMENT

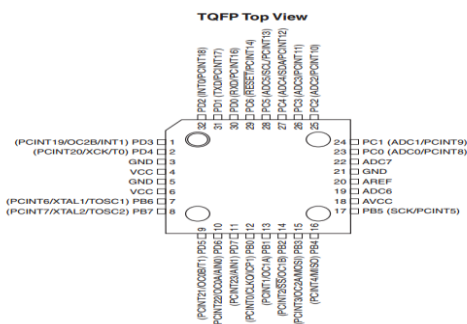


Figure 2

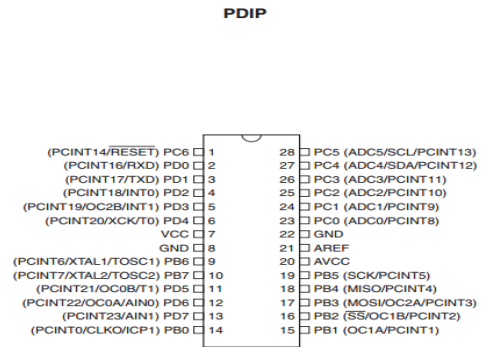


Figure 3

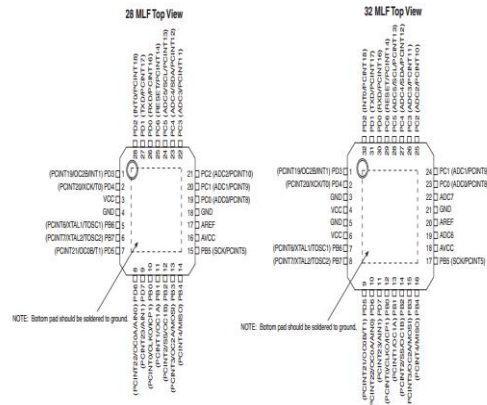


Figure 4

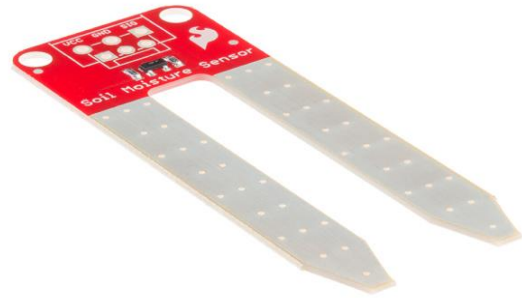
#### PIN VERSION

- ❖ VCC: Digital supply voltage.
- ❖ GND: Earth ground.
- ❖ Port B (PB.7-PB.0):
  - ❖ It contains the data transmission from 8-bit two-way I/O port, these having internal pull-up resistors. It has the PIN range from PB.7-PB.0. These pins also have some external features such as XCTL1, XCTL2 and OSC1, OSC2 for oscillator Frequency and Asynchronous timer/Counter.
- ❖ Port C (PC.5-PC.0):
  - ❖ It is a 7-bit two-way port I/o port which has in-built pull-up resistors the pin arrangement is from PC.5-PC.0. it has a tri-state condition which is used when reset condition becomes active the clock don't run.
- ❖ PC6/RESET:

- ❖ It is a programmable reset pin which is used to RESTART the program from the starting position. The Execution starts from the first line of the program.
- ❖ **Port D (PD.7PD.0):**
- ❖ It is a 7-bit two-way port I/O port which has in-built pull-up resistors the pin arrangement is from PC.5-PC.0. it has a tri-state condition which is used when reset condition becomes active the clock don't run.
- ❖ **AVCC:**
- ❖ It is the Power Supply pin for A/D conversions, PC3:0 and ADC7:6. It should be linked with the VCC supply
- ❖ **AREF:** AREF is the analog reference pin for the A/D Converter
- ❖ **ADC7:6 (TQFP and QFN/MLF Package Only):** In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

**Soil Moisture sensor:**

Soil dampness sensors degree the volumetric water content in soil. Since the direct gravimetric estimation of free soil dampness calls for wiping out, drying, and weighting of an example, soil dampness sensors degree the volumetric water content material roundabout by utilizing some different resources of the dirt, comprising of electric resistance, dielectric relentless, or transaction with neutrons, as an intermediary for the dampness content material. The connection among the planned belongings and soil dampness have to be aligned and can range contingent upon ecological additives, for example, soil type, temperature, or electric conductivity. Reflected microwave radiation is stimulated by using the dirt dampness and is utilized for detecting in hydrology and farming. Versatile take a look at devices can be utilized by agriculturists or cultivators.



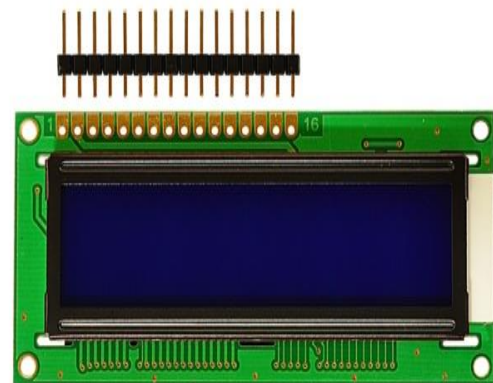
**Figure 5**

**LCD (Liquid Crystal Display)**

LCD (Liquid Crystal Display) screen is a computerized show module and find a huge mishmash of occupations. A 16x2 LCD indicates is phenomenally essential module and is regularly utilized as a bit of various devices and circuits. These modules are bolstered more than seven components and diverse multi section LEDs.

The expense enroll shops the summon bearings given to the LCD. A summon is a course given to LCD to do a predefined undertaking like presenting it, clearing its show, setting the cursor work, controlling exhibit et cetera. The measurements enroll shops the insights to be appeared on the LCD. The realities are the ASCII estimation of the character to be demonstrated at the LCD. Snap to douse up additional about internal structure of a LCD. There are various styles of LCD resembles 16x2 and 20x4. Here on this test we utilize 16x2 LCD. Here we utilize dab grid LCD.

**Pin Diagram:**



**Figure 6**

## POWER SUPPLY:

It is a circuit which converts AC to DC. It is very essential circuit required for any electronic gadget like mobile, laptop, etc.,

### Some Basic components used in Power Supply:

#### Transformers

Transformer is an electrical component which transfers electrical energy from one circuit to another circuit by changing its voltage strength.

Here we are using step down transformer for reducing 230 V to 12 v.

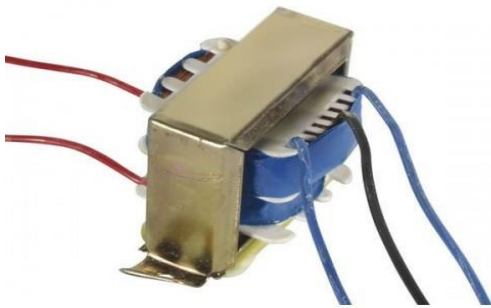


Figure 7

Basically, there are two sides in a transformer one is primary coil and other one is secondary coil.

#### Rectifier:

Rectifier is an electronic component which converts AC to pulsating DC.

Here we are using four diodes as a bridge rectifier which has high efficiency.



Figure 8

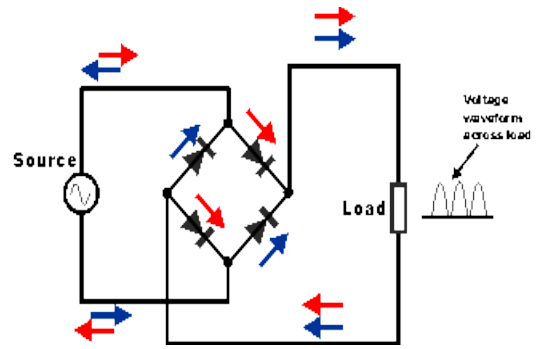


Figure 9

It doesn't change voltage strength.

#### Capacitors:

Capacitors are used to convert pulsating DC to smooth pure DC. It filters small AC components.



Figure 10

#### Voltage regulators:

Voltage regulator is used to regulate constant voltage.

Here we are using 7805IC

Which can output 5 V DC.

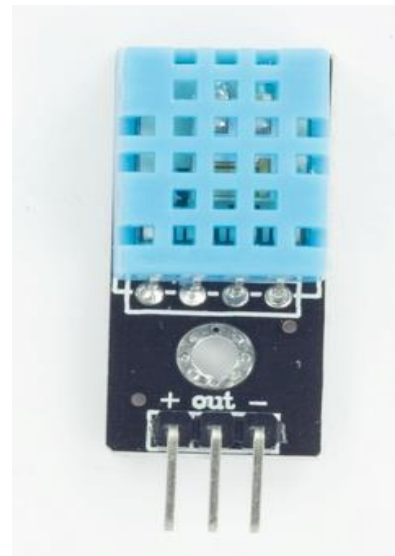


Figure 11

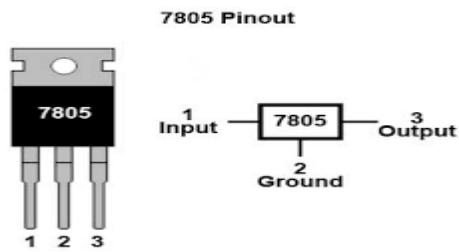


Figure 12

**DHT11SENSOR (TEMPERATURE/HUMIDITY SENSOR):**

This DHT11 Temperature and Humidity Sensor include an adjusted advanced flag yield with the temperature and mugginess sensor complex. Its innovation guarantees the high dependability and magnificent long haul solidness. An elite 8-bit microcontroller is associated. This sensor incorporates a resistive component and a feeling of wet NTC temperature measuring gadgets. It has superb quality, quick reaction, hostile to impedance capacity and high cost execution points of interest.

Each DHT11 sensors highlights to a great degree exact adjustment of dampness alignment chamber. The adjustment coefficients put away in the OTP program memory, inner sensors identify motions all the while, we should call these alignment coefficients. The single-wire serial interface framework is coordinated to end up noticeably snappy and simple. Little size, low power, flag transmission remove up to 20 meters, making it an assortment of utilizations and even the most requesting applications. The item is 4-stick single column stick bundle. Advantageous association, uncommon bundles can be given by clients require.

**Specification**

- Supply Voltage: +5 V
- Temperature range :0-50 °C error of ± 2 °C
- Humidity :20-90% RH ± 5% RH error
- Interface: Digital

**GSM/GPRS:**

It is a standard set created by the European Telecommunications Standards Institute (ETSI) to

portray conventions for second era (2G) computerized cell systems utilized by cell phones. A Modem is a gadget which tweaks and demodulates motions as required to meet the correspondence necessities. It regulates a simple transporter flag to encode computerized info, and furthermore demodulates such a bearer flag to interpret the transmitted data.

A GSM/GPRS module has a MAX-232 interface for serial response with an outside World. For this circumstance, the transmitter (Tx) of the PC's Serial port is connected with the Receiver (Rx) of the GSM module's MAX-232 interface. The transmitter (Tx) of the MAX-232 of GSM/GPRS module is related with Receiver (Rx) of microcontroller's serial transmission stick. Besides, the serial transmit stick of the microcontroller is related with the get stick of the PC's Serial port. In this way the summons and their results are transmitted and gotten in a triangular way as depicted underneath.

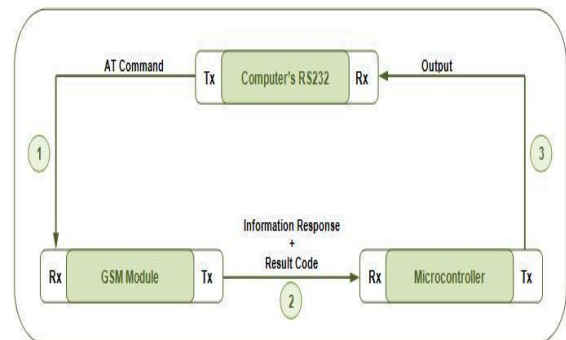


Figure 13

In resulting ventures (see MC075 and MC076), the HyperTerminal will be supplanted by the microcontroller itself; along these lines staying away from the need of utilizing a Computer to set up an interface. This would prompt a free GSM based framework.

The microcontroller is modified to get and transmit information at a baud rate of 9600. For more points of interest on setting the baud rate of microcontroller, elude serial correspondence with Arduino

GSM module is interfaced with Arduino Processor by adjusting the TX, RX and ground pins in it. The instruction to the GSM is altered in the code itself when there is need of the GSM, ARM processor initiates the instruction through the AT (Attention Commands) such as AT, ATEO, AT+CMGF, AT+CMGS etc;

### Software Description:

#### Arduino IDE:

The Arduino IDE software is a open source software, where we can have the example codes for the beginners. In the Present world there are lot of version in the Arduino IDE in which present usage is Version1.0.5. It is very easy to connect the PC with Arduino Board.

#### Working of the project:

By using DHT11 we can find the temperature and humidity and soil moisture sensor is used to detect the condition of the soil. If soil moisture sensor is in dry condition the pumping motor will on. Here LCD is used to display the temperature and humidity values. By using GPRS we can transmit the data.

#### Advantages:

- Provides a healthy, beautiful landscape
- Reduces water waste
- Saves money
- Provides convenience

#### Applications:

- At home
- Nurseries
- In Gardens

### Results:

1. The hardware Setup of our proposed system is shown below

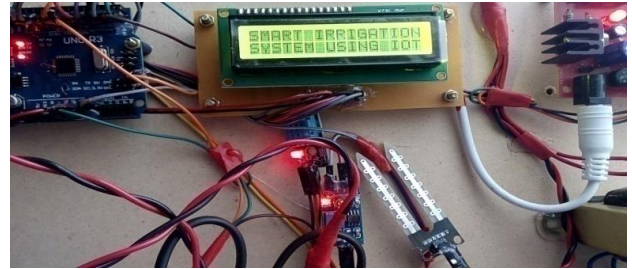


Figure 14

2. When the Moisture level is high then motor is in OFF Condition

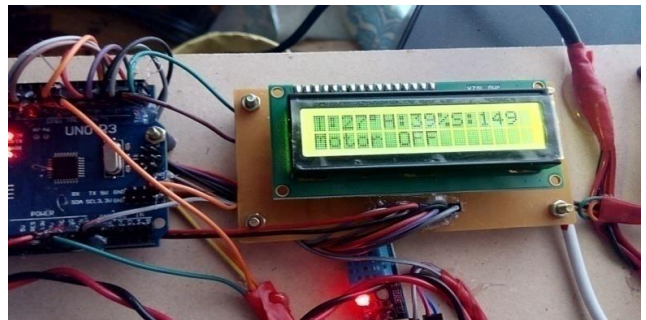


Figure 15

3. The data is uploaded to the server continuously

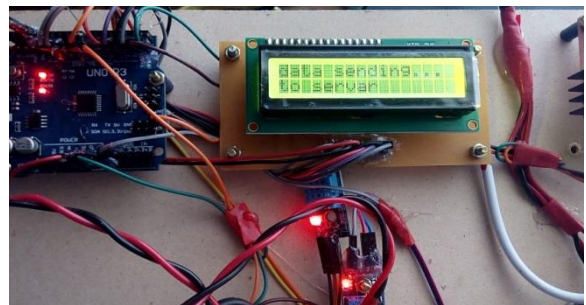


Figure 16

4. After Completion of uploading the data to the server

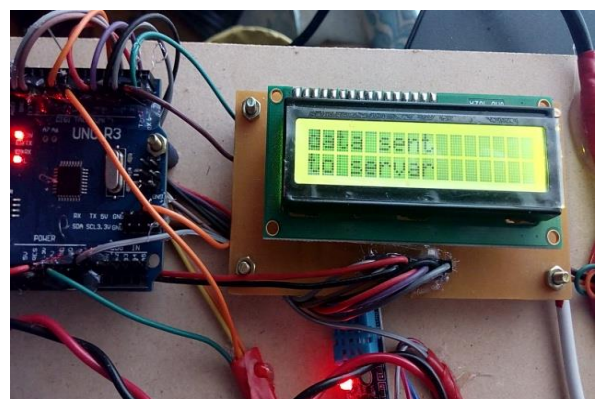


Figure 17

5. When the soil moisture is in low condition the motor is in ON Condition

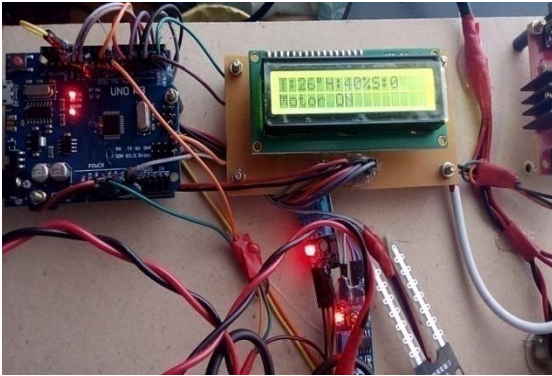


Figure 17

6. Continuously this data is uploaded to the sever in cyclic process

## V. CONCLUSION

The small scale water system device done wind up plainly resolved to be reasonable and fetched capable for enhancing water valuable asset for rural creation. This water system framework lets in development in areas with water shortage subsequently improving maintainability. The miniaturized scale water system framework created demonstrates that the utilization of water might be dwindled for a given measure of crisp biomass generation. The utilization of sun control on this water system gadget is correlated and obviously imperative for natural plants and other farming stock which can be geologically insolated, in which the interest in electric vitality supply could be exorbitant. The water system machine might be changed in accordance with a spread of particular product craves and requires least upkeep. The particular setup of the smaller scale water system machine lets in it to be scaled up for bigger nurseries or open fields. Likewise, unique projects which incorporate temperature observing in compost assembling might be effortlessly done.

## VI. REFERENCES

- [1]. "W. A. Jury and H. J. Vaux, -The developing worldwide water emergency: Managing shortage

and struggle between water users, Adv. Agronomy, vol. 95,pp. 1-76, Sep. 2007."

- [2]. "X. Wang, W. Yang, A. Wheaton, N. Cooley, and B. Moran, -Efficient enlistment of optical and IR pictures for programmed plant water push appraisal, Comput. Electron. Agricult., vol. 74, no. 2, pp. 230-237,Nov. 2010."
- [3]. "G. Yuan, Y. Luo, X. Sun, and D. Tang, - Evaluation of a harvest water push record for recognizing water worry in winter wheat in the North China Plain, Agricult. Water Manag., vol. 64, no. 1, pp. 29-40, Jan. 2004."
- [4]. "S. B. Idso, R. D. Jackson, P. J. Pinter, Jr., R. J. Reginato, and J. L. Hatfield, -Normalizing the anxiety degree day parameter for natural variability,Agricult. Meteorol., vol. 24, pp. 45-55, Jan. 1981."
- [5]. "Y.Erdem, L.Arin, T.Erdem, S.Polat, M.Deveci, H.Okursoy, and H. T. Gültas, -Crop water stretch file for surveying water system planning of trickle inundated broccoli (Brassica oleracea L. var. italica),Agricult. Water Manag., vol. 98, no. 1, pp. 148-156, Dec. 2010."



# Performance Analysis of Energy-Aware Load Adaptive Schemes for Optical Communication Networks

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## ABSTRACT

Wireless Sensor Network (WSN) is one of the new paradigms which is helping for sharing and disseminating data in the Sensor Networks. Extended Network Lifetime, Scalability, and Traffic Balancing among the Nodes in the Network are significant requirements and challenges for Wireless Sensor Networks which requirements are achieved by clustering that is one of the effectual techniques for achieving these requirements. This research work identifies a few popular Energy Efficient Clustering Protocols namely i. Switch-On, ii. Load Adaptive Sequence Arrangement-Fixed Minimal Transmission Time (LASA-FMT) and iii. Internet Protocol/Wavelength-Division-Multiplex (IP-WDM) for analysis and studied thoroughly. From the experimental results, it was noticed that the Switch-On model is performing well in term of Routers/ Throughput but however it fails to achieve Throughput, Router Utilization and it is also consuming more Power. The LASA-FMT is outperforming in term of Throughput and the IP-WDM model is outperforming in terms of Router Utilization and Power Consumption, but however this model was incompetent to achieve Throughput.

**Keywords:** Clustering, Energy Efficiency, Fuzzy Logic, Residual Energy, Ring Routing, Routing Technique, Wireless Sensor Networks

## I. INTRODUCTION

Present day administration suppliers confront a large group of difficulties, numerous originating from the mind boggling, dynamic activity examples of mobile, video, and cloud services and expanding interest for transmission capacity with exclusive standards about the nature of service[1,2,3]. The expectations incorporate system availability, more data transfer capacity or bandwidth and a "superior than best exertion" approach.

The expenses for meeting the expectations of the client challenge numerous service supplier income models. They must indeed balance the cost of infrastructure upgrades against the return on investment. To remain competitive as well as profitable, assuredly the service providers must be

capable of providing new and developed services while gaining increased efficiencies from the network to lower costs.

The three recently proposed popular models[1,2,3] namely Switch-On, Load Adaptive Sequence Arrangement (LASA) the Fixed Minimal Transmission Time (FMT) and Internet Protocol (IP) / Wavelength-Division-Multiplex (WDM) are here discussed and compared in the following sections.

## II. RECENTLY PROPOSED POPULAR MODELS

In the following sections, we have discussed all the above mentioned three models.

### A. ILP based Switch-On Schemes[1]

The ILP based Switched-On Scheme was proposed by

the author[1,5,6] Marcel Caria and et al. Dynamic transport circuit services are adapted by load adaptive energy saving schemes for backbone IP networks which use to adapt the active network resources to the current traffic demand in order to reduce the network's energy consumption. Although it has been shown that the scheme can notably decreases the network's energy consumption, it is still prone to instabilities in the IP routing service and decreased resilience due to reduced connectivity and they may induce monitoring reconfigurations in fact. To face these challenges, the Switch-On scheme in an IP-over-WDM network, where the network is designed so that the essential IP connectivity is maintained during low traffic periods while dynamic circuits are switched on in the optical layer to boost network capacity during the phases of high traffic demand was indeed proposed.

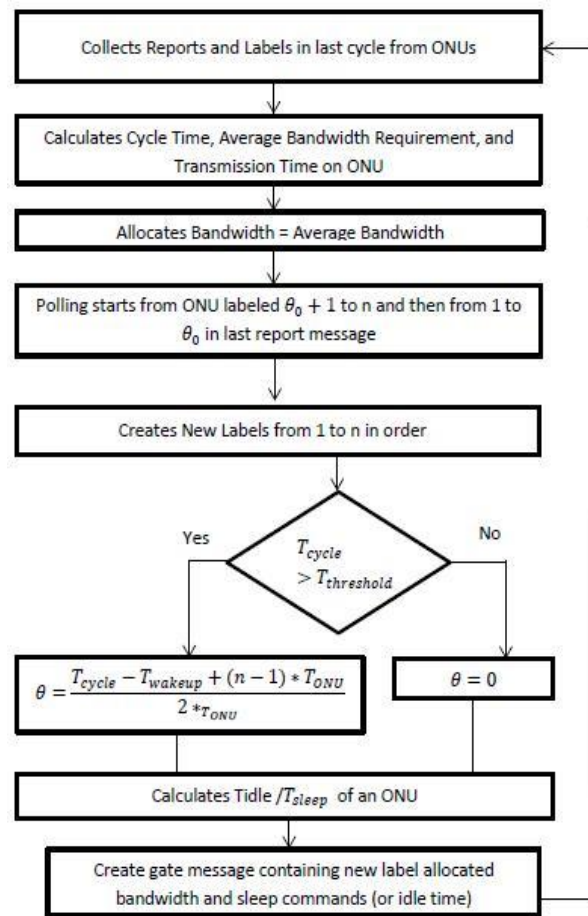
Switching on the optical links during peak network loads can address some of the challenges still linked with the switching off IP ports and links during the low traffic periods. The already research results perform that the multilayer approaches in IP-over-WDM networks carry remarkable potential for improvement in energy efficiency [1,2,3,4].

In this Switch-On scheme, the network was designed so that the essential IP connectivity is maintained during low traffic periods while dynamic circuits are switched on in the optical layer to boost up the network capacity during the periods of high traffic demand. The Wavelength Division Multiplexed (WDM) layer is provided[1,3,4,5] with the traffic management flexibility and the engineering simplicity of digital transport systems and with the network cost savings of large-scale photonic integration.

The result[1] shows that the Switch-On Technique saves Energy in Optical Networks rather a considerable computational complexity.

**B. LOAD ADAPTIVE SEQUENCE ARRANGEMENT (LASA) WITH FIXED MINIMAL TRANSMISSION TIME (FMT)**

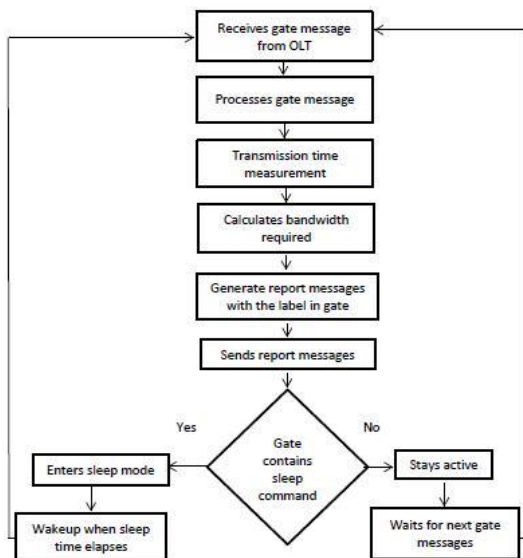
The Load Adaptive Polling Sequence Arrangement (LASA) Scheme jointly working with Fixed Minimal Transmission Time (LASA-FMT) was proposed[2] by the author Yunxin Lv and et al [2,8,9,10]. An energy-efficient scheme termed as load adaptive sequence arrangement (LASA) is successfully introduced by the authors[2,11,12]. Based on changing the polling sequence of optical network units (ONUs) according to the traffic load, the scheme can successfully develop the energy efficiency of the passive optical access networks. The Flow chart of the LASA scheme that executed at Optical Line Terminal is shown at the Figure 1 and the Flow chart of the LASA scheme that executed at Optical Network Units is shown at the Figure 2



**Figure 1.** Flow chart of the LASA scheme executed at Optical Line Terminal

The polling sequence arrangement is demonstrated by processing a label that is added in the gate/report message and allocating each ONU an uneven idle time rather. When the polling sequence is changed, the ONUs that have been allocated longer idle times could sleep much longer indeed. Theoretical analysis indicates that the polling sequence arrangement has a remarkable impact on the energy efficiency of the network.

It can provide ONUs longer total sleeping time, and can also barely lengthen the average cycle time. Moreover, to optimize the energy consumption performance under a low-traffic scenario, the LASA scheme as jointly working with the fixed minimal transmission time (FMT) of the ONU scheme, which is called the LASA-FMT scheme, is further investigated in the research. By ensuring the minimal transmission time of an ONU, the LASA-FMT scheme further lengthens the total sleeping time of ONUs and improves the energy efficiency.



**Figure 2.** Flow chart of the proposed LASA scheme executed at Optical Network Units

When an energy-efficient scheme termed as load adaptive sequence arrangement (LASA) is introduced, based on changing the polling sequence of optical network units (ONUs) according to the traffic load, the scheme can improve the energy efficiency of

passive optical access networks. The polling sequence arrangement is performed by means of processing a label that is added in the gate/report message and allocating each ONU an uneven idle time. When the polling sequence is changed, the ONUs that have been allocated longer idle times could sleep much longer. Theoretical analysis indicates that the polling sequence arrangement has a significant effect on the energy efficiency of the network.

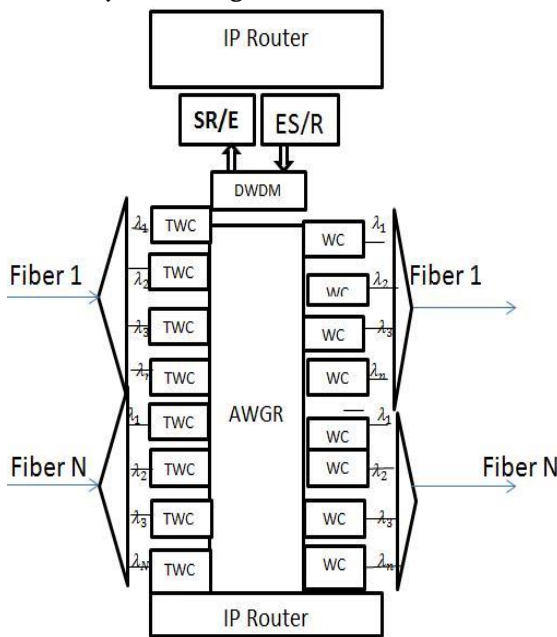
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### C. ARCHITECTURE MODELS OF OPTICAL LAYERS

It was considered two types of Optical Layer Architecture Designs such as the ones depending on wavelength conversion capability. Optical Nodes with wavelength conversion can successfully convert the wavelength of an incoming signal to another wavelength channel rather. However, this is not available in all the Optical Nodes. An Optical Node without wavelength conversion depends on the IP layer to provide wavelength conversion to determine the wavelength contention in the process of traffic grooming[3,13,14,15]. Figure 3 shows Optical Node Architecture with (a) and without (b) wavelength conversion. For the IP layer and optical layer interfaces, the Dense WDM (DWDM) ports are

connected to SR/Es and E/SRs. In the energy model, the consideration is here for the integrated DWDM ports with SR/E (E/SR) inside an IP line card for the sake of simplicity. Figure 3(a) shows an: All-optical node model employing wavelength switching. The optical layer consists of following 5 major elements; WDM mux, WDM demux, fast tunable wavelength converter (TWC), broadband wavelength converter (WC), and optical cross connector (OXC).

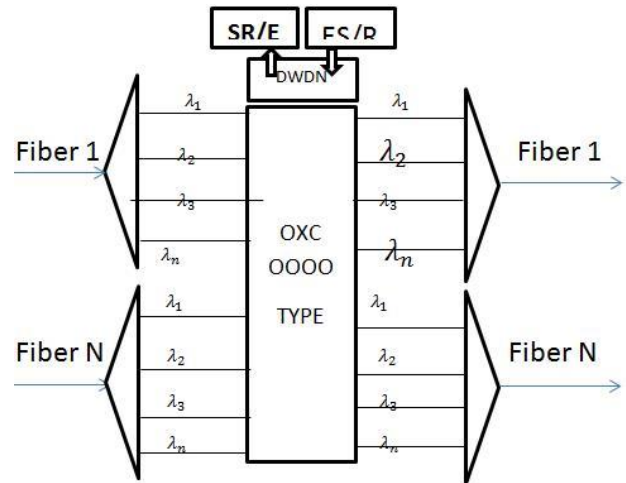
A TWC can tune the output wavelength for an arbitrary WDM [3,16,18] channel to switch the input port to an available output port of an arrayed waveguide grating router (AWGR). In turn, the wavelength is all converted rather to that of the output port WDM channel. Figure 3(b) shows the all-optical node model that provides space switching without any wavelength conversion at all.



**Figure 3.** All-Optical Node Schematic Models with IP Router and the AWGR-based Wavelength Switching Optical Node

The Node employs all-optical switching that can connect input ports to output ports only in the same wavelength channel, i.e., Wavelength Layered Switching. Here, an OXC consists of WDM mux, WDM Demux, and slices of passive-medium fiber

switch devices.



**Figure 4.** All-Optical Node Schematic Models with IP Router and Space Decision Switching Node without Wavelength Conversion Function

An Amplified Optical Fiber Transmission System Model consists of Erbium-Doped Fiber Amplifiers (EDFAs). Broadband EDFAs are installed at the end of every optical fiber link in order to compensate for the fiber signal attenuation of all WDM channels at once. They employ electro-optic switches for minimal energy consumptions. The total number of the TWCs and WCs in an AWGR wavelength switch is because TWCs and WCs are installed on each side of OXC. An EDFA is installed at every 80 km of a fiber link.

**1) Energy Consumption Model[3]**

This work[3] considers the static traffic case in order to investigate network dimensions or dimensioning against a worst-case scenario with a maximum traffic demand. Note that this dimensioning objective is different from the dynamic provisioning objective. And it was noted the energy consumption of network as:

$$E_{net} = \sum_{e \in \{\text{network element}\}} p^e (t^e), \quad 0 < t^e \quad (1)$$

Here, labels each network element, and denote energy consumption of and traffic load at element, respectively. A total energy consumption of a network

can be expressed by summation of energy consumptions of all network elements as described in (1). The energy consumption of a network element increases as traffic load increases. That is, more the traffic loads more the energy consumption of a network element. Generalization of the energy consumption of a network element requires consideration of two terms: load-independent power term  $p_I^e$  for idle-state power

consumption of element and load-dependent power term of element determined by a product of varying power portion

$p_M^e - p_I^e$  and normalized traffic load on the element,  $t^e$ . The energy consumption for a given traffic load is expressed as:

$$P^e(t^e) = P_I^e + (P_M^e - P_I^e) t^e, \quad 0 \leq 1 \quad (2)$$

This expression in the first-order approximation can model the energy efficiency of a network element: An ideal network element will have a value of zero for  $p_I^e$  and a very small value for  $p_M^e - p_I^e$ .

The energy consumptions of IP and optical layers modeled by (2) can be understood as following. In an IP layer, a line card consisting of input and output ports of an IP router performs packet processes to route traffic. These processes include packet framing, forwarding, flow control, and address and class filtering, which are responsible for the major portion of the energy consumption of an IP router indeed. Therefore, the energy consumption of an IP layer can be modeled as the total energy consumption of each IP router port. Hence, employing the EPI model for an IP router port, one can model traffic-dependent IP network energy consumption, and accordingly optimize network capacity dimensioning for optimal energy consumption. An optical layer for path switching consumes little energy when compared to that of with the IP layer, since no complicated computing process is required at all in an optical layer.

An OXC can be constructed by use of passive medium switch devices and the energy consumption is negligible. We consider the energy consumption of TWC, WC, and EDFA to model the energy consumption of the optical layer. In an optical layer, wavelength converters are turned on if light path is switched by wavelength converters, meaning that there is no traffic dependency in the energy consumption by wavelength converters. Hence, we consider wavelength converters consume energy fully whenever they are turned on.

### 2) Traffic Grooming With Wavelength Conversion (TGWC)

In a TGWC network, lightpaths consist of connected multiple links were established the constructing virtual topologies. It is a sequence of unidirectional links and those links using different wavelengths. Each IP routing hop is connected by a lightpath and flows that can share a lightpath are groomed at every IP hop. An intermediate node in the middle of the lightpath, which is capable of optical path switching switches the traffic to its next intermediate node. The traffic proceeds in the optical domain until it is received by the end node of the lightpath that terminates the lightpath traffic. This node re-inserts the traffic to another lightpath through an IP layer of the node. Finally the traffic arrives at the destination node as discussed at [3,17].

$$\min \sum_{(i,j) \in Z} \left( P_F^{LP} b^{ij} + P_V^{LP} t^{id} \right) + P_{wc} \sum_{(s,d) \in Z} b^{ij} \quad (3)$$

### 3) Traffic Grooming Without Wavelength Conversion

In a TG network, lightpaths are established by the same way as in a TGWC network, but a lightpath uses only a single wavelength. Each flow uses virtual links of lightpaths in order to send its traffic. An optical layer of this TG network has no wavelength channel conversion capability. Therefore,

wavelength conversion as well as traffic routing occurs in the IP layer

$$\min \sum_{(i,j) \in Z} (P_F^{IP} h^{ij} + P_V^{IP}) + P_{WC} \sum_{(s,d) \in Z} t_{ij}^{sd} \quad (4)$$

### III. RESULTS AND DISCUSSION

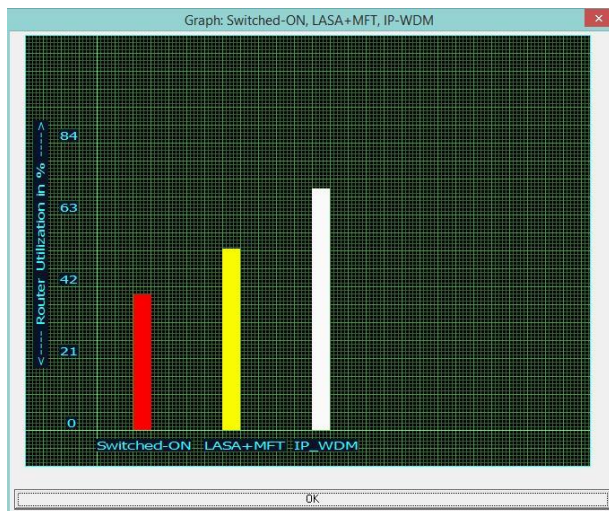
The performances of the three identified Energy Efficient Clustering Protocols namely i. Switch-On, ii. Load Adaptive Sequence Arrangement-Fixed Minimal Transmission Time (LASA-FMT) and iii. Internet Protocol/Wavelength-Division-Multiplex (IP-WDM) were studied thoroughly and analyzed in terms of Router Utilization, Throughput and Power Consumption.

**Table 1.** Comparative Study Analysis

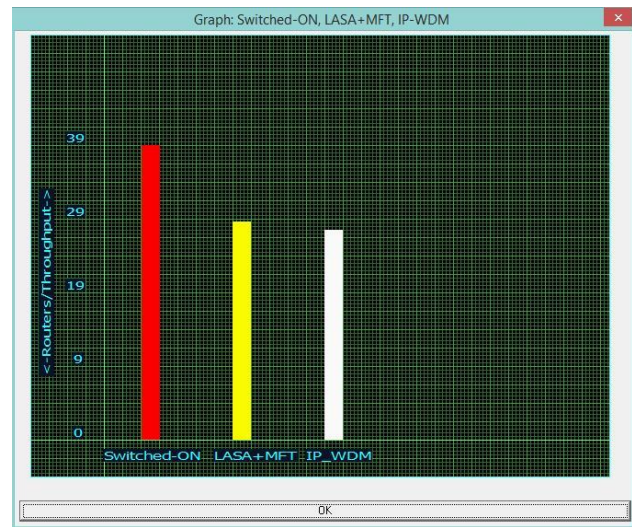
Parameters	Utilization	Throughput	Router/Throughput	PowerConsumption
Switch-On	FAIR	FAIR	BEST	FAIR
LASA+MFT	GOOD	BEST	GOOD	GOOD
IP/WDM	BEST	GOOD	FAIR	BEST

A few parameters like Traffic Load, Packet Size, Inter-Frame Gap, Transmission Time, Bandwidth Usage, Packet Delay, Topology were considered to study the above mentioned Models. The Results were discussed and the experimental results of the above Clustering Protocols were shown at the Figures Figure 5 to Figure 8.

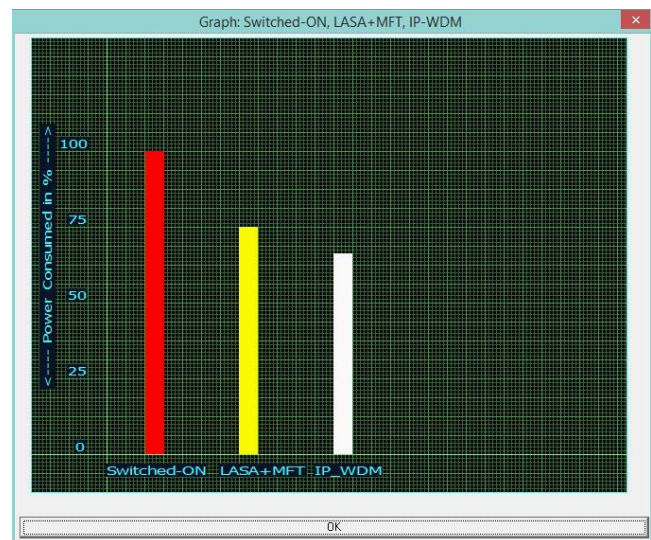
As shown at the Figure Figure 5, the IP/WDM is performing well in term of Router Utilization. In other words as IP/WDM doesn't have an efficient Queue Management Scheme, its Throughput is less than that of Switch-On and LASA+MFT Models.



**Figure 5.** Comparative Study of Models - Router Utilization



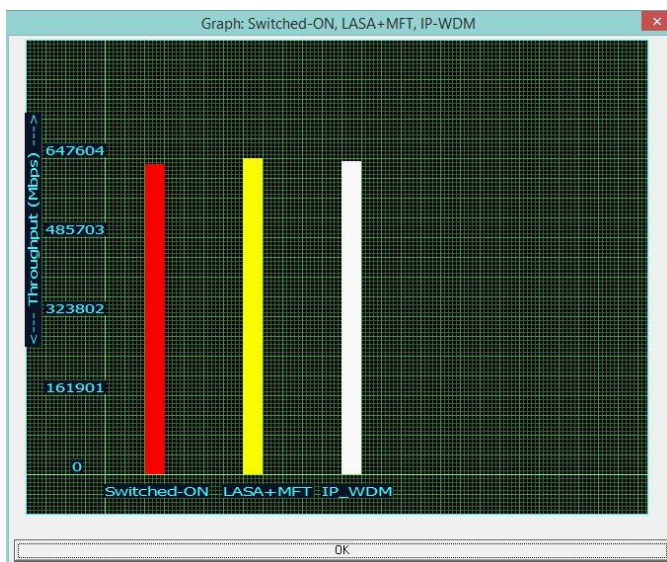
**Figure 6.** Comparative Study of Models – Routers' Throughput



**Figure 7.** Comparative Study of Models – Power Consumption

As shown at the Figure Figure 6, the Switch-On Model is performing well in term of Router/Throughput. That is as this model Switch Off all the lower usage Routers, its Throughput is higher. In other words as Switch-On permits only higher usage Routers to work, the Network Load is going higher and hence more Packets were dropping which leads more Power Consumption and less Router Utilization. ie more packets need to retransmit by Routers.

As shown at the Figure Figure 7, the IP/WDM is performing well in term of Power Consumption. The LASA+MFT Energy Efficient Model is perming well in term of Throughput as compared with other two models which is shown in the Figure Figure 8.



**Figure 8.** Comparative Study of Models – Throughput

#### IV. CONCLUSIONS

This research work has implemented the three popular Energy Efficient Clustering Protocols i. Switch-On, ii. LASA-FMT and iii. IP-WDM and studied thoroughly. From the experimental results, it was noticed that the Switch-On model is performing well in term of Routers/ Throughput but however it fails to achieve Throughput, Router Utilization and it is also consuming more Power. The LASA-FMT is

outperforming in term of Throughput, but however, it fails to achieve Power Consumption. The IP-WDM model is outperforming in terms of Router Utilization and Power Consumption, but however this model was incompetent to achieve Throughput.

#### V. REFERENCES

- [1]. Marcel Caria, Mohit Chamania, and Admela Jukan, "A Comparative Performance Study of Load Adaptive Energy Saving Schemes for IP-Over- WDM Networks," *Journal of Optical Communication Network*, Vol. 4, No. 3, 2012.
- [2]. Yunxin Lv, Ning Jiang, Kun Qiu, and Chenpeng Xue, "Energy-Efficient Load Adaptive Polling Sequence Arrangement Scheme for Passive Optical Access Networks," *Journal of Optical Communication Network*, Vol. 7, No. 6, June 2015.
- [3]. Yoontae Kim, Chankyun Lee, June-Koo Kevin Rhee, Member, IEEE, and Sangyoum Lee, "IP-Over- WDM Cross-Layer Design for Green Optical Networking With Energy Proportionality Consideration," *Journal Of Lightwave Technology*, Vol. 30, No. 13, July 1, 2012.
- [4]. Annual Cisco Visual Networking Index Forecast Projects Global IP Traffic to Increase More Than Fourfold by 2014, Cisco Press Release Online]. Available: [http://newsroom.cisco.com/dlls/2010/prod\\_060210.html](http://newsroom.cisco.com/dlls/2010/prod_060210.html).
- [5]. W. Fisher, M. Suchara, and J. Rexford, "Greening backbone networks: reducing energy consumption by shutting off cables in bundled links," in *ACM SIGCOMM Workshop on Green Networking 2010*, New York, Aug. 2010.
- [6]. A. Coiro, M. Listanti, A. Valenti, and F. Matera, "Reducing power consumption in wavelength routed networks by selective switch off of optical links," *IEEE J. Sel. Top. Quantum Electron.*, vol. 17, no. 2, pp. 428-436, Apr. 2011.

- [7]. F. Farahmand, I. Cerutti, M. M. Hasan, and J. P. Jue, "Energy-efficiency of drop-and-continue traffic grooming," in *Optical Fiber Communication Conf.*, 2011.
- [8]. C. Lange, D. Kosiankowski, A. Betker, H. Simon, N. Bayer, D. Hugo, H. Lehmann, and A. Gladisch, "Energy efficiency of load-adaptively operated telecommunication networks," *J. Lightwave Technol.*, vol. 32, no. 4, pp. 571-590, Feb. 2014.
- [9]. Y. Lv, N. Jiang, K. Qiu, and C. Xue, "Study on the energyefficient scheme based on the interconnection of opticalnetwork-units for next generation optical access network," *Opt. Commun.*, vol. 332, pp. 114-118, Dec. 2014.
- [10]. M. P. I. Dias and E. Wong, "Sleep/doze controlled dynamic bandwidth allocation algorithms for energy-efficient passive optical networks," *Opt. Express*, vol. 21, no. 8, pp. 9931-9946, Apr. 2013.
- [11]. A. Dixit, B. Lannoo, D. Colle, M. Pickavet, and P. Demeester, "ONU power saving modes in next generation optical access networks: Progress, efficiency and challenges," *Opt. Express*, vol.20, no. 26, pp. B52-B63, Dec. 2012.
- [12]. M. S. Bazaraa, J. J. Jarvis, and H. D. Sherali, *Linear Programming and Network Flows*, 4th ed. New York: Wiley, 2010.
- [13]. E. Yetginer, Z. Lieu, and G. N. Rouskas, "RWA inWDMrings:An efficient formulation based on maximal independent set decomposition," in *Proc. IEEE LANMAN 2010*, Long Branch, NJ, May 2010, pp. 1-7.
- [14]. W. V. Heddeghem, W. Vereecken, D. Colle, M. Pickavet, and P. Demeester, "Reduction of the energy footprint in optical networks," in *Proc. Int. Conf. Photonics in Switching 2010, Energy Efficient Networking and Systems Workshop*, Monterey, CA, Jul. 2010.
- [15]. M. Jinno, "Energy and spectrally efficient elastic optical path network: Introducing elasticity and adaptation into optical domain," in *Proc. Int. Conf. Photonics in Switching, Energy Efficient Networking and Systems Workshop*, Monterey, CA, Jul. 2010.
- [16]. J.-K. K. Rhee, C. K. Lee, J. Y. Choi, J. H. Kim, Y. H. Won, and J. S. Choi, "Power and cost reduction by hybrid optical packet switching with shared memory buffering," *IEEE Commun. Mag.*, vol. 49, no. 5, pp. 102-110, May 2011.
- [17]. S. Zhang, D. Shen, and C. K. Chan, "Energy efficient time-aware traffic grooming in wavelength routing networks," in *Proc. IEEE GLOBECOM 2010*, Miami, Dec. 2010, pp. 1-5.
- [18]. M. Xia, M. Tornatore, Y. Zhang, P. Chowdhury, C. U. Martel, and B. Mukherjee, "Green provisioning for opticalWDM networks," *IEEE J. Sel. Topics Quantum Electron.*, vol. 17, no. 2, pp. 437- 445, Mar. 2011.



# Image Guided Radiotherapy Workflow for Localized Prostate Cancer : A Hybrid Solution for A Better Therapeutic Outcome

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## ABSTRACT

Image guided radiotherapy (IGRT) workflow was introduced to manage localized prostate cancer treatment by hybridizing treatment planning and dose delivering optimization. Seven main challenges were examined over a four year period with simple hybrid tailor-made solutions and workflow protocols formulated with limited resources. These techniques significantly improved the therapeutic ratio by safely reducing the large target margins and enhanced the possibility for dose escalation. However, clinical implementations were explored cautiously and a comprehensive dosimetric evaluation done to address uncertainties in workflow.

**Keywords :** Image Guided Radiation Therapy, Prostate Cancer, Workflow Protocol, Image Fusion.

## I. INTRODUCTION

A three dimensional conformal radiotherapy (3D CRT) is used routinely in prostate cancer radiation treatment in an effort to maximize its therapeutic ratio. Its successes rely on the accurate delivery of escalated dose to the targets and minimal dose to surrounding normal tissues. Temporal variations either by patient/organ geometry or dose-response related [1] were the predominant sources of treatment uncertainties with numerous imaging studies confirming this [2, 3, 4]. Conventional methods to compensate for these variations typically involve adding a large margin around the target while limiting the tumor dose prescription. Encouraging results in dose escalation trials for localized prostate cancer [5, 6, 7] establish a better method of safely escalating doses without unduly compromising the treatment volume. This workflow involves fused images from a dedicated computed tomography (CT) and magnetic resonance

imaging (MRI) scanners. CT scans solely used for delineation tends to overestimate the prostate volume and underestimate the prostate to rectum distance, in comparison to CT-MRI fusion-based treatment planning [8]. Another study [9] shows the dose-volume histogram (DVH) from CT-MRI fusion is possible to spare a mean 10% of rectal volume and approximately 5% of bladder and femoral heads. In IGRT prostate treatments [10, 11, 12] portal images and digitally reconstructed radiographs (DRRs) are the most frequently used image-guidance systems to monitor patient setup and verification. Several factors contribute to the accuracy of the delivered dose to patients; and in-vivo dosimetry is highly recommended [13]. Recently developed concepts of image-guided adaptive radiotherapy (IGART) workflow can lead to improved matching between planning and treatment [14] by considering an idea workflow. The main goal of this manuscript is to outline the evolution of an IGRT workflow generated

over the years with limited resources to deliver very high standard therapeutic outcome for localised prostate cancer patients.

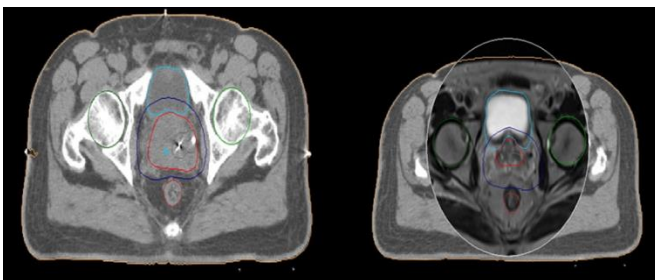
## II. METHODS AND MATERIAL

### A. Patient pre-scan preparations for CT/MRI simulation:

Patients are instructed to take 10mg of dulcolax three days prior to CT/MRI scanning to empty their bowels. The bladder is kept comfortably full by drinking 200ml of water mixed with 18ml Gastrografin and intravenous (IV) contrast 30 minutes prior to the scan. These are reproduced by the patient continuing with the dulcolax and taking 200ml of water 30 minutes before daily treatment. Three fine gold markers are implanted transrectally into the prostate guided by an ultrasound, and this is verified before the scanning.

### B. CT/MRI fusion for targets and OARs delineation:

Patients are scanned supine with both CT and MRI simulations done on customized flat couches to mimic that of the treatment unit. Dicom images are exported unto the TPS and later imported and fused based on bones and soft tissues. The two image series are registered before fusion. The implanted gold markers give an idea of the size and location of the prostate relative to other OARs. The gross tumor and clinical targets volumes (GTV and CTV) and OARs (bladder, rectum and femoral heads) are then drawn as region of interest (ROI) for onward planning. Fig.1 shows a fusion of CT/MRI images using a rigid alignment of patient contours.



**Figure 1.** MRI scans overlying a CT scan showing differences in targets and OARs definitions

### C. Gold marker implantation and enhancement of its artefacts on isodose lines and imaging:

Each patient had three cylindrical gold markers inserted into the prostate (to serve as a surrogate for the prostate) before CT/MRI scans. These markers are critical in image guided radiotherapy. However, they produce uncertainty in the dose calculation during treatment planning because of gold's (Au) higher photon mass attenuation coefficient than that of normal tissue. The immediate tissue around the fiducial markers was contoured and its density changed to 1.00 g/cm<sup>3</sup> (density of water). The geometric reliability of the digitally reconstructed radiographs (DRRs) generated by Oncentra Master Plan treatment planning system (TPS) are assessed and adjusted accordingly to give better images.

### D. Daily online target verification and shift protocols:

To verify the treatment position of the prostate, portal images representing the displacements are acquired with an iView imaging device. For inter-fraction prostate position corrections for both systematic and random errors, an on-line correction procedure is applied. After manual alignment of the marker annotations onto the portal images, the set-up deviations and required corrections are displayed on iView matching software [15].

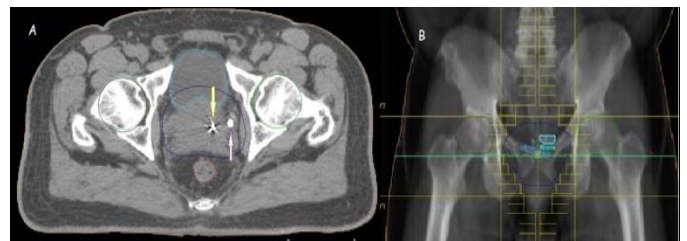
**E. In vivo diode dosimetry:** After satisfactory patient set up, diodes are placed on the crosswire at isocenter. The diodes placed are based on the energy and type (photons or electrons) of radiation used for the treatment. Commercial diodes and Apollo 5 electrometer are used for the in vivo measurement. Diode readings are taken for all fields for the first two fractions unless prescribed by the physicist

### III. RESULTS AND DISCUSSION

This workflow was developed over the years as a result of a careful and meticulous inter-departmental approach and contribution. Clinical implementations were carefully incorporated after cautiously exploring these new techniques and comprehensive dosimetric evaluation done to address uncertainties. It involves a treatment plan based on 3D volumetric CT/MRI imaging fusion, a strict pre-scan preparation protocol and a highly conformed 3DRT 78Gy in 39 fractions plans. Densities of implanted gold markers are changed in the TPS during dose calculation to obtain accurate isodose and DVHs. Without density correction, the minimum coverage to the PTV was 85.54% but went up to 100.05% when the density was changed. This is a true reflection of the dose coverage to the PTV leading to a more coherent DVH table. Superior DRRs are also generated to clearly distinguish the fiducial markers from intraprostatic calcifications (IPCs) and bones for image verification using the iView imaging system. CT based scans delineated the prostate volumes by approximately 30% thereby irradiate normal tissues around the prostate. These uncertainties in delineating the targets and OARs were compensated for by giving 2 cm margins around targets and a restriction on the total dose to 68Gy.

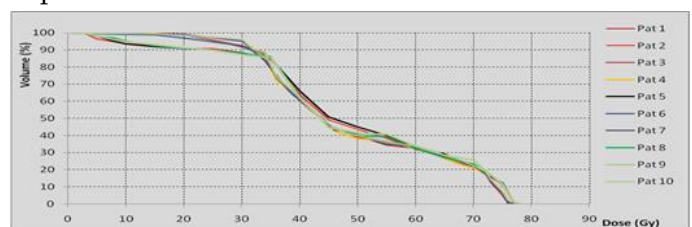
The introduction of multi-imaging technique presented a unique challenge for the evolution of the workflow. The two imaging devices had different shaped couches; a flat surface for the CT and a cradle-shaped for the MRI. These differences introduced anatomical variations during fusion and setup errors due to table sag. A home-made flat wooden table top was designed (without metallic and artefact producing objects) to be inserted inside the MRI cradle of the existing table. This made it very easy to fuse both images perfectly. The default DRRs generated by the TPS were of a poor quality and very difficult for matching portal images during imaging verifications.

These default image qualities were enhanced by generating customized TPS DRR settings for all prostate cancers patients with gold marker implants. Few patients also presented with IPCs which when during image verification mimic the gold marker implants and very difficult to distinguish as shown in Fig. 2 (A). Matching on wrong objects will lead to wrong shifts and wrong target treatment compromising on the prostate target and OARs. A simple but a very effective way was to draw blocks around the gold markers during planning as in Fig. 2 (B). The TPS provides a very distinct and clearly defined gold marker DRRs for imaging verification.



**Figure 3.** (A) Problem in distinguishing Gold marker implants from intraprostatic calcifications in the prostate (yellow arrow is gold marker and white arrow an IPC), (B) blocks on gold markers during treatment planning

The benefit of following pre-scan instructions as shown in fig.3 is the reduction of rectal volume dose. The shape of the rectum changed with this current workflow to achieve a  $V_{50Gy} \leq 50\%$ ,  $V_{60Gy} \leq 40\%$  and  $V_{75Gy} \leq 15\%$  constraint tolerance levels set by the department.



**Fig.3.** Variation of rectum DVH for new workflow

It was noted that, systematic errors reduced from an average of 4.34 mm to 2.92 mm and random errors from 3.95 mm to 2.68 mm with our gold marker

protocol. Approximately 39.6% of observed patient positioning setup (using gold markers) needed corrections prior to treatments as compared 56.8% when matched on bony anatomy. The rectal dose was significantly reduced in CT-MRI fusion-based plan. For online image guidance, The MV EPID has been a valuable tool to acquire image with patient in treatment position. The main obstacle limiting this workflow from wide clinical implementation is the time management challenge and resource allocation. Many components in this process require considerably increased cost to time and staff resources compared to old treatment technique.

#### IV.CONCLUSION

Implementation of this image guided radiation therapy workflow for prostate cancer patients required an in-house approach with limited resources. This workflow protocol was tailored specifically to maximize prostate cancer treatment therapeutic outcome while sparing the healthy surrounding organs. However, such workflow protocol requires substantially added cost and time to the clinical schedule. The accuracy with which the targets and organs at risks are contoured reduces target margins while daily volume imaging also reduces setup and treatment errors. There is no superior or inferior workflow; because a radiotherapy centre should adopt the most suitable workflow, as dictated by its resources (the equipment and personnel available). When this is done, it will maximize efficiency, reduce the possibility of treatment errors and invariably, increase the quality of the treatment offered by the radiotherapy centre. Continuous efficient workflows are required to enable frequent adaptive interventions regardless of available resources.

#### V. ACKNOWLEDGMENT

This study is based on work done at the Sweden Ghana Medical Centre (SGMC), Accra, Ghana. I wish

to express my gratitude to the oncologists, physicists, dosimetrists, therapists, radiographers, researchers and all staff of SGMC.

#### VI.REFERENCES

- [1] Yan D, Lockman D. (2001) Organ/patient geometric variation in external beam radiotherapy and its effects. *Med Phys.* 28:593–602.
- [2] Brierley JD et al. (1994) The variation of small bowel volume within the pelvis before and during adjuvant radiation for rectal cancer. *Radiother Oncol.* 31:110–116.
- [3] Davies SC et al. Ultrasound quantization of respiratory organ motion in the upper abdomen. *Br J Radiol.* 1994; 67:1096–1102.
- [4] Nuyttens J et al. The variability of the clinical target volume for rectal cancer due to internal organ motion during adjuvant treatment. *Int J Radiat Oncol Biol Phys.* 2002; 53:497–503.
- [5] Hanks G, Hanlon A, Schultheiss T, et al. Dose escalation with 3D conformal treatment: five year outcomes, treatment optimization, and future directions. *Int J Radiat Oncol Biol Phys.* 1998; 41:501-10.
- [6] Pollack A, Zagars G. External beam radiotherapy dose response of prostate cancer. *Int J Radiat Oncol Biol Phys.* 1997; 39:1011-8.
- [7] Zelefsky M, Leibel S, Gaudin P, et al. Dose escalation with three-dimensional conformal radiation therapy affects the outcome in prostate cancer. *Int J Radiat Oncol Biol Phys.* 1998; 41:491-500.
- [8] Hentschel B, Oehler W, Strauss D et al. Definition of the CTV prostate in Ct and MRI by using CT-MRI image fusion planning for prostate cancer. *Starhlfenther Onkol.* 2011; 187(3): 183-90.
- [9] Sannazzari G, Ragona R, Ruo Redda M. et al. CT-MRI image fusion for delineation of volumes in three-dimensional conformal radiation

- therapy in the treatment of localized prostate cancer. *Br J Radiol.* 2002; 75(895): 603-7.
- [10] Yan D, Lockman D, Brabbins D, et al. An off-line strategy for constructing a patient-specific planning target volume in adaptive treatment process for prostate cancer *Int J Radiat Oncol Biol Phys* 2000;48:289-302.
- [11] Woodford C, Yartsev S, Dar A R, et al. Adaptive radiotherapy planning on decreasing gross tumor volumes as seen on megavoltage computed tomography images *International journal of radiation oncology, biology, physics.* 2007; 69: 1316-22.
- [12] Nuver T, Hoogeman M, Remeijer P, et al. An adaptive off-line procedure for radiotherapy of prostate cancer *International journal of radiation oncology, biology, physics* 2007; 67: 1559-67.
- [13] Aikins M, Acquah G, Hasford F, et al. Accuracy of Using In-Vivo Dose Verification with Diodes for Different Sites. *IJST.* 2015; 5(1).
- [14] Cazoulat G, Lasaunier M, Simon A et al. From image-guided radiotherapy to dose-guided radiotherapy. *Cancer/Radiotherapie,* 2011; 15(8): 691-8.
- [15] Acquah G, Gustavsson M, Schiestl B. et al. Clinical use of electronic portal imaging to analyze tumor motion variation during a 3D-conformal prostate cancer radiotherapy using online target verification and implanted markers. *Int J Cancer Ther Oncol.* 2014; 2(4).

# Power Efficient, Reliable & Secure Body Area Network using Clustering

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## ABSTRACT

Healthcare systems use a medical text mining which have been increasingly facilitating health condition monitoring and disease modelling. System works on the Personal Health Information (PHI) of the user. and analysis, which can hardly afford the dynamic health condition fluctuation Healthcare system grant users access to range of health information and medical knowledge. In proposed system I basically created the database of 150 to 200 diseases with their precaution suggestions. System will output the next highly probable disease by narrowing down the number of diseases from the list of diseases according to the related symptoms either entered by the users or captured by the different sensors nodes. Benefit of the system is all the information about disease, precautions and healthcare are store at one place. Unfortunately, delegating both storage and computation to the untreated entity would bring a series of security and privacy issues. One of the controversial issues for PHI is how the technology could threaten the privacy of patient health information. The proposed system focused on fine-grained privacy-preserving static medical text access.

**Keywords:** WBAN, WSN, Cloud Computing, K-Mean Clustering Algorithm, Rijndael AES algorithm

## I. INTRODUCTION

Progressing in medical concern such as the aging population in developed countries and the skyrocketing cost of healthcare have told the emergence of technology-driven improvements of present healthcare practice. For instance, recent advances in electronics have enabled the progress of bio-medical sensors that can be worn or put in the human body. These sensors have the capability to gathered important data about the body's health condition and thus facilitating the introduction of various types of networks among which are Wireless Body Area Networks (WBANs) [1]-[11]. WBANs are networks of nodes with the capability of original time monitoring of patient's vital signs such as pulse rate, body temperature, blood pressure, and etc. The information gathered is wirelessly relayed to the

physician or caregiver in a timely fashion. Essentially, the data gathered by the sensors is sent to an external server for analysis and storage. As it turns out, using a wired connection for this issue will be cumbersome and will involve high deployment and maintenance cost. While the use of a wireless interface permit an easier application and is additional cost efficient [1]. With the current traditional medical care system, there are limitations in diseases diagnosis in addition to difficulties experienced in previous detection of diseases and long term patients monitoring. WBANs constitute an powerful and efficient result to the formerly mentioned issues [2]. WBAN can monitor single or multiple vital signs at the same time and can include implantable or wearable bio-sensors. The data transmission in WBANs can include ZigBee, Bluetooth, and Wi-Fi. Data access points in a WBAN where the data is gathered, save or displayed can

include laptop computers, smart phones and personal digital assistants etc.

## II. LITERATURE REVIEW

Basically, here we can say that the medical diagnosis process can be interpreted as a decision making process, throughout which the physician induces the analysis of a new & unknown case from an available set of medical data from her/his clinical experience. At the University of Calabria in Italy, the medical decision making process has been computerized, Physicians at the Cosenza General Hospital currently are using the diagnostic decision support system to help them with the timely identification of breast Cancer in patients through The application of a well-defined set of classification data. Dr. MirnmoConforti presented the system in Year 1999 & he explained the architecture from this particular point of view emphasizing the powerful efficiency and effectiveness of Mathematical Programming approaches as the basic tools for the design of the or Computer Aided Medical Diagnosis system. MimmoCnnforti addresses our attention to previous detection of cancer on the basis of minimum amount of clinical information [3].

Hubert Kordylewski[5], Daniel Graupe[6] in 2001 describes the application & principal of a large memory storage and retrieval (LAMSTAR) neural network. The LAMSTAR was specifically useful for application to problems having very large memory that contains various different categories or attributes, like where some of the data is exact while other data are fuzzy and where, for a given problem, there may be some data categories are totally missing. The LAMSTAR network is fast, speedy and can shrink/grow in dimensionality without any reprogramming. LAMESTER network is a self-organized also having features of forgetting and of interpolation & extrapolation, thus being able to handle map (SOM) with link weight between two

neurons of this SOM module. The network partial data sets. Applications of the network to 3 specific medical diagnosis problems are described: two from nephrology and one related to an emergency-room drug identification problem.

DejanDinevski, Peter Kokol, GregorStiglic, Petra Povalej [7] elaborates the use of self-organization to combine different specialist opinions generated by different intelligent classifier systems with a purpose to raise the classification accuracy. Early and accurate diagnosing of various diseases has proved to be of vital importance in many health care processes. In recent years intelligent systems have been often used for decision support & classification in many scientific and engineering disciplines including health care. However, in many cases the proposed treatment or the prediction or diagnose can vary from one intelligent system to another system similar to the real world where various specialists may have different opinions. The main aim here is to imitate this situation in the manner to combine different opinions generated by diverse intelligent systems using the self-organizing abilities of cellular automata because most ensembles are construct using definite machine learning method or a combination of that method, but the drawback being this is that the selection of the appropriate method or the combination of that method for a specific issue must be made by the user. So, to overcome this issue an ensemble of classifiers is constructed by a self-organizing system applying cellular automata (CA).

## III. PROPOSED WORK

### Wireless Body Area Network

WBAN is a technology that is very helpful in monitoring the health conditions overcome the wired line limitations of conventional signals from the body[1]. As it is played in Fig.1, WBAN can be considered as a sensor network used for personal

matter. This network is in hybrid form which is formed by using a group of sensor nodes that uses wireless transmissions for forwarding the data which they collect from the body sensors. The nodes which are found in WBAN have very much higher speeds and they are affected by regularly occurring topological changes. The topology of WBAN is similar to topology of MANETs, but they are having a movement that is based on the groups, when compared to that of node-based movement. Also reliability becomes a difficult task due to the power and mobility issues which is caused by frequent changes in network topology. In cost of the existing literature works of WBAN the security and reliability are handled individually. The node sensing the data wants to transmit the data to BAN coordinator, it either sends directly or via relay node based on its battery power and SNR[1].

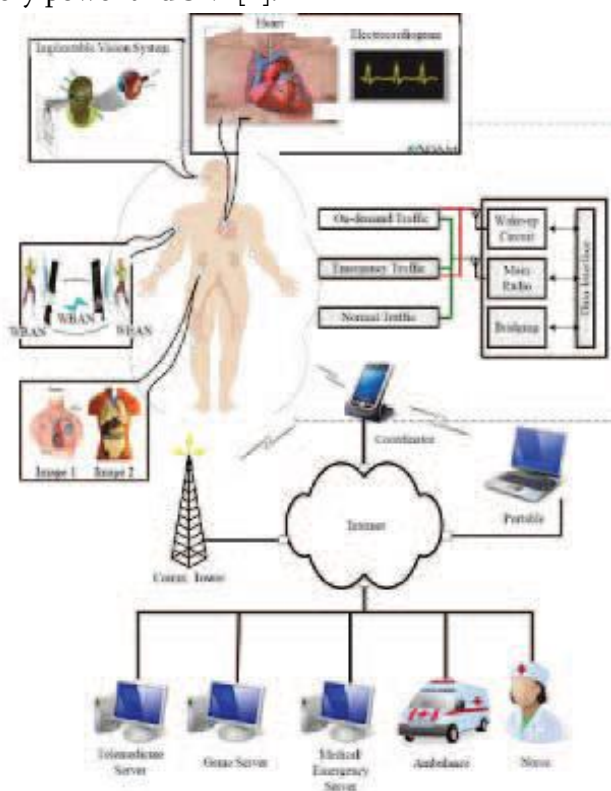


Figure 1 Wireless Body Area Network

### Proposed System

Developments in microcircuits & medical field are to help in long term health monitoring. These sensors are battery supported & are very small devices which are deployed along the body of human [1]. The collected data from the sensors is sent to a data hub by using wireless channels. The sink may be device which may portable (PDA) or a smart phone. The device which collects all the necessary data sends it to a health agency using a cellular or wireless network or internet etc. This helps to forward the real time information which is collected from the sensors to the human who are specialists in that, by using this data they can deliver the required treatment to the patients who are under the monitoring in short period of time. WBANs are efficient, it aims to help in monitoring people who are suffering from unique diseases and problems which are chronic or those who are working and living in adverse environment conditions or far from care givers. In a spatial region WBANs are deployed (around the body of human being) instead of single hop communication they tend to follow multi-hop communication as their main communication pattern. Previous research states [2] that since the body of human will be having much physical absorption, the channels in WBAN will undergo higher path loss when the same are compared with the WBAN network which deployed in free space. In WBANs using of high power RF along the human body is not recommended as the RF waves can generate some heat which might cause damage to body tissue. For determining the required transmission power for each and every wireless link for which we use dynamic power assignment [3]. In the solution the information of transmission power used by the sender to transmit the packet exists. By measuring the received signal strength at the receiver the decision is taken if power of transmissions is more or less, or is informed to the client for adjusting the power of transmissions depending on the observations done, which will improve the trusting ability of the communication. Researchers mainly point on efficient



routing algorithm, which helps in creation of communicating the data [4].

Normally experienced doctors classify diseases based on the different diagnosis [2] method. This involves narrowing down the diseases to the root disease out of the list of diseases which shows similar symptoms. This is done using their knowledge & experience, and it is then confirmed by performing various tests. Especially in some area, the problem of lack of trained and experienced doctors leads to intensification of this problem [3]. So we are trying to build this process of differential diagnosis to make this rather tough task a lot easy.

The system, using various techniques mentioned, will in twist display the root disease along with the set of most likely diseases which have similar symptoms. This system will give the list of diseases that the patient has maximum or more probability of suffering from. This, in turn, will help to recommend specific tests corresponding to diseases in the list, thus reducing the number of non-consequential tests and thus resulting in saving time and money for both the doctor & the patient [14].

### System Design

System design is the process or art of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. One could see it as the application of systems theory to product development. There is some overlap & synergy with the disciplines of systems analysis, systems architecture and systems engineering.

### System Architecture

The Fig. 2 will works as the user of the system enter the input symptoms to the system and their level of occurrences or gravity then clustered the entered data by providing the aquiline distance by performing the subtraction of symptom weight from the users symptoms weight to the expert symptoms weight. the closest distance considered the next highly probable disease, then system provide the prescription and

Google data related to particular disease and doctor appointment through mail

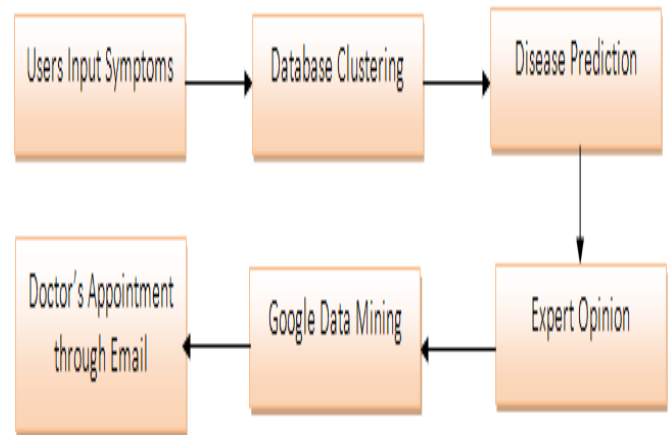
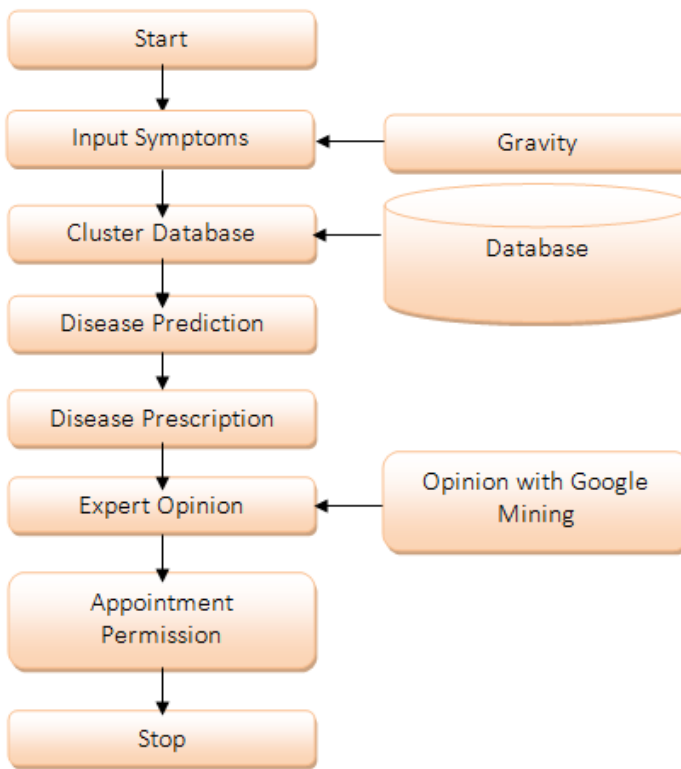


Fig. 2 System architecture block diagram

### Data Flow Diagram

The DFD is a simple graphical structure that can be used to system representation in terms of input data to the system, various processing carried out on this data, & the output data is generated by this system. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. Those components are the process the system; this process used the data, an exterior entity that cooperate with the system & the flows of information in the system.

DFD shows way of the information moves during the process of system & it is adapted by a transformations series. It is a graphical method which represents information flow & the transformations so as to apply as data moves from input to output,



**Fig. 3 Data flow diagram**

### UML Diagram

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, & was created by, the Object Management Group. The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML. The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.

The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems. The UML is a very important part of developing objects oriented software

& the software development process. The UML uses mostly graphical notations to express the design of software projects.

### Use case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system and depicting the specifications of use case. A use case diagram can portray the different types of users of a system and the various ways that they interact with the system. Use case diagrams describe the interaction of any person or external device with the system which is under design process. Use cases are often developed in collaborations between software developer & other users of the proposed system. The main purpose of the use case diagram is to help developing teams to visualize the functional requirements of the system. Use case diagram shows the relationship between actors & use cases. It consists of two elements: Use cases Actor The actor characterizes the interacting person or a thing. The use case describes the specific interaction of an actor.

The purpose of use case diagram is to capture the dynamic aspect of a system. But this definition is too generic to describe the purpose. Because other 4 diagrams (activity, sequence, collaboration and State chart) are also having the similar purpose. So it will look into some specific purpose which will distinguish it from other 4 diagrams. Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements.

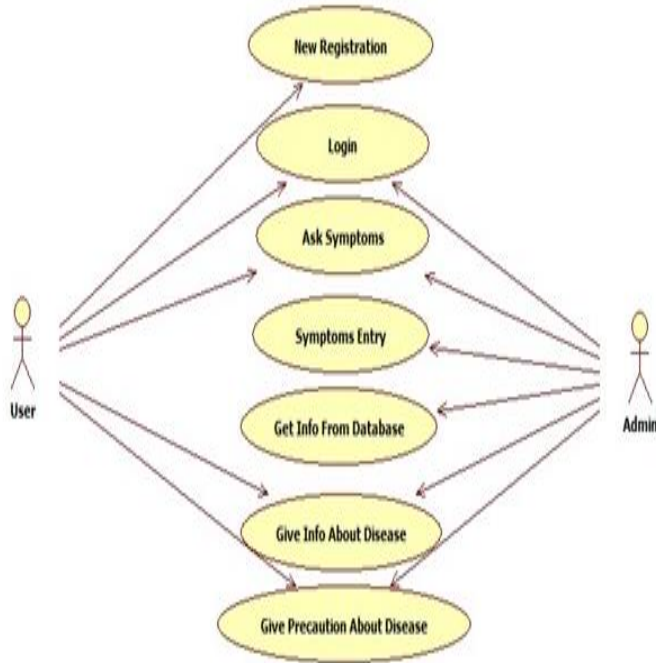


Fig. 4 Use case Diagram

**Class Diagram**

The class diagram is a static diagram. It's represents the static view of an application. Class diagram is not only used for visualizing, describing & documenting different aspects of a system but also for constructing executable code of the software application. The class diagram describes the attributes and operations of a class & also the constraints imposed on the system. The class diagrams are widely used in the modelling of object oriented systems because they are the only UML diagrams which can be mapped directly with object oriented languages. The class diagram shows a collection of classes, interfaces, associations, collaborations& constraints. It is also known as a structural diagram.

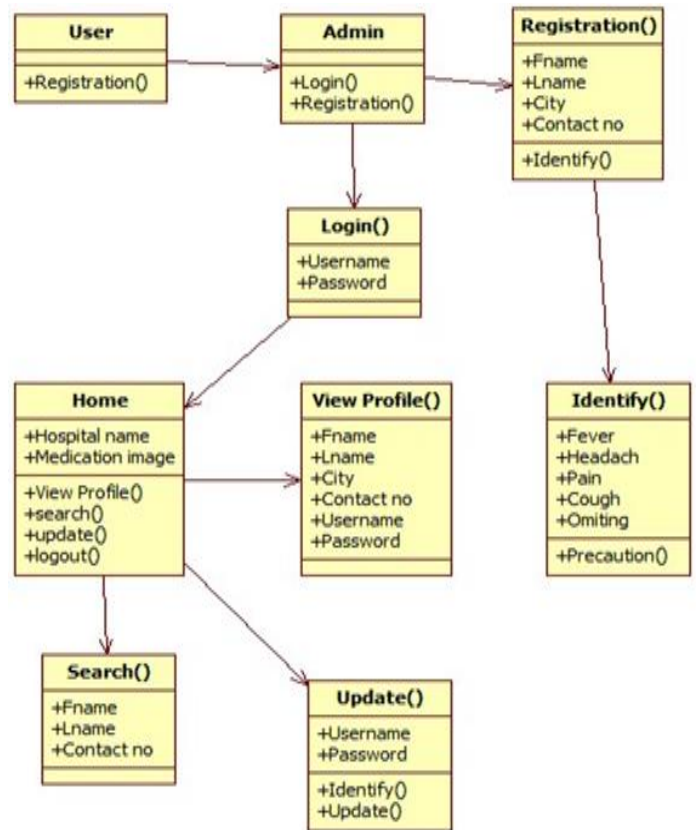
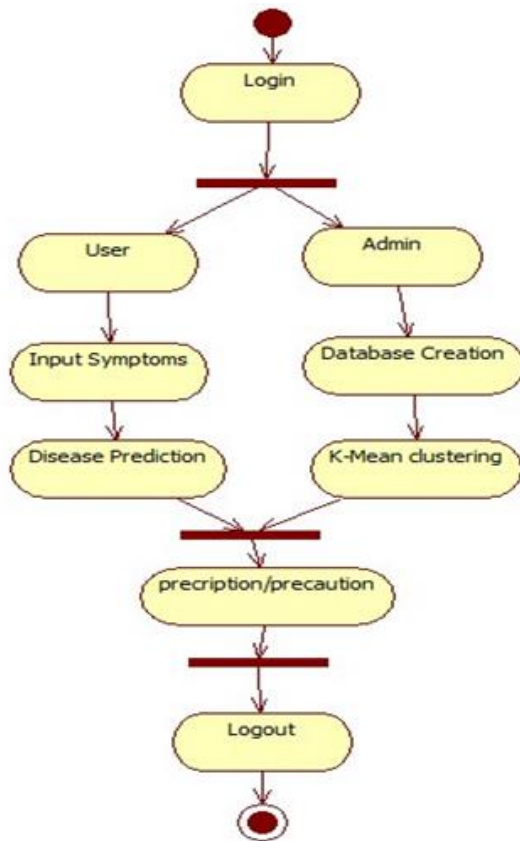


Fig. 5 Class Diagram

**Activity Diagram**

Activity diagrams are graphical representations of workflows of stepwise activities & actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the Business and operational step-by-step workflows of components in system. An activity diagram shows the overall flow of control.



**Fig. 6 Activity Diagram**

### Sequence Diagram

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that show how processes operate with one another & in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, & timing diagrams. The Sequence Diagram models the collaboration of objects based on a time sequence. It shows how the objects interact with each other's in a particular scenario of a use case. With the advanced visual modeling capability, you can also create complex sequence diagram in few clicks. Besides, Visual Paradigm can generate sequence diagram from the flow of events which you have defined in the use case descriptions.

A sequence diagram shows object interactions arranged in time sequence. It depicts the objects & classes involved in the scenario & the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence

diagrams are typically associated with use case realizations in the Logical View of the system under developments.

A sequence diagram shows, as parallel vertical lines (lifelines) different processes or objects that live simultaneously, & as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner.

The purposes of interaction diagrams are to visualize the interactive behaviour of the system. Now visualizing interaction is a hard task. So the result is to use different types of models to capture the different aspects of the interaction. That is why the sequence and collaboration diagrams are used to capture dynamic nature but from a different angle. So the purposes of interaction diagram can be describes as:

- To capture dynamic behaviour of a system.
- To describe the message flow in the system.
- To describe structural organization of the objects.
- To describe interaction among objects.

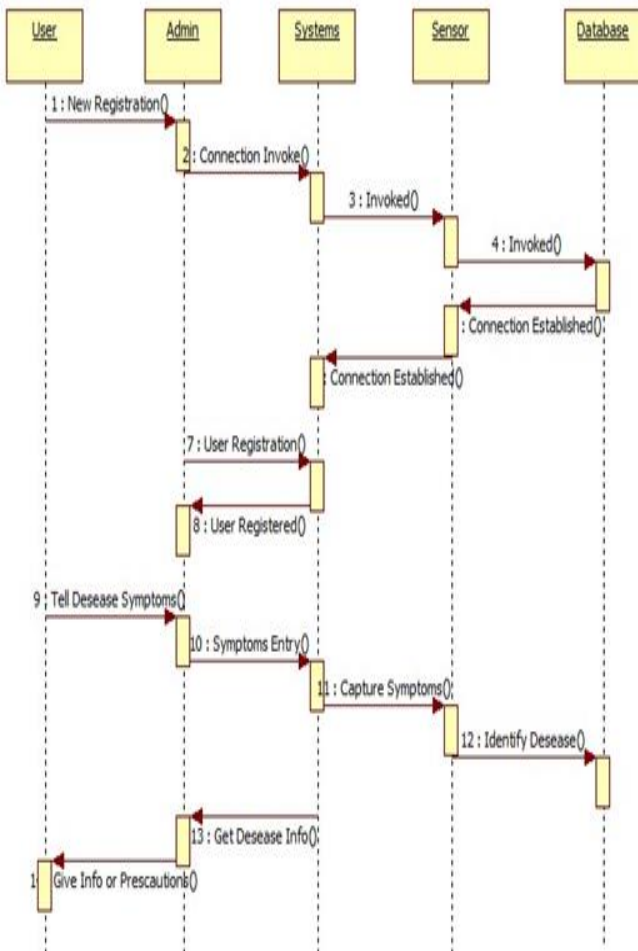


Fig. 7 Sequence Diagram

**Component Diagram**

Component diagrams are used to model physical aspect so system likes voice, voice processing System, Database server etc. So, component diagrams are used to imagine the organizations and relationships among components in a scheme. These Diagrams are also used to create executable systems.

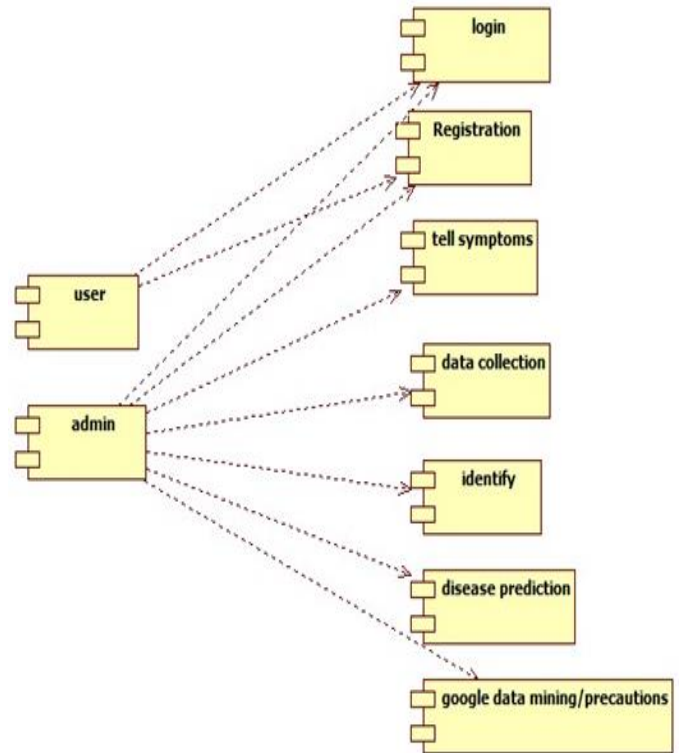


Fig. 8 Component Diagram

**Input Design**

The input design is the link between the information system & the user. It comprises the developing specification and procedures for data preparation & those steps are necessary to put transaction data in to usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, problem, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things given as below:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.

- Methods for preparing input validations and steps to follow when error occur.
- Confirm an action

**Objectives**

- To diagnose correct disease.
- To assist doctors for various diseases associated with symptoms i.e to be a home assistant.
- To assist Medical students working as in pathological labs and to help nurses, nursing student.
- To help military in battle field.

**Output Design**

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users & to other system through outputs. In output design it is determined how the information is to be displaced for immediate need & also the hard copy output. It is the most important and direct source information to the user.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is design so that people will find the system can use easily and effectively and really. When analysis designs computer output, they should identify the specific output that is needed to meet the requirement.
2. Select methods for presenting information's.
3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.

**IV. RESULT**

**Experimental Result**

In this system disease prediction performed on data base of symptoms either manually entered by the users or captured by the sensors, it detects the next highly probable disease. Body Area Network without using clustering & Body Area Network with using clustering, both types of Systems are used for health condition monitoring and timely treatment of patients suffer from chronic disease. The following Table-1 shows the effective experimental result of the proposed system comparing to the existing system considering the parameters Disease prediction, Detection Accuracy & Time. Clustering is more important in disease prediction as well as data transformation in the network from one node to another node with power efficiency.

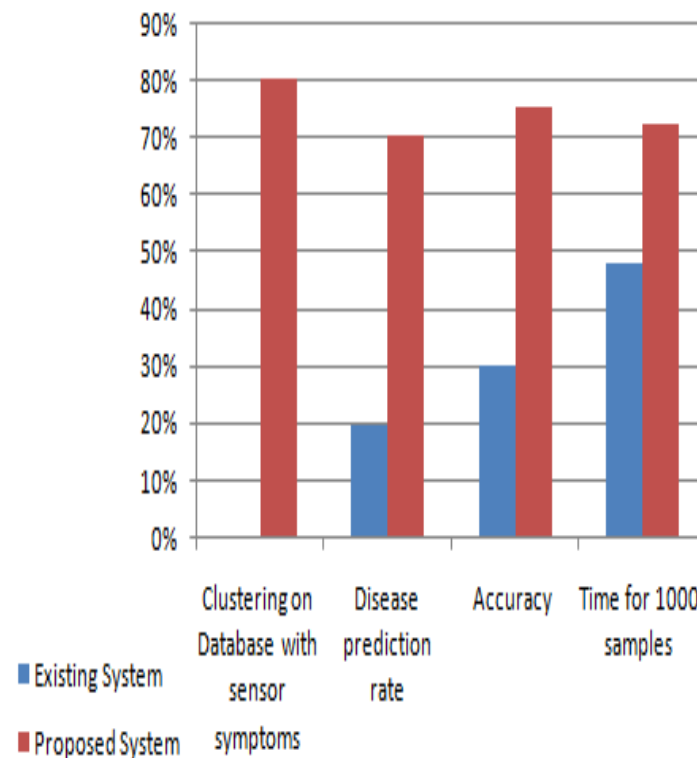
**Table 1: Experimental Result**

Parameters	Existing System	Proposed System
Clustering on Database with sensor symptoms	00%	80%
Disease prediction rate	20 %	70 %
Accuracy	30 %	75 %
Time for 1000 samples	48%	72%

**Graphical Representation**

The statistical data can be represented graphically here. In fact, the graphical representation of statistical data is an essential step during statistical analysis. So

here we have used bar graph for showing graphical representation. As shown below



**Fig. 9 Graphical representation of result**

The Fig. 9 shows the graphical representation of the table 9 for showing the comparison between the BAN using clustering & existing system, considering the parameters Disease prediction, clustering on data base, Accuracy & Time in between proposed system & existing system.

### V. CONCLUSION

A low cost Wireless BAN, using off-the-shelf hardware was built & successfully tested in real time where data was successfully captured & displayed on website. The BAN collected the pulse rate, the temperature & the location of the patient. The captured data was made available through graphing application programming interface, where data can

be continuously monitored on website. Future enhancements to safeguard the data, including the encryption of the patient data is under investigation. Currently the BAN is powered using a either 9V or 5V battery. In the future we plan to investigate use of body temperature or the physical movement of the patient as means to produce power for the BAN. The captured data was made available through a graphing application programming interface, where data can be continuously monitored on a website.

The proposed system can effectively detect next highly probable disease by applying well clustering on symptoms as well as provide the security to the users old data records, this system most useful for continuous health conditions monitoring but not capable to work on blood samples and cancers tumour prediction this process comes under image processing, this issues can be resolved by applying relevant image processing techniques this will kept as future work of systems further enhancement.

### REFERENCES

- [1] R.A. Miller, "Medical diagnostic decision support systems Past, present, and future A threaded bibliography and brief commentary," *J. Amer. Med. Inf. Assoc.*, vol. 1, pp. 8–27, 1994.
- [2] W. Siegenthaler, *Differential Diagnosis in Internal Medicine: From Symptom to Diagnosis*. New York: Thieme Medical Publishers, 2011.
- [3] S. F. Murray and S. C. Pearson, "Maternity referral systems in developing countries :Current knowledge and future research needs," *Social Sci. Med.*, vol. 62, no. 9, pp. 2205–2215, May 2006.
- [4] L. Li, L. Jing, and D. Huang, "Protein-protein interaction extraction from biomedical literatures based on modified SVM-KNN," in *Nat. Lang. Process. Know. Engineer.*, 2009, pp. 1–7.
- [5] H. Kordylewski and D. Graupe, "Applications of the LAMSTAR neural network to medical and

- engineering diagnosis/fault detection,” in Proc7th Artificial Neural Networks in Eng. Conf., St. Louis, MO, 1997.
- [6] D. Graupe and H. Kordylewski, “A large memory storage and retrieval neural network for adaptive retrieval and diagnosis,” *Int. J. Software Eng. Knowledge Eng.*, vol. 8, no. 1, pp. 115–138, 1998.
- [7] Kokol P, Povalej, P., Lenič, M, Štiglic, G.: Building classifier cellular automata. 6th international conference on cellular automata for research and industry, ACRI 2004, Amsterdam, The Netherlands, October 25-27, 2004. (Lecture notes in computer science, 3305). Berlin: Springer, 2004, pp. 823-830.
- [8] G.Z. Wu, “The application of data mining for medical database”, Master Thesis of Department of Biomedical Engineering, Chung Yuan University, Taiwan, Chung Li, 2000.
- [9] R. Carvalho, R. Isola, and A. Tripathy, “MediQuery—An automated decision support system,” in Proc. 24th Int. Symp. Comput.-Based Med. Syst., Jun. 27–30, 2011, pp. 1–6.
- [10] Shucheng Yu, Cong Wang, KuiRen, Wenjing Lou in their paper “Attribute based data sharing with attribute revocation”
- [11] C.Y. Hsu, C.S. Lu and S.C. Pei, Image Feature Extraction in Encrypted Domain with Privacy preserving SIFT, *IEEE Trans. on Image Processing*, 21(11): 4593-4607, 2012.
- [12] Jun Zhou, Zhenfu Cao, Xiaolei Dong, Xiaodong Lin “PPDM: Privacy-preserving Protocol for Dynamic Medical Text Mining and Image Feature Extraction from Secure Data Aggregation in Cloud-assisted e-Healthcare Systems,” *IEEE journal of selected topics in signal processing*.
- [13] Olawuni, Omotayo, Adegoke, Olarinoye, “Medical image Feature Extraction: A Survey,” *International Journal of Electronics Communication and Computer Technology (IJECCCT)* Volume 3 Issue 5 (September 2013).
- [14] Peter L. Stanchev, David Green Jr., BoyanDimitrov, “High Level Colour Similarity Retrieval,” 28th international conference ICT & P 2003, Varna, Bulgaria.
- [15] Jun Zhou, Zhenfu Cao, XiaoleiDong, “Securing M-Healthcare Social Networks: Challenges



# Automatic Meter Reading using Wireless Sensor Module

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## ABSTRACT

In the recent time huge advances have been made in the way the consumers are charged for the energy they consume. Things are moving out quite fast and areas where there was human intervention are being fast replaced by machines. The concept of e-metering (Electronic Metering) has been progressing at a very fast pace and with the ever increasing customer base the energy transmission companies are in need of a reliable and efficient Automatic Meter Reading (AMR) system. This paper presents a simple inexpensive GSM based Automatic Energy Meter Reading system (AEMR). The proposed system provides a remote access method for the consumer as well as the energy provider. It gives an opportunity to both the consumer as well as the supplier to remotely monitor the energy meters and thus helps in obtaining the energy reading in a hassle free manner. The Automatic Energy Meter Reading system (AEMR) regularly read the energy meter and calculate total amount of bill at the set dead line and sends the message to service provider. From energy meter received data i.e. user name, meter ID, total units with paying amount this message maintained at database server which located at service provider department. This system optimizes the time used in billing and provides a transparent interface to the consumer and the supplier to have an idea about energy consumed and the bill generated. AEMR System can provide message at hourly, daily and monthly by the request, reduces the manpower required and prevent pilferage, improves the system efficiency thus turning out to be more efficient than conventional billing system.

**Keywords :** AMR, AEMR, Electronic Metering, TTL, WAMRS, GSM, ZIGBEE, GPRS, MAX-232, ARM7

## I. INTRODUCTION

Now a day energy meter reader goes to every premise and takes the reading manually then issues the bill. In manually reading human error possible and not provide reliable meter reading. An energy meter is a device which is used to measure the consumption of energy of any residence or other industrial establishment. In Conventional metering system to measure electricity consumption the energy provider company hire persons who visit each house and record the meter reading manually. This is only a

sluggish and laborious. In Conventional metering system people try to manipulate meter reading by adopting various corrupt practices such as current reversal or partial earth fault condition, bypass meter, magnetic interference etc. If any consumer did not pay the bill, the electricity worker needs to go to their houses to disconnect the power supply.[1] The wide proliferation of wireless communication propose and explore new possibilities for the next generation Automatic Meter Reading (AMR) whose goal is to help collect the meter measurement automatically and possibly send commands to the meters. Automation

ranges from Connecting to a meter through an RS-232 interface for transmitting the meter measurements all the way from the meter to the utility company via GSM network. [2] We are use the digital energy meter in implies a times-sampled system. An analog to digital converter sampled current and voltage transducers output at a high frequency, translating real world waveforms to binary words that digital circuitry can understand and manipulate. Digital energy meters maintain their accuracy over a larger current range than the mechanical meter. These new meters are also stable over change in temperature, voltage and line frequency.

## II. LITERATURE STUDY

O. Homa Kesav, B. Abdul Rahim in their work titled of "Automated wireless meter reading system for monitoring and controlling power consumption" have used the ARM7 LPC2148 microcontroller module which takes the data from the energy meter and performs the necessary control operations like breaking the circuit through Relay control unit and the required information to the mobile phone via the communication module GSM. The MAX-232 which was inbuilt in the ARM7 is used as a serial communication interface for the GSM modem for transmitting the data from the controller to the mobile phone. In the Load bank section a 60W incandescent bulb is used as a load for the purpose of energy consumption of the user.

E. Moni Silviya, K. Meena Vinodhini, Salai Thillai Thilagam. J.in their work titled "GSM Based Automatic Energy Meter System with Instant Billing"employ the IR sensor to mesure the current consumption. The IR transmitter is placed in the rotating unit of the EB meter. The receiver photo diode is placed in a certain place which is used to find no of rotation. By getting the number of rotation we get the current consumption. These system may be

applied in Industrial control, medical system and access control.

Shraddha Male Pallavi Vethekar, Kavita More, Prof. V. K. Bhusari in their work "Smart Wireless Electronic Energy Meter Reading Using Embedded Technology" conclude that the metering IC creates the output in the form of pulses which are counted using the default timer of PIC microcontroller unit. These pulses are identified by the transition of high and low voltage of the automatic voltage regulator. A TTL inverter circuit is used to reverse the produced pulse before applying to the counter. For reading the data from the metering IC, microcontroller is programmed using software interfacing. When microcontroller reads the energy usage, this data is stored and updated in software. In this, meter is measured for 1 unit of energy consumption and it creates 3200 pulses in LED.

S. Arun, Dr. Sidappa Naidu in their work "Design and Implementation of Automatic Meter Reading System Using GSM, ZIGBEE through GPRS" present an implementation methodology for a wireless automatic meter reading system (WAMRS) incorporating the widely used GSM and Zigbee network. In many countries GSM and GPRS network is widely known for its vast coverage area, cost effectiveness and also for its competitive ever growing market. Using GSM as the medium for WAMRS provides a cost-effective, wireless, always-connected, two-way data link between utility company and WAMRS, the WAMRS sends information of utility usage, power quality and outage alarm to utility company, tampering detection to the utility servers. In this paper we suggest a method where we utilize telecommunication systems for automated transmission of data to facilitate bill generation at the server end and also to the customer via SMS, Email.

Ashna. k, Sudhish N. George in their work titled "GSM Based Automatic Energy Meter Reading System

with Instant Billing” use the two wire power supply which is connected to the energy metering IC through the analog front end of the MCP3905 energy meter evaluation board which provides average active power information via a pulse output which may be then used to be processed by a Micro Controller Unit (MCU). The GSM unit is interfaced to the micro controller via a MAX 232. User GSM modem transmits usage details to office modem. Every house/premise has a unique number (consumer number), which is given by the corresponding authority.

V. Rajesh Parvathala, T Venkateswara reddy, N V G Prasad in their work “ARM Based Wireless Energy Meter Reading System along with power on/off circuit” present a system which has 3 sections, Meter section, control unit section & mobile unit. The entire operation of the system is controlled by control unit with the help of switches. The switches provide the option to read the energy meter, and to disconnect the services as and when needed.

On the basis of the research work carried out we conclude that there is a need of automatic GSM based energy meter system which eradicates the issue of manpower, power theft, human errors in recording the data and maintenance cost.

### GSM METER – ARCHITECTURE

Whenever it is intended to develop a new technology the focus is to ensure that key issues are addressed properly and it is also necessary that the advanced features proposed address the problems of the previous technology and gets improved. Similarly there is need to upgrade the existing system and allow its use for everybody. The key is to develop a product that can serve as a replacement for the metering and billing system currently in use. This emphasizes that the meter under development has to work under the old circumstances and perform all the previous functions, but also be able to relay the information in a new way

and perform additional functions, without the need of replacing all meters on the electrical grid simultaneously.

The developed AEMR system consists of three main segments: an energy meter installed at the consumers place, transmission facility (SMS gateway), and the receiver which is a GSM mobile. The block diagram of the system is shown below Fig. 1 and Fig 2.

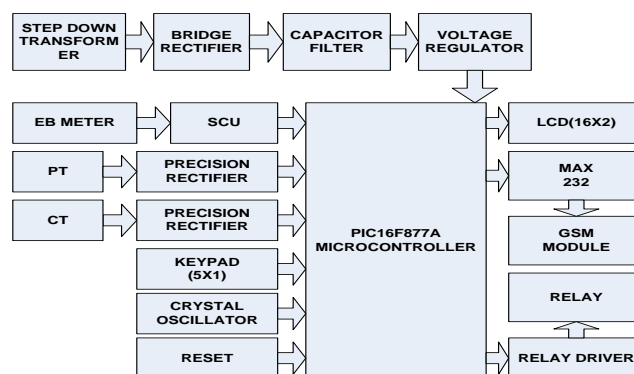


Figure 1 Block Diagram of Transmitter

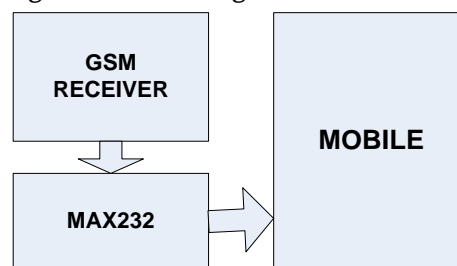


Figure 2 The receiver section with GSM Modem

### III. DETAILED DESIGN

The main components of the project are PIC based microcontroller, 16x2 LCD, and GSM module. Here, we'll need to connect a crystal, a reset circuit to operate microcontroller. To use the external oscillator, a 4 MHz quartz crystal is connected to pins 13 (OSC1) and 14 (OSC2) of the microcontroller. Two 27pF ceramic capacitors are connected from the crystal to ground. The reset on the PIC microcontroller is active high i.e. upon applying a high pulse to RST pin, the microcontroller will reset. A 10KΩ resistor is connected from the RST of the microcontroller to ground. A 10μF electrolytic capacitor is connected between the positive supply and RST pin. The

External Access pin (Pin 11) is connected to positive supply using a 10KΩ resistor. This completes the basic connections with respect to microcontroller. Now we'll connect the LCD to microcontroller. To adjust the contrast of the display, a pot is connected to contrast adjust pin i.e. Pin 3 of LCD. First, connect the three control pins of the LCD i.e. RS, RW and E to RC4, GND and RC5. Then connect the 8 data pins of the LCD display to PORTD pins of the microcontroller. After connecting the display, now we are going to connect the GSM module. Connect the TX pin of GSM to RXD pin i.e. RC7 of the microcontroller. Similarly, connect the RX pin of GSM to TXD pin i.e. RC6 of the microcontroller. Output of precision rectifier is connected to RA0 and RA1 pin of microcontroller. Keypad is connected to RB0 – RB4 pin of microcontroller. Finally relay is connected to RB5 pin of microcontroller.

The aim of this project is to design an automatic meter reading using PIC microcontroller, in which meter reading will be send to power grid as well as customer along with bill amount. The working of the project is explained here. When this circuit is powered ON, initially the microcontroller will display the project name on the LCD display and shows meter reading. System will send message to power gride automatically after set duration and to the customer in a month along with bill amout. But if customer send “\*1” message to the sim registered with gsm modem then microcontroller will send current reading along with bill amount to customer number. Along with meter reading our system will monitor voltage and current fault. Whenever over voltage is measure then microcontroller will switch off circuitry using relay similarly for under voltage and over current. Our system will operate on 5V dc power supply and to provide dc supply we have converted AC power to DC power using power supply unit.

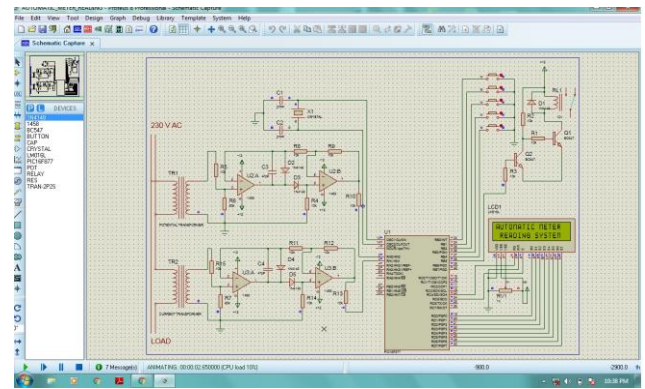


Figure 3: Proteus Simulation Circuit of Proposed System



Figure 4: Hardware Implementation of Proposed System

#### IV. CONCLUSION

Numerous of electronic meters have been proposed and presented and the GSM system proposed here provides numerous advantages over methods that have been previously used. Data transmission is charged at standard SMS rates, thus the charges are not based on the duration of data transmission. The cost efficient transmission of readings will ensure that power consumption values can be transmitted more frequently to a remote station. The implications of being able to transmit readings more often are that energy utilities will be able to generate timely bills, better understand energy demand patterns, manage meter failures more efficiently and manage fraud better.

## V. REFERENCES

- [1]. Yujun Bao and Xiaoyan Jiang, "Design of electric Energy Meter for long-distance data information transfers which based upon GPRS", ISA 2009. International Workshop on Intelligent Systems and Applications, 2009.
- [2]. HG.Rodney Tan,C.H. Lee,V.H.Mok,"Automatic power meter reading system using GSM network", The 8 Conference (IPEC 2007). International Power Engineering
- [3]. Vivek Kumar Sehgal,Nitesh Panda, Nipun Rai Handa, "Electronic Energy Meter with instant billing",UKSim Fourth European Modelling Symposium on Computer Modelling and Simulation.
- [4]. Bharath P, Ananth N, Vijetha S, Jyothi Prakash K. V. ,"Wireless automated digital Energy Meter", ICSET 2008.
- [5]. PK. Lee and L.L. Lai, Fieeee, "A practical approach to wireless GPRS on-line power quality monitoring system", Power Engineering Society General Meeting, 2007.
- [6]. Subhashis Maitra, "Embedded Energy Meter- A new concept to measure the energy consumed by a consumer and to pay the bill", Power System Technology and IEEE Power India Conference, 2008.
- [7]. T El-Djazairy, B J Beggs and I F Stewart, " Investigation of the use of the Global System for Mobile Communications (GSM) network for metering and load management telemetry", Electricity Distribution. Part 1: Contributions. CIRED. 14th International Conference and Exhibition on (IEE Conf. Publ. No. 438).
- [8]. Li Kaicheng, Liu Jianfeng, Yue Congyuan, Zhang Ming. "Remote power management and meter-reading system based on ARM microprocessor", Precision Electromagnetic Measurements Digest, 2008. CPEM 2008. Conference on Digital Object Identifier.
- [9]. MP Praveen, "KSEB to introduce SMS-based fault maintenance system", The Hindu News on 26/06/2011, <http://www.hindu.com>.

# Implementing Cryptographic Method for Ensuring Data Security In Cloud Computing Based On Hybrid Cloud

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## ABSTRACT

In this modern era, Cloud Computing is the most emerging technology in the world, through which people can share resources, services and information among the people using the internet. Information security has been a major issue in cloud computing because the data is stored in different location in the cloud so Data security is the key factors of people's concerns, because cloud computing have been investigated in both academics and industries so data security and privacy are most essential for the future development of cloud computing technology in government, industry, and business. For enhancing the security in cloud computing we have developed the new technology and methodology to secure data in cloud computing, accordingly I have built an application using Cryptographic Algorithms encryption technology to secure & upload data in database, and during upload & retrieve the data they have to use the three level of encryption method to fetch the information.

**Keywords:** Cloud Computing, Deployment models, Data security, IaaS, PaaS, SaaS, Challenges

## I. INTRODUCTION

Cloud computing is Internet based computing technology where virtual shared servers provide software, infrastructure, platform, devices and other resources for hosting customers on a pay as per you-use basis. All information that a digitized system has to offer is provided as a service in the cloud computing model. Users can access these services available on the "Internet cloud" without having any previous know-how on managing the resources involved.

Cloud computing customers do not own the physical infrastructure; rather they rent the usage from a third-party provider. This helps them to save huge financial resources. They consume resources as a service and pay only for resources that they use. Most cloud

computing infrastructures consist of services delivered through common centers and built on servers. Sharing resources amongst can improve, as servers are not unnecessarily left idle, which can reduce costs significantly and also increasing the speed of application development.

A few years ago, abstract shapes of cloud were used to denote the internet and cyberspace. Afterwards the cloud has been utilized to represent a more specific idea, with a word Cloud Computing. The expansion and evolution of the electronic services requires continuous improvement in terms of infrastructure. Cloud computing offers a relatively low-cost scalable alternative to in-house infrastructure, both in hardware and software defined the term "Cloud Computing" as a ubiquitous on-demand model for accessing common resources over a network.

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## II. OBJECTIVE

we introduce the implementation in cloud environment we called "HYBRID Drive". We have implement the **hybridrive.in** that adding the new facilities in existing cloud application in term of improving the security as well as data storage techniques. Data security and privacy protection are the two main factors of user's concerns about the cloud technology. Though many techniques on the topics in cloud computing have been investigated in both academics and industries, data security and privacy protection are becoming more important for the future development of cloud computing technology in government, industry, and business. Data security and privacy protection issues are relevant to both hardware and software in the cloud architecture.

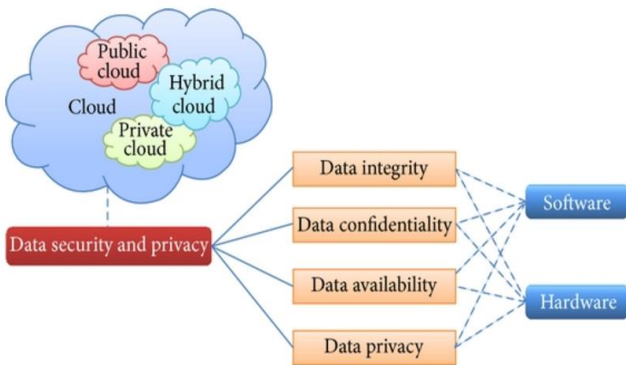


Fig. 1. Organization of data security and privacy in cloud computing.

## III. III. EXISTING SYSTEM

Data security in Cloud Computing involves more than data encryption. Requirements for data security

depend upon on the three service models SaaS, PaaS, and IaaS.

A. Two states of data normally have threat to its security in clouds; Data at Rest which means the data stored in the cloud and Data in Transit which means data that is moving in and out of the cloud. Confidentiality and Integrity of data is based upon the nature of data protection mechanisms, procedures, and processes.

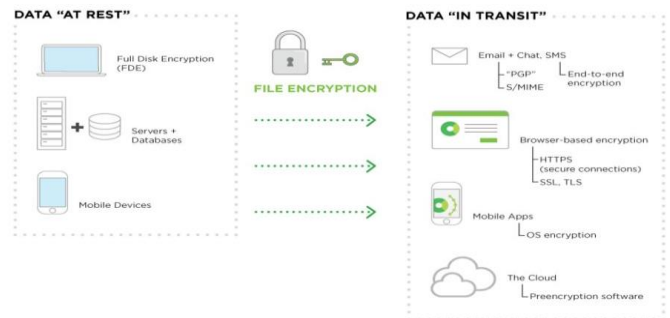


Fig.3. Data at Rest and in Transit

B. Encryption algorithm plays a vital role. It is the fundamental tool for protecting the data. Encryption algorithm converts the data into scrambled form by using "the key" and only user have the key to decrypt the data. In Symmetric key encryption, only one key is used to encrypt and decrypt the data. Another technique is using asymmetric key encryption; two keys- private and public keys are used. Public key is used for encryption and private key is used for decryption. Fig shows some of the symmetric & asymmetric algorithms.

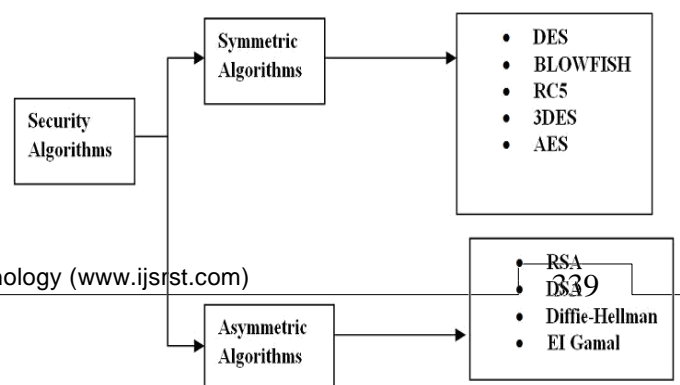


Fig.2. Existing Algorithm

#### IV. PROPOSED METHOD

In this paper I have been proposed different security algorithms to eliminate the concerns regarding data loss, segregation and privacy while accessing web application on cloud. Algorithms like: RSA, DES, AES, Blowfish and hybrid algorithm have been used and comparative study among them have also been presented to ensure the security of data on cloud.

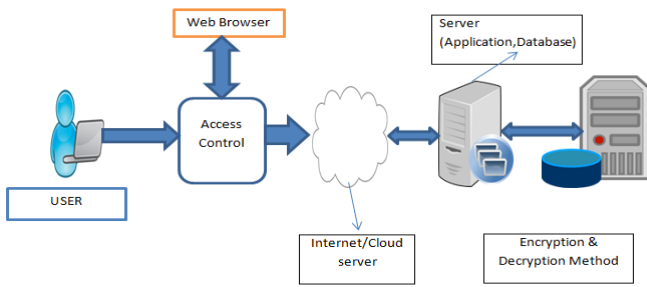


Fig.4. Proposed Architecture

when we upload data in cloud how it reside and how many security are implemented over there. Accordingly I have try to implement Multilevel of Encryption and Decryption algorithm. Thus, in our proposed work, only the authorized user can access the data. Even if some intruder (unauthorized user) gets the data accidentally or intentionally, he must have to decrypt the data at each level which is a very difficult task without a valid key. It is expected that using multilevel encryption will provide more security for Cloud Storage than using single level encryption.

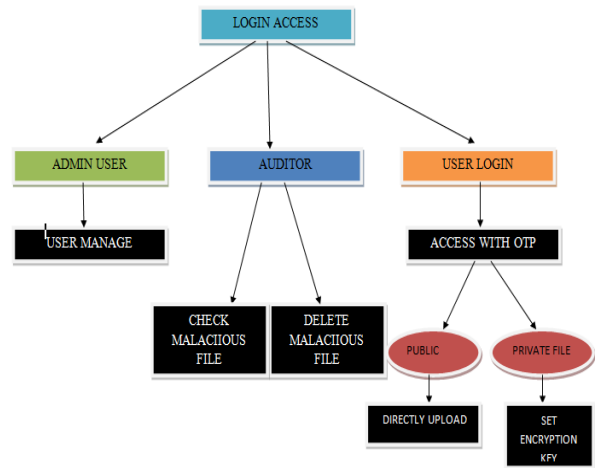


Fig. 5. Implementation Design

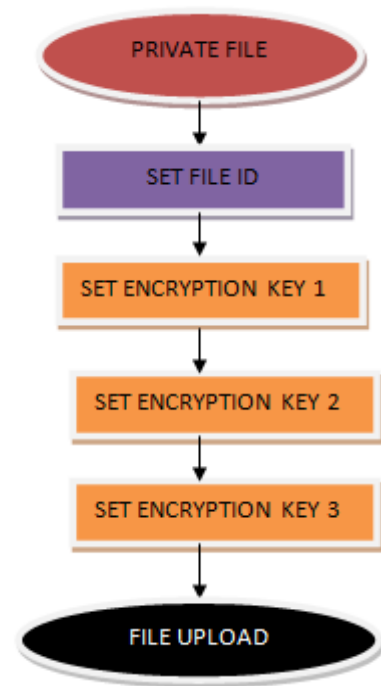


Fig.6. Uploading Section of Private section

#### V. ALGORITHM

##### A. Login Module:

Keygen procedure: It consist of different procedure.

##### Login(userid, password)

This procedure is used Login the user into the system by generating, sending and verifying OTP/private key :

- i. VerifyUserIDandPassword(userid,password) //To check userid and password



- ii. If(verified) Verify\_encryption\_key\_1\_entered\_by\_u
- iii. Generate\_OTP\_private\_key\_and\_send\_email() ser()
- iv. VerifyOTP() //By matching key entered by user and stored in database. Verify\_encryption\_key\_2\_entered\_by\_u ser()
- v. If(OTP\_verified) Verify\_encryption\_key\_3\_entered\_by\_u ser()
- Redirect\_to\_userSection()
- Else Decrypt the contents of file and download from cloud.
- Show\_message()
- redirect\_to\_loginPage()

### B. FileUpload()

Procedure uploads desired file in the cloud by encrypting the contents of file and storing it in cloud and it encrypt the given file with the help of FILENAME, SECRET KEY and encryption algorithm.

- i. Generate\_file\_random\_ID()
- ii. Save\_File\_name\_entered\_by\_user()
- iii. Select\_file\_access() //public or private
- iv. If(file\_access == public)
  - Upload\_file()//MAX 25MB OF FILE
  - Set\_file\_access\_to\_public()
- Else
  - Upload\_file()
  - set\_file\_access\_to\_private()
- v. Generate\_encryption\_key\_1\_entered\_by\_user()
- vi. Generate\_encryption\_key\_2\_entered\_by\_user()
- vii. Generate\_encryption\_key\_3\_entered\_by\_user()
- viii. Encrypting the contents of file and storing it in cloud.
- ix. END

### C. File\_Download(fileid)

**download ():** This procedure sends the decrypted file to user

- i. Find\_file\_access\_by\_fileid()
- ii. If(access == public)
  - Downloadfile()
- Else if(access == private)

### D. Audit\_file\_uploaded\_on\_cloud()

Audit(): this procedure to check the file content using extension if it found any thing malicious it will deleted.

- i. If(malicious\_file\_found)
  - Delete\_from\_the\_cloud()
  - Write\_remark()
  - Send\_email\_with\_file\_deletion\_reason\_to\_the\_user()

### Auditing\_process()

- i. List\_file\_uploaded() //all files both private and public
- ii. If(file\_is\_malicious == true)
  - Show\_file\_in\_red\_color()
  - Click\_on\_delete\_button\_to\_delete\_the\_file();
  - Ask\_reason\_for\_deleting()
  - After\_deletion\_send\_email\_to\_user\_with\_reason();

### E. Admin\_process()

Admin(): this procedure administrator check the any unauthorized user access the cloud services it will delete that user.

- i. List\_all\_users() //all users with emailid and contact number
- ii. If(user\_is\_not\_authorized == true)
  - Delete\_the\_user();

## VI. RESULT & ANALYSIS

1. our proposed system is in hybrid drive in cloud commuting hence we have implement as in application form which is hybriddrive.in.
2. It is high security is provided using hybrid encryption algorithm.
3. Using hybrid encryption leads to high security of text file and make the access of original file by intruders near to impossible.
4. If a user logins and forgets to log out or leaves the system idle. In that case if a intruder tries to download the data from the system then that person will be asked to enter to verify the three level of encryption key. we can see in the picture how data is flowing using encryption.

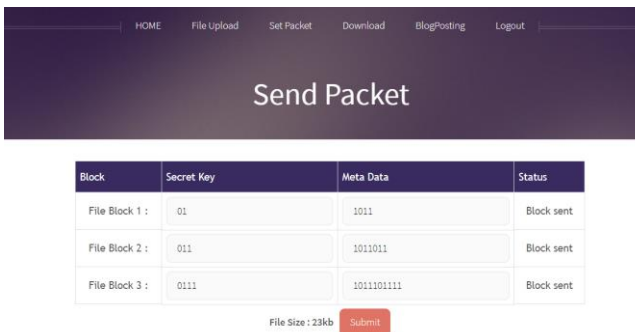


Fig. 7. level of encryption to upload file

5. To download the data in a secure way the user is always required to enter the private key and secret key. Since the private key and secret is not even known to the Cloud's Administrator. Thus, the main advantage of proposed system is that even the Cloud's Administrator cannot access the data of the user.

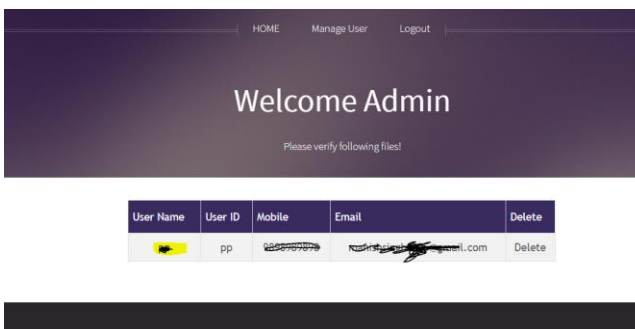


Fig.8. Admin Authorization for user manage

## VII. CONCLUSION & FUTURE WORK

This paper is proposed a hybrid encryption algorithm providing data security to the user in the Cloud. here we use s a Multilevel Encryption and Decryption algorithm. in our proposed work, only the authorized user can access the data. Even if some intruder (unauthorized user) gets the data accidentally or intentionally, he must have to decrypt the data at each level which is a very difficult task without a valid key. It is expected that using multilevel encryption. even the Cloud's Administrator cant access the user data. will provide more security for Cloud Storage than using single level encryption. In the future we would emphasize on finding an encryption algorithm which will be more light and secured for data in Cloud Computing. The strength of Cloud Computing is the ability to manage risks in particular to security issues. Security algorithms mentioned for encryption and decryption can be implementing in future to enhance security over the network. In the future, we will extend our research by providing algorithm implementations and producing results to justify our concepts of security for Cloud Computing.

## VIII. REFERENCES

- [1] Md Sajid Khan, Mayank Deep Khare and Dr. Chandra Shekhar Yadav. "An Approach for Ensuring Data Security in Cloud Computing Based on Hybrid Cloud-A Survey." International Journal for Scientific Research and Development 5.12 (2018): 596-599.
- [2] Vishwanath S Mahalle, Aniket K Shahade, "Enhancing the Data Security in Cloud by Implementing Hybrid (Rsa & Aes) Encryption Algorithm" 978-1-4799-7169-5/14/ IEEE
- [3] Adviti Chauhan, Jyoti Gupta, "A Novel Technique of Cloud Security Based on Hybrid

- Encryption by Blowfish and MD5” 4th IEEE International Conference on Signal Processing, Computing and Control ('SPCC 2k17), Sep21-23, 2017, Solan, India
- [4] Mohammad Nashir Uddin, He Lie, & Hao Li. “Hybrid Cloud Computing and Integrated Transport System” 2017 International Conference on Green Informatics, IEEE DOI 10.1109/ICGI.2017.27
- [5] Vikas K.Soman, Natarajan V, “An Enhanced hybrid Data Security Algorithm for Cloud” 2017 International Conference on Networks & Advances in Computational Technologies (NetACT) |20-22 July 2017| Trivandrum.
- [6] Aarti Singh, Manisha Malhotra, “Hybrid Two-Tier Framework for Improved Security in Cloud Environment” 978-9-3805-4421-2/16, 2016 IEEE
- [7] Divya Prathana Timothy, Ajit Kumar Santra,” A Hybrid Cryptography Algorithm for Cloud Computing Security” 978-1-5386-1716-8/17/,2017 IEEE
- [8] Shweta Kaushik, Charu Gandhi, "Cloud data security with hybrid symmetric encryption" 2016 International Conference on Computational Techniques in Information and Communication Technologies (ICCTICT), 978-1-5090-0082-1/16, IEEE
- [9] Santosh Bulusu, Kalyan Sudia "A Study on Cloud Computing Security Challenges" Thesis School of Computing, Blekinge Institute of Technology, SE-371 79 Karlskrona,Sweden

# An Improved Multilevel resource handling strategy for Cloud based Video Streaming

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## ABSTRACT

Video data transmission and video streaming allows people to access the stored video media using the network anywhere in the world. An adaptive scheme is applied to perform the resource allocation in terms of bandwidth and video memory in cloud-based video streaming. Advances and commoditization of media generation devices enable capturing and sharing of any special event by multiple attendees. Video streaming is multimedia that is constantly received by and presented to an end-user while being delivered by a video service provider or sender. With the rapid development of cloud technology, many services have been transferred from local computers to the cloud-based platform, which decreases the amount of computation done on the former. Graphics processing, apart from providing user interfaces featuring diversified special effects, is also significant in terms of application programs and play interactions. The proposed model combines a QoS aware resource allocation strategy for mobile 3D graphics rendering, which is a hybrid rendering technology combining the client-side graphics processing capabilities with the graphics processing units on the cloud-based platform. The proposed system is called Graphics Adaptive Resource Allocation Strategy (GARAS), and it delivers multiple views of an event to viewers at the best possible video representation based on each viewer's available bandwidth GARAS is a complex system having many research challenges. The objective of the study is to maximize the overall viewer satisfaction by allocating available resources to transcode views in an optimal set of representations, subject to computational and bandwidth constraints.

**Keywords :** Cryptography, ECC, Graphics processing, QoS, RSA, Streaming, Streaming Cloud.

## I. INTRODUCTION

Cloud Computing refers to both the hardware and systems software in the datacenters that provide those services and the applications delivered as services over the Internet. The services are referred to as Software as a Service (SaaS), so we use that term. The datacenter hardware and software are what we will call a Cloud. In cloud computing, cloud service providers offer an abstraction of infinite storage space for clients to host data. Today's cloud service

providers offer both massively parallel computing resources and highly available storage at relatively low costs. As cloud computing becomes extensive, an increasing amount of data is being stored in the cloud and shared by users with specified privileges, which defines the access rights of the stored data.

In a cloud computing environment many entities are involved. The entities that we are concerned about is the cloud provider and the cloud consumer. The entity which owns and manages the resources is the

cloud provider and the entity that consumes the resources which may be an individual or an organization, is the cloud consumer. When a cloud consumer is an organization, the users or employees will have access to its cloud resources. There may be casual users that have no relationship with the cloud provider but are accessing cloud consumers' web services that are developed and hosted within the cloud. Here the concern about the security and trust relationship is between the cloud provider and the cloud consumer.

In this work the main objective is to improve the security in a cloud environment by utilizing the available cloud resources, for creating the streaming cloud. The goal is to provide secured storage and access normal & multimedia data seamlessly in cloud communication. This work is done to reduce eavesdropping and to increase the performance efficiently.

## II. Related Work

Monjur Ahmed and Mohammad Ashraf Hossain (2014) in this paper "Cloud Computing and Security Issues in the Cloud" addressed that Cloud-based service providers are being evolved, which has resulted in a new business trend based on cloud technology. The introduction of diverse cloud-based services and service providers dispersed geographically, sensitive information of different entities is normally stored in remote servers. The locations of these servers with the possibilities of being exposed to unwanted parties in situations where the cloud servers storing this information are compromised. If security is not sturdy and consistent, the flexibility and advantages that cloud has to offer will have little reliability. This paper presents a review on cloud computing concepts as well as security issues inherent within the context of cloud computing and cloud infrastructure.

### ***Water Marking Multimedia Content***

The problem of protecting various types of multimedia content has gained significant attention from academicians and the industry. One approach to this problem is to use watermarking, in which some distinctive information is embedded in the content itself. A method is used to search for this information to verify the authenticity of the content. Watermarking is simply inserting watermarks in the multimedia objects before releasing them as well as mechanisms to find objects and verify the existence of correct watermarks in them.

### ***Crowdsourced Live Streaming Over The Cloud***

The focus of this paper is on the other approach for protecting multimedia content, which is content-based copy detection (CBCD). In this approach, signatures (or fingerprints) are extracted from original objects. Signatures are also created from query (suspected) objects downloaded from online sites. Then, the similarity is computed between original and suspected objects to find potential copies. Many previous works proposed different methods for creating and matching signatures. These methods can be classified into four categories: spatial, temporal, colour and transform-domain. Spatial signatures (particularly the block-based) are the most widely used. However, their weakness is the lack of resilience against large geometric transformations. Temporal and colour signatures are less robust and can be used to enhance spatial signatures. Transform-domain signatures are computationally intensive and not widely used in practice.

### ***3D Video Signature***

Content-based copy detection of 3D videos is a new problem; we are aware of only two previous works. On one hand, the work computes SIFT points in each view and uses the number of matching SIFT points to verify matches. Comparing all SIFT points in each frame is not practical for large databases due to the storage overhead and search complexity. On the other

hand, the work assumes that the depth maps are given or estimated. Estimating the depth map from stereoscopic videos is quite expensive. The method is suitable for 3D videos encoded in the video plus depth format, but not for stereoscopic videos. The proposed method in this paper captures the depth properties without calculating the depth map itself and it is computationally efficient because it does not compare all features in the frame.

### III. Existing System

Common cloud services are mostly meant to speed up CPU computing. However, with improved graphics processors, cloud services that can speed up GPU computing concerning remote streaming are coming into the spotlight, such as virtualized screen, remote operation interface and cloud gaming systems, etc. Increased GPU computing was first achieved through open source code, and through hybrid streaming architectures, etc., which have been proposed in recent years. Regarding the current research topic, while there are already many relevant studies of the reduction of data transfer, solutions under unstable network Resource remain lacking. In terms of this research topic, however, there have been few relevant issues concerning network speed and quality in terms of remote streaming systems, thus, this research sets out to enhance graphic capabilities through the graphic operations of mobile devices.

Given that remote streaming might call for greater Internet Resource, this research takes the graphic processing capabilities of mobile devices into consideration, and simultaneously puts the graphic processors of mobile devices and cloud-based platforms into computing operations, and with the graphics capabilities of current embedded devices, the current network transmission rate and quality as the selective parameters for the function of cloud support streaming in the current research. Through this parameter operation, the users can carry out drawing

via the remote cloud-based platform when network transmission is not stable. To achieve a relatively smooth frame rate for the local computer, as well as to reduce the transmission of network packets, the priority of this research will be given to the graphics processing capabilities of the local computer. In addition, the resource allocation strategy for mobile graphics streaming for mobile graphics streaming proposed here will only be used in drawing when the mathematical capabilities of the local computer are below the minimum frame rate.

With the progress of computer mathematical capabilities in recent years, application programs have placed substantially higher demands of 3D graphics. Instead of the simple application programming interfaces in the past, application programs are placing more emphasis on beautiful user interfaces. Apart from Flash animations, the user interfaces of many application programs are presented by 3D graphics. Given the substantially higher demands for 3D graphics, the hardware of the local computer is often found by the users to be functionally insufficient. If the 3D graphics can be transferred and computed by remote hardware featuring higher efficiencies by means of remote streaming, and the ultimate frames are transferred back to be displayed on the client side, the user's experience of these 3D application programs could be improved.

The client side is a mobile device, which hardware is inferior to ordinary PCs, and when complex 3D graphics calculations occur, it will be impossible for the client side to carry out real-time calculations, resulting in a poorer user experience. The 3D graphics calculations in this study are mostly concerned with complex mathematical calculations, such as matrix, inverse matrix, trigonometric functions, etc. Remote streaming works by carrying out a drawing transferred by complex graphic calculations to the remote cloud-based platforms, thus, not only improving the user experience, but also increasing 3D

graphics efficiency. In its applications however, the key issue faced by this technology is the network environment.

Priority should thus be given to the network speed and quality between the client side and the cloud-based platform in terms of this technology. Remote streaming could also be applied through frame splitting. That is, when an application program is running on a monitor featuring high resolution, small blocks of the frames could be handed over to be rendered by the cloud-based platform after the frames are split. A large cloud-based platform can simultaneously process multiple small blocks before they are transferred back to be displayed on the monitor.

A management program for frame splitting is required in this application to manage the frames waiting to be split. For the client side, therefore, the splitting could only be done after detailed analysis of the application information is made. In most common remote streaming architectures, it is necessary to increase the computing time of the cloud-based streaming platform to reduce the transfer of packets; however, if the aim is to create better user experiences and increase the users' interactive feedbacks, the transfer of packets should be increased.

The cloud-based streaming platform will produce two 3D models, a high-quality model and a low-quality model. When the low-quality model is completed, it will be compressed and transmitted to the client side for first-phase streaming. At the same time, the platform will carry out a difference calculation between the high-quality model and the low-quality model, in which a difference image of the two models will be produced. This image is compressed and transmitted to the client side. After the first-phase streaming is completed on the client side, an image overlay calculation will be conducted via the difference image from the cloud-based platform, thus,

generating the ultimate frame.

### ***Drawbacks of Existing System***

The existing system is used to protect different multimedia content types including videos, images and audio. It is deployed in both public and private cloud. A key management process during the new user join or revoking existing user in hybrid cloud is not included. A same key is used for long period in hybrid cloud communication. Symmetric key encryption standard has less secure. Exponential based polynomial function will increase the complexity of algorithm in both memory well as execution time. In existing system, during the user update process private key information is not updated. This will lead to data leakage in the cloud data access in secured groups. If the file size is large, then signature code size is high. It increases the complexity of the signature generation process.

## **IV. Proposed System**

The proposed system is used to protect different multimedia content types including videos, images and audio. It is deployed in both public and private in-network. It creates signatures for multimedia content, and distributed matching engine for multimedia objects. The signature is generated based on the depth signal in the video like spectrum value of the audio signal. Multi-level signature generation process is used to design the efficient encryption for multimedia content this code generation process is repeated by processing the complete file into number of chunks Individual signature codes are merged by using logical operation such as XOR operation.

The aggregate user satisfaction obtained by using a specific set of representations are considered as profit or gain, and consumed number of cloud instances and aggregate bandwidth for all users serve as weights. For instance, if a view is transcoded to all five representations, then the weight will be 5, and

viewers' QoE will be maximum, as all of the viewers will get the desired representation. However, if a view is transcoded in just one representation, then the weight will be 1, and aggregate user QoE will be  $\leq 1$ , depending on the bandwidth capabilities of the viewers watching that view.

The profit values serve as the major selection criteria. Considering number of representation in set R, a single view can be transcoded into  $2^R - 1$  possible combinations considering requirement to fulfill all of the viewer's bandwidth constraints. For instance, if a chunk of viewers can only receive 360p video, then the selected representations set must have 360p representation. If there is only one computational instance available, then the only possible representation is 360p, as only this representation fulfills constraint (4a) for all of the viewers. Though, the overall QoE for this representation will be less as viewers capable to receive higher bitrate representations are forced to watch 360p representation. If the view can be transcoded into two representations, then the possible set to choose a representation set is  $\{\{360, 480\}, \{360, 720\}, \{360, 1080\}, \text{ or } \{360, 4K\}\}$ . 360p represents the least bitrate representation required to serve the users having capability to receive 360p only.

The response of a local Web cache is often three times faster than the download time over the WAN, for the same content. End users see impressive improvements in response times, and the implementation is completely transparent to them. A Web cache stores Web pages and content on a storage device, that is logically or physically closer to the user-closer and faster than a Web lookup. By reducing the amount of traffic on WAN links and on overburdened Web servers, caching provides significant benefits to ISPs, enterprise networks, and end users.

Ensuring that the network supports traffic localization is the first step in creating a network-integrated cache

engine, which can be achieved by setting specific parameters to optimize network traffic and enabling content routing technology at the system-level. Once the right network foundation is in place, network caches are added into strategic points within the existing network. By pairing software and hardware, Cisco creates a network-integrated cache engine.

RSA is widely used public-key encryption algorithm. RSA stands for Ron Rivest, Adi Shamir and Len Adleman, who first publicly described it in 1977. In our proposed work, we are using RSA algorithm to encrypt the data to provide security so that only the concerned users can access it. By securing the data, we are not allowing the unauthorized access to it. RSA is an algorithm for public key cryptography, involves a public key and a nonpublic key. The overall public keys are regularly known to everybody and are utilized for scrambling messages. Messages encoded with the overall population key will exclusively be unscrambled abuse that particular key. Client information incorporate encryption before capacity, client verification methodology before capacity or recovery, and building secure channels for information transmission.

RSA crypto framework understands the properties of the multiplicative Homomorphic encryption. Ronald Rivest, Adi Shamir and Leonard Adleman have imagined the RSA calculation and named after its creators. RSA utilizes measured exponential for encryption and decoding. RSA utilizes two examples, a and b, where a is public and b is private. Let the plaintext is P and C is cipher text, then at encryption. User data is encrypted first and then it is stored in the Cloud. When required, user places a request for the data for the Cloud provider. The Cloud provider delivers the data after authenticating the user. RSA is a block cipher, in which every message is mapped to an integer. In our Cloud environment, private key is only known to the user for who originally owns the data whereas public key is known to all. Does,



encryption is done by the cloud service provider and decryption done by the Cloud user or consumer. Once the data is encrypted with the public key, it can be decrypted with the corresponding private key only.

### V. Results And Discussion

Simulation is conducted in random environment 50 mobile devices using NS2 with random way point mobility model. Network area is defined as 1000 x 1000 sq.ft area. The connection pattern is generated using Video Generation and the mobility model is generated using setdest utility. Setdest generates random positions of the nodes in the network with pause time and specified mobility. Protocol performance is estimated in terms of Packet delivery ratio, Throughput, Transmission Delay. Cloud based Regular Video Streaming model achieve acceptable results compare to Video Streaming.

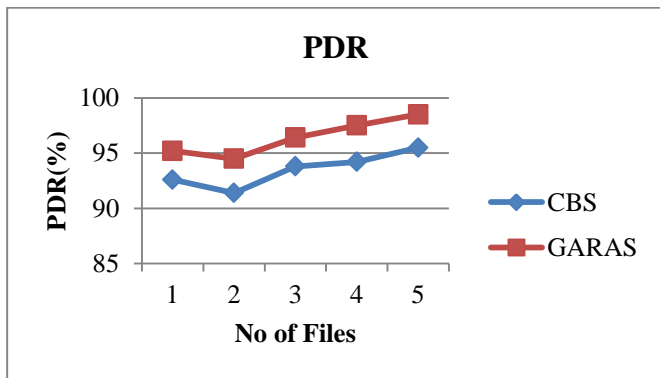


Fig.1 Packet delivery ratio

CBS Model outcomes high packet delivery ratio compare to Streaming Model. Packet delivery ratio has been evaluated for Cloud Video streaming and regular streaming results as shown in Fig.1. CBS model throughput is high compared to Streaming model.

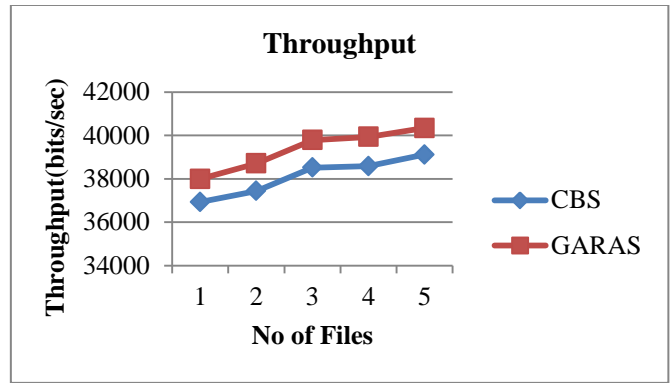


Fig.2 Throughput

Throughput has been evaluated for Cloud Video streaming and regular streaming results as shown in Fig.2.

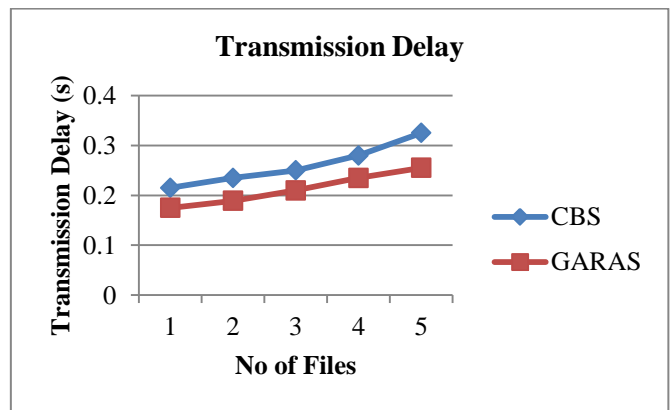


Fig.3 Transmission Delay

Transmission delay is achieved very less compare to Streaming Model. Transmission delay has been evaluated for Cloud Video streaming and regular streaming results as shown in Fig.3.

### VI. Conclusion

Video streaming is a type of multimedia that is constantly received and presented to an end-user while being delivered by a video service provider or sender. The proposed model combines a QoS aware resource allocation strategy for mobile graphics rendering, which is a hybrid rendering technology combining the client-side graphics processing capabilities with the graphics processing units on the

cloud-based platform. Key updating process is done for each user update process in the user join and leave the process. i.e., whenever any node leaves or added in cloud, a new key is generated without exchanging the key message with Third Party Auditing. Moreover, the QoE metric is based on the received video quality and the viewer's bandwidth capabilities. The proposed system significantly differs from legacy multi-view video systems in the fact that multiple views are generated from non-professional crowdsources instead of professionally calibrated settings and expensive equipment. The presented cloud-based architecture of the system for a scalable and cost-effective solution.

## VII. References

- [1] Ahmed, M. and Hossain, M.A., 2014. Cloud computing and security issues in the cloud. *International Journal of Network Security & Its Applications*, 6(1), p.25.
- [2] Angius, F., Westphal, C., Gerla, M. and Pau, G., 2015, January. Drop Dead Data-What to expect Securing Data instead of Channels. In *Consumer Communications and Networking Conference (CCNC), 2015 12th Annual IEEE* (pp. 267-275). IEEE.
- [3] Curtmola, R., Garay, J., Kamara, S. and Ostrovsky, R., 2011. Searchable symmetric encryption: improved definitions and efficient constructions. *Journal of Computer Security*, 19(5), pp.895-934.
- [4] He, Q., Liu, J., Wang, C. and Li, B., 2016. Coping with heterogeneous video contributors and viewers in crowdsourced live streaming: A cloud-based approach. *IEEE Transactions on Multimedia*, 18(5), pp.916-928.
- [5] Jagadeesan, N.A., Pal, R., Nadikuditi, K., Huang, Y., Shi, E. and Yu, M., 2014, August. A secure computation framework for SDNs. In *Proceedings of the third workshop on Hot topics in software defined networking* (pp. 209-210). ACM.
- [6] Liang, J., Jiang, J., Duan, H., Li, K., Wan, T. and Wu, J., 2014, May. When HTTPS meets CDN: A case of authentication in delegated service. In *Security and privacy (sp), 2014 IEEE symposium on* (pp. 67-82). IEEE.
- [7] Liao, Xiaofei, Li Lin, Guang Tan, Hai Jin, Xiaobin Yang, Wei Zhang, Bo Li et al. "LiveRender: A cloud gaming system based on compressed graphics streaming." *IEEE/ACM Transactions on Networking (TON)* 24, no. 4 (2016): 2128-2139.
- [8] Liluashvili, V., Kalayci, S., Flouder, E., Wilson, M., Gabow, A. and Gümüş, Z.H., 2016. iCAVE: an open source tool for immersive 3D visualization of complex biomolecular interaction networks. *bioRxiv*, p.061374.
- [9] Misra, S., Tourani, R. and Majd, N.E., 2013, August. Secure content delivery in information-centric networks: Design, implementation, and analyses. In *Proceedings of the 3rd ACM SIGCOMM workshop on Information-centric networking* (pp. 73-78). ACM.
- [10] Mpeg, I., 2012. Information technology-dynamic adaptive streaming over http (dash)-part 1: Media presentation description and segment formats. ISO/IEC MPEG, Tech. Rep.
- [11] O'Connell, T.W. and Patlas, M.N., 2016. Mobile devices and their prospective future role in emergency radiology. *The British journal of radiology*, 89(1061), p.20150820.
- [12] Rueda, A.J., Noguera, J.M. and Luque, A., 2016. A comparison of native GPU computing versus OpenACC for implementing flow-routing algorithms in hydrological applications. *Computers & Geosciences*, 87, pp.91-100.
- [13] Sherry, J., Lan, C., Popa, R.A. and Ratnasamy, S., 2015. Blindbox: Deep packet inspection over encrypted traffic. *ACM SIGCOMM Computer Communication Review*, 45(4), pp.213-226.

- [14] Singh, A.K., 2017. Improved hybrid algorithm for robust and imperceptible multiple watermarking using digital images. *Multimedia Tools and Applications*, 76(6), pp.8881-8900.
- [15] Sun, Y., Fayaz, S.K., Guo, Y., Sekar, V., Jin, Y., Kaafar, M.A. and Uhlig, S., 2014, December. Trace-driven analysis of ICN caching algorithms on video-on-demand workloads. In *Proceedings of the 10th ACM International on Conference on emerging Networking Experiments and Technologies* (pp. 363-376). ACM.
- [16] Wang, R., Shoshitaishvili, Y., Kruegel, C. and Vigna, G., 2013, August. Steal This Movie: Automatically Bypassing DRM Protection in Streaming Media Services. In *USENIX Security Symposium* (pp. 687-702).
- [17] Yi, Y.H., Cho, M.G. and Cho, S.H., 2015. A Study on Copyright Protection Method of Web Image Contents. *The Journal of The Institute of Internet, Broadcasting and Communication*, 15(1), pp.37-43.
- [18] Yuan, F., Po, L.M., Liu, M., Xu, X., Jian, W., Wong, K. and Cheung, K.W., 2016. Shearlet based video fingerprint for content-based copy detection. *Journal of Signal and Information Processing*, 7(02), p.84.

# An Experimental Study on the Properties of Concrete by the Partial Replacement of Sand with Glass Powder

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## ABSTRACT

Disposal of more than 300 tonnes waste glass daily derived from post-consumer beverage bottles is one of the major environmental challenges for India, and this challenge continues to escalate as limited recycling channels can be identified and the capacity of valuable landfill space is going to be saturated at an alarming rate. For this reason, in the past ten years, a major research effort has been carried out to find practical ways to recycle waste glass for the production of different concrete products such as concrete blocks, self-compacting concrete and architectural mortar. Some of these specialty glass-concrete products have been successfully commercialized and are gaining wider acceptance. This paper gives an overview of the current management and recycling situation of waste glass and the experience of using recycled waste glass in concrete production India. Glass is widely used in our lives through manufactured products such as sheet glass, bottles, glassware, and vacuum tubing. Glass is an ideal material for recycling. The use of recycled glass helps in energy saving. The increasing awareness of glass recycling speeds up inspections on the use of waste glass with different forms in various fields. One of its significant contributions is to the construction field where the waste glass was reused for concrete production. The application of glass in architectural concrete still needs improvement. Laboratory experiments were conducted to further explore the use of waste glass as coarse and fine aggregates for both ASR (Alkali-Silica-Reaction) alleviation as well as the decorative purpose in concrete. The study indicated that waste glass can effectively be used as fine aggregate replacement (up to 50%) without substantial change in strength.

**Keywords :** Alleviation, Landfill, Glass Powder, Vacuum Tubing

## I. INTRODUCTION

Laboratory investigations were carried out to assess the potential of the crushed recycled glass as natural sand replacement using ratios of 30%, 45% and 60%. Replacement of cementitious materials in concrete was also considered using cement replacement ratios of 7.5%, 15% and 25% of powder glass. The effects of glass sand replacement and cementitious materials replacement with powder glass on fresh and hardened concrete properties were assessed. It was concluded that with the incorporation of 45% of crushed glass as

a natural sand replacement, the compressive and flexural strengths have marginally increased, while the indirect tensile strength marginally decreased. The concrete with glass as the natural sand replacement had lower shrinkage and significant lower chloride diffusion coefficient. Concretes with powder glass as cementitious materials replacement showed lower compressive strength and marginally higher drying shrinkage than the control mix, but meeting the concrete mix design requirements.

Glass is a transparent material produced by melting a mixture of materials such as silica, soda ash, and  $\text{CaCO}_3$  at high temperature followed by cooling where solidification occurs without crystallization. Glass is widely used in our lives through manufactured products such as sheet glass, bottles, glassware, and vacuum tubing. Glass is an ideal material for recycling. The use of recycled glass saves lot of energy and the increasing awareness of glass recycling speeds up focus on the use of waste glass with different forms in various fields. However, the applications are limited due to the damaging expansion in the concrete caused by ASR between high-alkali pore water in cement paste and reactive silica in the waste glasses. The chemical reaction between the alkali in Portland cement and the silica in aggregates forms silica gel that not only causes crack upon expansion, but also weakens the concrete and shortens its life (Swamy, 2003). Ground waste glass was used as aggregate for mortars and no reaction was detected with fine particle size, thus indicating the feasibility of the waste glass reuse as fine aggregate in mortars and concrete. Estimated cost for housing is more and some construction materials like natural sand are also becoming rare. Waste glasses are used as aggregates for concrete. In this study, an extensive experimental work was carried out to find the suitability of use of waste glass in concrete with the following objectives:

1. To study the workability of concrete made using glass waste as partial replacement of fine aggregate.
2. To study the compressive strength of concrete made using glass waste as partial replacement of fine aggregate.

## II. INTRODUCTION OF GLASS IN CONCRETE

Glass is one of the oldest man-made materials. It is produced in many forms such as packaging or container glass, flat glass, and bulb glass, all of which have a limited life in their manufactured forms and

therefore need to be recycled so as to be reusable in order to avoid environmental problems that would be created if they were to be stockpiled or sent to landfills. The construction industry has shown great gains in the recycling of industrial by-products and waste, including waste glass materials.

Quantities of waste glass have been rising rapidly during the recent decades due to the high increase in industrialization and the considerable improvement in the standards of living, but unfortunately, the majority of these waste quantities are not being recycled but rather abandoned causing certain serious problems such as the waste of natural resources and environmental pollution. Recycling of this waste by converting it to aggregate components could save landfill space and also reduce the demand for extraction of natural raw material for construction activities. Herein is a quick review for some of the previous research studies concerned with the waste glass as an aggregate material, but from different points of view and perspectives.

## III. CONCRETE COMPOSITE MATERIALS

This section summarizes the properties of all the components used in the various concrete mixes. Concrete is a structural material that contains some simple elements but when mixed with water would form a rock like material. Concrete mix is comprised of coarse aggregates usually gravel, fine aggregates usually sand, cement, water, and any necessary additives. Concrete possesses many favourable properties as a structural material, among which are its high compressive strength and its property as a fire-resistant element to a considerable extent. The unfavourable properties include a relatively weak tensile strength as compared to its compressive strength and the ability to form cracks in unpredictable areas. With steel bars as internal reinforcement, the cracks can be controlled to some degree. Unlike other building materials such as steel

and plastic, concrete is not a uniform material due to the fact that it contains a ratio of gravel and sand, thus failure mode or location of the failure is unpredictable. Due the nature of concrete, concrete has an ability to have its recipe changed or altered to meet situational needs. Thus, if a job calls for high strength, lightweight or weather resistant concrete, its recipe is available or a custom one can be devised. Concrete has three main components when it's freshly mixed and they are water, cement and aggregates. Water is needed to begin the hydration process for the concrete and after four weeks of curing until full potential strength of the concrete can be achieved.

### **Water**

Water is one of the most important elements in concrete production. Water is needed to begin the hydration process by reacting with the cement to produce concrete. There has to be a sufficient amount of water available so that the reaction can take its full course but if too much water is added, this will in fact decrease the strength of the concrete. The water-cement ratio is an important concept because other than the recipe for the concrete mix, the amount of water used would also determine its final strength .

In more details, if too little water were added, there would not be enough water available to finish the reaction, thus some of the cement would harden and bond with other dry cement shorting the hydration process. On the other hand, if too much water were added then while the cement is undergoing hydration the cement would be in a slurry solution, and the probability of cement bonding with aggregates would decrease. And as a result, when the hydration process is completed, the cement content would still be in a slurry solution and with no strength. The type of water that can be used to mix concrete must be potable which is essentially has neither noticeable taste nor odor. Basically, water containing less than 2000 ppm of total dissolved solids can be used. Thus the type of water that was used to mix concrete

throughout the testing program was normal tap water with attention paid for not including impurities.

### **Cement**

There are currently more than eight types of cement that are used under specific conditions. Cement is a very important part of the concrete because it is the cement, which gives the concrete its strengths. Because of the importance of cement, the ASTM has set guide lines to follow for the make-up of cement. For experimental program of this research study, normal Portland Cements Type I was used.

Water is the element that is used to begin the hydration reaction where cement reacts with the water to produce a rock like substance. The reaction is also exothermic, where heat is released in the chemical reactions. This is an important fact because in very large structure like concrete dams, the heat released can pose a potential problem.

When the chemical reaction has reached the end, the initial cement paste is transformed into a substance, which has tremendous strength. But using too much cement in concrete is expensive, and thus aggregates would take the place of cement without reducing its strength and reduce the cost. In the engineering practice in Palestine, the dominating range of water-cement ratios in the concrete mix process is between 0.4 up to 0.6. For this research, three different categories for water-cement ratios were used during testing phase: 0.4, 0.5, and 0.6.

### **Aggregates**

Aggregates are broken down into two main categories, which are coarse and fine aggregates. Coarse aggregates in general are larger than 2 mm in diameter and fine aggregates are defined to be smaller than 2 mm. Aggregates that are used in concrete have to pass the standards set in ASTM. The economics part of concrete is to use as little cement as possible and still obtain the required strength. Thus, when concrete is formed, the coarse aggregates with its large volume would make up a large portion of the concrete. The fine aggregates would fill in the voids created from the

coarse aggregate and reduce the amount of cement required. If only coarse aggregates are used then there would be voids between the particles and the voids created would be filled with cement paste. Thus fine aggregates are used to fill those voids. In essence, the goal is to produce a concrete mixture that has the least amount of void spaces thus using less cement paste to fill the voids between the particles. When fresh aggregates are used to mix concrete, the aggregates themselves also contain some moisture either from water condensing on the particles or the aggregates was washed in some way with water.

### **Waste Glass**

Theoretically, glass is a fully recyclable material; it can be recycled without any loss of quality. There are many examples of successful recycling of waste glass: as a cullet in glass production, as raw material for the production of abrasives, in sand-blasting, as a pozzolanic additive, in road beds, pavement and parking lots, as raw materials to produce glass pellets or 9 beads used in reflective paint for highways, to produce fiberglass, and as fractionators for lighting matches and firing ammunition. Waste glass can also be produced from empty glass bottles and pots, and come in several distinct colors containing common liquids and other substances. This waste glass is usually crushed into small pieces that resemble the sizes of gravels and sands. Therefore - as an alternative - there is a potential to partially replace the concrete mix aggregate with waste glass due to the lack of natural recourses in Gaza Strip.

### **IV. USE OF RECYCLED GLASS BOTTLES AS FINE AGGREGATES IN CONCRETE MIXTURE**

As time goes by, human civilization is continuously becoming more industrialized. More factories are built, vehicles are continuously growing in number, and buildings were built all around. As a result of these, our natural environment was permanently changed from what it has been twenty years or more.

Over, the last several decades, sociologists have investigated the public's increasing concern about the environment, but they have had little success explaining attitudes toward the environment or the adoption of pro-environment behaviors like recycling. The researcher examine the role of social context in the link between individual attitudes about the environment and recycling behavior by comparing communities that vary in their access to recycling programs. Results show that people with access to a structured recycling program have much higher levels of recycling than do people lacking such access. Furthermore, individual attitudes toward the environment affect recycling behavior only in the community with easy access to a structured recycling program. Individual concern about the environment enhances the effect of the recycling program, but does not overcome the barriers presented by lack of access. The human population is continuously growing in number, because of this; there is a great demand of constructing more structures to facilitate the needs of the community. Quarry operations become rampant to satisfy the need for gravel and sand for construction. As a consequence there are massive destruction of mountains which has been one of the major costs of landslides, and flashfloods during earthquakes and typhoons resulting to loss of thousands or even millions of lives.

### **V. EXPERIMENTAL INVESTIGATION**

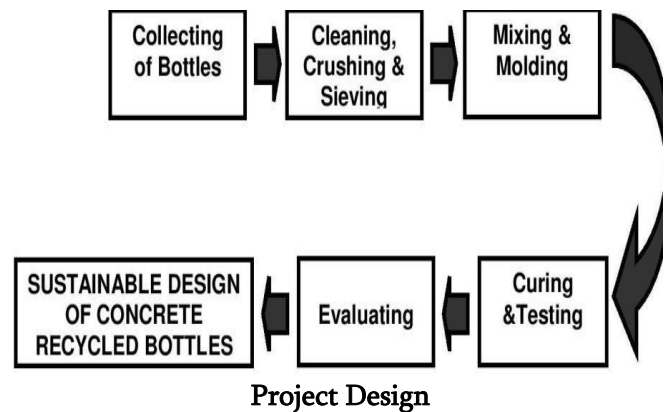
This experimental research focuses on the effect of using recycled bottles as concrete material for mass housing projects. This research aims to determine the effect of using recycled bottles on the properties of hardened concrete namely: compressive strength and modulus of elasticity. Also included, are the effect of recycled bottles on water-cement ratio, quality and size of aggregates and consistency of the mix. Experiments shall be conducted to acquire the necessary data needed in the analysis. Each

experiment shall be conducted in accordance with the standards which are applicable in our country, in which in our case, specified by ASTM requirements. Bottles from junkshops are used in this study. These bottles are crushed and use as a replacement for fine aggregates for concrete mixture. The researcher used manually crushed and clean bottles and chosen bottles with the same property for uniformity. The crushed samples were passed through sieve analysis to ensure that the size of the cullet will be less than 2.0 mm but greater than 0.0625 mm with accordance to ASTM standards. The research concentrates on the effect of using recycled bottles as fine aggregate and not on its properties as an aggregate. The researchers used only Portland Pozzolan Cement (Type IP), which are commonly used in the field at present, for the specimens. This type of cement has low hardening characteristics. It will also cover the difference between the common concrete cement and concrete recycled glass bottles in terms of its properties as a fine aggregate. The specimens are tested for compressive strength using Universal Testing Machine (UTM) on its 7th, 14th, 21st and 28th day of curing. This will be the basis for the data. The study focuses on compressive strength and elastic modulus. This study also gives emphasis on the environmental concerns and not on its economic aspect. In addition, study is also delimited to durability, creep, shrinkage and water tightness. These four properties of hardened concrete are time-dependent properties which will entail so much time to determine.

## VI. PROJECT DESIGN

The researcher believes that glass bottles can be processed into construction grade cullet using any convenient mechanical method. For cullet-aggregate blends, glass cullet can be blended with natural aggregates by any convenient mechanical method. Normal precautions should be followed to prevent segregation. Typical aggregates for construction include sands, gravels, crushed rock and recycled

concrete. The glass cullet and cullet aggregate blends should be compared with these standard specifications for each specific application. The intent of this research is to encourage regulatory departments to amend specifications to allow glass cullet and cullet aggregate blends as an alternative to conventional aggregate in numerous applications. Several states in United States of America, including the Washington State Department of Transportation, have already included specifications for glass aggregate.



## VII. RESULTS AND DISCUSSION

### Design of Concrete Mixture with Recycled Glass Bottles

#### Materials

These are waste glass bottles, Portland cement, sand, gravel, water, crushing tools, mixing tools, cylindrical molds and, experimental and testing equipment.

#### Operation and Testing Procedures

- 1) Collect waste glass bottles
- 2) Clean the collected bottles.
- 3) Crush the bottles. After crushing, the crushed bottles must pass through sieve number 10 with 2 mm opening diameter. Make sure that the sizes of particles are uniform.
- 4) Mix the design mixture desired to be performed. Mix the components thoroughly to ensure that the distribution is even all throughout. Carefully measure the water to be added.



5) Follow the experimental procedures from the ASTM specifications:

- a) Making and Curing of Concrete Test Specimen (ASTM C192).
- b) Slump in Consistency of Mixture (ASTM C143).
- c) Compressive Strength of Cylindrical Specimens (ASTM C39)
- d) Modulus of Elasticity (NSCP Section 5.8.5)

reduces the strength. Compressive strength of cubes (sand is partially replaced by glass powder) of M-20 mix increases up to 15% glass powder. As glass powder exceeds 15%, compressive strength decreases. In M-25 and M-30 concrete mix, compressive strength also follows the same trend as it did in the M-20 mix. Compressive strength is maximum at 20% powder, and then it starts decreasing. Optimum percentage of glass and glass which can replace sand is 15% and 20% respectively. Compressive strength of cubes corresponding to these percentages of glass and glass powder is more than the strength corresponding to 0% glass and glass powder which clearly indicates that sand can be partially replaced by glass or glass powder.

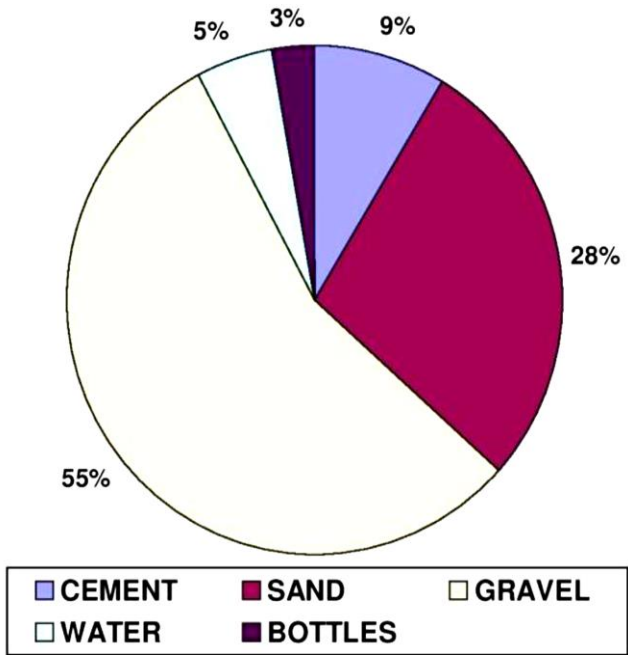
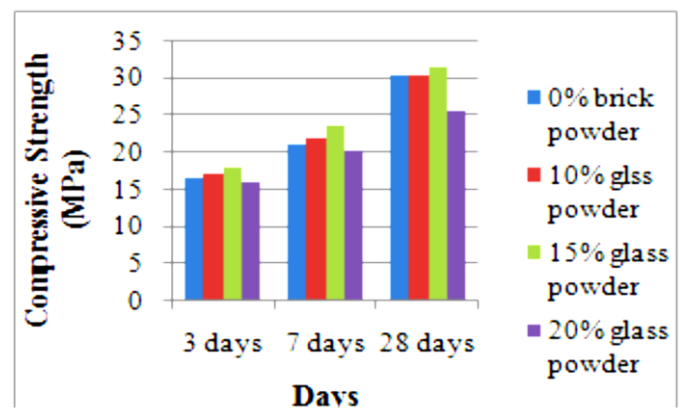


Fig 1 : Design of Concrete Mixture with Recycled Glass Bottles

**COMPRESSIVE STRENGTH**

As per design obtained in accordance to code IS-10262, mix proportion of various materials (viz. Cement, Sand, Aggregate and Water) is calculated for M-20, M-25 and M- 30 grade of concrete. The cubes were crushed in the laboratory in accordance to code IS 1343-1980. The results of crushing strength of cubes for 3, 7 and 28 days of various grades of concrete prepared as per mix design are shown below:

It is observed that the compressive strength of cubes (sand is partially replaced by glass powder) of M-20 mix decrease initially at 10% glass powder. But as percentage of glass powder increased to 20% strength increases and further increase in glass powder again



**COMPARISON OF COMPRESSIVE STRENGTH OF M-20 MIX FOR DIFFERENT PERCENTAGE OF GLASS POWDER**

**Workability**

The slump tests were performed according to IS 1199-1959. The value is presented in table below:

The results show that with increase in glass powder, the slump value decreases and with increase of glass content, the slump value increases.

**Slump Test Results**

The amount of water greatly affects the consistency of the mixture. Based on the water cement ratio and slump test, the use of recycled bottles as concrete material has no significant effect on the consistency of the mixture. The consistency and procedural of mixing cement and aggregates implementing the Class A mixture.

Sample	Slump (inch)
Control	4.00
25 %	4.00
50%	5.00
75 %	5.00
100 %	3.00

**SPLIT TENSILE STRENGTH**

Three numbers of samples in each of concrete were subjected to testing using the compression testing machine as shown in Figure 6. The result of the average strength of cylinders is shown in Table 2 and the comparison of split tensile strength of conventional concrete with that of glass powder concrete is illustrated using bar chart. The concrete where sand was partially replaced by glass powder showed a decrease in split tensile strength. The split strength decreased as the level of replacement of glass powder increased. The strength increased with the number of days of curing. The maximum split tensile strength attained was 3.22 N/mm for 10% replacement at the end of 28 days.



No. of Days	Replacement Levels of Glass Powder			Conventional Concrete
	10%	25%	50%	
3	2.17	1.77	1.52	1.11
7	2.47	1.91	1.69	2.11
28	3.22	2.78	2.35	3.02

**VIII. CONCLUSIONS**

On the basis of results obtained, following conclusions can be drawn:

- (1) The replacement of fine aggregate by crushed brick powder is found to be very effective. The optimum replacement is found to be 20% at which the strength of concrete at 3 days, 7 days & 28 days are higher than those of concrete prepared without replacement of sand. Even at 30% replacement of sand, there is a marginal decrease in the achieved strength at 3, 7 & 28 days. The target strength is 26.6 MPa for M-20 grade of concrete whereas at 28 days, the achieved strength is 25.10 MPa, thus, there is a deficiency of only 5.6%. The target strength is 31.6 MPa for M-25 grade of concrete whereas at 28 days, the achieved strength is 28.5 MPa, thus there is a deficiency of only 9.81%. The target strength is 38.25 MPa for M-30 grade of concrete, whereas at 28 days the achieved strength is 37.40 MPa, thus there is a deficiency of only 2.22%.

(2) Similarly replacement of fine aggregate by crushed glass powder is also found to be very effective. The optimum replacement is found to be 15% at which the strength of concrete at 3 days, 7 days & 28 days are higher than those of concrete prepared without replacement of sand. Even at 20% replacement of sand there is marginal decrease in the achieved strength at 3, 7 & 28 days. The target strength is 26.6 MPa for M-20 grade of concrete whereas at 28 days the achieved strength is 25.80 MPa, thus there is a deficiency of only 3%. The target strength is 31.6 MPa for M-25 grade of concrete whereas at 28 days the achieved strength is 28.8 MPa, thus there is a deficiency of only 8.86%. The target strength is 38.25 MPa for M-30 grade of concrete whereas at 28 days the achieved strength is 35.90 MPa, thus there is a deficiency of only 6.14%.

(3) Where ever brick bat aggregates are used made from slightly over brunt bricks, this will be hard and eventually absorb less water.

(4) Results of this investigation suggest that brick powder or structural concrete.

## IX. BIBLIOGRAPHY

- [1]. Specification for Coarse and Fine Aggregate from Natural Sources for Concrete. IS 383-1970, Bureau of Indian Standard, New Delhi.
- [2]. IS Method of Mix Design IS 10262-1981, Bureau of Indian Standard, New Delhi.
- [3]. Method of Tests for Strength of Concrete. IS 516-1959, Bureau of Indian Standard, New Delhi.
- [4]. Code of Practice for Plain and Reinforced Concrete. IS 456-2000, Bureau of Indian Standard, New Delhi.
- [5]. Concrete technology by M.S. Shetty.

# Energy Efficient Homogeneous Routing in Clustered Wireless Sensor Networks among Obstacles

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## ABSTRACT

An essential problem of studies in Wi-Fi sensor networks (WSNs) is to dynamically organize the sensors into a Wi-Fi network and direction the sensory facts from sensors to a sink. Clustering in WSNs is an effective technique for prolonging the network lifetime. In most of the traditional routing in clustered WSNs assumes that there is no impediment in a field of interest. Although it isn't always a practical assumption, it removes the consequences of barriers in routing the sensory statistics. In this paper, we first suggest a clustering approach in WSNs named strength-efficient homogeneous clustering that periodically selects the cluster heads consistent with a hybrid of their residual strength and a secondary parameter, inclusive of the utility of the sensor to its buddies. In this manner, the selected cluster heads have same variety of pals and residual strength. We then present a course optimization method in clustered WSNs amongst limitations the usage of Dijkstra's shortest path algorithm. We display that our work reduces the common hop count number, packet put off, and strength-consumption of WSNs.

**Keywords :** Clustering, Energy-efficient, Obstacles, Routing.

## I. INTRODUCTION

A typical Wi-Fi sensor network (WSN) includes several tiny and coffee-power sensors which use radio frequencies to carry out distributed sensing obligations. WSNs find their packages in lots of areas that include plant monitoring, battle field surveillance, fire detection, and leakage of toxic chemicals, radiations, and gasoline detection [1]–[5]. In such WSNs, a massive number of sensors are deployed in a field of hobby (FoI) in stochastic manner. In stochastic deployment, sensors are typically dropped randomly in big numbers to assure reliability [1], [4], [6], [7]. Minimising the energy fed on even as making sure the connectivity of a network is an important trouble to be addressed in WSNs due to the fact the batteries powering the sensors won't be on hand for recharging frequently. Cluster-based

totally routing in WSNs has been investigated via researchers to attain the network scalability and management, which maximizes the life of the community with the aid of using nearby collaboration amongst sensors [2]–[5], [8] In a clustered WSN, every cluster has a cluster head (CH). CHs periodically acquire, aggregate, and forward records to the sink.

In any software of WSNs, connectivity is considered to be an important metric to measure the first-rate of provider of WSNs. A network is stated to be connected if all sensors inside the FoI can attain to the sink. Geographic routing [9] has been considered as an appealing approach in large scale WSNs as it does now not require the worldwide topology of a WSN. A sensor can make routing selections based totally on the geographic function of itself and its pals.

The sensor forwards the sensory records to a neighbour, that is closest to the sink. This reduces the average hop count number. However, geographic routing cannot optimize the range of hops while a sensor has no neighbour towards the sink. This trouble is known as neighbourhood minimum problem in the literature . The occurrence of the problem can be caused by many factors, including sparse deployment of sensors, bodily obstacles, and sensor screw ups.

## II. METHODS AND MATERIAL

### A. Major Contributions:

In this paper, we endorse an power-efficient homogeneous clustering method in WSNs and a path optimization approach in clustered WSNs among obstacles. The main contributions of our work on this area are as follows:

1) We propose an Energy-efficient Homogeneous Clustering (EHC) technique in WSNs that selects the CHs to create a connected spine network. EHC is a disbursed method, wherein sensors make local selections on whether to sign up for a spine community as a CH or to a member of a cluster. The decision of each sensor is primarily based on their residual strength and an estimate of the way many of its neighbouring CHs will benefit from it being a CH. We provide a allotted method wherein CHs rotate with time, demonstrating how localized sensor choices result in a homogeneous related worldwide topology.

2) We propose a Route Optimization Technique (ROT) in clustered WSNs among limitations. ROT bureaucracy an power-efficient path between the CHs decided on by EHC method and the sink. ROT makes use of Dijkstra's shortest path algorithm . What attracts us is that we do no longer change the underlying forwarding strategy of existing geographic

routing . ROT works below the routing layer and above the MAC and bodily layers in WSNs.

3) We analysis message and time complexities of our work that are almost most reliable. We derive an expression to estimate the power consumption of the network considering EHC and ROT strategies. The relaxation of the paper is organised as follows: In the next phase, we briefly discuss the literature to address the clustering and the local minimal hassle in WSNs. We propose EHC and ROT techniques in Section II. The complexity evaluation and the strength intake calculation of EHC and ROT are presented in Section III. In Section IV, we gift the simulation outcomes carried out to evaluate the choice of EHC and ROT. We finish the paper in Section V.

### B. Clustering in WSNs:

The restricted battery power and the difficulty in recharging the batteries in a adversarial surroundings require that the sensors be deployed with a high density for a long life of WSNs. Distributed clustering strategies are greater useful in WSNs. Low Energy Adaptive Clustering Hierarchy (LEACH) [9] selects CHs based on a predetermined probability in order to rotate the CH role among the sensors to stability of the residual electricity of the sensors. Following the idea of LEACH, a number of protocols were provided within the literature [9], [10]. Hybrid Energy-Efficient Distributed (HEED) [8] clustering selects the CHs based totally on the residual energy of sensors and a secondary parameter, including proximity to its buddies. SPAN selects CHs based totally on the residual electricity and quantity of pals [6]. The CHs shape a connected network this is used to ahead the information. An Energy Efficient Clustering Scheme [5] allocates a fewer variety of sensors to clusters with longer distances to the sink. A Fuzzy-good judgment based totally clustering technique is proposed in [2].

### C. Local Minimum Problem:

Several geographical routing protocols had been proposed in recent years to cope with the local minimal hassle in WSNs. Most of the present answers for the local minimum trouble use perimeter routing approach (PRT) [9], [10]. By the PRT, while grasping forwarding fails at a local minimum, i. E. no buddies toward the sink, packets tend to be routed alongside the hollow obstacles. The Greedy Perimeter Stateless Routing (GPSR) makes use of grasping forwarding and switches to perimeter routing mode whilst a local minimal hassle is reached. The right-hand rule is used inside the perimeter routing mode, wherein packets are forwarded along the brink counter clockwise at the face of a planar graph. It provided the idea of Hole Avoiding In develop Routing protocol (HAIR) to bypass holes in advance. In WSNs, packets are commonly routed from sensors to a sink. When a sensor recognizes itself as a local minimal, it asks its neighbour sensors to mark itself as a hole sensor. Data packets are despatched to non-hole sensors while feasible. Li et al. proposed a brand new geographic Hole Bypassing Forwarding (HBF) protocol to cope with the hole diffusion trouble in WSNs. The HBF protocol fashions a hole using a virtual circle whose radius is adjustable inside a sure variety and is calculated on a per-packet foundation. The records associated with the virtual circle is used for deciding on an anchor point to bypass the hole so as for a packet to reach a specific sink sensor. Nguyen et al. offered a singular routing protocol named Greedy Forwarding with Virtual Destination (GFVD) strategy. The primary concept is that during the transmission of a packet, a brand new destination called virtual vacation spot is installed place whilst the packet is forwarded to a caught sensor. The abstracted holes protocol in [5] makes use of a dispensed convex hull algorithm to achieve a consistent direction stretch with decrease verbal exchange and garage overhead.

Motivation:

The work on this paper is encouraged by means of the following boundaries found in the literature. The paintings [2], [9]–[10] requires all CHs to carry out direct transmissions to the sink, hence it suffers from the price of lengthy-distance transmissions. As a end result, the sensors which are a ways far from the sink draining their energy much in advance than others. The paintings [10] calls for multiple rounds to form a clustered WSN. The a couple of rounds introduce communication and processing overhead and taxing the electricity as a result. Moreover, HEED [10] has a worst case processing time complexity of  $O(N)$  in line with sensor, where  $N$  is the variety of sensors in the WSN. A sensor buddies with a CH in a step. A cluster with a better CH diploma might also emerge as notably loaded. Another drawback of present clustering strategies [5] is they require more than one transmission power tiers for routing the statistics. Such techniques aren't appropriate for low-value sensors which have typically unmarried power level. The work [10] makes a detour path along the fringe of the hollow or barriers. A new detour is required over and over, which causes partial breakdown of the WSN. In [6] because of the proper-hand rule, GPSR does no longer reap shorter routing paths. Similarly, GFVD [10] does not assemble a shorter routing path and may burden the power consumption of sensors. The anchor can be some distance from the hollow in [10], and thus detouring the hole in an extended route. In précis, there are no paintings within the literature on routing in clustered WSNs among limitations. The existing paintings specializes in man or woman components, i. E., on clustering, routing, or routing quantity barriers in WSNs. Considering those boundaries inside the literature, we recommend an EHC approach in WSNs that periodically selects CHs according to their residual electricity and the software of the sensor to its neighbours. The predominant difference between existing clustering techniques and EHC approach is the application of the CHs in WSNs. In the EHC approach sensor turns into a CH if the software of the

sensor is higher than its neighbours. Different from the existing paintings, a CH in EHC method has most 11 neighbouring CHs and does not make any assumptions approximately the density of sensors. The worst case processing time and area complexities of EHC technique is  $O(1)$  according to sensor. We gift a direction optimization technique in clustered WSNs among barriers using Dijkstra's shortest direction algorithm.

**ROUTING IN A CLUSTERED WSN:**

**A. Network Model :**

A community consists of  $N$  sensors, deployed at random uniformly in a FoI among limitations. The sensors are desk bound and powered by using the batteries. We expect the binary disc conversation version in which a sensor, denoted with the aid of  $s$ , can communicate with other sensors within the disc of radius  $C$  focused at  $s$ , denoted by  $A(s, C)$ , where  $A(s, C) = \pi C^2$ . Thus,  $C$  denotes the communiqué variety of  $s$ . Two sensors  $i$  and  $j$  can speak with each other at once and are known as friends if the Euclidean distance among them is not greater than  $C$ . The wide variety of neighbouring CHs of a CH is said to be the CH degree. In this paper, the lifetime of WSNs is the time from the begin of the network operation to the dying of the first sensor inside the community. The lifetime of WSNs is split into rounds to stability the strength intake among sensors. Each round consists of phases: selection segment and operating section. At the start of a spherical, all sensors participate in the selection segment to form a clustered WSN using the EHC approach. In the running segment, the sensory records from the sensors in a cluster are transmitted without delay to their CH which then aggregates and forwards information to other CHs, which en-direction to the sink the usage of ROT.

**B. Energy-Efficient Homogeneous Clustering (EHC):**

In this segment, we first advise EHC approach after which describe its properties.

i. **EHC Description:** EHC works inside the following two steps to shape a clustered WSN:

- **Initial cluster head election:**

The intention of this step is to opt for the CHs in a disbursed way. Let  $P$  be the probability that the predicted variety of CH-applicants for a round is okay of  $N$  sensors in . The possibility that there are as a minimum one CH-candidate inside the area  $A(i, C)$  is  $1 - e^{-k\|A(i,C)\|/\|\varphi\|}$  is with high possibility [30]. The opportunity  $P$  is consequently given via

$$P = k/N \tag{1}$$

where  $1 - e^{-k\|A(i,C)\|/\|\varphi\|} \geq 0.99$

$$\geq \frac{1.46\|\varphi\|}{NC^2} \tag{2}$$

The possibility  $P$  is both saved in each sensor off-line or can be despatched via the base station to begin with on the time of deployment. At the start of every round, sensor  $i$  selections a random quantity in (zero, 1). If the random quantity is less than  $P$ , then sensory  $i$  is a CH-candidate. With this mechanism, approximately  $k$  of  $N$  sensors are elected as CH-candidates. The random range does now not depend upon the previous round. Note that if a sensor  $i$  elects to become a CH-candidate,  $i$  proclaims an advertisement message CH advert( $i, E_i, n_i$ ) to inform different sensors of its availability, wherein  $E_i$  and  $n_i$  are the residual electricity and the list of neighbouring CHs of  $i$ , respectively. Advertisement contention happens while more than one CH-candidate put it on the market at the identical time. To clear up the contention, we use a randomized again-off delay. The randomized back-off delay for a CH-candidate  $i$  is denoted through delay .

$$l_i = \left( \frac{E_{init} - E_i}{E_{init}} + R \right) * T \tag{3}$$

In which  $E_{init}$ ,  $R$ , and  $T$  are the preliminary power of sensors, a random range in (0,1), and

the round-journey delay for a small control packet, respectively. The randomized back-off delay assures that a CH-candidate with higher residual electricity amongst its buddies could have better chance to become a CH. The preference of delay is a reasonable technique for lightly intake of power of the sensors whilst stopping additional overhead. The CHs elected in this step are denoted.

**Algorithm of Initial cluster head election:**

The goal of this step is to elect the cluster head in a distributed manner.

- Set  $n_i < -\{\emptyset\}$  initially neighbours will be zero.
- Pick random numbers R and R1 in between (0,1).
- Check for the condition  $P \leq R1$  and expiry of delay time.
- If true
- Sensor “i” is a initial cluster head ICH.
- Broadcast a message C Advertisement (particular node i ,initial energy  $E_i$  ,neighbouring CH of i for  $n_i$  )
- And if  $i^{th}$  sensor receives message from j th sensor that C Advertisement (particular node j ,initial energy  $E_j$  ,neighbouring CH of j for  $n_j$  )
- J is also a ICH.
- Add j to the neighbour list of i that  $n_i$ .

**Algorithm of Connected network formation:**

**Associated message:** the message which has sent from non- cluster head to the cluster head.

**Advertisement message:** the message which has sent from cluster head to the non -cluster head.

**Case 1 :** If sensor i is a CH then if associated message from  $i^{th}$  sensor to  $j^{th}$  CH then j is a Non-cluster head(NCH).If advertisement message from  $i^{th}$  sensor to  $j^{th}$  then j is a gateway cluster head (GCH).

**Case 2 :** sensor i is a Non-cluster head(NCH)

**PART - A:** if delay time is expired

**Case: 1** no neighbour (no CH) then i is a GCH.**Case: 2** if number of neighbours is one then i is a (NCH).

**Case: 3** if CH are not connected then i is a GCH.

**PART - B :** if delay time is not expired then i is a Non-CH(if any message comes ) Associated message comes i is a NCH.Advertisement message comes i is a NCH.

**C.Route Optimization Technique (ROT) :**

The purpose of a path optimization approach is to acquire a course from the supply to the sink however we also want to attain the aim at a minimal cost , i. e. Shortest path in terms of hop counts among obstacles. Most of the literature on routing in WSNs does now not have any special treatment for the boundaries in a FoI [1], [4], [6]. In this segment, we suggest ROT in clustered WSNs that optimizes the path period all through statistics transmission with none extra overhead.

We don't forget m obstacles in , where  $m \geq$  zero. Each sensor is aware of approximately its location. Let view-vertices  $V = \cup_{i=1}^m V_i$  is a fixed of view-vertices of an impediment i,  $1 \leq i \leq m$  and  $n_i > 0$  [32]. The view-vertices of all of the barriers are saved in every sensor first of all at the time of deployment or may be updated by means of the sink. Fig. 2 indicates the view-vertices of two barriers. 1) ROT Description: In the early section of ROT, a backbone network is constructed using the proposed EHC, where a sensor is a CH or a member of a cluster. Consider a source CH i and a sink t as shown in Fig. 2. Before sends information to the sink t, it identifies the barriers between t and itself. If there is no obstacle, i forward facts to t using geographic forwarding (GF) [16]. Otherwise i finds a shorter path (SP) to t, denoted by it , via the view vertices of boundaries the usage of Dijkstras shortest direction (DSP) set of rules. I sets the view-vertices along SP because the intermediate destinations (IDs). When statistics reach the closest CH of a ID, denoted by way of j, ROT reruns among j and t to find a brand new SP. The pseudo code of ROT is defined in Procedure three. 2) Property of ROT: Due to the barriers inside the FoI, the direction generated within the literature [9] can deviate some distance from the shortest course. Fig three illustrates an instance of the course formation in ROT and GPSR. The Euclidean



distance among source  $i$  and sink  $t$  is  $d + b$ . A  $Ab \times 1$  rectangular shaped obstacle separates  $i$  and  $t$  such that  $t$  is at the back of the impediment. The length of the direction fashioned by using ROT and GPSR are  $\sqrt{\left(\frac{l}{2}\right)^2 + d^2} + \left(\frac{l}{2} + b\right)$  and  $d + l + b$  respectively. If  $d = l$  and  $d \gg b$ , the path reduce in ROT is given by  $2d - \left(\frac{\sqrt{d^2 + \frac{d^2}{2}} + \frac{d}{2}}{2d}\right) * 100 = 19\%$ . (4)

The path shrink reduces the energy consumption during routing the sensory data and therefore prolongs the lifetime of WSNs, stability, and delay.

**Algorithm of Route optimization technique:**

The goal of a ROT is to achieve a shortest path in terms of hop counts among obstacles.

**Step 1 :** if  $i^{th}$  sensor is a source then send data to CH.

**Step 2 :** else if  $i^{th}$  sensor is a CH.

**Case 1:** if there is a obstacles then apply algorithm for finding shortest path.

**Case 2:** if there is a no obstacles then send to destination by using greedy forwarding method (GFM).

**Step 3:** else  $i^{th}$  sensor is a Non CH then send date to destination by using GFM.

**Properties of EHC Technique:**

First assets of a clustered WSN are that each one sensors clustered. Line 10 in Procedure 2 illustrates that an isolated sensor turns into a CH. Therefore, every sensor in WSN is either

a CH or a member of a cluster. All CHs are connected is second one belongings of connected WSNs. Line 14 Procedure 2 suggests that if a sensor has or gre neighbouring ICHs, which are not related, the sensor t into a GCH. Third property in a connected clustered WS that every NCH has precise one CH.

**III. RESULTS AND DISCUSSION**

**Simulation Results:**

We have deployed 50 nodes( i.e.) sensors and we assign number to each node from 1 to 50 as  $n_1, n_2, n_3, \dots, n_{50}$ . we calculate probability of each node by using the formula  $P_i = k_i / N$ . After performing algorithm1 we get 8 nodes as cluster heads and rest of the nodes as non-clustershead.

From the below fig 1 we observe that green nodes considered as non cluster heads and lavender colour nodes as cluster heads.

The cluster head which is inside the circle as initial cluster head.

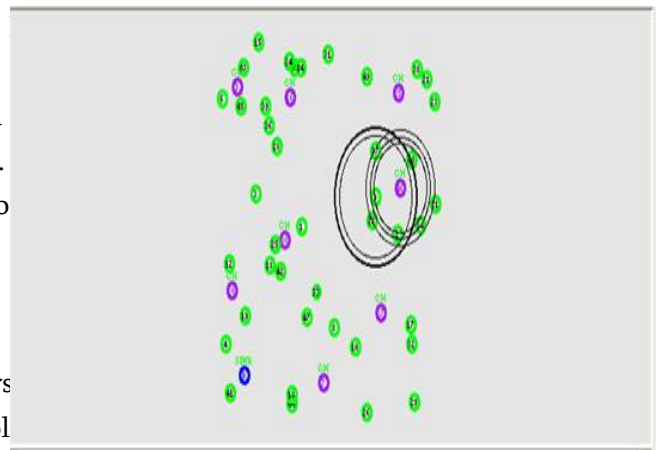


Fig:1 Initial cluster head selection animation window

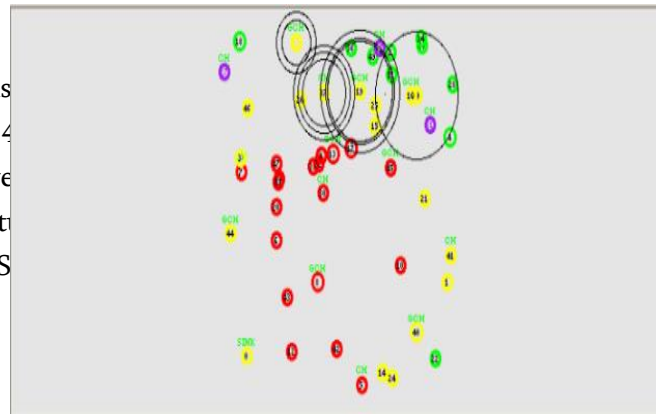


Fig: 2 connected network formation & ROT animation window

From the above fig 2 we observe that yellow nodes as gateway cluster heads and red colour nodes as dead nodes. After performing algorithm2 &3 we connect the cluster wireless sensor network among the CH,GCH and NCH by using the route optimization

technique which is based on dikshatras shortest path algorithm.

From the below fig 3 shows that the average hop count decreases as the communication range increases from 25m to 100m. We compare our work with GPSR. It illustrates that for all the protocols, the average hop count increases with obstacles since a geographic routing protocol does not guarantee shortest routing path among obstacles. shows that EHC-ROT-GPSR achieve a good gain in the average hop count for the routing the packets. This is because in EHC-ROT-GPSR, only CHs participate in routing.

provide the routing for a short duration. also illustrates that ROT-GPSR is consumed less delay than GPSR. This is because a geographical routing without ROT requires more number of the average hop count.

From the below fig 5 shows the energy consumption in WSNs for the entire duration of the simulation for GPSR and EHC-ROT-GPSR. It can be concluded that when EHC is not used, all the sensors remain active to provide the routing for a short duration. also illustrates that ROT-GPSR is consumed less energy than GPSR. This is because a geographical routing without ROT requires more number of the average hop count for routing the packets.

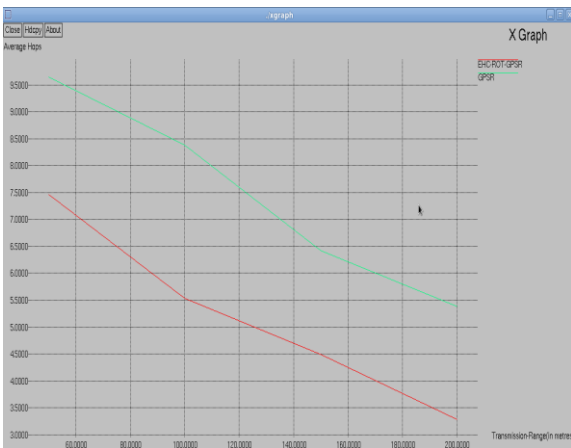


Fig: 3 Transmission Range VS Average Hops

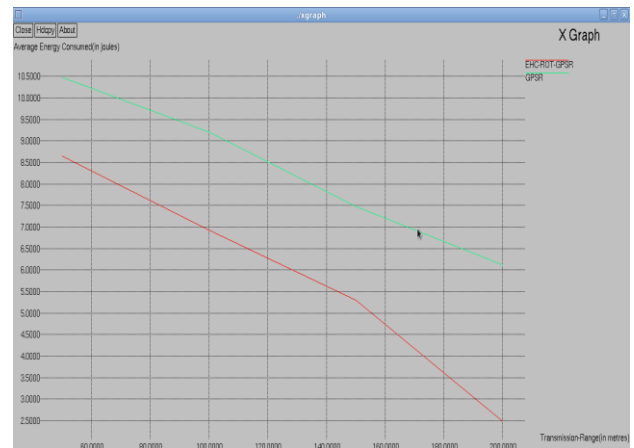


Fig: 5 Transmission Range VS Average Energy Consumed

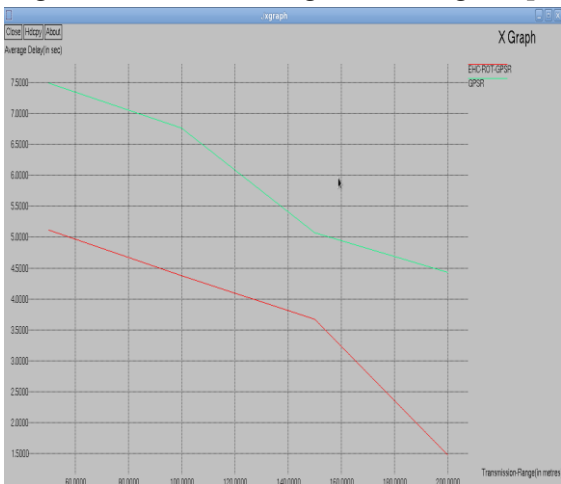


Fig: 4 Transmission Range VS Average Delay

From the above fig 4 shows the Average delay in WSNs for the entire duration of the simulation for GPSR and EHC-ROT-GPSR. It can be concluded that when EHC is not used, all the sensors remain active to



Fig: 6 Transmission Range VS Network Lifetime

From the above fig 6 the network life time of a how long the nodes live inside the network. Shows the overall network lifetime for the entire duration of the simulation for GPSR and EHC-ROT-GPSR. We

conclude that the network life time increases comparing to GPSR. EHC-ROT-GPSR achieve a stable performance for the entire duration of the simulation. From the below fig 7 The packet delivery ratio of a flow is the ratio of the number of packets that are received by the sink over packets submitted to the network by the source. shows the overall delivery ratio for the entire duration of the simulation for GPSR and EHC-ROT-GPSR.

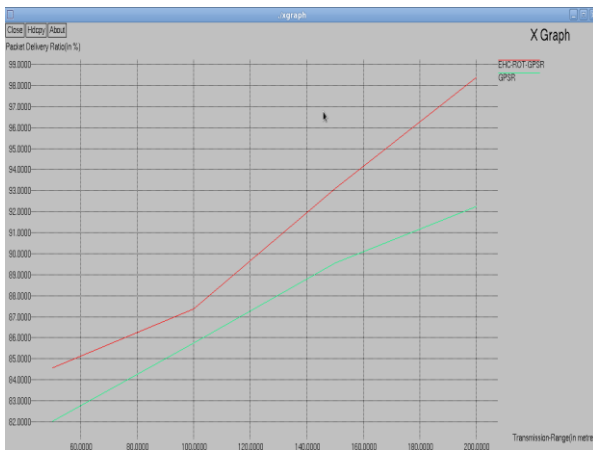


Fig: 7 Transmission Range VS Packet Delivery Ratio

We conclude that the packet delivery ratio reduces as the average hop count increases. EHC-ROT-GPSR achieve a stable performance for the entire duration of the simulation

#### IV. CONCLUSION

In this paper, we proposed a distributed approach to determine if a sensor in WSNs is a CH to meet the desired connectivity requirements. We mainly focused on energy-efficient clustered WSNs to prolong the lifetime of WSNs. We also proposed a technique to optimize the routing path among obstacles in clustered WSNs. We simulated the performance of the proposed EHC and ROT for different network scenarios and demonstrated that the energy consumption and average hop count in WSNs are reduced due to the clustering of sensors and optimization of routing path, hence the lifetime of WSNs is increased. The results demonstrated that the geometry and location of the

obstacles should be considered to compute an optimized routing path.

#### V. REFERENCES

1. D C. Hoang, P. Yadav, R. Kumar, and S. Panda, "Real- time implementation of a harmony search algorithm-based clustering protocol for energy-efficient wireless sensor networks," *IEEE Trans. Ind. Informant.*, vol. 10, no. 1, pp. 774-783, Feb. 2014.
2. J H. Lee, T. Kwon, and J. Song, "Group connectivity model for industrial wireless sensor networks," *IEEE Trans. Ind. Electron.*, vol. 57, no. 5, pp. 1835-1844, May 2010.
3. Z. Ha, J. Wu, J. Zhang, L. Liu, and K. Tian, "A general self-organized tree-based energy-balance routing protocol for wireless sensor network," *IEEE Trans. Nucl. Sci.*, vol. 61, no. 2, pp. 732-740, Apr. 2014
4. M Tarhani, Y. S. Kaviani, and S. Siavoshi, "SEECH: Scalable energy efficient clustering hierarchy protocol in wireless sensor networks," *IEEE Sensors J.*, vol. 14, no. 11, pp. 3944-3954, Nov. 2014.
5. H Lu, J. Li, and M. Guizani, "Secure and efficient data transmission for cluster-based wireless sensor networks," *IEEE Trans. Parallel Distrib. Syst.*, vol. 25, no. 3, pp. 750-761, Mar. 2014.
6. D Wei, Y. Jin, S. Vural, K. Moessner, and R. Tafazolli, "An energy efficient clustering solution for wireless sensor networks," *IEEE Trans. Wireless Commun.*, vol. 10, no. 11, pp. 3973-3983, Nov. 2011.
7. M J. Handy, M. Haase, and D. Timmermann, "Low energy adaptive clustering hierarchy with deterministic cluster-head selection," in *Proc. 4th Int. Workshop MWCN, 2002*, pp. 368-372.
8. D Zhang, G. Li, K. Zheng, X. Ming, and Z.-H. Pan, "An energy balanced routing method based on forward-aware factor for wireless sensor

- networks," *IEEE Trans. Ind. Informant.*, vol. 10, no. 1, pp. 766-773, Feb. 2014.
9. Y. Cao, Z. Sun, N. Wang, H. Cruickshank, and N. Ahmad, "A reliable and efficient geographic routing scheme for delay/disruption tolerant networks," *IEEE Wireless Commun. Letts.*, vol. 2, no. 6, pp. 603-606, Dec. 2013.
10. O. Younis and S. Fahmy, "HEED: A hybrid, energy-efficient, distributed clustering approach for ad hoc sensor networks," *IEEE Trans. Mobile Comput.*, vol. 3, no. 4, pp. 366-379, Oct./Dec. 2004.

# Comparative Analysis of Dimensionality Reduction Techniques for Machine Learning

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## ABSTRACT

Dimensionality reduction as a pre-processing step to machine learning is effective in removing irrelevant and redundant data, increasing learning accuracy, and improving result comprehensibility. However, the recent increase of dimensionality of data poses a severe challenge to many existing feature selection and feature extraction methods with respect to efficiency and effectiveness. In the field of machine learning and pattern recognition, dimensionality reduction is important area, where many approaches have been proposed. Aim of this paper is to reduce the dimensionality of the dataset without the loss of any information from the datasets. We have implemented three dimensionality reduction algorithms. So this three algorithms are performed on two datasets, Iris and Wines datasets and the results are analyzed.

**Keywords :** PCA, LDA, KPCA.

## I. INTRODUCTION

Machine learning aims to build computer programs that automatically improve with experiences. In statistical language, it is simply learning from data that we generate in our day to day life. Machine learning is related to diverse disciplines as it is all about automating the process of problem solving to a larger extent. It is usually studied as a part of artificial intelligence thus relating it to computer science. As already stated it deals with data that we generate thus relating it to statistics and mathematics domain. After everything, problems that it tries to solve may have origin in any discipline like biology (in DNA analysis), medicine (medical diagnosis), and commercial purposes (like product recommendations, stock trading, and credit card fraud detection). Machine learning grew out from pattern recognition. However it has progressed dramatically over the past two

decades. In AI systems, it has emerged as a popular method to develop software's for various fields like computer vision, speech recognition, natural language processing etc.

In pattern recognition, data mining, and other kinds of data analysis applications, we often face high dimensional data. For example, in face recognition, the size of a training image patch is usually larger than  $60 \times 60$ , which corresponds to a vector with more than 3600 dimensions. Feature extraction based on the domain knowledge can be performed to explore more important information from the face patch and may result in a lower dimensional vector, usually the remaining dimensionality is still too high for learning. And for training data without explicit background or meaning, where domain knowledge cannot directly be performed, data-driven techniques for reducing the dimensionality of features are of high demand.

In recent face-related research topics, especially for face recognition and facial age estimation, dimensionality reduction (DR) plays a tremendous important role not only because features of these two topics are hard to define and usually of really high dimensionality, but also because they are both multi-class problems. For face recognition, there may be more than a hundred of people in the database and each person has no more than a dozen of images, which results in a multi-class classification problem with limited training set. The feature dimensionality does affect the VC dimension, and under the condition of limited training data, the feature dimensionality should also be carefully considered in order to maintain generalization performance. For facial age estimation, each possible age could be seen as a class, so usually the problem is of over 60 classes, which also requires limited feature dimensionality to avoid over-fitting. Outstanding face recognition techniques such as Eigen faces, fisher faces, Laplacian faces, and face recognition based on independent component analysis (ICA) exploit different kinds of dimensionality reduction methods to directly reduce the dimensionality of face patches. DR also widely used in facial age estimation.

## II. Related Work

### A. DIMENSIONALITY REDUCTION

Data mining refers to the task of analysing large amount of data with intend of finding hidden patterns and trends that are not immediately apparent from summarized data. Data mining and knowledge extraction from raw data is becoming more and more important and useful as the amount and complexity of data is rapidly increasing. Data mining commonly involves four classes of tasks: Classification - arranges the data into predefined groups, Clustering - is similar to classification but the groups are not predefined, so the algorithm will try to group similar items together, Regression - attempts to find a function which models

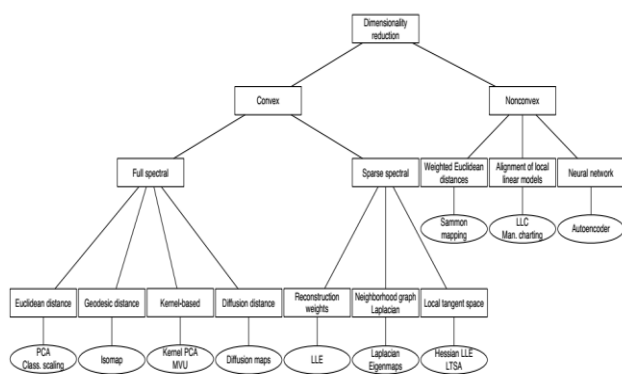
the data with the least error and Association rule learning - searches for relationships between variables. Data has become highly available now-a-days and consists of complex structures and high dimensions. In order to achieve accuracy in classification of such data, we require identifying and removing irrelevant and insignificant dimensions. The process of reducing dimensions is referred as Dimensionality Reduction. It is a crucial pre -processing step in Data Mining to improve computational efficiency and accuracy. Dimensionality reduction provides benefits such as improved dataset classification accuracy, increased computational efficiency and better visualization of dimensions.

### B. What Is Dimensionality Reduction

The problem of (nonlinear) dimensionality reduction can be defined as follows. Assume we have a dataset represented in a  $n \times D$  matrix  $X$  consisting of  $n$  data vectors  $x_i$  ( $i \in \{1, 2, \dots, n\}$ ) with dimensionality  $D$ . Assume further that this dataset has intrinsic dimensionality  $d$  (where  $d < D$ , and often  $D$ ). Here, in mathematical terms, intrinsic dimensionality means that the points in dataset  $X$  are lying on or near a manifold with dimensionality  $d$  that is embedded in the  $D$ -dimensional space. Note that we make no assumptions on the structure of this manifold: the manifold may be non-Riemannian because of discontinuities (i.e., the manifold may consist of a number of disconnected sub manifolds).

Dimensionality reduction techniques transform dataset  $X$  with dimensionality  $D$  into a new dataset  $Y$  with dimensionality  $d$ , while retaining the geometry of the data as much as possible. In general, neither the geometry of the data manifold, nor the intrinsic dimensionality  $d$  of the dataset  $X$  is known. Therefore, dimensionality reduction is an ill posed problem that can only be solved by assuming certain properties of the data (such as its intrinsic dimensionality). Throughout the paper, we denote a high-dimensional data point by  $x_i$ , where  $x_i$  is the  $i$ th row of the  $D$ -dimensional data matrix  $X$ . The low dimensional counterpart of  $x_i$  is denoted by  $y_i$ , where  $y_i$  is the  $i$ th

row of the d-dimensional data matrix Y. Figure 1 shows a taxonomy of techniques for dimensionality reduction. We subdivide techniques for dimensionality reduction into convex and does not contain any local optima non-convex techniques. Convex techniques optimize an objective function that, whereas non-convex techniques optimize objective functions that do contain local optima.



**Figure 1:** Taxonomy of techniques for dimensionality reduction

**C. Principal Component Analysis:**

It is a Feature Extraction technique that is used to analyse statistical data by transforming the starting set of variables into various set of linear combinations which are known as the principal components (PC), and these components have some specific properties with regard to variances. This make the dimensionality of the system more concentrated and at the same time, variable connections information is also maintained. Calculations are made on the data set by analysing eigenvalue and its eigenvectors, covariance matrix arranged systematically in descending order. This technique produces the maximum feasibility arbitrary solutions in the high-dimensional space. We can view it as data visualization method because here, the high dimensional data sets can be reduced to two dimensional or three dimensional data sets that can be easily plotted using graphs or charts.

**D. Linear Discriminant Analysis:**

Linear Discriminant Analysis can be used to perform supervised dimensionality reduction, by projecting the input data to a linear subspace consisting of the directions which maximize the separation between classes. The dimension of the output is necessarily less than the number of classes, so this is a in general a rather strong dimensionality reduction, and only makes senses in a multiclass setting.

LDA can be derived from simple probabilistic models which model the class conditional distribution of the data for each class Predictions can then be obtained by using Bayes rule.

**E. Kernel PCA**

Standard PCA only allows linear dimensionality reduction. However, if the data has more complicated structures which cannot be well represented in a linear subspace, standard PCA will not be very helpful. Fortunately, kernel PCA allows us to generalize standard PCA to nonlinear dimensionality reduction.

Assume we have a nonlinear transformation  $\phi(x)$  from the original D-dimensional feature space to an Multidimensional feature space, where usually MD. Then each data point  $x_i$  is projected to a point  $\phi(x_i)$ . We can perform standard PCA in the new feature space, but this can be extremely costly and inefficient. Fortunately, we can use kernel methods to simplify the computation.

**III. RESULTS AND DISCUSSION**

In this paper we have used two datasets:

**A.Iris Dataset:**

The Iris flower data set or Fisher's Iris data set is a multivariate data set introduced by the British statistician and biologist Ronald Fisher in his 1936 paper The use of multiple measurements in taxonomic problems as an example of linear discriminant analysis. It is sometimes called Anderson's Iris data set because Edgar Anderson collected the data to quantify the morphologic variation of Iris flowers of three related species. Two of the three species were collected in the Gaspé Peninsula "all from the same

pasture, and picked on the same day and measured at the same time by the same person with the same apparatus".

The data set consists of 50 samples from each of three species of Iris (Iris setosa, Iris virginica and Iris versicolor). Four features were measured from each sample: the length and the width of the sepals and petals, in centimetres. Based on the combination of these four features, Fisher developed a linear discriminant model to distinguish the species from each other.

**B. Wines Dataset:**

The data was used with many others for comparing various classifiers. The classes are separable, though only RDA has achieved 100% correct classification.(RDA : 100%, QDA 99.4%, LDA 98.9%, 1NN 96.1% (z-transformed data))(All results using the leave-one-out technique) In a classification context, this is a well posed problem with "well behaved" class structures. A good data set for first testing of a new classifier, but not very challenging.

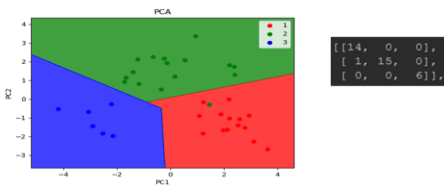
**Number of Instances:**

- class 1 59
- class 2 71
- class 3 48

**Class Distribution: number of instances per class**

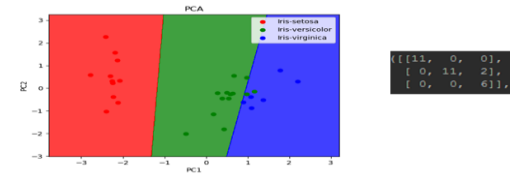
- class 1 59
- class 2 71
- class 3 48

**C. PCA using Wines Dataset**



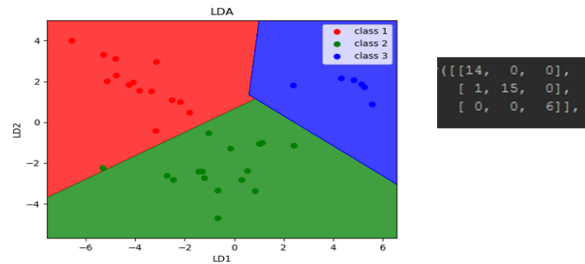
75 percent of dataset is used for training and 25 percent data is used for testing.

**D. PCA Using Iris Dataset:**



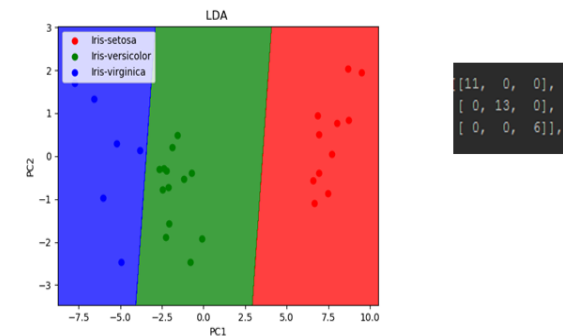
75 percent of dataset is used for training and 25 percent data is used for testing.

**E. LDA Using Wines dataset:**



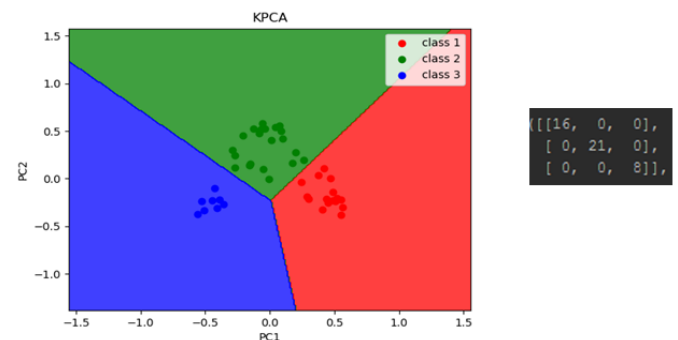
75 percent of dataset is used for training and 25 percent data is used for testing. By this method efficiency is not more compared to KPCA.

**F. LDA Using Iris Dataset**



75 percent of dataset is used for training and 25 percent data is used for testing. By this method efficiency is not more compared to PCA and KPCA.

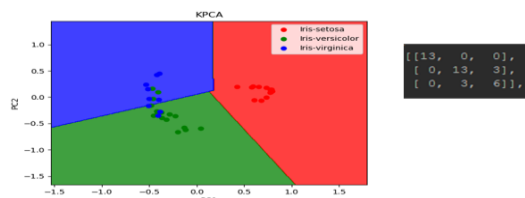
**G. KPCA Using Wines dataset:**





75 percent of dataset is used for training and 25 percent data is used for testing. By this method efficiency is more compared to LDA and PCA.

#### H.KPCA Using Iris Dataset



75 percent of dataset is used for training and 25 percent data is used for testing. By this method efficiency is not more compared to LDA and PCA.

#### IV.CONCLUSION

The primary objective of this paper is to compare various schemes that are being used to reduce the dimensionality of high dimensional datasets in order to improve accuracy and time complexity of machine learning algorithms such as classification and clustering.

The paper presented a review and comparative Analysis of techniques for dimensionality reduction. From the results obtained, we may conclude that nonlinear techniques for dimensionality reduction are, de-spite their large variance, often not capable of outperforming traditional linear techniques such as PCA. In the future, we foresee the development of new nonlinear techniques for dimensionality reduction that do not suffer from the presence of trivial optimal solutions, may be based on non-convex objective functions, and do not rely on neighbourhood graphs to model the local structure of the data manifold. The other important concern in the development of novel techniques for dimensionality reduction is their optimization, which should be computationally and numerically feasible in practice.

#### V.REFERENCES

1. Tom M. Mitchell, "Machine Learning ",McGraw Hill, 1997
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009. Margaret H Dunham, "Data Mining", Pearson Edition, 2003.
3. GalitShmueli, Nitin R Patel, Peter C Bruce, "Data Mining, 2007 for Business Intelligence", Wiley India Edition.
4. Rajjall Shinghal, "Pattern Recognition ",Oxford University Press, 2006.
5. Ashish Kumar and Avinash Paul the authors of the book Mastering Text Mining with R,
6. Nonlinear Dimensionality ReductionAuthors: Lee, John A., Verleysen, MichelMathematical Methodologies in Pattern Recognition and MachiLearningEditors: Latorre Carmona, Pedro, S-nchez, J. Salvador, Fred - 502 854.
7. Understanding Machine Learning: From Theory to Algorithms Textbook by Shai Ben-David and ShaiShalev-Shwartz.
8. Foundations of Machine Learning Textbook by Afshin Rostamizadeh, Ameet Talwalkar, and Mehryar Mohri.K-glDonald, C. WunschAndrei, Y. ZinovyevChristopher.
9. A survey of dimension reduction techniques Imola K. FodorCenter for Applied ScientificComputing, Lawrence Livermore National Laboratory P.O. Box 808, L-560, Livermore, CA 94551.
10. IEEEI.T Jolliffe, Principal Component Analysis, Springer,second edition.
11. Chao Shi and Chen Lihui, 2005. Feature dimension reduction for microarray data analysis using locally linear embedding, 3rdAsia Pacific Bioinformatics Conference, pp. 211-217.
12. Dimensionality Reduction for Data Mining- Techniques, Applications and Trends- Jieping Ye, HuanLiuArizona State University.

13. Principal Component Analysis With Complex Kernels Athanasios Papaioannou, Student Member, IEEE, Stefanos Zafeiriou, Member, IEEE
14. A review of feature selection methods with Applications A. Jovic\*, K. Brkic\* and N. Bogunovic\*
15. Nonlinear Multimode Industrial Process Fault Detection Using Modified Kernel Principal Component Analysis XIAOGANG DENG , NA ZHONG, AND LEI WANG College of Information and Control Engineering, China University of Petroleum, Qingdao 266580, China

# Test Quality of Variance and Tabulation : Case study from Indonesia

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## ABSTRACT

This paper aims to examine the relationship between financial ratios of banks namely NIM, ROA, CAR and NPL variables in 43 banking industry in Indonesia. This paper uses the analysis of quality of variance and tabulation to see the relationship between the financial ratios of banking in detail, based on data published in the financial statements during the period of 2011 to 2015. From the paper that has been completed studies, it was concluded that the test quality of variance and tabulation of banking financial ratios are carefully distributed simultaneously showing the positive effects and negative effects as presented in table 2 and table 3. While the value for the range of data generated, the amount of data, the average value of each data, and the resulting median values are presented normally as shown in table 1 results.

Keywords : Test Quality of Variance, Tabulation Test, Banking Industry.

## I. INTRODUCTION

To see the banking industry and to find banks with financial ratios, capital, deposit amount, or the amount of credit and good assets, always viewed from the financial performance that is owned. No exception by looking at the profitability and operational efficiency levels and in managing the value of assets owned, indirectly can affect the operational value and financial performance of the banking. In theory and some empirical studies [See Study 1,2,3,4,5] provide explanations related to operational performance and assess the level of efficiency in asset management and can directly affect the financial ratios of banks in value with ROA, CAR, NIM, NPL and others. In the literature, reviewing how the commercial banking in the State Country in doing research such as Jordan, Pakistan, India Romania, and the American continent to make banking ratios such as ROA, CAR, NIM, NPL in making measurement tools performance in the banking industry.

With this background, this research is done by the authors to see how the analysis of banking in performance ratio with test equality of variance dan tabulation, with case studies in Indonesia on 43 banks listed on the BEI during the period 2011-2015.

## II. LITERATURE REVIEW

In a study conducted [6,7,8], empirically see how the performance value of banking industry ratios in several countries in doing research, by taking case studies of some commercial banks and state banks as a tool of financial performance analysis of banks. The use of variable operating income and other banking financial ratios, is considered as a dependent variable that can be made in the size of research in the banking industry. Management of asset management and operational level of banking efficiency, made as a measure of independent variables in their research. Some of these studies provide results that, the value of ROA that is owned by banks in doing research, strongly influence the size of the banking indirectly. Values Efficiency in terms of banking operations

occurs a negative relationship to the variable rate of return on assets, which is indirectly valued statistically significant. So it can be concluded that the hypothesis is accepted with the assumption that the value of Interest income in the made as other dependent variable of the banking in doing research, significantly influence the SIZE banking in the perusal.

There is a relationship between interest income that shows a negative value with the level of banking efficiency in doing research and operational values that significantly influence. Empirically and practically, the research they have done has helped the banking industry and bankers in making decisions for the banking world and can see firsthand the improvement and financial performance as well as banking operations. The existence of positive correlation value among the variables in doing research such as ROA, CAR, SIZE, and asset management value with variable interest income in which indicate the level of efficiency achieved by the banking industry.

See paper [9,10,11] describes the study of the effects of a banking crisis caused by the global financial crisis. In their paper, to ownership of the banking sector which is a State-Owned Public Bank and Private Bank owned by Private. If you look specifically, there are some fundamental factors of macroeconomics, which cause and influence the value of efficiency of banking sector in the country in doing research. They assess how the performance of banks in the country in doing research by using data analysis methods such as: Database Based Envelopment Analysis, Ordinary Least Square (OLS) analysis based on panel data regression, Generalized Least Square and Fixed Effect Effect model and Random Effect . Some models of this analysis, believed to be adopted to test the performance of banks and the ability of banks in generating profits. Empirically shows the level of efficiency in the banking sector that continues to

increase from three point seven percent to five point eight percent during the period of global financial crisis. Furthermore, from the research they have done, empirically also showed the level of profit efficiency that decreased by thirty eight point seven percent became Nine point nine percent. This is very significant difference in the relationship between variables SIZE bank, the level of banking liquidity, economic growth in the country in doing research and market orientation to the efficiency of profit.

### III. RESEARCH METHOD

This research was conducted during November and December 2017, using banking financial ratio data, for banks have financial statements listed on the BEI as many as 34 banks for the year ending 2011-2015. The financial ratios used in this study consist of ROA, NPL, NIM and CAR. In this study using descriptive statistical data analysis with histogram method, cumulative data tabulation test and equality of variance analisis test. The following is presented in the data analysis using descriptive statistics, as attached to table 1:

**Table 1 : Result for statistic descriptive**

	ROA	NPL	NIM	CAR
Mean	1.595628	1.631814	5.36502 3	17.90265
Median	1.570000	1.450000	5.19000 0	16.39000
Maximum	5.420000	4.910000	16.6400 0	68.60000
Minimum	-7.580000	0.000000	1.64000 0	8.020000
Std. Dev.	1.761945	1.184174	2.09192 7	6.214754
Skewness	-1.597669	0.740042	1.77386 4	3.525161
Kurtosis	9.853022	2.737930	8.86591	25.16679

			9	
Jarque-Bera	512.1846	20.23981	421.000	3
Probability	0.000000	0.000040	0.000000	0
Sum	343.0600	350.8400	1153.48	0
Sum Sq. Dev.	664.3521	300.0852	936.497	8
Observations	215	215	215	215

Source : Proceed author by statistic program

in table 1, the results of analysis are statistically descriptive for ROA, NPL, NIM and CAR variables for 34 banks in doing research. There are mean, median, maximum, minimum, skewness and kurtosis with 215 observations of data observation.

#### IV. RESULT AND DISCUSSION

##### Histogram statistical results

In the picture below, we can see the frequency distribution of the panel data by histogram. Histogram statistics divide the time range for the valued data between the maximum and minimum values into the same length interval form and show some calculations of the number of observations made on the data, included in each bin. Using the histogram analysis model, there is a greater possibility of control over the width and placement of the bin count, or in other words the analysis with the histogram makes it easier to create related graphics such as kernel density plots or polynomial histograms. Here is the display of histogram analysis using data from ROA, NIM, NPL and CAR ratio at 43 banks registered in BEI during 2011-2015 period.

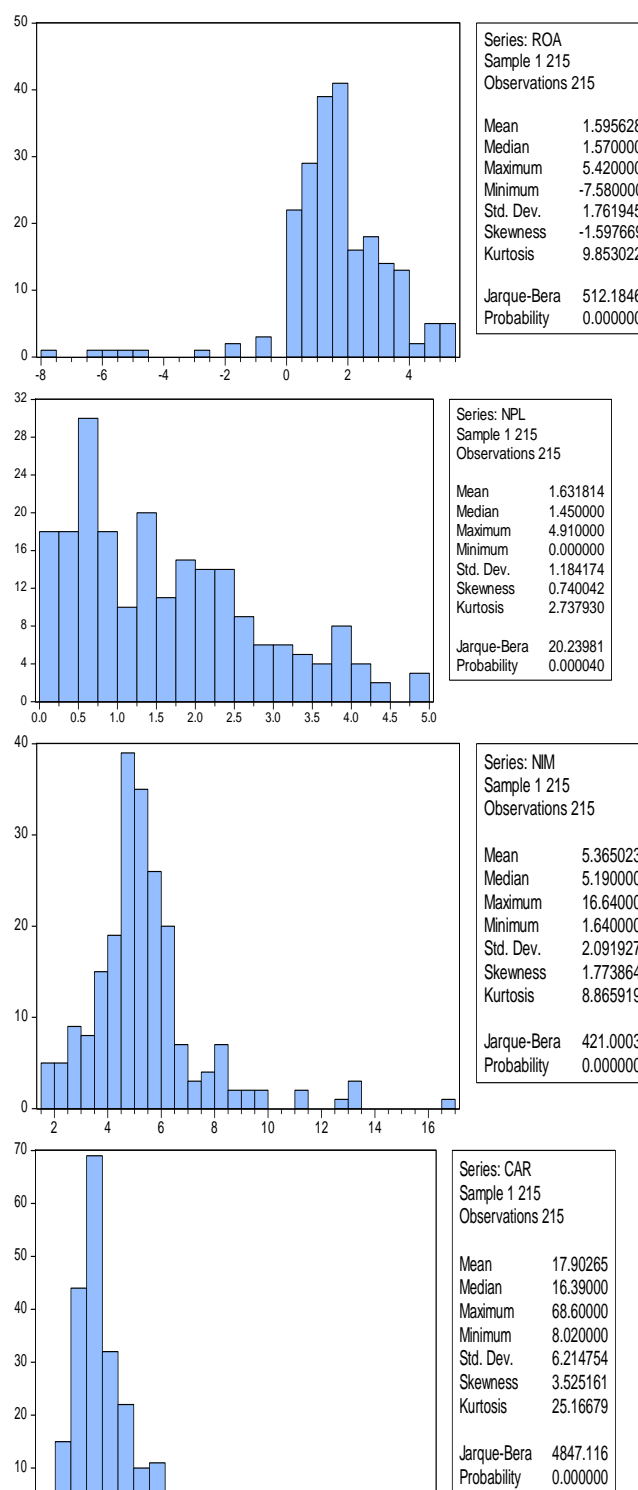


Figure 1 : Result for statistic histogram

Source : Proceed author by statistic program

From figure 1 above, there is a complementary value of descriptive statistics that is displayed together with the result of histogram analysis. All statistics are calculated using observations on the current sample.

Visible and presented the value of Mean which is the average value of the circuit, obtained by adding the circuit and dividing by the number of observations. Then there is a Median value that displays the middle value (or average of the two middle values) of the circuit when the value is ordered from the smallest to the largest. The median is a strong measure of the distribution center that is less sensitive to the outlier than the mean. And lastly the value of Max and Min which is the maximum and minimum value of the circuit in the current sample. Furthermore, in doing cumulative test tabulation of variable ROA, NIM, NPL and CAR on 43 banks in the perusal

**Test cumulative tabulation of variable**

The test of the cumulative frequency distribution of the tabulation can provide a description of one variable, but it does not provide information thoroughly about how two or more variables relate to each other simultaneously. To understand the relationship between several variables, we can use this cross-tabulation test. Thus if we want to see whether the variables in the research tend to want another variable or vice versa, then the table can be used as a reference or commonly known as a contingency table. This table allows us to evaluate the number and percentage, such as the frequency distribution. But while the frequency distribution provides information for each level of one variable, the cross tabulation shows the results for all combinations of second-rate variables [12,13,14,15].

**Table 2 : Result for tabulation statistic**

Tabulation of ROA				
			Cumulative	Cumulative
Value	Count	Percent	Count	Percent
[-10, -5)	4	1.86	4	1.86
[-5, 0)	7	3.26	11	5.12
[0, 5)	199	92.56	210	97.67
[5, 10)	5	2.33	215	100.00
Total	215	100.00	215	100.00

Tabulation of NPL				
			Cumulative	Cumulative
Value	Count	Percent	Count	Percent
[0, 1)	84	39.07	84	39.07
[1, 2)	56	26.05	140	65.12
[2, 3)	43	20.00	183	85.12
[3, 4)	23	10.70	206	95.81
[4, 5)	9	4.19	215	100.00
Total	215	100.00	215	100.00

Tabulation of NIM				
			Cumulative	Cumulative
Value	Count	Percent	Count	Percent
[0, 5)	100	46.51	100	46.51
[5, 10)	108	50.23	208	96.74
[10, 15)	6	2.79	214	99.53
[15, 20)	1	0.47	215	100.00
Total	215	100.00	215	100.00

Tabulation of CAR				
			Cumulative	Cumulative
Value	Count	Percent	Count	Percent
[0, 20)	162	75.35	162	75.35
[20, 40)	50	23.26	212	98.60
[40, 60)	2	0.93	214	99.53
[60, 80)	1	0.47	215	100.00
Total	215	100.00	215	100.00

**Source : Proceed author by statistic program**

In table 2 above or referred to as cross tabulation table, it shows that ROA variable is approaching more than 1.86% to 3.26% and other variables choose ROA ranged between 2.33%. The value of value denotes the value of the range variables and is located where, while the percentage makes some variables that will select other variables, while the cumulative is the number of the data variables in detail, in detail in the form of numbers. To evaluate the statistical significance of cross-tabulation results, it can be done by using a hypothesis test called a chi-square test. This test compares the observed numbers in the data we have collected to the counts we expect if there is no relationship between variables then using the test of quality of variance.

### Test equality of variance

If it is common in many studies that use independent sample t test and ANOVA or commonly known as statistical tests t and F, which are generally strong against assumption violations during group size are the same. So in this study we use the equality of variance test, a test that explains how much the size of the same group can be determined by the ratio of the largest and smallest group of less than 1.5. If the value of the group size is very unequal and the homogeneity of the variance is violated, then the F statistic will be biased when the large sample variance is associated with the small group size. When this happens, the level of significance will be underestimated, which can cause the null hypothesis to be rejected incorrectly. On the other hand, F statistics will be biased in the opposite direction if large variance is associated with large group sizes. This means the level of significance will be too high. This does not cause the same problem by rejecting the null hypothesis incorrectly, but may lead to a decrease in test strength. The following test results equality of variance for variable ROA, NIM, NPL and CAR bank in doing research.

**Table 3 : Result for statistic quality of variance**

Test for Equality of Variances of ROA				
Method	df	Value	Probability	
Bartlett	3	11.13879	0.0110	
Levene	(3, 211)	2.452819	0.0643	
Brown-Forsythe	(3, 211)	1.998371	0.1153	
Category Statistics				
ROA	Count	Std. Dev.	Mean Abs. Mean Diff.	Mean Abs. Median Diff.
[-10, -5)	4	1.003826	0.730000	0.730000
[-5, 0)	7	1.439183	1.072245	0.950000
[0, 5)	199	1.122252	0.898857	0.884623
[5, 10)	5	0.171610	0.124000	0.108000
All	215	1.761945	0.883341	0.865814
Bartlett weighted standard deviation: 1.120551				

Test for Equality of Variances of NPL				
Method	df	Value	Probability	
Bartlett	4	4.236326	0.3750	
Levene	(4, 210)	1.971285	0.1001	
Brown-Forsythe	(4, 210)	1.603777	0.1746	
Category Statistics				
NPL	Count	Std. Dev.	Mean Abs. Mean Diff.	Mean Abs. Median Diff.
[0, 1)	84	0.255688	0.221508	0.220595
[1, 2)	56	0.274662	0.222883	0.220714
[2, 3)	43	0.262650	0.211325	0.208837
[3, 4)	23	0.339353	0.294858	0.293913
[4, 5)	9	0.348477	0.299012	0.284444
All	215	1.184174	0.230921	0.228791
Bartlett weighted standard deviation: 0.275834				

Test for Equality of Variances of NIM				
Method	df	Value	Probability	
Bartlett	3	3.318210	0.3451	
Levene	(3, 211)	0.912912	0.4356	
Brown-Forsythe	(3, 211)	0.456417	0.7130	
Category Statistics				
NIM	Count	Std. Dev.	Mean Abs. Mean Diff.	Mean Abs. Median Diff.
[0, 5)	100	0.932409	0.771840	0.740500
[5, 10)	108	1.108829	0.851706	0.786204
[10, 15)	6	0.843366	0.715556	0.623333
[15, 20)	1	NA	0.000000	0.000000
All	215	2.091927	0.806798	0.756744
Bartlett weighted standard deviation: 1.023844				

Test for Equality of Variances of CAR				
Method	df	Value	Probability	
Bartlett	3	1.345250	0.7184	
Levene	(3, 211)	0.414917	0.7425	
Brown-Forsythe	(3, 211)	0.267451	0.8488	
Category Statistics				
ROA	Count	Std. Dev.	Mean Abs. Mean Diff.	Mean Abs. Median Diff.
[-10, -5)	4	3.587357	2.635000	2.265000
[-5, 0)	7	6.714673	5.467755	5.037143
[0, 5)	199	6.193805	3.904677	3.648342
[5, 10)	5	5.517874	4.835200	4.042000
All	215	6.214754	3.953586	3.676977
Bartlett weighted standard deviation: 6.167809				

Source : Proceed author by statistic program

From table 3 above shows and presented results for testing the value of the homogeneity of variance, there are several statistical tests that can be used. These tests include: Hartley's F max, Cochran's, Levene and Barlett tests. Some of these judgments are too sensitive to abnormal circumstances and are not often used. From this test, the most common assessment for the homogeneity of variance is the

Levene test. Just like the Levene Test uses the F test to test the null hypothesis that the variance is the same between groups. A p value less than 0.05 indicates a violation of assumptions. In case of violation, the possibility of conducting a non-parametric assessment is more appropriate. When viewing the results from Levene's original paper only proposed using the mean. However, looking at the study [12,13] further extends the Levene test to use a median or a mean that is pruned besides the mean. There are several studies that do this by using the Monte Carlo test which shows that using a cropped average is best done when the underlying data follows the Cauchy distribution (ie, the weight tail) and the best median when the underlying data follows the  $\chi^2$  distribution (ie, tilt). Although the optimal choice depends on the underlying distribution, the median definition is recommended as an option that provides good resistance to many types of non-normal data while maintaining good strength. In [16,17] for example, there is a test using the hypothesis that group variance is the same. And there is a failure and reject the null hypothesis at the 0.05 significance level because the Levene test statistic value is less than the critical value. It can thus be concluded that there is not enough evidence to claim that the variance is not the same.

## V. CONCLUSION

From the studies that have been done look how the data distribution of variable ROA, NIM, NPL and CAR bank by histogram. In this study also used cumulative test table variabel and equality of variance test. With the test can be explained how the distribution of data in doing the research in separate values for the mean, median, max and min distributed in table, with the value of the range described in the table. And also the equality of variance test, for example, can explain the probability of the value described in the form of bartlet and levene test. How much of the amount of data distributed by numbers

can be explained by the range of count and value generated in the table presented.

## VI. REFERENCES

- [1]. Tarawneh, M, (2006) , "a comparison of financial performance in the banking sector: some evidence from Omani commercial banks", *International Research Journal of Finance and Economics*, vol. 3, pp. 101-112.
- [2]. Ahmed A. A., (2011), "Financial Performance Evaluation of Some Selected Jordanian Commercial Banks", *International Research Journal of Finance and Economics*. Issue 68.
- [3]. Khizer, A. et, all., (2011), "Bank-Specific and Macroeconomic Indicators of Profitability - Empirical Evidence from the Commercial Banks of Pakistan", *International Journal of Business and Social Science*, Vol. 2 No, 2011.
- [4]. Siddiqui. M.A., and Shoaib, A., (2011), "Measuring performance through capital structure: Evidence from banking sector of Pakistan", *African Journal of Business Management*. Vol. 5(5), pp.1871-1879.
- [5]. Rizvi, S. F. A, (2001), "Post-liberalization Efficiency and Productivity of the Banking Sector in Pakistan". *The Pakistan Development Review* 40: 4, 605-632.
- [6]. Shah, S.Q., and Rizwan J., ( 2014 ) *Analysis of Financial Performance of Private Banks in Pakistan*, *Procedia - Social and Behavioral Sciences* 109, 1021 - 1025, doi: 10.1016/j.sbspro.2013.12.583
- [7]. Khizer, A. et all., (2011), "Bank-Specific and Macroeconomic Indicators of Profitability - Empirical Evidence from the Commercial Banks of Pakistan", *International Journal of Business and Social Science*, Vol. 2 No, 2011.
- [8]. Raza, A. et all., (2011) "A Comparison of Financial Performance in Investment Banking



- Sector in Pakistan", *International Journal of Business and Social Science* Vol. 2 No. 9.
- [9]. Kamarudin, F. et al., (2016) Global financial crisis, ownership and bank profit efficiency in the Bangladesh's state owned and private commercial banks, *Contaduria y Administracion* 61, 705-745, <http://dx.doi.org/10.1016/j.cya.2016.07.006>.
- [10]. Islam, M., et al. (2014). Performance evaluation of the banking sector in Bangladesh: A comparative analysis. *Business and Economic Research*, 4(1), 70-107. <http://dx.doi.org/10.5296/ber.v4i1.4672>
- [11]. Jayaraman, A., and Srinivasan, M. (2014). Analyzing profit efficiency of banks in India with undesirable output - Nerlovian profit indicator approach. *IIMB Management Review*, 26(4), 222-233. <http://dx.doi.org/10.1016/j.iimb.2014.10.004>.
- [12]. Brown, M. B. and A. B. Forsythe (1974a). "Robust Tests for the Equality of Variances," *Journal of the American Statistical Association*, 69, 364-367.
- [13]. Brown, M. B. and A. B. Forsythe (1974b). "The Small Sample Behavior of Some Test Statistics which Test the Equality of Several Means," *Technometrics*, 16, 129-132.
- [14]. Conover, W. J., M. E. Johnson and M. M. Johnson (1981). "A Comparative Study of Tests for Homogeneity of Variance with Applications to the Outer Continental Shelf Bidding Data," *Technometrics*, 23, 351-361.
- [15]. Levene, H. (1960). "Robust Tests for the Equality of Variances," in I. Olkin, S. G. Ghurye, W.
- [16]. Harvey, Andrew C. (1990). *The Econometric Analysis of Time Series*, 2nd edition, Cambridge, MA: MIT Press.
- [17]. Harvey, Andrew C. (1993). *Time Series Models*, 2nd edition, Cambridge, MA: MIT Press.

# Optimized and Secure Multiple Predictions Based Traffic Redundancy Elimination - A Survey

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## ABSTRACT

Cloud computing is a specific term that involves delivering hosted services over the Internet, Cloud offers various types of on demand services that enable users to access simultaneous computing capabilities. Traffic Redundancy elimination is the most common factor in cloud computing. Cloud Computing involves mostly based on the concepts of high performance computing. Cloud Storage delivers virtualized storage on demand, over a network based on a request for a given quality of service. Redundancy elimination can be enhanced by mutual perceptive between the sender and receiver. Using either sender-based TRE or receiver-based TRE cannot simultaneously capture traffic redundancy in both short-term) and long-term data redundancy, which concurrently appear in the traffic. Cloud security is a major risk factor in cloud computing. In order to enhance the security and elimination of redundant data can be done by a novel proposed algorithm based on neural network schema.

**Keywords :** Cloud Computing, Neural Networks, Traffic redundancy Elimination, Optimization

## I. INTRODUCTION

Cloud Computing is a way of using a network of remote servers hosted on the Internet for storage, data processing and to manage large rather than a local server or a personal computer. A large amount of data is flooded over the internet contains redundant data. Large amount redundant data storages leads to inefficient use of precious resources in cloud. Several cloud providers are available to provide services to users. Examples of cloud providers are amazon, google, Microsoft, VM ware etc. Traffic redundancy leads to the interruption of data present in the cloud. To provide un interrupted services in cloud traffic redundancy elimination is a major task.

There are several techniques are used to eliminate traffic redundancy in cloud. Techniques like PACK[[1] uses prediction based technique to eliminate

redundant data with the help of SHA-1 algorithm, ENDRE[2] provides receiver based elimination technique to eliminate redundancy. WANAX [9] uses Middle box based algorithm to eliminate redundant data. Such sender or receiver based elimination of redundant data does not provide complete solution for such problems. Mutual co-relation between sender and receiver along with neural network scheme is used to provide a redundancy elimination mechanism to clients.

Cloud security is also a major factor for data storage in cloud environment, convergent encryption based technique used in mutual cooperation of sender and receiver to remove replica data in communication channels and optimize the bandwidth and cost in cloud. Redundancy in cloud is the process of sending replicated data stored in various parts of cloud, when a cloud computing system fails to send or receive data

the entire files in cloud cannot be accessed. This redundancy is made available by having fully replicated data several times on multiple computers or units involved in the same data center leads to higher costs.

## II. LITERATURE SURVEY

Bandwidth cost of data transfer reduces from the cloud using Traffic Redundancy Elimination (TRE) technologies has been moralized [10]. Redundancy has been found in the network traffic [11], [12], due to common accesses to the same or similar data objects from the Internet end-users, by eliminating the transmission of replica information can reduce the bandwidth usage cost. A number of Traffic redundancy elimination techniques has been introduced for WAN optimization that provided an end to end solution EndRE [2] deployed at client and server side. Caches play an important role in order to synchronize data at sender and receiver side. Sender compares data from its local cache and detects redundant data available by sending the reference of the replicated data to the receiver instead of transmitting the entire data. It has been inefficient for cloud platforms that EndRE require stretched synchronization for maintaining caches at two ends, which is costly to maintain.

Additional usage of computation and storage resources in cloud platforms. Recently, a receiver-based TRE solution named PACK [1] is proposed to address the above issues arising in cloud environment. In PACK, once a client receives a data chunk that already available in its local cache, it is expected that the future coming data are also matched with its cached data. The client makes predictions for future coming data chunks and notifies the cloud server. PACK maintain cloud Elasticity and reduces computation, storage and traffic redundancy. It Uses the scale of time persistent data storage. Since long term persistent data storage make way for the long term usage of disks in which the data are stored which requires a huge

amount of space. EndRe reduce short term redundant data elimination and PACK reduces Long Term redundant data elimination. PACK cannot exploit full term of network traffic redundancy.

## III. OBJECT LEVEL APPROACHES.

Object level approaches uses [13] web objects in nature. Web objects have an impact on the access patterns and caching. Most of the objects required to access the objects at the same time which leads to network traffic and higher usage of bandwidth. During the file downloading all the data stored in the cache memory leads to the redundancy of data and shared among network. Cache storage in client or receiver side has a limit in the network access. Redundancy elimination during file downloads has also received a large amount of attention. Content based approach is used to divide the data into chunks and download only that chunk which are already present in the cache. Object level approaches are purely based on the data centric approaches which do not focus on the repetition of contents within the data chunks. Packet level content shares different data pool of users which results in the higher usage of caching and sharing of packet level.

Data de duplication scheme used to eliminate redundant data from the data base to ensure minimum amount of storage and bandwidth usage. Jin LI etal [3] proposed an authorized de duplication scheme for eliminating redundancy and to optimize bandwidth in cloud. Authorized de duplication scheme uses a convergent key to encrypt original copy of data from user. Original copy of data is used to generate convergent key and convergent key is used to encrypt the original data. Client derives a tag for data copy, in order to ensure that if data copy are same then tag are also same. Client tag is used to remove the duplicate copy of data. A token based mechanism is used to eliminate duplicate copy of data in hybrid clouds.

Lei Yu, et al [4] proposed a traffic redundancy scheme that provides services simultaneously and generate congestion in data transmission channel. TRE based elimination techniques can be done at both the sender and receiver based on the redundancy schemes. Co-operative based redundancy schemes uses both the sender and receiver based traffic redundancy elimination and to remove redundant data from the bandwidth itself.

Swathi Kurunji et al [5] proposed a technique for communication cost optimization which involves a read optimized data bases for providing better performance of data base ware house applications. In data warehouse applications data increases rapidly and a flexible, dynamically environment was required to provide better performance to the user. A strong query mechanism is required to provide better performance to store data in data bases. Due to the rapid increase in nodes an enhanced inter communication cost is required to improve the functionality of each nodes. Inter node communication cost increases when a large amount of data is handled. Primary Key map used to reduce inter node communication cost but the use of primary key and foreign key increases the delay in the network from collecting data from various database tables.

Lluis Pamies-Juarez, Pedro et al [6] proposed Towards the Design of Optimal Data Redundancy Schemes for Heterogeneous Cloud Storage Infrastructures described about distributed redundancy schemes over heterogeneous infrastructures. Heterogeneous cloud networks interested in infrastructures different type of nodes present different online capabilities. An optimal data placement policy is required to present a mechanism to measure data availability more precisely than existing works. Optimal data placement policy that reduces the redundancy used and overhead increase up to 70%.

Gupta, et al [7] proposed network redundancy traffic method in cloud computing provides significant benefits for service suppliers and users due to its characteristics: e.g., on demand, gets use, scalable computing. Virtualization management is an important concept of establishing effective shared physical resources and scalability. Server specific TRE approach is inefficient of handling troublesome traffic with efficiency and it doesn't suites for the cloud atmosphere due to high process prices. During this paper we have a tendency to provide a survey on the new traffic redundancy technique called novel-TRE conjointly called receiver based mostly TRE and Sender based TRE. This novel-TRE has a concept of redundancy detection and reduction at the sender and receiver the server for predicting higher term of information.

Zhifeng Xiao et al [8] proposes Security and Privacy in Cloud Computing [7] They have worked on various attribute confidentiality, integrity, availability, accountability, and privacy. Preservability in privacy provides a higher range of security aspects and privacy issues in cloud computing based on an attribute-driven methodology. Most representative security and privacy attributes are confidentiality, integrity, availability, accountability and privacy preservability.

#### IV. PACKET-LEVEL APPROACHES

EndRE [2] manily focused on sender-based end-to-end TRE for large enterprise based networks. A new was chunking scheme was implemented faster than commonly-used Rabin fingerprint Algorithm, and restricted to chunks as small as 32-64 bytes. PACK, EndRE requires the server that has to maintain a fully and reliably synchronized cache for each and every client. To remain with the server memory requirements cache size are kept small, leads the client to be inadequate for medium to large content data or long term redundancy. EndRE is server specific scheme and not suitable for cloud

## V. PROPOSED

environment to provide best redundancy reduction method.

Wanax [17] is a TRE system where storage and WAN bandwidth are insufficient to send and receive data. Wanax is software based approach on which the middle box replacement is expensive commercial hardware sectors. Sender middle box holds TCP stream for each and every data transmission and sends data signatures to the receiver middle box. The receiver checks the entire data is available in its local cache, and if available it sends the data to client. Data from the sender to receiver are splits in to small portions chunks. Data chunks those are not present in the cache memory are collected from the sender middle box or nearby middle box which increases the latency for non cached data.

N. T. Spring et al [11] proposed independent packet level TRE solution uses rabins finger print by applying hash function to each 64 byte sub string of the packet content and selects a subset of fingerprint representing the recently transferred packets. Sender checks whether its current fingerprints have appeared in earlier stored packets. If present the sender identifies maximal overlap region around each and every matched fingerprint and replaces the finger print with a fixed size pointer value into the cache region. The sender is decoded with the fingerprint and compresses the data before sending. In order to decode compressed data, receiver has to replace the corresponding pointer data to local cache. Local Cache stores the currently received packets in both sender and receiver. Traffic redundancy in independent protocol packet level is about 75% and implies end to end elimination which results in the usage of bandwidth.

Traffic redundancy is one of the most common end user activities in retrieving data. A distributed optimized dynamics of mutually co related connected neural networks are used to select heterogeneous cloud storages. Cloud networks optimize the network traffic without any centralized computation. Mutually connected network can be used for large scalable networks without compromising the network security. Sender based elimination or receive based redundancy elimination is not able to provide better solution for network traffic reduction and redundancy elimination. But a combination of both sender and receiver based elimination provide a better solution for network traffic and redundancy elimination.

Redundancy Elimination based on neural networks has the following characteristics

Users are allowed to perform security privileges and check the replicated data files in the network. Security on cloud networks is high when compared to the existing approaches. Storage cost and computation cost reduces on neural network based approach. Integrity and Confidentiality of Data present in cloud are maintained Security is the most important factor in cloud computing and also in a major concern. Mutual cooperation concern and neural network scheme increases the redundancy elimination and Security in homogeneous as well as heterogeneous cloud. Comparisons of the existing schemes are given in the table 1.1

Table 1.1 Comparison of Existing Approaches

Method	Data Size	Approach	Signature Type	File Type	Advantage	Disadvantage
PACK	Any Size Data	TRE Based Approach	SHA - 1	Text	Reduces Computation cost, Eliminating Redundancy based on the content from the sender	Limited Latency on cloud mobility and elasticity, Less efficient on large data, Bandwidth consumption is higher
ENDRE	32-64 byte of limited data	Sample Byte based approach	SHA-1	Text	Sender based solution, Cache synchronization is high	Suitable for enterprise networks, Not suitable for long term traffic redundancy, Processing and Memory Cost is high on servers
WANAX	Limited Data	Middle Box TCP stream approach		Text	Reduces latency for cached data	Expensive on commercial servers, Higher latency on non cached data, Limited security on contents
Rabins Fingerprint	64 Bye Data	Signature Based Approach	SHA-1	Text	Compress the data sizes, Security on data Contents, Independent of protocol	Only a limited amount of data is transferred, Computation cost is high on servers
Neural Network Schema (Proposed)	Any Size of Data	Fuzzy logic based Approach	SHA - 2	All files	Uses simple fuzzy sets to retrieve data from cache as well as from the servers, Highly secured and traffic redundancy elimination is high, Minimal Computation cost	

## VI. CONCLUSION

Applied distributed optimization dynamics of mutually connected neural network to select optimal heterogeneous type cloud and homogeneous cloud storages to evaluate the performance of the proposed approach. Neural network based approach mutually connected neural network directly optimizes objective functions for the entire networks by distributed computation on each terminal of wireless cloud storages. The proposed algorithm can optimize various kinds of complicated objective functions without any centralized computation. Centralized Computation cost of cloud storages is reduced. New secured, cost effective, highly reliable heterogeneous multi cloud architecture for enabling privacy preserving outsourced storage of data has been introduced.

## VII. REFERENCES

1. Eyal Zohar, Israel Cidon, and Osnat Mokryn "PACK: Prediction-Based Cloud Bandwidth and Cost Reduction System" IEEE, 2014.
2. B Agarwal, A. Akella, A. Anand, A. Balachandran, P. Chitnis, C. Muthukrishnan, R. Ramjee, and G. Varghese, "Endre: An end-system redundancy elimination service for enterprises," in NSDI, 2010, pp. 419– 432.
3. Jin Li, Yan Kit Li, Xiaofeng Chen, Patrick P. C. Lee, Wenjing Lou "A Hybrid Cloud Approach for Secure Authorized Deduplication" IEEE, 2014.
4. Lei Yu, Haiying Shen, Karan Sapra, Lin Ye and Zhipeng Cai "CoRE: Cooperative End-to-End Traffic Redundancy Elimination for Reducing Cloud Bandwidth Cost" IEEE, 2016.
5. Swathi Kurunji, Tingjian Ge, Benyuan Liu, Cindy X. Chen "Communication Cost Optimization for Cloud Data Warehouse Queries" IEEE, 2012.
6. Lluís Pamies-Juarez, Pedro Garc\_a-Lopez, Marc S\_anchez-Artigas, Blas Herrera, "Towards the Design of Optimal Data Redundancy Schemes for Heterogeneous Cloud Storage Infrastructures" Computer Networks, 2011.
7. A Gupta, A. Akella, S. Seshan, S. Shenker, and J. Wang, "Understanding and exploiting network traffic redundancy" UWMadison, Madison, WI, USA, Tech. Rep. 1592, Apr. 2007.
8. Zhifeng Xiao and Yang Xiao, Senior Member, IEEE, "Security and Privacy in Cloud Computing", IEEE 2013.
9. S Ihm, K. Park, and V. Pai. Wide-area Network Acceleration for the Developing World. 2010.
10. E. Zohar, I. Cidon, and O. O. Mokryn, "The power of prediction: cloud bandwidth and cost reduction," in ACM SIGCOMM, 2011, pp. 86–97.
11. N. T. Spring and D. Wetherall, "A protocol-independent technique for eliminating redundant network tra\_c," in ACM SIGCOMM, 2000, pp. 87–95.
12. A. Anand, C. Muthukrishnan, A. Akella, and R. Ramjee, "Redundancy in network traffic: findings and implications," in SIGMETRICS /Performance, 2009, pp. 37–48.
13. L. Breslau, P. Cao, L. Fan, G. Phillips, and S. Shenker. Web caching and zipf-like distributions: Evidence and implications. In IEEE Infocom, 1999.

# Modern Effluent Treatment Plant

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## ABSTRACT

In this study, the sugar industry waste water generation sources, characteristics, recent advancements in the aerobic, anaerobic, and physico-chemical treatment technologies, and the areas needing further research have been explored. Possibility of treated wastewater reuse was also investigated. A treatment plant was setup with the introduction of activated charcoal Unit and the effluent sample was allowed to pass through the treatment unit and various tests were carried out the results proved satisfactory.

**Keywords:** Sugar Industry, Activated Charcoal, Effluent

## I. INTRODUCTION

Sugar industry is a seasonal industry working for maximum of 5-6 months in one season. The industry uses sugarcane as their raw material along with various chemicals added to increase the face value of the final product. During the process a huge amount of water is also used per day and as a result industry generates waste water (effluent) on daily basis

Waste water from sugar industries, if not treated properly, contains significant amount of TDS and TSS. This water may not be useful for crop land irrigation. There are reports which indicate that infiltration rate decreases with increased loading of BOD and TDS & TSS. The high value of TSS can cause decrease in soil porosity due to salt deposition. High TDS value in waste water may also have adverse effect on crops. A TDS of 500-1000 ppm may have detrimental effect on sensitive crops. In view of the above facts, it is quite evident that the sugar industry is a significant contributor to the environmental pollution and has typical problems. Another important factor in studying the pollution effect is that the sugar industry is seasonal industry and the waste flow is mainly during the crushing season. This

causes difficulty in employing biological pollution abatement systems which should otherwise remain very suitable for treating such wastes. Waste water from sugar industries, if not treated properly, contains significant amount of TDS and TSS. This water may not be useful for crop land irrigation

### Objectives of the project

- To generate the working model of the activated charcoal unit
- To carry out the various test of the effluent sample
- To determine the BOD,COD,PH of the effluent sample

## II. SOURCES OF EFFLUENT

The waste water generated from different sub streams can be classified as follows

### A Mill House

The effluent consists of water used for cleaning the mill house floor which is liable to be converted by spills and pleased sugar juice (This clearing up operation will prevent growth of bacteria on the



juice-covered floor). Water used for cooling of mills also forms part of the waste water from this source. Basically this water contains organic matter like sucrose, bagacillo, oil and grease from the bearings fitted in to the mills.

#### **B. Waste Water from Boiling House**

The waste water from boiling house results from leakages through pumps, pipelines and the washings of various sections such as evaporators, juice heaters, clarification, pans crystal is action, and centrifugation etc. The cooling water from various pumps also forms part of water

#### **C. Waste Water from Boiler Blow-down**

The water used in boiler contains suspended solids dissolved solids like calcium salts, magnesium salts, sodium salts, fatty salts etc. These salts get concentrated after generation steam from the original water volume. These solids have to be expelled time to time to save the boiler being covered up by scales.

#### **D. Excess Condensate**

The excess condensate does not normally contain any pollutant and is used as boiler feed water and the washing operations. Sometimes it gets contaminated with juice due to entrainment of carry-over of solids with the vapours being condensed in that case if goes in to the waste water drain. The treatment requirement in this case is almost negligible and can replace fresh water or let out directly as irrigation water after cooling it to ambient temperature.

#### **E. Condenser cooling water**

Condenser cooling water is re-circulated again unless it gets contaminated with juice, which is possible due to defective entrainment separators, faulty operation beyond the design rate of evaporation etc. if gets

contaminated, and the water should go into the drain invisibly. This volume of water also increased by additional condensing of vapour of trained from the boiling juice the pan.

### **III. METHODS AND MATERIAL**

Effluent Treatment plant is the one type of waste water treatment method which is particularly designed to purify industrial waste water for its reuse and its aim is to release safe water to environment from the harmful effect caused by the effluent.

Sugar industrial effluent contains various materials Depending on the industry. Some effluent contains oil and grease and some toxic materials. Therefore specific treatment technology called ETP is required.

1. Screens.
  2. Oil and Grease trap.
  3. Aeration tank.
  4. Equalisation tank.
  5. Biological filter.
  6. Buffer tank.
  7. Clarifier.
  8. Sludge digestion tank.
  9. Activated charcoal carbon filter
- Storage tank

#### **1. Screen Chamber:**

Screening is a unit operation that separates large floating materials in and/or on water (found in different sizes) from water and from entering water treatment/ Waste water treatment facilities and mains. The unit involved is called a screen.

#### **2. Oil and Grease Trap**

Grease and oil traps are devices utilizes within plumbing systems to capture grease and oil from the discharge of industrial and consumer equipment and applications.

### 3. Aeration Tank

Aeration is one of the important unit operation of gas transfer the aim of the aeration is to create extensive, new and self-renewing interface between air and water to keep interfacial films from building thickness

### 4. Equalization Tank:

Effluent from collection tank comes to the equalization tank in waste water treatment. The main function is to act as buffer. to collect the incoming raw effluent that comes at widely fluctuating rates

### 5. Biological filter

Biological filter enable bacterial colonies to propagate and breakdown wastes.

### 6. Buffer tank:

A buffer tank is a unit where the holdup (volume) is exploited to provide smoother operation.

### 7. Clarifier

Clarifiers are settling tanks built with mechanical means for continuous removal of solids being deposited by sedimentation

### 8. Sludge digestion tank

Sludge digestion is a biological process in which organic solids are decomposed into stable substances

### 9. Activated Charcoal Carbon filter

Activated carbon is used for the control of tastes and odours in water, resulting from the presence of dissolved gases. It has also valuable colour removal properties. Activated carbon is produced by passing a carbonaceous material such as coke, charcoal, paper,

char or sawdust through a heating mechanism at high temperature against a counter current of air, steam, carbon dioxide, chlorine or flue gases. Sometimes, chemical agents, such as phosphoric acid or zinc chloride may be added. This 'activation' and the greatly increased power of carbon to absorb gases and organic matters distinguishes activated carbon from charcoal. The activation of the carbonaceous materials removes the hydrocarbons which might interfere with the adsorption of organic matter. Activated carbon is very porous and has many carbon atoms with free valencies. It is available in granular as well as powder form, and is sold under trade names such as Darco, Minchar and Nuchar. Activated carbon must possess the properties of easy wettability, prolonged suspension and effective odour absorption capacity. Activated carbon removes organic contaminants from water by the process of adsorption. High surface area is the prime consideration in adsorption. Granular activated carbons typically have surface areas of 500-1400 m<sup>2</sup>/g.

#### A. Activated Carbon Treatment has the following Functions:

- It has been found effective in aiding coagulation, if adopted before filtration of water
- It has valuable colour removing properties
- It is effective in preventing or retarding the decomposition of sludge in settling basins
- It is useful in removing tastes and odours due to excess chlorine, hydrogen sulphide, phenols and other elements
- It reduces the chlorine demand of treated water.
- It adsorbs organic matter in water

#### B. Activated carbon can be applied to water treatment in two ways:

(a) As filter media (b) as fine powder feed.

As a filter media, granular activated carbon is used in place of the usual filter sand. Filtered water is passed through the bed of activated carbon. This will remove taste and odour, and will also adsorb organic

compounds. The activated carbon filter bed, 75 to 100 cm thick is supported on about 35 to 50 cm thick graded gravel bed. When used in pressure filters, the tank interior should be coated against electrolytic corrosion. In the course of time, the carbon reaches the limit, of its adsorptive powers and must be 'rejuvenated'. This is done by passing live steam into the carbon through steam pipes placed in the gravel.



Fig.1 Activated Carbon

The activated carbon in powder form may be applied to water at various stages of its treatment as follows:

- i. It may be applied to raw water, ahead of treatment plant.
- ii. It may be applied in the mixing basin, either alone or fixed with other chemicals such as alum, by means of any of the types of dry chemical feed machines.
- iii. It may be fed before, during or after coagulation, at more than one point. This is known as *split treatment*. Usually, a portion is fed in the mixing basin and the balance just ahead of filter.
- iv. It may be applied just ahead of fillers. Its rate of application is high when filter is washed, and becomes lower and lower as filter gets clogged.

The required dosage of powdered activated carbon is controlled by means of thresh hold odour test. For effective use, the dose must be adequate, the mixing thorough and the time of contact long enough for the material to carry out its intended work. Compared to dosing with powdered carbon, the use of carbon filter beds is more advantageous, since it is effective in removing not only the 'earthy' or 'mouldy\*' tastes or odours, but also in removing a wide range of complex organic substances such as pesticides and aromatic hydrocarbons.

#### IV. EXPERIMENTAL PROGRAMME

##### A. Developed working treatment plant with activated charcoal

The working treatment plant is developed and the effluent sample is allowed to pass through the various units of the treatment plant. The various tests such as COD, BOD, PH TDS, TSS are carried out for the treated effluent plant

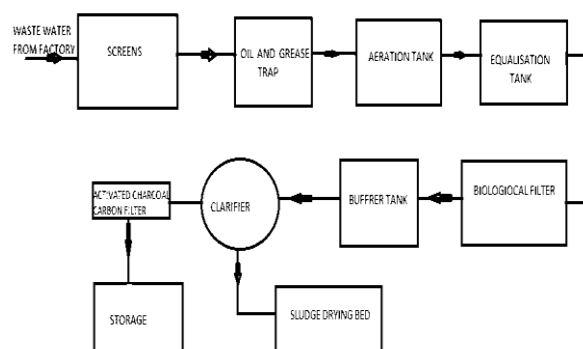


Figure 2. Flow Chart of Effluent Treatment Plant

The working model has been developed and the effluent water has been passed and the results are obtained by the tests carried out



Fig. 3 Developed Effluent Treatment Plant

The Tests conducted are

- a) PH Value Test
- b) Bod Test
- c) Cod Test
- d) Chloride Test
- e) Total Dissolved Solids Test
- f) Sulphate
- g) Oil And Grease Test

	Solids		
7	Sulphates	257mg/l	1000mg/l
8	Oil and Grease	200mg/l	10mg/l

### V. RESULTS AND DISCUSSION

The operation of the ETP is such that it will give an effluent of such standard, prescribed by the Karnataka Pollution Control Board (KPCB). The following prescribed standard by the board

Table.1

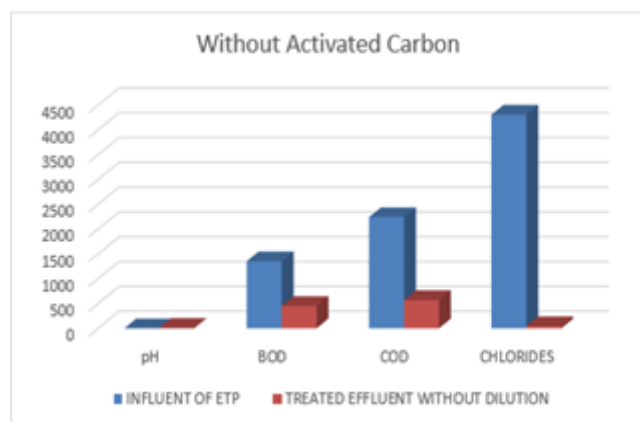
Permissible parameters

SL NO	parameter	Range(not exceeding)
1	pH	5.5-9
2	BOD	100mg/l
3	COD	250mg/l
4	Chloride	600mg/l
5	Total Dissolved solids	2100mg/l
6	Total suspended Solids	100mg/l
7	Sulphates	1000mg/l
8	Oil and Grease	10mg/l

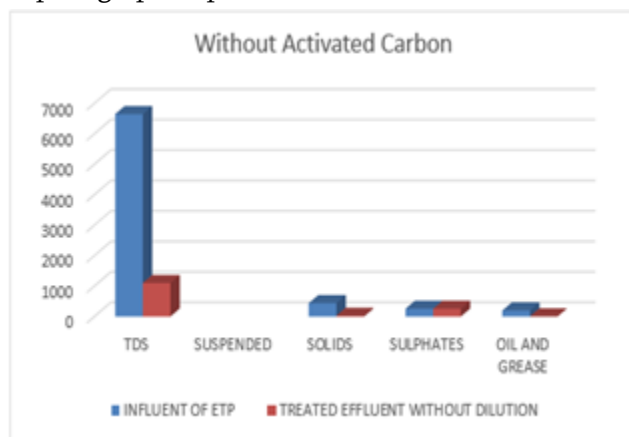
Table. 2

Parameter treated without Activated Carbon

SL NO	Parameters	Influent of Effluent Treatment Plant(ETP)	Treated Effluent without Dilution
1	pH	4.5-5.5	8
2	BOD	1350mg/l	100mg/l
3	COD	2240mg/l	250mg/l
4	Chloride	4305mg/l	600mg/l
5	Total Dissolved solids	6645mg/l	2100mg/l
6	Total suspended Solids	440mg/l	100mg/l



Graph.1 graph of parameters without activated carbon



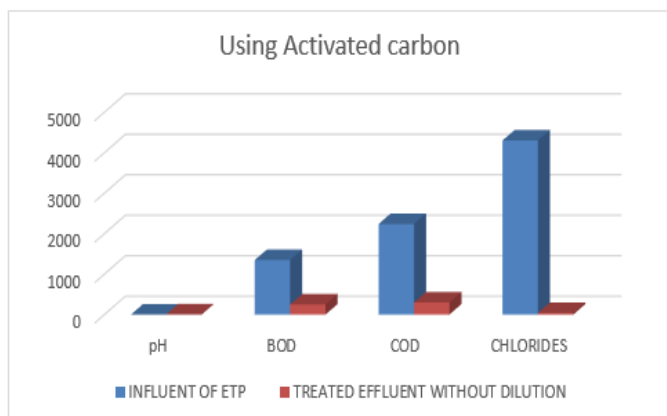
Graph.2 graph of parameters without activated carbon

Table. 3

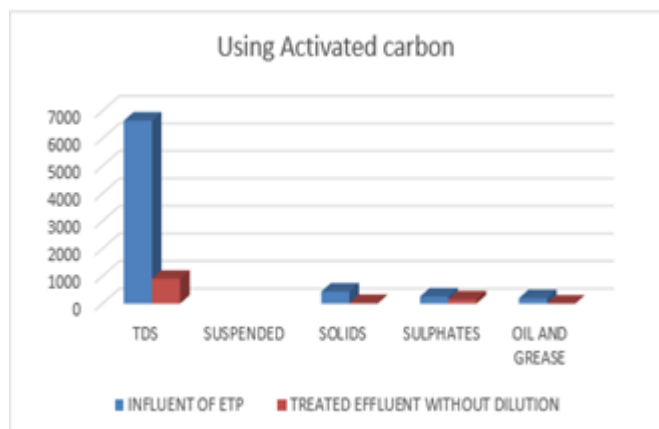
Parameter treated without Activated Carbon

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6	Total suspended Solids	440mg/l	100mg/l

7	Sulphates	257mg/l	1000mg/l
8	Oil and Grease	200mg/l	10mg/l



Graph. 3 graph of parameters using activated carbon



Graph. 4 graph of parameters using activated carbon

## VI.CONCLUSION

The project carried for ETP for sugar industry can be concluded that, the overall performance of the effluent treatment plant was satisfactory. The individual units are also performing well and their removal efficiencies are satisfactory

- The parameters after treating with activated carbon gives good quality of water.
- The treated effluent water can be used for gardening, and other normal usages

## VII. REFERENCES

1. Rakesh Singh Asiwal, Dr. Santosh Kumar Sir\*, Shweta Singh, Megha Sahu "Wastewater Treatment by Effluent TreatmentPlants" SSRG International Journal of Civil Engineering (SSRG-IJCE) – volume 3 Issue 12 – December 2016.
2. Kavita N. Choksi, Margi A. Sheth, Darshan Mehta "To evaluate the performance of Sewage Treatment Plant: A Case study" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 08 | Nov-2015 www.irjet.net p-ISSN: 2395-0072.
3. Chidanand Patil, Mugdha Ghorpade, &Manika Hugar "performance and evaluation of sugar industry effluent treatment plant" ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, VOLUME-2, ISSUE-2, 2015.
4. J Reungoat , B.I. Escher , M. Macova , F.X. Argaud , W. Gernjak &J. Keller. "Ozonation and biological activated carbon filtration of wastewater treatment plant effluents" Water Research Volume 46, Issue 3, 1 March 2012, Pages 863-872.
5. M Sunitha and Mohd.& Abdur Rafeeq "sugar industry wastewater treatment using adsorption" Jr. of Industrial Pollution Control 25 (2) (2009) pp 139-140 © Enviromedia.

# A CORDIC Architecture Implementation for Rectangular to Polar Conversion

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## ABSTRACT

Co-ordinate Rotation Digital Computer(CORDIC) is a simple and efficient algorithm for performing computing tasks such as the calculation of trigonometric, hyperbolic and logarithmic functions, real and complex multiplications, division, square-root and many more using simple add, subtract and shift operations. Rectangular to polar conversion is an important operation in ALU, DSP processors, wireless communication, multimedia etc. This conversion requires hardware implementation of squaring, square root and arctangent circuits, which results in hardware complexity, large area requirement and high power consumption. To overcome this drawback, rectangular to polar conversion is carried out using CORDIC architecture. This paper proposes pipelined CORDIC architecture for rectangular to polar conversion using much simpler, cheaper and efficient hardware. Pipelining increases throughput of the system. The implementation has been done in VHDL language and simulation can be done on XILINX ISE software.

**Keywords :** CORDIC algorithm, pipelining, VHDL, XILINX ISE

## I. INTRODUCTION

Co-ordinate Rotation Digital Computer is shortened as CORDIC. The simple principles of two-dimensional geometry are the basis of CORDIC arithmetic but the iterative method of a computational algorithm to implement this was first given by Jack E. Volder to compute multiplication, division and trigonometric functions in 1959[1], [2].

The key concept of coordinate rotation digital computer (CORDIC) algorithm is that it involves a simple shift-add iterative procedure. This shift-add iterative procedure perform several computing tasks by operating in either vectoring-mode or rotation-mode following any one among linear, hyperbolic, and circular trajectories [3]. CORDIC operates in both rotation and vectoring-modes for applications such as synchronization in digital receivers, 3-D graphics processor, phase and frequency estimations, eigen value estimations, QR decomposition, interpolators,

singular value decomposition etc. CORDIC operates in both circular and hyperbolic trajectories for 3-D structures such as hyperboloids, paraboloids and ellipsoids. The hardware implementation of these applications requires more than one CORDIC processor to operate in different modes and different trajectories. Multiple CORDIC processors are replaced by a reconfigurable CORDIC, which can operate in rotation and vectoring-modes, for both circular and hyperbolic trajectories. For range of applications in communication systems, signal processing, 3-D graphics, multimedia etc. a reconfigurable CORDIC can be used.

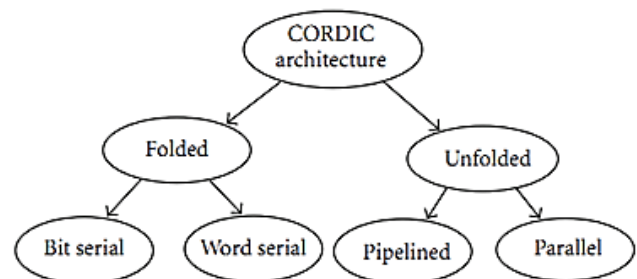


Figure 1: Classification of CORDIC architecture

In general, the architectures can be broadly classified as folded and unfolded as shown in Figure 1, based upon the realization of the three iterative equations. Folded architectures are obtained by duplicating each of the difference equations of the CORDIC algorithm into hardware and time multiplexing all the iterations into a single functional unit. Folding provides a means for trading area for time in signal processing architectures. The folded architectures can be categorized into bit-serial and word-serial architectures depending on whether the functional unit implements the logic for one bit or one word of each iteration of the CORDIC algorithm. The CORDIC algorithm has traditionally been implemented using bit serial architecture with all iterations executed in the same hardware [3]. This slows down the computational device and hence, is not suitable for high speed implementation. The word serial architecture [7, 48] is an iterative CORDIC architecture obtained by realizing the iteration equations. In this architecture, the shifters are modified in each iteration to cause the desired shift for the iteration. The appropriate elementary angles are accessed from a lookup table. The most dominating speed factors during the iterations of word serial architecture are carry/borrow propagate addition/subtraction and variable shifting operations, rendering the conventional CORDIC [7] implementation slow for high speed applications. These drawbacks were overcome by unfolding the iteration process [1], so that each of the processing elements always perform the same iteration as shown in Figure 5. The main advantage of the unfolded pipelined architecture compared to folded architecture is high throughput due to the hard-wired shifts rather than time and area consuming barrel shifters and elimination of ROM. It may be noted that the pipelined architecture offers throughput improvement by a factor of  $n$  for  $n$ -bit precision at the expense of increasing the hardware by a factor less than  $n$ .

## II. BRIEF LITERATURE SURVEY

Co-ordinate Rotation Digital Computer is shortened as CORDIC. The simple principles of two-dimensional geometry are the basis of CORDIC arithmetic but the iterative method of a computational algorithm to implement this was first given by Jack E. Volder to compute multiplication, division and trigonometric functions in 1959[1], [2].

Concept, Design, and Implementation of Reconfigurable CORDIC Supriya Aggarwal, Pramod K. Meher, and Kavita Khare IEEE Transactions On Very Large Scale Integration (VLSI) Systems 2016.

The proposed method allow CORDIC to work in different modes and different trajectories of operations. A range of applications such as synchronizers, waveform generators, low-cost scientific calculators etc can use this reconfigurable CORDIC architectures, without affecting the maximum operating frequency. This proposed method save approximately 60% of the area compared to the conventional CORDIC architecture.

Implementation of a Fast Hybrid CORDIC Architecture Bhawna Tiwari, Nidhi Goel 2016 Second International Conference on Computational Intelligence & Communication Technology IEEE 2016. In this paper, the proposed architecture is faster in execution but reduced accuracy and high power consumption as compared to the reference architecture.

CORDIC-based FFT Real-time Processing Design and FPGA Implementation Aimei Tang\*, Li Yu, Fangjian Han, Zhiqiang Zhang, 2016 IEEE 12th International Colloquium on Signal Processing & its Applications (CSPA2016), 4 - 6 March 2016, Melaka, Malaysia.

The proposed method reduces the hardware complexity of the system. The pipelined structure, the

dual-port RAM, butterflies of the radix-2Decimation-In-Time (DIT) algorithm have been used to increase the performance of the design and Signal Noise Ratio is also increased as per the simulation results.

CORDIC II: A New Improved CORDIC Algorithm Mario Garrido, Member, IEEE, Petter Källström, Martin Kumm and Oscar Gustafsson, Senior Member, IEEE *Ieee Transactions On Circuits And Systems Part Ii: Express Briefs* 2016.

A number of versions of CORDIC algorithm are proposed but no authors has given the substitution of CORDIC micro-rotation. So a new algorithm called CORDIC II is presented that uses minimum number of adders as compared with the other CORDIC algorithm as it uses new variety of rotators.

CORDIC Architectures: A Survey B. Lakshmi and A. S. Dhar, Hindawi Publishing Corporation *VLSI Design* Volume 2010, doi:10.1155/2010/79489

This paper proposes various classification and survey of CORDIC algorithm and also focussed on algorithm that pre compute the direction of rotations. Depending on the specific application such algorithms are used. Special focus and more stress have been given on higher radix and redundant algorithms.

### III. PROBLEM DEFINITION

Rectangular to polar conversion is an important operation in ALU and DSP processors wireless communication, multimedia etc. The conversion requires hardware implementation of squaring, square root, adder, and arctangent circuits. This results in hardware complexity, large area requirement and high power consumption. There are different types of architecture of CORDIC algorithm and each architecture has its own merits and demerits. So various existing methods have been studied and compared. From all the architectures, pipeline

CORDIC algorithm is best suited to implement rectangular to polar conversion.

### IV. MOTIVATION

If FPGAs are implemented using digital signal processing algorithm, then the algorithm uses a nontrivial (transcendental) algebraic function, like square, square root, adder, and arctangent. Taylor series can be used to approximate these functions. The problem is then reduced to a sequence of multiply and adds operations. But more efficient approach, based on the Coordinate Rotation Digital Computer (CORDIC) algorithm can also be considered. This algorithm uses simple add, subtract and shift operations, which reduces hardware complexity of the circuit. The throughput of the circuit can be increased by pipelined CORDIC. This results in small, cheap, fast in calculation and reconfigurable hardware.

### V. PROPOSED WORK

Figure shows the block diagram of CORDIC processor. Three fundamental blocks of CORDIC Processor are the pre-processor, the post-processor and the actual CORDIC core.

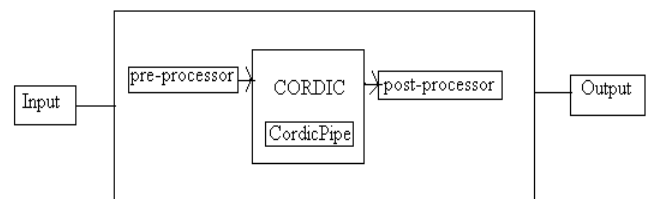


Figure 2: Block Diagram of CORDIC processor

#### 1. Pre-Processors and Post-Processors

The arctan table used in the CORDIC algorithm allows it to converge in the range of  $-1(\text{rad})$  to  $+1(\text{rad})$ . To use the CORDIC algorithm over the entire  $2\pi$  range the inputs need to be manipulated to fit in the  $-1$  to  $+1$  rad. range. The pre-processor handles this manipulation. The post-processor corrects this and



places the CORDIC core's results in the correct quadrant.

### 2. CORDIC

The actual CORDIC algorithm is performed by CORDIC Processor, therefore CORDIC core is considered as the heart of the CORDIC Processor Core. A pipeline of CordicPipe blocks are used to make the CORDIC and each CordicPipe block represents a single step in the iteration processes. For each iteration and the logic, the atan table is used. Pipelined structure is used to perform all the iterations. Pipelined structure makes CORDIC transformation in each clock cycle and enables to achieve highest throughput.

### 3. CORDIC Pipeline

A pipeline of CordicPipe blocks are used to make the CORDIC and the CordicPipe core performs each iteration step to manipulate the values as shown in the figure 3.

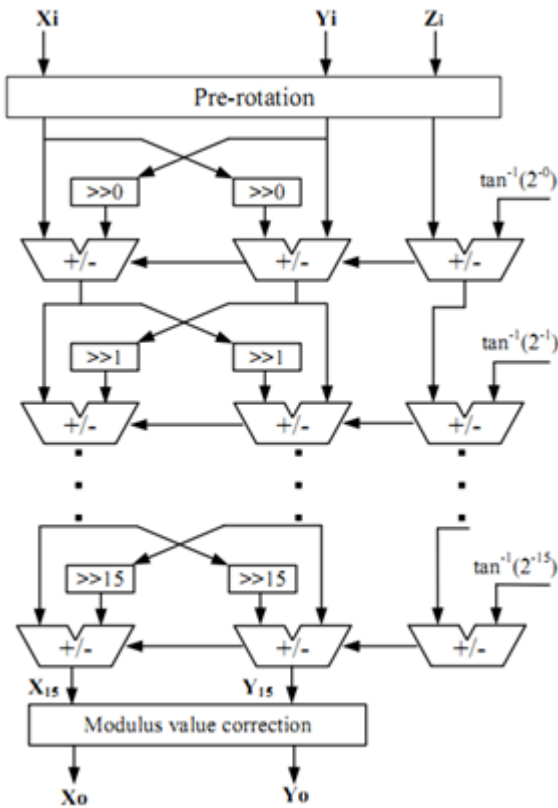


Figure 3: CORDIC Pipeline

## VI. RESULTS AND DISCUSSION

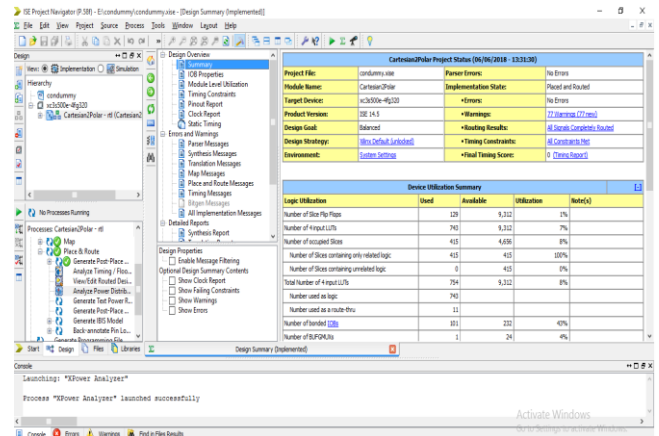


Figure 4 Area Report for sizes Conventional CORDIC Implementation

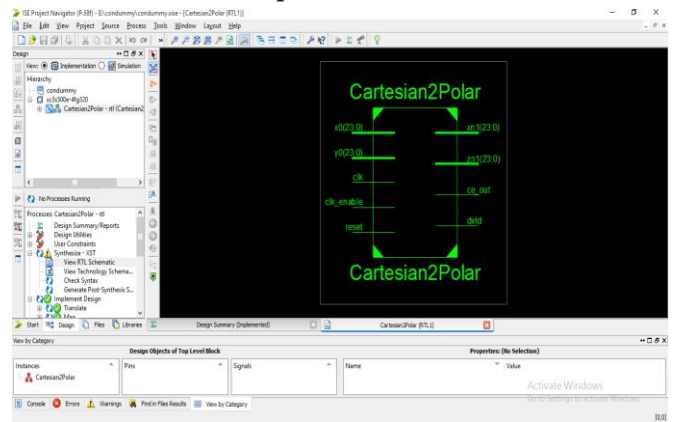


Figure 5 RTL Top view for Conventional CORDIC Implementation

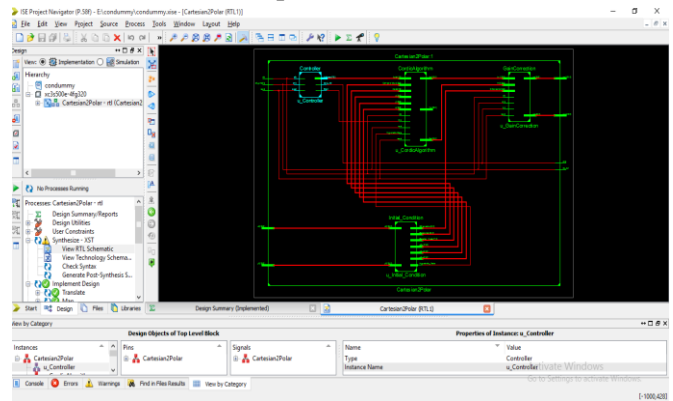


Figure 6 Detail RTL View for Conventional CORDIC Implementation



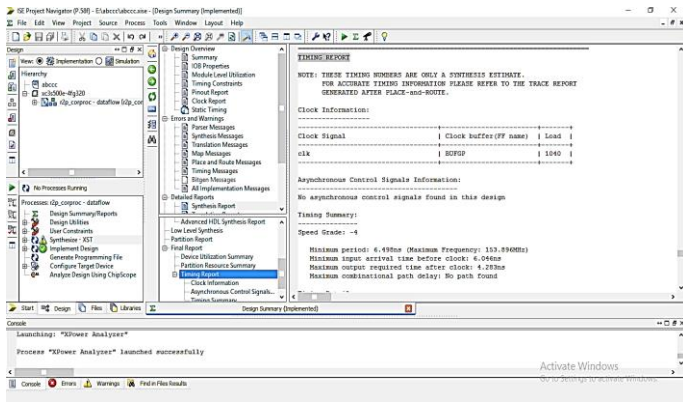


Figure 14 Timing report of Pipelined CORDIC Implementation

Table I Comparative analysis of the conventional CORDIC and Pipelined CORDIC

Sr. No.		Conventional CORDIC	Reconfigurable Pipelined CORDIC
1	Number of slice flip flops	129	1035
2	Number of 4 input LUTs	743	1016
3	Maximum Frequency(MHz)	46.70	153.89
4	Power (mW)	0.81	0.81

Thus from the result obtained we observe that in conventional CORDIC area is optimized and in pipelined CORDIC speed is optimized

**VII. CONCLUSION**

Rectangular to polar conversion is an important operation in many applications, which uses complex hardware. So various existing methods have been studied, compared and better performance approach has been proposed. The block diagram of proposed work has been discussed, that uses simple add, subtract and shift operations. The CORDIC algorithm has been implemented in VHDL language and simulation has been carried on XILINX ISE software. We also conclude that in conventional CORDIC area

is optimized and in pipelined CORDIC speed is optimized.

**VIII. REFERENCES**

- [1]. J E. Volder, "The CORDIC trigonometric computing technique," IRE Trans. Electronic Computing, vol. EC-8, pp. 330-334, Sep. 1959.
- [2]. Sudhakar Reddy.P , Ramachandra Reddy "ASIC Implementation of Autocorrelation and CORDIC Algorithm for OFDM Based WLAN", ISSN 1450-216X Vol.27 No.4 (2009), pp.588-596
- [3]. C.-S. Wu, A.-Y. Wu, and C.-H. Lin, "A high-performance/low-latency vector rotational CORDIC architecture based on extended elementary angle set and trellis-based searching schemes," IEEE Trans. Circuits Syst. II, vol. 50, no. 9, pp. 589-601, Sep. 2003.
- [4]. R. Shukla and K. Ray, "Low latency hybrid CORDIC algorithm," IEEE Trans. Comput., vol. 63, no. 12, pp. 3066-3078, Dec 2014.
- [5]. C.-S. Wu and A.-Y. Wu, "Modified vector rotational CORDIC (MVR-CORDIC) algorithm and architecture," IEEE Trans. Circuits Syst. II, vol. 48, no. 6, pp. 548-561, Jun. 2001.
- [6]. S. Aggarwal, P. K. Meher, and K. Khare, "Area-time efficient scaling-free CORDIC using generalized micro-rotation selection," IEEE Trans. VLSI Syst., vol. 20, no. 8, pp. 1542-1546, Aug. 2012.
- [7]. F. Jaime, M. Snchez, J. Hormigo, J. Villalba, and E. Zapata, "Enhanced scaling-free CORDIC," IEEE Trans. Circuits Syst. I, vol. 57, no. 7, pp. 1654-1662, July 2010.
- [8]. Y. Liu, L. Fan, and T. Ma, "A modified CORDIC FPGA implementation for wave generation," Circuits Syst. Signal Process., vol. 33, no. 1, pp. 321-329, 2014.
- [9]. Concept, Design, and Implementation of Reconfigurable CORDIC Supriya Aggarwal, Pramod K. Meher, and Kavita Khare IEEE

TRANSACTIONS ON VERY LARGE SCALE  
INTEGRATION (VLSI) SYSTEMS 2016.

- [10]. Implementation of a Fast Hybrid CORDIC Architecture Bhawna Tiwari, Nidhi Goel 2016 Second International Conference on Computational Intelligence & Communication Technology IEEE 2016.
- [11]. CORDIC-based FFT Real-time Processing Design and FPGA Implementation Aimei Tang\*, Li Yu, Fangjian Han, Zhiqiang Zhang, 2016 IEEE 12th International Colloquium on Signal Processing & its Applications (CSPA2016), 4 - 6 March 2016, Melaka, Malaysia.
- [12]. CORDIC II: A New Improved CORDIC Algorithm Mario Garrido, Member, IEEE, Petter Kllstrm, Martin Kumm and Oscar Gustafsson, Senior Member, IEEE Ieee Transactions On Circuits And Systems Part Ii: Express Briefs 2016.

# Phytochemical Investigation of Medicinal Plants of Kalrayan Hills, Villupuram District

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## ABSTRACT

Medicinal plants make many chemical compounds for biological functions including defense against bacteria, fungi and viruses. The phytochemicals on the human body in exactly the same way as pharmaceutical drugs, herbal medicines can be beneficial and have harmful side effects just like conventional drugs. In the present investigation suggested that the analysis of qualitative and quantitative phytochemicals of medicinal plants with aqueous and methanol solvent extract were performed and the medicinal plant was collected from kalrayan hills, Villupuram district, Tamilnadu. The selected medicinal plants such as *Acalypha indica*, *Chloroxylon swietenia*, *Cipadessa baccifera*, *Eupatorium odoratum*, *Dodonaea viscosa*, *Glycosmis pentaphylla*, *Mallotus philippensis*, *Mukia madasapatana*, *Ocimum gratissimum*, *Stachyarrheta jamaicensis*, *Solanum trilobatum*, and *Vitex trifolia* were investigated and analysis of phytochemicals like alkaloids, flavonoids, phenols, reducing sugar saponins, steroids, terpenoids, and triterpenoids represented in various aspects of strongly presented and some of the phytochemicals also observed. The quantitative phytochemicals such as alkaloids, flavonoids, reducing sugar, saponins, steroids, terpenoids, and triterpenoids were performed from the twelve medicinal plants. Among the twelve medicinal plants, the *Eupatorium odoratum* was excellent indicative of phytochemicals in qualitatively as well as quantitatively recorded when compared with other medicinal plants with aqueous extract. The medicinal plants are used for discovering and screening of the phytochemical constituents which are very helpful for the preparation of new drugs.

**Keywords :** phytochemicals, medicinal plants, Kalrayan hills

## I. INTRODUCTION

The medicinal plants are useful for healing as well as for curing of human diseases because of the presence of phytochemical constituents Nostro *et al.*, (2000). Phytochemicals are naturally occurring in the medicinal plants, leaves, vegetables and roots that have defense mechanism and protect from various diseases. Phytochemicals are primary and secondary compounds. Chlorophyll, proteins and common sugars are included in primary constituents and secondary compounds have terpenoids, alkaloids and phenolic compounds Krishnaiah *et al.*, (2007). Terpenoids

exhibit various important pharmacological activities i.e., anti inflammatory, anticancer, antimalarial, inhibition of cholesterol synthesis, antiviral and antimicrobial activities by Mahato and Sen (1997). Terpenoids are very important in attracting useful mites and consume the herbivorous insects by Kappers *et al.*, (2005). Alkaloids are used as anaesthetic agents and are found in medicinal plants by Herouart *et al.*, (1988). Phytochemicals are the chemicals produced by various parts of the plants. These bioactive constituents of plants are steroids, terpenoids, carotenoids, flavanoids, alkaloids, tannins, and glycosides were reported from the medicinal plants.

These compounds have various activities such as antimicrobial have been reported to exhibit hemolytic and foaming activity reported by Feroz *et al.*, (1993).

## II. MATERIALS AND METHODS

### Collection of plant materials

The medicinal plants were collected from the Kalrayan hills, Villupuram District, Tamil Nadu

### Authentication of plant materials

The plant material was authenticated by the Rapinet Herbarium, St. Joseph's College, Tiruchirappalli, Tamil Nadu.

### Preparation of medicinal plant powder

The collected plant samples were air dried. After air dried the samples were ground in grinding machine made for the laboratory. Exposure direct sunlight and avoided to prevent the loss of active components. These powdered materials were used for further analysis

### Preparation of plant extract

Phytochemical test were carried out on the basis of aqueous and methanol solvent. The extract of medicinal plants using standard procedures for determination the phytochemical constituents as described by Sofowara (1993) Treas and Evans (1989)

### Qualitative phytochemical analysis (Harborne, 1973)

Preliminary phytochemical analysis was carried out for the extract as per standard methods described by Brain and Turner (1975) and Evans (1996)

### Detection of alkaloids

Extracts were dissolved individually in dilute hydrochloric acid and filtered. The filtrates were used to test the presence of alkaloids.

### Detection of flavonoids

Two ml of extract was taken in a 10 ml test tube and added few drops of 1% ammonia solution. Change the yellow colouration was observed indicating the presence of flavonoids.

### Detection of steroids

Two ml of acetic anhydride was added to five gram of the plant extracts, each with two ml of H<sub>2</sub>SO<sub>4</sub>. The colour was changed from violet to blue or green in some samples indicate that the presence of steroids.

### Detection of terpenoids

#### Salkowski's test

Five gram of the plant leaf extract was mixed with two ml of chloroform and concentrated H<sub>2</sub>SO<sub>4</sub> (3ml) was carefully added to form a layer. An appearance of reddish brown colour in the inner face was indicated that the presence of terpenoids.

### Detection of phenols

#### Lead acetate test:

Ten gram plant leaf extracts were treated with few drops of lead acetate solution. Formation of yellow colour precipitate indicated that the presence of phenol.

### Detection of saponins

Two ml of plant extract was added in 5ml of distilled water in a water bath next shaken vigorously for a stable persistent froth appears. Two ml of extract with few drops of olive oil and shaken vigorously then observed for the formation of emulsion.

### Detection of tannins

A small quantity of plant leaf extract was mixed with water and heated on a water bath. The mixture was filtered and ferric chloride was added to the filtrate. A dark green colour was formed. It indicated that the presence of tannins.

### **Detection of protein**

#### **Biuret test:**

Five mg of plant leaf extract with equal volume of 40% NaOH solution and two drops of one percent copper sulphate solution was added. The appearance of violet colour indicates that the presence of protein.

### **Detection of triterpenoids**

The substance was warmed with tin and thionyl chloride. Pink colour indicated the presence of triterpenoids.

### **Detection of Reducing sugar**

#### **Fehling's test:**

The extract treated with Fehling's reagent A and B. The appearance of reddish brown colour precipitate indicated the presence of reducing sugar.

### **Quantitative phytochemical analysis**

#### **Estimation of alkaloids**

Alkaloid determination by using Five gram of the plant leaf sample was weighed into a 250 ml beaker and 200 ml of 10% acetic acid in ethanol was added and its covered and allowed to stand for 4 h. It was filtered and the extract was concentrated on a water bath to one quarter of the original volume. Concentrated NH<sub>4</sub>OH was added by drop wise to the extract until the precipitation was completed. The whole solution was allowed to settle and the precipitate was collected and washed with dilute NH<sub>4</sub>OH and then filtered. The residue is the alkaloids which was dried and weighed.

#### **Estimation of flavonoids**

Five grams of plant leaf sample was repeatedly extracted with 100ml of 80% aqueous and methanol at room temperature. The mixture was filtered through a Whatman No1 filter paper into a pre-weighed 250ml beaker. The filtrates was transferred into a water bath and allowed to evaporate to dryness and weighed.

### **Estimation of tannins**

Five hundred milligram of the plant leaf samples was weighed into a 50 ml plastic bottle. 50 ml of acetone solvent was added and shaken for 1 h in a mechanical shaker. This was filtered into a 50 ml volumetric flask and made up to the mark. Then 5 ml of the filtered was pipette out into a test tube and mixed with 2 ml of 0.1M FeCl<sub>3</sub> in 0.1 N HCL and 0.008 M potassium ferrocyanide. The absorbance was measured at 120 nm with in 10 mm.

### **Estimation of total phenols**

The fat free sample was boiled with 50 ml of ether for the extraction of the phenolic component for 15 min. Five ml of the extract was pipette out into a 50 ml flask, then 10 ml of distilled water was added. Two ml of NH<sub>4</sub>OH solution and 5 ml of concentrated amyl alcohol were also added. The samples were made up to mark and left to react for 30 min for colour development. This was read at 500nm.

### **Estimation of saponins**

Test extract were dissolved in 80% methanol, 2ml of Vanilin in ethanol was added, mixed well and the 2ml of 72% sulphuric acid solution was added, mixed well and heated on a water bath at 600 c for 10min and the absorbance was measured at 544nm against reagent blank.

### **Estimation of steroids**

One ml of test extract of steroid solution was transferred into 10 ml volumetric flasks. Sulphuric acid (4N, 2ml) and iron (III) chloride (0.5% w/v, 2 ml), were added, followed by potassium hexacyanoferrate (III) solution (0.5% w/v, 0.5 ml). The mixture was heated in a water-bath maintained at 70±20 C for 30 minutes with occasional shaking and diluted to the mark with distilled water. The absorbance was measured at 780 nm against the reagent blank.

### III. RESULTS AND DISCUSSION

The content of primary and secondary phytochemicals that the variation in the contents like alkaloids, flavonoids, phenol, carbohydrate and other constituents. These variations are due to number of environmental factors such as climate, altitude, rainfall etc. as mentioned (Kokate *et al.*, 2004). The phytochemical screening of flowers and flower buds are not been reported earlier although flower and flower buds of also help in abortion and leucorrhoea (Anba zhakan *et al.*, 2007).

In the present investigation suggested that the medicinal plants of *Acalypha indica* was alkaloids, flavonoids, saponins, terpenoids, and triterpenoids with aqueous extract in qualitatively investigated. In the plant of *Chloroxylon swietenia* was reducing sugar, saponins, steroids, terpenoids and triterpenoids represented in aqueous extract. In the plant *Cipadessa baccifera* has flavonoids, saponins, and triterpenoids recording in the same solvents. The medicinal plant of *Eupatorium odoratum* was alkaloids, flavonoids, phenols, reducing sugar, saponins, steroids, terpenoids, and triterpenoids represented from the aqueous extract whereas *Dodonaea viscosa* was saponins, terpenoids, and triterpenoids recording with respective plants. The plant *Glycosmis pentaphylla* was alkaloids, strongly flavonoids, saponins, steroids, terpenoids, and triterpenoids recorded. The *Mallotus philippensis* was alkaloids, flavonoids, saponins, terpenoids, and triterpenoids were represented from the plant. In the lord Siva plant of *Ocimum gratissimum* was only there compounds such as saponins, terpenoids, and triterpenoids, with aqueous solvent extracted and represented. The *Stachyarrheta jamaicensis* plant contain alkaloids, flavonoids, reducing sugar, saponins, terpenoids, and triterpenoids were analysed. In the case of saponins, steroids, terpenoids were estimated and some of the phytochemicals strongly represented. The plant *Vitex*

*trifolia* alkaloids, phenols, reducing sugar, saponins, and terpenoids was represented. (Table – 1).

The phytochemical analysis clearly indicated the presence of wide range of potential bioactive compounds in various polar solvents. The qualitative phytochemical analysis showed the presence of alkaloids, carbohydrate, cardiac glycosides, flavonoids, glycosides, phenols, phytosterol, saponin and tannin in appreciable amount by Saranya and Uma Gowrie (2016).

According to the hexane extract of qualitative phytochemical compounds from medicine plants of Kalrayan hills, Villupuram district were investigated. In the plant *Acalypha indica* was alkaloids, saponins, steroids, terpenoids and triterpenoids recorded respectively. whereas *Chloroxylon swietenia* was saponins, terpenoids and triterpenoids estimated with respective plants. The medicinal plant *Cipadessa baccifera* was flavonoids, saponins, steroids, terpenoids, and triterpenoids performed with methanolic extract respectively. The plant *Dodonaea viscosa* was flavonoids and steroid reported only selective phytochemical compounds recorded respectively. The methanolic extract of *Mallotus philippensis* has flavonoids, terpenoids, and triterpenoids estimated in qualitatively. whereas *Mukia madasapalana* also contain flavonoids, from extract of medicinal plants. The *Ocimum gratissimum* was alkaloids, flavonoids, saponins, steroids, and terpenoids represented respectively. The medicinal plant of *Stachyarrheta jamaicensis* was alkaloids flavonoids, saponins, terpenoids and triterpenoids analysed with respective solvents. In the case of *Solanum trilobatum* was alkaloids, flavonoids, reducing sugar, saponins, terpenoids and triterpenoids recorded respectively. whereas *Vitex trifolia* was alkaloids, saponins, and terpenoids recorded in qualitatively from the medicinal plants (Table – 2).



The phytochemical experiments may chemical constituents in the plant material, inducing their quantitative estimation and locating the origin of pharmacologically active chemical compound. Qualitative analysis of phytochemical compounds like saponins, tannins, flavonoids, terpenoids, phenols, coumarins, Di-terpenes, quinones, cardiac glycosides, quinones and phlobatannins were examined in the ethanolic extracts of flowers and leaves of *Hypericum perforatum* L. employing standard methodology were followed. In ethanolic extracts of flowers of *Hypericum perforatum* L. tested were positive. In ethanolic extracts of leaves of *Hypericum perforatum* L. The results found that most of the biologically active phytochemicals were presented in the ethanolic extracts of flowers and leaves of *Hypericum perforatum* L. Asgharian and Ojani S (2017).

Isolation and characterization of pharmacologically active compounds from medicinal plants continue today non-infectious ailments (Mukhtar et al., 2008). Many of the compounds exhibited potent biological activity extended to be present in plants at low concentration levels (Douglas kinghorn et al., 2011). Medicinal plants remain an important source of new drugs, new drug leads, and New Chemical Entities (NCEs) (Douglas kinghorn, 2005). This indicates the chemical potential of the extract to facilitate the process of chemical isolation ad supported by previous studies (Douglas kinghorn, 2005 and Muthaura et al., 2011). It has been reported that many medicinal plants are rich in flavonoids, tannins, and terpenoids (Lewis and Ausubel, 2006), (Swetha venpoosa et al., 2013), (Viajayalakshmi 2013), these secondary plant metabolites exert a wide range of biological activities on physiological systems (Olagunju et al., 2006). The results of preliminary phytochemical screening showed the presence of flavonoids, phenolic groups, steroids and terpenoids in all the extract of leaves and stem. Flavonoids are reported to possess antioxidant, antiproliferative, antitumor, antiinflammatory, proapoptotic activities with molecular targets have

been identified (Williams et al., 2004; Taylor and Grotewold, 2005). The health promoting effects of flavonoids may relate to interactions with key enzymes, signaling cascades involving cytokines and transcription factors, or antioxidant systems (Polya, 2003). Phenolic compounds have also been known as have shown medicinal activity as well as exhibiting physiological functions. It was reported that compounds such radical scavenging effects of most plants (Omale and Okafor, 2007). Due to the presence of these many compounds the extracts possess the medicinal potential to develop novel therapeutic agents.

The ethanolic extracted yield of *D. fortunei* rhizomes (9.31%) showed the highest value following by the yields of *B. pinnatum* whole plant (5.19%), *D. ovata* barks (4.38%) and *wallichii* barks (1.98%) successively Samell et al., (2018)

The aqueous extract of medicinal plants showed the presence of terpenoids in *Piper nigrum* leaves but it is not seen in the *Piper nigrum* roots. Tannins are only detected in *Carica papaya* leaves and it is not seen in *Carica papaya* roots. Quinones showed the best result in *Agave americana* root aq. extract. All the three medicinal plants have the presence of alkaloids in their aqueous root extract. Sugar, proteins, flavonoids are found in abundant amount and detected in all the three medicinal plants by Pallavi Singh et al.,(2018).

The analysis of quantitative phytochemical compounds from the medicinal plants with aqueous extract was performed The phytochemicals such as alkaloids, flavonoids, saponin, terpenoids and triterpenoids was 0.32, 0.42, 0.48, 0.58 and 0.64mg/ml recorded from the *Acalypha indica* plant *Chloroxylon swietenia* have the minimum yield of reducing sugar, saponins, steroids, terpenoids and triterpenoids estimated qualitatively. The *Cipadessa bacifora* was flavonoids, saponins and triterpenoids was 0.46, 0.69 and 0.80 mg/ml recorded respectively whereas *Eupatorium odoratum* results of quantitative analysis

of major groups of phytochemical constituents in the medicinal plants. The highest yield of alkaloids, flavonoids, phenols, reducing sugars, saponin, steroids, terpenoids and triterpenoids was 0.52, 0.54, 0.59, 0.64, 0.70, 0.74, 0.82 and 0.89 mg/ml estimated respectively.

*Eupatorium odoratum* as a good source of biological activities because of the presence of bioactive components. In the case of *Dodonaea viscosa* have saponins and terpenoids was 0.62 and 0.74 mg/ml. represented respectively.

The medicinal plants *Glycosins pentaphylla* contains five phytoconstituents such as alkaloids (0.26 mg/ml), flavonoids (0.37 mg/ml), saponins (0.54 mg/ml), terpenoids (0.68 mg/ml) and triterpenoids (0.74 mg/ml) represented respectively. The phytochemicals of *Mallotus philippensis* was alkaloids, flavonoids, saponins and terpenoids was 0.20, 0.32, 0.56 and 0.68 mg/ml recorded and *Mukia madaspalana* was 0.36, 0.48, 0.62, 0.69, 0.72 and 0.76 mg/ml with flavonoids, phenols, saponin, steroids, terpenoids and triterpenoids estimated respectively. The *Ocimum gratissimum* was saponins (0.58 mg/ml), terpenoids 0.57 mg/ml and triterpenoids (0.69 mg/ml) recorded respectively. The moderate amount of phytochemical like alkaloids (0.22mg/ml), flavonoids (0.29 mg/ml), reducing sugar (0.43 mg/ml), saponins (0.47 mg/ml), terpenoids (0.62 mg/ml) and triterpenoids (0.74 mg/ml) recorded from *Stachyarrhetaja maicensis* medicinal plants (Table 3 and Fig.1 and 2). whereas *Solanum trilobatum* was minimizing amount of phytoconstituents of alkaloids, flavonoids, saponins steroid and terpenoids was 0.27, 0.38, 0.64, 0.69 and

0.72 mg/ml recorded respectively. Finally *Vitex trifolia* was alkaloids (0.20 mg/ml), phenol (0.34 mg/ml) reducing sugar (0.46 mg/ml) saponins (0.54 mg/ml) and terpenoids (0.75 mg/ml) represented respectively.

#### IV.CONCLUSION

The concluded that the twelve medicinal plants are the source of the phytochemicals like alkaloids, flavonoids, saponin, terpenoid, steroids, triterpenoids, phlobatannins, and reducing sugars were represented medicinal plants play a vital role in preventing various diseases. The antidiuretic, anti inflammatory, antianalgesic, anticancer, antiviral, antimalarial, antibacterial, and antifungal activities of the medicinal plants are due to the presence of the above mentioned secondary metabolites. Medicinal plants are used for discovering and screening of the phytochemical constituents which are very helpful for the manufacturing of new drugs. The previous phytochemical analysis and present studied showed nearly the similar results due to the excellent quantity of presence of the phytochemical constituents recorded. The phytochemicals analysis of the medicinal plants are also important and have commercial interest in both research institutes and pharmaceuticals companies for the manufacturing of the new drugs for treatment of various diseases. Thus we hope that the important phytochemical properties identified by our study in the local plant of *Eupatorium odoratum* will be helpful in the coping different diseases of this particular region.

**Table 1:** Qualitative analysis of phytochemical compounds of medicinal plants with aqueous extract

Medicinal Plants	Phytochemical compounds							
	Alkaloids	Flavonoids	Phenols	Reducing sugar	Saponins	Steroids	Terpenoids	Triterpenoids
<i>Acalypha indica</i>	+	+	-	-	+	-	+	+
<i>Chloroxylon swietenia</i>	-	-	-	+	+	-	+	+

<i>Cipadessa baccifera</i>	-	+	-	-	+	-	-	+
<i>Eupatorium odoratum</i>	+	+	+	+	+	+	+	+
<i>Dodonaea viscosa</i>	-	-	-	-	+	-	+	-
<i>Glycosmis pentaphylla</i>	+	++	-	-	+	-	+	+
<i>Mallotus philippensis</i>	+	+	-	-	+	-	+	-
<i>Mukia madasapalana</i>	-	+	-	-	+	+	+	+
<i>Ocimum gratissimum</i>	-	-	-	-	+	-	+	+
<i>Stachyarrheta jamaicensis</i>	+	+	-	-	+	-	+	+
<i>Solanum trilobatum</i>	+	+	-	-	+	+	++	-
<i>Vitex trifolia</i>	+	-	-	-	+	-	+	-

+ - present. (-) - Absent

**Table 2 :** Analysis of qualitative phytochemical compounds of medicinal plants with hexane extract kalrayan hills, Villupuram district.

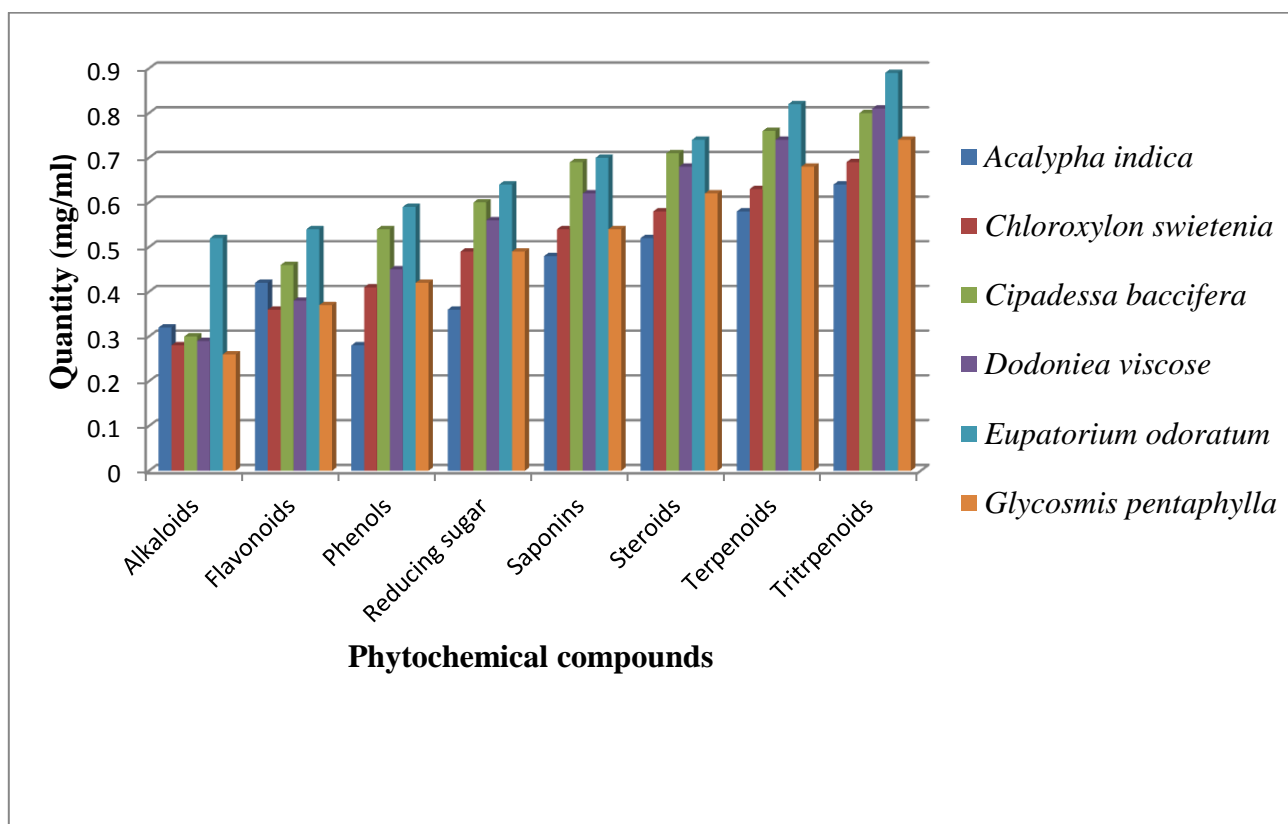
Medicinal Plants	Phytochemical compounds							
	Alkaloids	Flavonoids	Phenols	Reducing sugar	Saponins	Steroids	Terpenoids	Triterpenoids
<i>Acalypha indica</i>	+	-	-	-	+	+	+	+
<i>Chloroxylon swietenia</i>	-	-	-	-	+	-	+	-
<i>Cipadessa baccifera</i>	+	+	-	-	+	+	+	+
<i>Dodonaea viscosa</i>	-	+	-	-	-	+	-	-
<i>Eupatorium odoratum</i>	+	+	+	+	+	+	+	+
<i>Glycosmis pentaphylla</i>	-	+	-	-	+	+	+	+
<i>Mallotus philippensis</i>	+	+	-	-	-	-	+	+
<i>Mukia madasapalana</i>	-	+	-	-	-	-	+	+
<i>Ocimum gratissimum</i>	+	+	-	-	+	+	+	-
<i>Stachyarrheta jamaicensis</i>	+	+	-	-	+	-	+	+
<i>Solanum trilobatum</i>	+	+	-	+	+	-	+	+
<i>Vitex trifolia</i>	+	-	-	-	+	-	+	-

+ - present. (-) - Absent

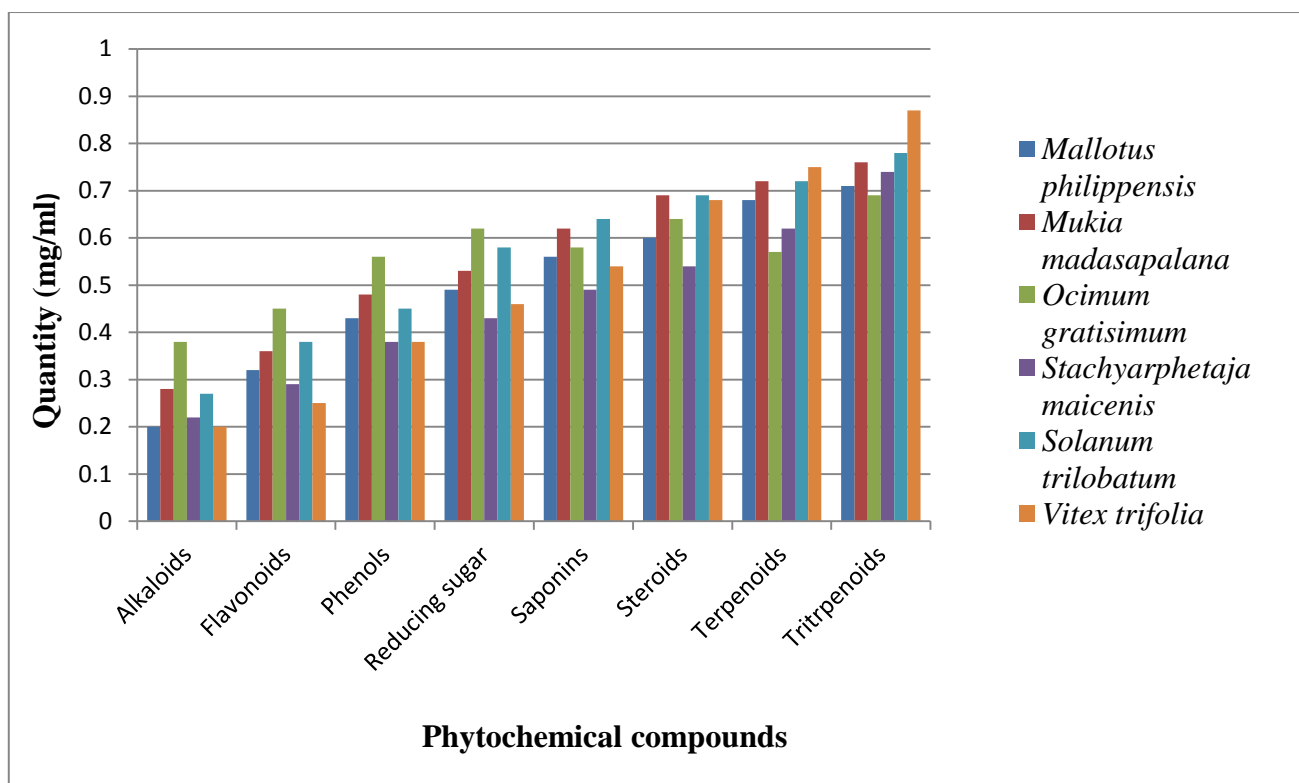
**Table 2:** Analysis of quantitative phytochemical compounds of medicinal plants with aqueous extract Kalrayan hills, Villupuram district

Medicinal plants	Phytochemical compounds(Quantity (mg / ml))							
	Alkaloids	Flavonoids	Phenols	Reducing sugar	Saponins	Steroids	Terpenoids	Tritrpenoids
<i>Acalypha indica</i>	0.32	0.42	-	-	0.48	-	0.58	0.64
<i>Chloroxylon swietenia</i>	-	-	-	0.49	0.54	-	0.63	0.69
<i>Cipadessa baccifera</i>	-	0.46	-	-	0.69	-	-	0.80
<i>Eupatorium odoratum</i>	0.52	0.54	0.59	0.64	0.70	0.74	0.82	0.89
<i>Dodoniea viscosa</i>	-	-	-	-	0.62	-	0.74	-
<i>Glycosmis pentaphylla</i>	0.26	0.37	-	-	0.54	-	0.68	0.74
<i>Mallotus philippensis</i>	0.20	0.32	-	-	0.56	-	0.68	-
<i>Mukia madasapalana</i>	-	0.36	0.48	-	0.62	0.69	0.72	0.76
<i>Ocimum gratissimum</i>	-	-	-	-	0.58	-	0.57	0.69
<i>Stachyarphe taja maicensis</i>	0.22	0.29	-	0.43	0.49	-	0.62	0.74
<i>Solanum trilobatum</i>	0.27	0.38	-	-	0.64	0.69	0.72	-
<i>Vitex trifolia</i>	0.20	-	0.38	0.46	0.54	-	0.75	-

**Fig 1:** Quantitative analysis of phytochemical compounds of medicinal plants with aqueous extract



**Fig 2:** Quantitative analysis of phytochemical compounds of medicinal plants with aqueous extract



## V. REFERENCES

- [1]. Anbazhakan, S., R. Dhandapani., P. Anandhakumar and Balu, S. (2007). Traditional medicinal knowledge on *Moringa concanensis* Nimmo of perambalur District, Tamilnadu, Anc sci. of life, 24(4): 42 – 45.
- [2]. Asgharian AM, and Ojani S (2017) Invitro Antioxidant activity and phytochemical screening of flowers and leaves of *Hypericum perforatum* L. ethanolic extracts from Tonekabon-Iran. J Phytochemistry Biochem 1: 102.
- [3]. Douglas A, Kinghorn L, Pan JN. Fletcherand H. and Chai, R (2011). the Relevance of Higher Plants in Lead Compound Discovery Programs. J Nat. Prod,
- [4]. Feroz, M., R, Ahmad, S.T.A.K. Sindhu and. Shahbaz, A.M (1993). Antifungal activities of saponin from indigenous plant roots. Pak. Vet.J., 13:44.
- [5]. Herouart D, Sangwan RS, Fliniaux MA, and Sangwan Norreel BS (1988). Variations in the Leaf Alkaloids Content of Androgenic Diploid plants of *Datura innoxia* Planta Med 54: 14 – 17.
- [6]. Harborne JB. (1973), A guide to modern technique of plant analysis.London: Chapman and Hill; Phytochemical methods; p. 279.
- [7]. Kokate, C.K., Purohit , A.P., and Gokhale, S.B (2004). Practical pharmacognosy , 2nd edition. Vallabh Prakashan, New Delhi, 466 – 470.
- [8]. Kappers IF, Aharoni A, Herpen TW, Luckerhoff LL, Dicke M, (2005). Genetic engineering of terpenoid metabolism attracts bodyguards to *Arabidopsis*, Science 309: 2070 – 2072.

- [9]. Krishnaiah D, Devi T, Bono A, and Sarbatly R (2009). Studies on phytochemical constituents of six Malaysian medicinal plants. *J. Med. Plants Res.*, 3(2): 67-72.
- [10]. Lewis K, Ausubel FM.( 2006) Prospects for plant-derived antibacterials. *Nat. Biotech.* 24(12):1504-1507.
- [11]. Mahato SB, Sen S(1997). Advances in triterpenoid research, 1990 – 1994. *Phytochemistry* 44: 1185 – 1236.
- [12]. Muthaura CN, Keriko JM, Derese S, Yenesew A, Rukunga GM. (2011). Investigation of some medicinal plants traditionally used for treatment of malaria in Kenya as potential sources of antimalarial drugs. *Experimental Parasitology*; 127:609-626.
- [13]. Mukhtar M, Arshad M, Ahmad M, Pomerantz RJ, Brian Wigdahl B, Parveen Z.(2008). Antiviral potentials of medicinal plants. *Virus Research*; 131:111-120.
- [14]. Nostro A, Germano MP, D`angelo V, Marino A, Cannatelli MA (2000). Extraction methods and bioautography for evaluation of medicinal plant antimicrobial activity. *Let Appl Microbiol* 30: 379 – 384.
- [15]. Olagunju JA, Fagbohunka BS, Oyedapo OO, Abdul AIA. (2006) Effects of an ethanolic root extract of *Plumbago zeylanica* Linn. on some serum parameters of the rats. *RPMP-Drug Dev. Mol.*, 11:268-276.
- [16]. Omale J, Okafor PN. (2007) Comparative antioxidant capacity, membrane stabilization, polyphenol composition and cytotoxicity of the leaf and stem of *Cissus multistriata*. *Afr. J. Biotechnol.* 7(17):3129-3133.
- [17]. Polya GM., (2003) *Biochemical Targets of Plant Bioactive Compounds: A Pharmacological reference guide to sites of action and biological effects.* Taylor & Francis, London. New York, 4(3) 45-56.
- [18]. Pallavi Singh, Nainika Tanwar, Trisha Saha, Aishwarya Gupta and Sargam Verma (2018) Phytochemical Screening and Analysis of *Carica papaya*, *Agave americana* and *Piper nigrum* *Int.J.Curr.Microbiol.App.Sci* 7(2) 1786-1794
- [19]. Sofowara A, (1993). *Medicinal plants and traditional medicine is africa spectrum books ltd., Ibadan, Nigeria, 289- 295.*
- [20]. Swetha venpoosa, Devareddy Sandeep, Sumathi K, Senthil kumar .( 2013) Phytochemical and antimicrobial evaluations of *Dichrostachys cinerea*. *International research journal of pharmacy*, 4(1):107-111.
- [21]. Samell K, Sonita L, Chanseiha N, Sokhany L, Kosalvorlak C, et al. (2018) Phytochemical Analysis and Antioxidant Property of Selected Medicinal Plants Native to Cambodia. *Drug Des Int Prop Int J* 1(2)-
- [22]. Saranya, V.T.K. and Uma Gowrie, S. (2016) Study on phytochemical screening from cladode extracts of *Casuarina equisetifolia*. L., using various polar solvents *International Journal of Information Research and Review* 03, (3), 2087-2090
- [23]. Trease GE and Evans WC, (1989); *Pharmacognosy*”, 11th ed., Brailliar Tiridel can, Macmillian Publishers, 10 (2): 108–15.
- [24]. Viajayalakshmi M. (2013) Pharmacognostical Standardization and Phytochemical Analysis of Leaves of *Dichrostachys cinerea*, Arn *International Journal of Pharmacognosy and Phytochemical Research.* 5(3):232-235.
- [25]. Williams RJ, Spencer JPE, and Rice-Evans C. (2004) Flavonoids: antioxidants or signalling molecules. *Free Radic. Biol. Med.*, 36:838-849.

# Seismic Analysis and Design of INTZ Water Tank by Using Staadpro

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### ABSTRACT

Water tank is used extensively for storage water, inflammable liquids, and other chemicals. The current analysis and design of supporting structures of elevated water tanks are extremely vulnerable under lateral forces due to wind and an earthquake, By past provided illustration when a great many water tank staging's suffered damage and a few collapses. The aim of this paper is to understand the behaviour of Elevated Water Tank with the framed staging in lateral earthquake loading using Indian code guidelines by using Staad Pro. By using Rapid Assessment of Seismic Safety of Elevated Water Tank gives the optimum value of Base Shear and Base Moment and hence it is economical. The design based on above gives the most economical section and also it is safe.

**Keywords :** Elevated Water Tank, Intz Water Tank, Siesmic Analysis, Earthquake, Shear, Moment

### I. INTRODUCTION

For storage of large quantities of liquids like water, oil, petroleum, acid and sometime gases also, containers or tanks are required. These structures are made of masonry, steel, reinforced concrete and pre stressed concrete. Out of these, masonry and steel tanks are used for smaller capacities. The cost of steel tanks is high and hence they are rarely used for water storages. Reinforced concrete tanks are very popular because, besides the construction and design being simple, they are cheap, monolithic in nature and can be made leak proof. Generally no cracks are allowed to take place in any part of the structure of Liquid Retaining R-C.C. tanks and they are made water tight by using richer mix (not less than M 30) of concrete. In addition sometimes water proofing materials also are used to make tanks water tight.

1. To make a study about the analysis and design of water tanks.
2. To make a study about the guidelines for the design of liquid retaining structure according to IS Code.
3. To know about the design philosophy for the safe and economical design of water tank.
4. To develop programs for the design of water tank of flexible base and rigid base and the underground tank to avoid the tedious calculation
5. In the end, the programs are validated with the results of manual calculation given in concrete Structure.

### 1.2 WATER QUANTITY ESTIMATION:

The quantity of water required for municipal uses for which the water supply scheme has to be designed requires following data:

### II. METHODS AND MATERIAL

#### 1.1 OBJECTIVES

Water consumption rate (Per Capita Demand in liters per day per head) Population to be served.

Quantity= Per Capita demand x Population

Water Consumption for Various Purposes Table (1.1)

Types of Consumption	Normal Range(lit/capita/day)	Average	%
Domestic Consumption demand	65-300	160	35
Industrial and Commercial demand	45-450	135	30
Public including Fire Demand	20-90	45	10
Losses and Waste	45-150	62	25

the ground. The wall of these tanks is subjected to water pressure from inside and the base is subjected to weight of water from inside and soil reaction from underneath the base. The tank may be open at top or roofed. Ground water tank is made of lined carbon steel, it may receive water from water well or from surface water allowing a large volume of water to be placed in inventory and used during peak demand cycles



Fig: Tank resting on the ground

**1.3 POPULATION FORECASTING METHODS:**

The various methods adopted for estimating future populations are given below. The particular method to be adopted for a particular case or for a particular city depends largely on the factors discussed in the methods, and the selection is left to the discretion and intelligence of the designer.

1. Incremental Increase Method
2. Decreasing Rate of Growth Method
3. Simple Graphical Method
4. Comparative Graphical Method
5. Ratio Method
6. Logistic Curve Method
7. Arithmetic Increase
8. Geometric Increase Method

**1.4 CLASSIFICATION OF R.C.C. TANKS:**

In general they are classified in three categories depending on the situation.

1. Tanks resting on ground.
2. Tanks above ground level (Elevated tanks).
3. Underground tanks.

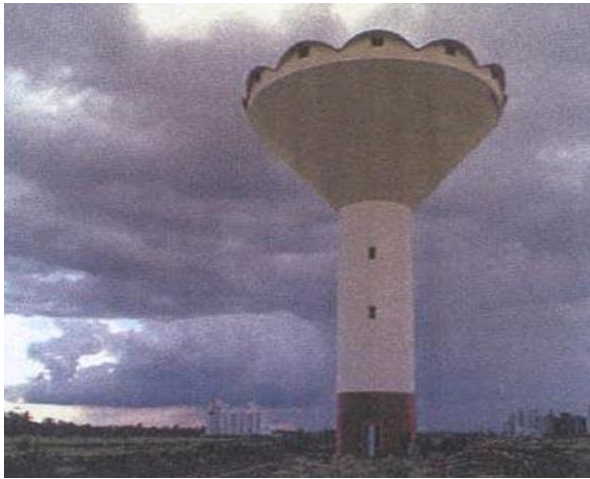
**1.4.1 TANKS RESTING ON GROUND:**

These are used for clear water reservoirs, settling tanks, aeration tanks etc. These tanks directly rest on

**1.4.2 ELEVATED TANKS:**

These tanks are supported on staging which may consist of masonry walls, R.C.C tower or R.C.C. column braced together- The walls are subjected to water pressure from inside. The base is subjected to weight of water, wt. of walls and wt. roof. The staging has to carry load of entire tank with water and is also subjected to wind loads. Water tank parameters include the general design of the tank, choice of materials of construction, as well as the following. Location of the water tank (indoors, outdoors, above ground or underground) determines color and construction characteristics. Volume of water tank will need to hold to meet design requirements.





**Fig: Elevated tank**

#### 1.4.3 UNDER GROUND TANKS:

These tanks are built below the ground level such as clarifiers filters in water treatment plants, and septic tanks .The walls of these tanks are subjected to water pressure from inside and earth pressure from outside. The design principles of underground tanks are same as for tanks resting on the ground. The walls of the underground tanks are subjected to internal water pressure and outside earth pressure. The section of wall is designed for water pressure and earth pressure acting separately as well as acting simultaneously. Whenever there is possibility of water table to rise, soil becomes saturated and earth



**Fig: Underground Tank**

### III. INTZ TANKS

This is a special type of elevated tank used for very large capacities. Circular tanks for very large

capacities prove to be uneconomical when flat bottom slab is provide.

Intz type tank consist of top dome supported on a ring beam which rests on a cylindrical wall .The walls are supported on ring beam and conical slab. Bottom dome will also be provided which is also supported by ring beam. The conical and bottom dome are made in such a manner that the horizontal thrust from conical base is balanced by that from the bottom dome. The conical and bottom domes are supported on a circular beam which is in turn, supported on a number of columns. For large capacities the tank is divided into two compartments by means of partition walls supported on a circular beam.



**Fig: Intz type water tank**

#### 2.1 PROVISIONS OF INDIAN CODE:

Indian Standard IS: 1893-1984 provides guidelines for earthquake resistant design of several types of structures including liquid storage tanks. This standard is under revision and in the revised form it has been divided into five parts. First part IS 1893 (Part 1): 2002; which deals with general guidelines and provisions for buildings has already been published. Second part, yet to be published, will deal with the provisions for liquid storage tanks. In this section, provisions of IS: 1893-1984 for buildings and tanks are reviewed briefly followed by an outline of the changes made in IS 1893 (Part 1): 2002.

In IS: 1893-1984, Base Shear for building is given by  $V = C_s W$ , where,  $C_s$  is the Base Shear

Coefficient given by

$$C_s = K C \beta I \alpha_o.$$

Here,

$K$  = Performance factor depending on the structural framing system and brittleness or ductility of construction;

$C$  = Coefficient defining flexibility of structure depending on natural period  $T$ ;

$\beta$  = Coefficient depending upon the soil-foundation system;  $I$  = Importance factor;

$\alpha_o$  = Basic Seismic Coefficient depending on Zone.

For buildings with moment resisting frames,  $K = 1.0$ .

Importance factor, for buildings is usually  $I = 1.0$ .

IS: 1893-1984; does not have any provision for ground-supported tanks. It has provisions for elevated tanks, for which it does not consider Convective Mode.

Base Shear for elevated tank is given by  $V = C_s W$ , where, Base Shear Coefficient,  $C_s$  is given by

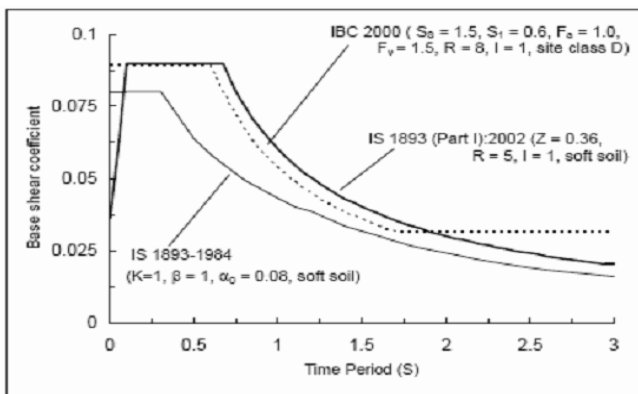
$$C_s = \beta I F_o (S_a/g)$$

Here,

$S_a/g$  = Average Acceleration Coefficient corresponding to the time period of the tank, obtained from acceleration spectra given in the code;

$F_o$  = Seismic Zone Factor;

$W$  = Weight of container along with its content and one-third weight of supporting structure.



Comparison of BSC of Building obtained from IS Codes & IBC 2000

#### IV. ANALYSIS AND RESPONSE

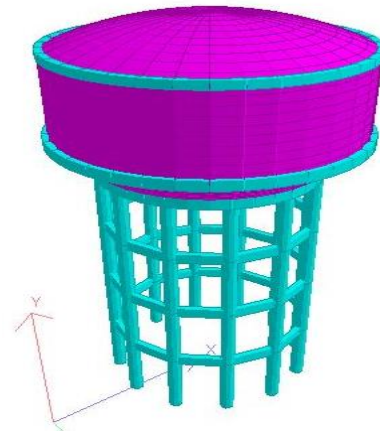


Fig: 3d Model

#### CENTER OF GRAVITY OF EMPTY CONTAINER

Components of empty container are: top dome, top ring beam, cylindrical wall, bottom ring beam, bottom dome, conical dome and circular ring beam. Height of CG of empty container above top of circular ring beam,

$$= [(209.3 \times 7.22) + (52.1 \times 5.9) + (552.9 \times 3.8) + (107.2 \times 1.65) + (321.3 \times 1) + (185.6 \times 0.92) - (148 \times 0.3)] / 1,576 = 2.88 \text{ m}$$

Height of CG of empty container from top of footing,  $h_{CG} = 16.3 + 2.88 = 19.18 \text{ m}$ .

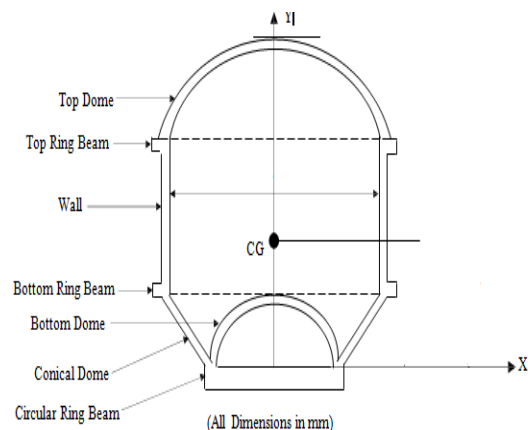


Fig: Parts of tank

## V. DESIGN CONCEPT

### MODELLING:

Creation of nodes.

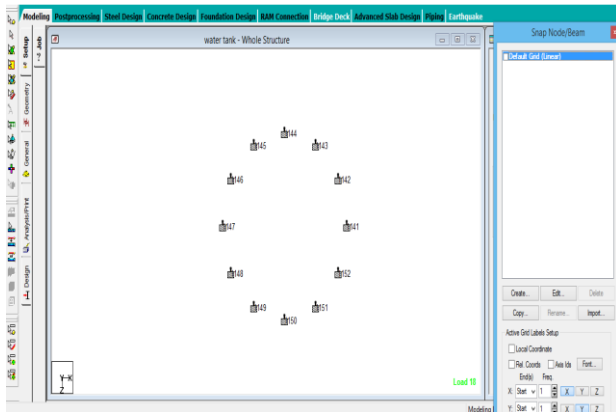


Fig: Nodes

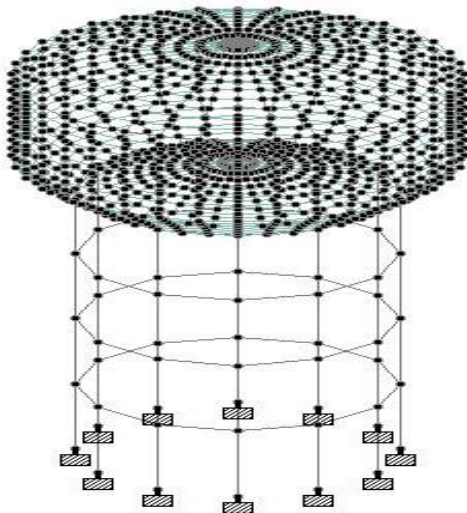


Fig: Model with nodes

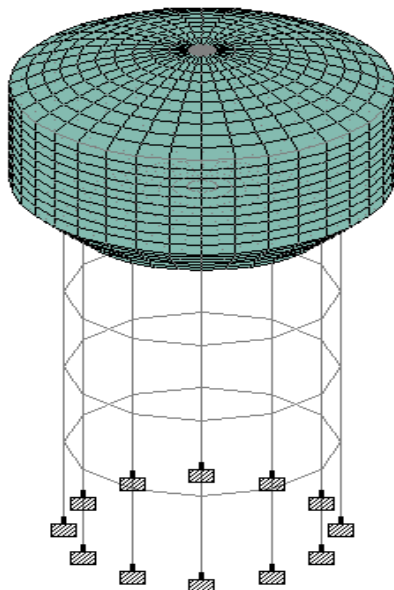


Fig: Model with beams & Plates.

In water retaining structure a dense impermeable concrete is required therefore, proportion of fine and course aggregates to cement should be such as to give high quality concrete. Concrete mix weaker than M20 is not used. The minimum quantity of cement in the concrete mix shall be not less than 30 kN/m<sup>3</sup>. The design of the concrete mix shall be such that the resultant concrete issue efficiently impervious. Efficient compaction preferably by vibration is essential. The permeability of the thoroughly compacted concrete is dependent on water cement ratio. Increase in water cement ratio increases permeability, while concrete with low water cement ratio is difficult to compact. Other causes of leakage in concrete are defects such as segregation and honey combing. All joints should be made water-tight as these are potential sources of leakage. Design of liquid retaining structure is different from ordinary R.C.C. structures as it requires that concrete should not crack and hence tensile stresses in concrete should be within permissible limits. A reinforced concrete member of liquid retaining structure is designed on the usual principles ignoring tensile resistance of concrete in bending. 1. For calculation purposes the cover is also taken into concrete area. Cracking may be caused due to restraint to shrinkage, expansion and contraction of concrete due to temperature or shrinkage and swelling due to moisture effects. Such restraint may be caused by

- (i) The interaction between reinforcement and concrete during shrinkage due to drying.
- (ii) The boundary conditions.
- (iii) The differential conditions prevailing through the large thickness of massive concrete

Use of small size bars placed properly, leads to closer cracks but of smaller width. The risk of cracking due to temperature and shrinkage effects may be minimized by limiting the changes in moisture content and temperature to which the structure as a

whole is subjected. The risk of cracking can also be minimized by reducing the restraint on the free expansion of the structure with long walls or slab founded at or below ground level, restraint can be minimized by the provision of a sliding layer.

## FLOORS

### (i) Provision of movement joints.

Movement joints should be provided as discussed in article 3.

### (ii) Floors of tanks resting on ground.

If the tank is resting directly over ground, floor may be constructed of concrete with nominal percentage of reinforcement provided that it is certain that the ground will carry the load without appreciable subsidence in any part and that the concrete floor is cast in panels with sides not more than 4.5m. with contraction or expansion joints between.

### (iii) Floor of tanks resting on supports.

(a) If the tank is supported on walls or other similar supports the floor slab shall be designed as floor in buildings for bending moments due to water load and self weight

(b) When the floor is rigidly connected to the walls (as is generally the case) the bending moments at the junction between the walls and floors shall be taken into account in the design of floor together with any direct forces transferred to the floor from the walls or from the floor to the wall due to suspension of the floor from the wall.

(c) In continuous T-beams and L-beams with ribs on the side remote from the liquid, the tension in concrete on the liquid side at the face of the supports shall not exceed the permissible stresses for controlling cracks in concrete. The width of the slab shall be determined in usual manner for calculation of the resistance to cracking of T-beam, L- beam sections at supports.

(d) The floor slab may be suitably tied to the walls by rods properly embedded in both the slab and the walls. In such cases no separate beam (curved or

straight) is necessary under the wall, provided the wall of the tank itself is designed to act as a beam over the supports under it.

## WALLS

### (i) Provision of joints:

(a) Where it is desired to allow the walls to expand or contract separately from the floor, or to prevent moments at the base of the wall owing to fixity to the floor, sliding joints may be employed.

(b) The spacing of vertical movement joints should be as discussed in article 3.3 while the majority of these joints may be of the partial or complete contraction type, sufficient joints of the expansion type should be provided to satisfy the requirements given in article

### (ii) Pressure on Walls:

(a) In liquid retaining structures with fixed or floating covers the gas pressure developed above liquid surface shall be added to the liquid pressure.

(b) When the wall of liquid retaining structure is built in ground, or has earth embanked against it, the effect of earth pressure shall be taken into account.

### (iii) Walls or Tanks Rectangular or Polygonal in Plan.

While designing the walls of rectangular or polygonal concrete tanks, the following points should be borne in mind.

In plane walls, the liquid pressure is resisted by both vertical and horizontal bending moments. An estimate should be made of the proportion of the pressure resisted by bending moments in the vertical and horizontal planes.

## DOMES:

A dome may be defined as a thin shell generated by the revolution of a regular curve about one of its axes. The shape of the dome depends on the type of the curve and the direction of the axis of revolution. In spherical and conoidal domes, surface is

described by revolving an arc of a circle. The centre of the circle may be on the axis of rotation (spherical dome) or outside the axis (conoidal dome). Both types may or may not have a symmetrical lantern opening through the top. The edge of the shell around its base is usually provided with edge member cast integrally with the shell.

#### **Design of Reinforced Concrete Domes:**

The requirements of thickness of dome and reinforcement from the point of view of induced stresses are usually very small. However, a minimum of 80 mm is provided so as to accommodate two layers of steel with adequate cover. Similarly a minimum of steel provided is 0.15% of the sectional area in each direction along the meridians as well as along the latitudes. This reinforcement will be in addition to the requirements for hoop tensile. The reinforcement is provided in the middle of the thickness of the dome shell. Near the edges usually some ring beam is provided for taking the horizontal component of the meridian stress.

### **VI. OVERHEAD WATER TANKS AND TOWERS**

Overhead water tanks of various shapes can be used as service reservoirs, as a balancing tank in water supply schemes and for replenishing the tanks for various purposes. Reinforced concrete water towers have distinct advantages as they are not affected by climatic changes, are leak proof, provide greater rigidity and are adoptable for all shape. Components of a water tower consists of-

(a) Tank portion with : Roof and roof beams

- (1) sidewalls
- (2) Floor or bottom slab
- (3) Columns
- (4) Bracings
- (5) Foundation

### **VII. CONCLUSION**

Storage of water in the form of tanks for drinking and washing purposes, swimming pools for exercise and enjoyment. Design of water tank is a very tedious method. Without power also we can consume water by gravitational force. Intz water tank is designed for seismic loads.

### **VIII. REFERENCES**

1. Rai Durgesh C; "Performance of Elevated Tanks in Bhuj Earthquake"; Proc. Indian Acad. Sci. (Earth Planet Sci.), 112, No. 3, September 2003.pp 421-429.
2. Jaiswal O. R., Rai Durgesh C and Jain Sudhir K; "Review of Code Provisions on Design Seismic Forces for Liquid Storage Tanks"; Document No.: IITK-GSDMA-EQ01-V1.0, Final Report: A - Earthquake Codes, IITK GSDMA Project on Building Codes.
3. Indian Institute of Technology Kanpur, IITK GSDMA Guidelines for Seismic Design of Liquid Storage Tanks, August 2005.
4. IS 1893:1984, criteria for earthquake resistant design of structures
5. IS 875:1987, Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 3: Wind Loads
6. Vazirani & Ratwani, "Concrete Structures", Khanna Publishers, Year of Publication 1996

# BOD, COD AND DO LOAD OF ASE CREEK, SOUTH-SOUTH NIGERIA

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## ABSTRACT

Water is an inorganic solvent and covers about 70% of the earth's surface. Quality and quantity of water are affected by an increase in anthropogenic activities and any pollution either physical or chemical which causes change to the quality of the receiving water body. Water samples were collected at three locations along Ase creek and analyzed for temperature, pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) using standard methods. Results obtained ranged as follows: 26 - 28 °C for temperature; 6.48 - 6.75 for pH; 6.50 - 8.50 mg/l for DO; 0.50 - 1.50mg/l for BOD; 1.50 -2.50mg/l for COD. The pH values for the water samples were slightly acidic. The BOD/COD ratios for all the sampling points were less than 1 indicating that the water samples have a biodegradable nature. The results obtained were within WHO permissible limit for drinking water except DO. There is thus the need to examine periodically water quality parameters of water bodies prior to use in order to ensure that they are free from organic and other pollutants. This in the long run will help to promote a healthy condition needed for sustainable development.

Keywords: Water, potable, BOD, COD, DO, Samples, locations

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## I. INTRODUCTION

Water is an inorganic solvent covering about 70% of the earth's surface (Egba and Okoye, 2008). Water availability determines the location and activities of man in a given area causing a great demand on natural fresh water resources (Waziri and Ogugbuaja, 2010). Water is one of the most essential needs for the continued existence of all living organisms on earth (Oladipo et al., 2009). The day-to-day activities of all living organisms required water in whatever form. Water is one of the most important, as well as one of the most abundant substances and it is particularly vital to living organisms (Tortora et al., 2002).

Rivers are among the basic water resources that ensures a remarkable economic value (Gunasekar and Isaac, 2015). Quality and quantity of water are

affected by an increase in anthropogenic activities and any pollution either physical or chemical which causes change to the quality of the receiving water body (Aremu et al., 2011). These changes may include: increased dissolved nutrients which may result in eutrophication, changes in stream temperature and bottom characteristics which leads to habitat destruction and alteration of species diversity and the addition of toxic substances which have either acute or chronic effects on organisms (Egborge, 1991; Aremu and Inajoh, 2007). The anticipated consequence of unregulated waste discharge into water bodies has elicited several studies on aquatic ecosystems (Chindah, 1998; Atolaiye and Aremu, 2007).

Biochemical oxygen demand (BOD) is a standard test carried out to assay the concentration of oxygen-demanding microbes to degrade organic matter over a given time period, usually five days (Samudro and

Mangkoedihardjo, 2010). It is the amount of oxygen required by bacteria for the breaking down of decomposable organic matter present in any water, waste water or treated effluent to simpler substances (Ademoroti, 1996). Chemical oxygen demand (COD) is a standard test carried out for water to consume oxygen during the degradation of organic matter and inorganic chemicals like ammonia and nitrite in the form of potassium dichromate (Samudro and Mangkoedihardjo, 2010). COD is a measure of the amount of oxygen required for complete oxidation carbon (IV) oxide and water of organic matter present in a sample of water, wastewater or effluent (Ademoroti, 1996). This present study was carried out to determine the DO, BOD and COD load of Ase creek, South-South, Nigeria.

## II. METHODS AND MATERIAL

### Study Area

The study was conducted in Ase creek, South-South, Nigeria. Three locations; Ashaka, Ndokwa East Local Government Area and Osemele and Kwale both in Ndokwa West Local Government Areas of Delta State, South-South, Nigeria situated along the creek were selected for this study. The people depends on the

creek as a source of drinking water, bathing, fishing, sand for building and other domestic uses.

### Sample Collection and Preparation

Water samples were collected from Ase creek on the 16<sup>th</sup> day of July, 2017 from three sampling locations (Ashaka, Osemele and Kwale) where human activities were high. At each sampling location, composite surface water samples were collected using a 1-liter plastic container, which have been rinsed with distilled water and taken to the laboratory for analysis.

### Methods

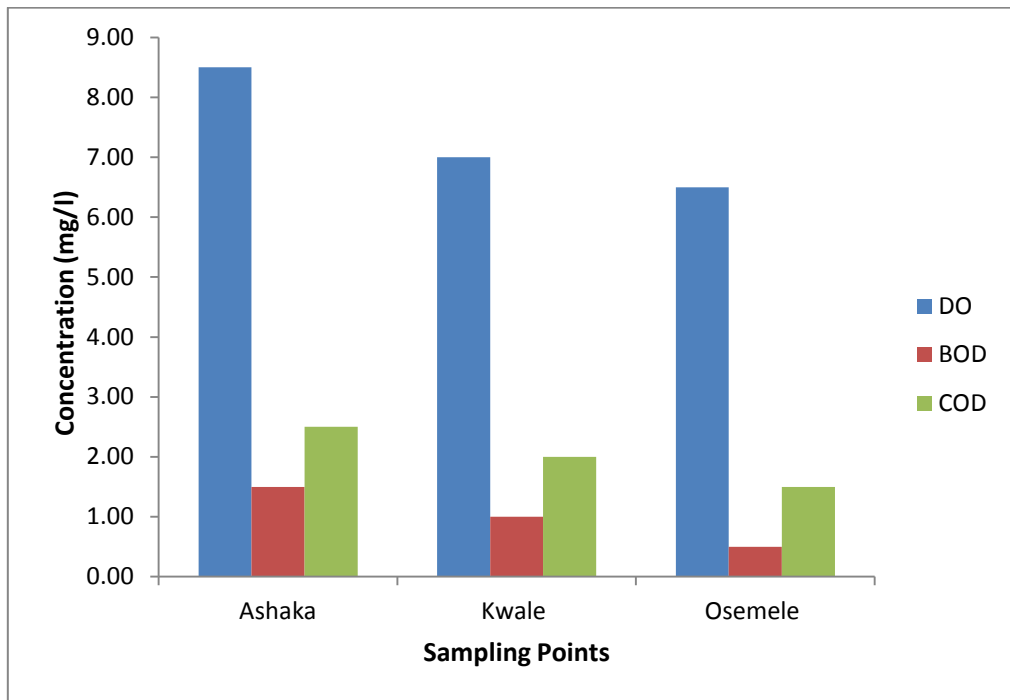
Temperature, pH, DO, BOD and COD, were analyzed in the laboratory by following standard methods prescribed by APHA (1998). All the water samples were analyzed 3 times. Results obtained were expressed as mean  $\pm$  SD

## III. RESULTS AND DISCUSSION

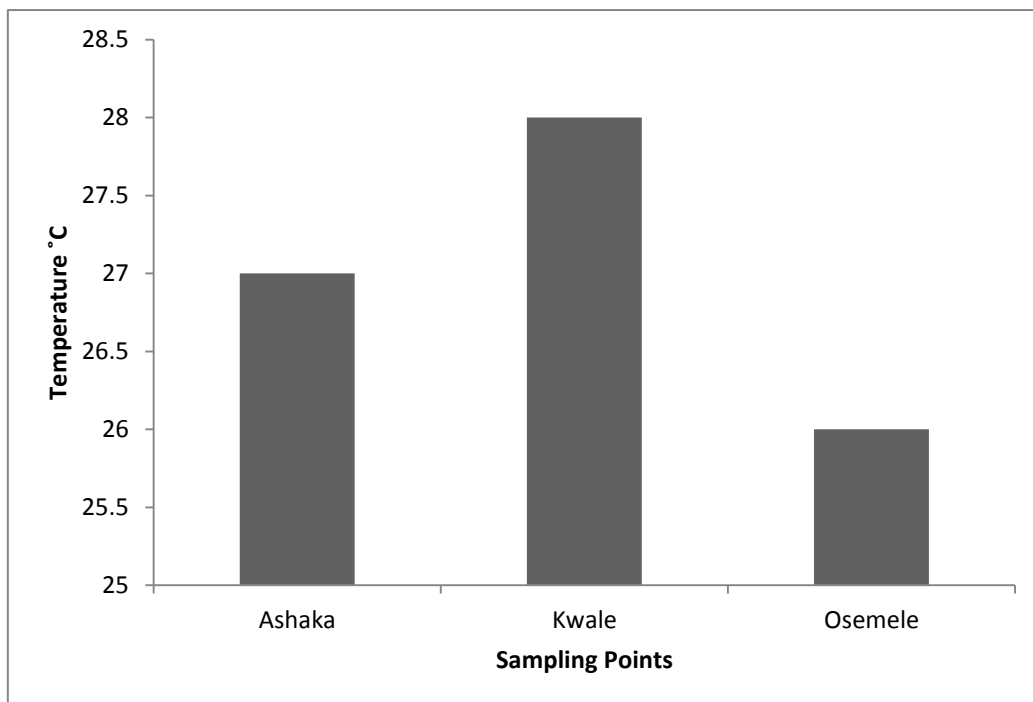
The results of the physiochemical parameters determined and the WHO standards for potable water are presented in table 1 and figure 1-3. The water samples from all the sampling points were tasteless and odourless.

**Table 1:** Showing Analytical Result of Physicochemical Parameters of Ase Creek.

Parameter	Results obtained				
	Ashaka	Kwale	Osemele	Mean	WHO Standard
Temperature	27.00 $\pm$ 0.10	28.00 $\pm$ 0.17	26.00 $\pm$ 0.00	27.00 $\pm$ 1.00	30-35°C
P <sup>H</sup>	6.88 $\pm$ 0.01	6.75 $\pm$ 0.05	6.48 $\pm$ 0.02	6.70 $\pm$ 0.20	6.5 – 8.5
DO (mg/l)	8.50 $\pm$ 0.10	7.00 $\pm$ 0.00	6.50 $\pm$ 0.01	7.33 $\pm$ 1.04	5.00
BOD (mg/l)	1.50 $\pm$ 0.10	1.00 $\pm$ 0.05	0.50 $\pm$ 0.05	1.00 $\pm$ 0.50	5.00
COD (mg/l)	2.50 $\pm$ 0.05	2.00 $\pm$ 0.17	1.50 $\pm$ 0.00	2.00 $\pm$ 0.50	10.00
BOD/COD Ratio	0.60	0.50	0.33	0.48	



*Fig 1: DO, BOD and COD profile for three locations along Ase Creek, South-South Nigeria*



*Fig 2: Temperature profile for three locations along Ase Creek, South-South Nigeria*



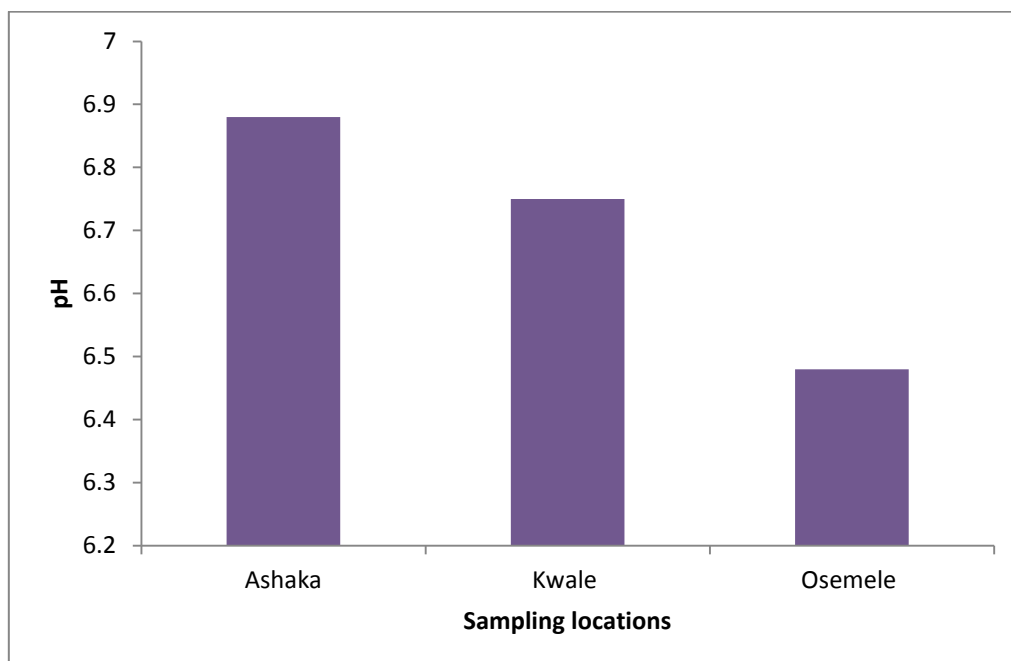


Fig 3: pH profile for three locations along Ase Creek, South-South Nigeria

## DISCUSSION

The temperature ranged from 26°C - 28°C with a mean value of 27.00±1.00°C. The temperature variation of water sample depends on the season, sampling time, and the temperature of the effluents discharged into the river (Jeyaraman *et al.*, 2003). The temperature recorded in this study was within the permissible limits of WHO (2008) for drinking water.

The pH of the Ase creek water samples ranged from 6.48 – 6.75 with an average value of 6.70±0.20. The results obtained were slightly acidic. The result was within the range of 6.2 – 8.27 reported by Gunasekar and Isaac, (2015) for River Sone, India. The pH result was also within WHO (2008) permissible range of 6.5 – 8.5 for drinking water. The pH of a water body is very important in the determination of water quality since it affects other chemical reaction such as solubility and metal toxicity.

The DO of the water samples ranged between 6.50 and 8.50 mg/l with a mean value of 7.33±1.04 mg/l (Table 1). The result was higher than the 0.76 and 4.85 mg/l range reported by Gunasekar and Isaac,

(2015) for River Sone, India. Dissolved oxygen (DO) is very important for the survival of aquatic organisms and it is also used to evaluate the degree of freshness of river water (Fakayode, 2005). The dissolved oxygen was high above the 5mg/l permissible guidelines level for drinking water stipulated by WHO (2008).

BOD result ranged from 0.50 - 1.50mg/l with an average value of 1.00±0.5mg/l (Table 1). The result was lower than the 5.00mg/l value stipulated by WHO (2008). The result varied slightly within the result range of 1.69 - 274.01mg/l reported by Gunasekar and Isaac, (2015) for Sone River. The result was also at variance with the 95 - 180 mg/l range reported by Sikder *et al.*, 2013 for Buriganga River, Bangladash. The low BOD recorded in this study is an indication of lower biological activity in the river (Mugdha *et al.*, 2012).

COD result ranged from 1.50 - 2.50mg/l with a mean value of 2.00±0.5mg/l (Table 1). The result was lower than the 10.00mg/l set by WHO (2008) for drinking water. The COD result was within the 1.48 – 198.43 range reported by Gunasekar and Isaac, (2015) for Sone River. However, COD result was very much

lower than the range of 95 - 180 mg/l reported by Sikder *et al.*, (2013) for Buriganga River, Bangladash.

The BOD/COD ratio for the three locations was 0.60, 0.50 and 0.33 with a mean value of 0.48 as shown in Table 1. The BOD/COD ratios were all less than 1 indicating that the water samples have a biodegradable nature. This agrees with the finding of other researchers (Lee and Nikraz, 2015; Magadam *et al.*, 2017), The BOD/COD ratio is an indicator for the outcome effect of organic matter containing materials (mainly water, wastewater, etc.) in environmental components of natural and man-made environment (Samudro and Mangkoedihardjo, 2010).

#### IV.CONCLUSION

The importance of water quality criteria cannot be over emphasized. The result obtained show that the water samples from the sampling locations along Ase creek, South-South, Nigeria meet up with permissible guidelines level for drinking water stipulated by WHO (2008) except DO result. There was no serious impact on the parameters analyzed for in the water samples except for the slight acidity (pH) and DO recorded. Water quality test if properly carried out would eradicate if not eliminate completely some forms of epidemics such as cholera, typhoid among others associated with water pollution.

#### V. RECOMMENDATION

A yearly analysis of water samples for detailed pollution survey on water body should be carried out to ascertain the pollution status arising from waste water effluent and exploration activities on Ase creek, South-South, Nigeria. Regulatory agents on the environment should ensure periodic monitoring of the creek and other surface water bodies in order to ensure safe acts for sustainable development.

#### VI. REFERENCES

- [1]. Ademoroti, C.M.A (1996). Standard Methods for Water and Effluents Analysis. Foludex press Ltd, Ibadan pp47- 52
- [2]. APHA (1998). Standard Methods for the Examination of Water and Wastewater, 20th Edition. Washington DC, USA: American Public Health Association
- [3]. Aremu, M. O and Inajoh, A (2007). Assessment of Elemental Contaminants in Water and Selected Sea Foods from River Benue, Nigeria. *Current World Environment* 2(2), 205-212.
- [4]. Aremu, M. O, Olaofe, O, Ikokoh, P. P and Yakubu, M. M (2011). Physicochemical Characteristics of Stream, Well and Borehole Water Sources in Eggon, Nasarawa State Nigeria. *J. Chemsoc. Nigeria* vol No 1 pp 130-137.
- [5]. Atolaiye, B. O and Aremu, M. O (2007). Bioaccumulation of Some Trace Elements in the Body Parts of Fish Species Associated with Soil Sediment and Water from Magani Confluence in Nasarawa State, Nigeria. *Electronic J. Envir. Agric & Food chem.* 6(5),2001-2008
- [6]. Chindah, A. C. (1998). The Effect of Industrial Activities on the Periphyton Community at the Upper Reaches of New Calabar River, Niger Delta, Nigeria. *Water Research* 32(4): 113-114
- [7]. Egba, C. O. and Okoye, P. A. C. (2008). Metal Pollutants of Ground Water Resources in Abakaliki Urban - An Influence of Quarry Industry. *Proceeds of the Chemical society of Nigeria 31st Annual International Conference and Exhibition Held in PTI 22nd - 26th September, 2008* pp 493-497.
- [8]. Egborge, A. B. M (1991). Industrialization and Heavy Metal pollution in Warri River. 32nd Inaugural lecture, University of Benin, Benin City. Pp 32.
- [9]. Fakayode, J. O. (2005) - Impact Assessment of Industrial Effluent on Water Quality of the

- Receiving Akaro River in Ibadan, Nigeria. *Ajeam Rage* volume 10, 1 - 13.
- [10]. Faragallah, H. M., Askar, A. I., Okbah M. A. and Moustafa, H. M. (2009). Physico- chemical Characteristics of the Open Mediterranean Sea Water far about 60 Km from Damietta Harbor, Egypt. *Journal of Ecology and The Natural Environment* 1(5):106-119,
- [11]. Gunasekar, A. and Isaac, S. Suthakar (2015). Assessment of Physicochemical Characteristics of River Sone at Bihar, India. *International Journal of Current Research in Biosciences and Plant Biology* 2(8):50-58
- [12]. Jayaraman, P. R., Ganga, D. T., Vasudevan, N. T., (2003). Water Quality Studies on Karamana River, Thiruvananthapuram District, South Kerala, India. *Poll. Res.* 22(1), 89-100.
- [13]. Lee, A. K. and Nikraz H. (2015). BOD: COD Ratio as an Indicator for River Pollution. *International Proceedings of Chemical, Biological and Environmental Engineering*, 88:89-94
- [14]. Magadum, A., Patel, T., Gavali, D. (2017). Assessment of Physicochemical Parameters and Water Quality Index of Vishwamitri River, Gujarat, India *International Journal of Environment, Agriculture and Biotechnology (IJEAB)* 2:1505-1510
- [15]. Mugdha A. and Kushwaha, V. B. (2012). Effect of Domestic Sewage on the Physicochemical Quality of River Rapti at Gorakhpur. *Int. Quart. J. Life Sci.*7(1), 135-138.
- [16]. Oladipo, I. C., Onyenike, I. C. and Adebisi, A. O. (2009). Microbiological Analysis of Some Vended Sachet Water in Ogbomoso, Nigeria. *African Journal of Food Science* 3(12): 406-41
- [17]. Samudro, G. and Mangkoedihardjo, S. (2010). Review on BOD, COD and BOD/COD ratio: A Triangle Zone for Toxic, Biodegradable and Stable Levels. *Intl. J of Academic Research* 2(4):23-28
- [18]. Sikder, M, Hasanuzzaman, M. D. and Mafizur Rahman M. D. (2010). Water Quality Modeling for BOD and COD Control Strategies for the Buriganga River of Bangladesh. *Proceedings of the 13th International Conference of Environmental Science and Technology Athens, Greece, 5-7 September 2013*
- [19]. Tortora, J. G., Funke, R. B. and Case, L. C (2002). *Microbiology: An Introduction*. Media update of 7th Edition including bibliography and index publisher. Daryl Fox: pp 258-260
- [20]. Waziri, M. and Ogugbuaja V. O. (2010). Interrelationships between physicochemical water pollution indicators: A case study of River Yobe, Nigeria. *American Journal of Scientific and Industrial Research* 1(1): 76-80
- [21]. WHO (2008). *Guidelines for drinking water quality*, World Health Organization, Geneva.

# Comparison and Performance Evaluation of ECG Classification Techniques Trained with Shorter Database

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## ABSTRACT

Diagnosis of cardiovascular diseases can be done effectively with the classification based on analysis of different electrocardiogram (ECG) features. Different algorithms for different data mining techniques have been put forward by the researchers for diagnosing the heart diseases. In our research we have compared three classification techniques namely, Pattern Recognition, Naive Bayes Classifier (NBC) and Support Vector Machine (SVM) in classification of different heart diseases. Based on the performance we have concluded that which one of the above techniques is much effective and accurate especially if a short database of ECG features is used for training the model. The data used in this study is collected from the cardiac patients from a hospital. The observations indicate that NBC is found to be more accurate and effective than SVM and Pattern Recognition when the model is trained by a sort training database.

**Keywords:** Electrocardiogram, Comparison, Artificial neural network, Naive Bayes Classifier, Support Vector Machine.

## I. INTRODUCTION

Now-a-days, people suffering from heart diseases are increasing at a faster rate. According to World Health Organization around 17.7 million people died from CVDs in 2015 accounting for 31% of all global deaths [1]. However, diagnosis at an early stage with a proper treatment can save a huge amount of lives but correct diagnosis of heart diseases at an initial phase is quite a challenging task because of various factors having complex inter dependence. Exact estimation of the risk factors associated with the heart diseases is equally important for diagnosis and treatment purposes [2].

ECG has been extensively used for diagnosing various heart conditions. The ECG is a graphical representation of the electrical activity of the heart

muscles (depolarisation and repolarisation) [2]. Classification of ECG into different heart diseases is a complex pattern recognition task and it can be successfully achieved by finding patterns in the ECG that can be differentiate effectively between the required heart diseases. Classification is achieved on the basis of the ECG parameters such as QRS complex, RR interval, R amplitude, ST height, T amplitude and P duration. A wide number of data mining techniques have been used by the researchers to assist healthcare practitioners for finding the effective accuracy in the diagnosis of heart disease. Decision Tree, Naïve Bayes, Neural Network, Genetic Algorithm, Support Vector Machine, and direct kernel self-organizing map are some techniques used so far in the diagnosis of heart disease.

In this paper, we are comparing three data mining techniques that may be used in machine learning for

classifying heart diseases, namely the Naïve Bayes classifier, Pattern Recognition and Support Vector Machine (SVM). Our main aim of the study is to find out the most suitable machine learning technique for a short database.

## II. METHODOLOGY

For recording of the ECG signal and SpO<sub>2</sub> from the patients as well as from the healthy subjects we have used an Equivital EQ02 Life Monitor device. The device consists of a sensor electronics module (SEM) worn on the body connected to a fabric chest belt. The Equivital EQ02 Life Monitor provides two leads of ECG sharing a common reference electrode (Left Hand Front location).



Figure 1: Equivital Life Monitor

The database was created from recording the ECG signals of patients reported at the department of Cardiology, North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS) Shillong, Meghalaya, India.

### Procedure of collecting the data:

1. The Bluetooth dongle is connected to the personal computer (PC) via USB and the SEM is also connected to the PC via USB using the SEM to USB lead.
2. Appropriate sized sensor belt is fitted to the subject. The SEM is connected to the belt after inserting it into the pouch on the belt. The devices are connected to the labchart software through a Bluetooth device. The pulse monitor is worn on the left hand for recording SpO<sub>2</sub> and blood pressure is also taken from the patients using a digital sphygmomanometer.

3. The Labchart software installed in the PC is opened and recording is done for two minutes by pressing the Start button. The patient is advised to relax while the data is recorded.

4. After the recording the data is saved and export as a text file with an appropriate name.

5. The data collected is analyzed in the labchart software itself in which all the different ECG features are obtained.

## III. METHODS OF CLASSIFICATION

### A. Pattern Recognition:

In the last 15 years, neural networks have been very popular in ECG classification [3]. It is a mathematical or computational models of the nervous system, to study and apply the computational concept. The computational system is inspired by structure, processing method and learning ability of a biological brain. For developing different pattern it also depends upon the different type of activities of organism. Pattern Recognition is powerful for its ability to detect patterns and extract data structure without expert knowledge. It is the most important part of image processing. It is the study of machines that how it works and it used to distinguish between the patterns of interest from the background. They implemented an artificial neural network (ANN) trained for further result. It gives the 99.01% of accuracy for the classification [3].

### Characteristics of pattern recognition:

1. Cognitive architecture: It gives the theory result of structure of human brain. It also states the activity of neurons which are organised in the manner of excitatory and inhibitory signals through which signals can be exchanged between them.
2. It also gives the possibilities of unsupervised and supervised learning:

- ✓ Supervised learning: both the output and input signals are provided to the circuit. According to the targeted outputs all the adjustments are done to the system to make closer to the desired output.
- ✓ Unsupervised learning: it affects the neural network to get the targeted output in general the targets shows the result as same as the inputs[4]
- ✓ Basically Neural Network can be group in different ways. They are just a simple group of neurons by creating layers and interconnections. The information's that we get from the neurons are collected in human mind and further it is processed in dynamic, interactive and self-organizing way[6].

In a general architecture of ANN there are 3 types of layers for network applications: input, hidden and output. The input layers receive all the data from input files and the output layer sends the information to the secondary computer devices. Between these two layers there are hidden neurons. All the signals are received from the neurons which are found in hidden layer. After completing the process the signals are passed to the output layer [5].

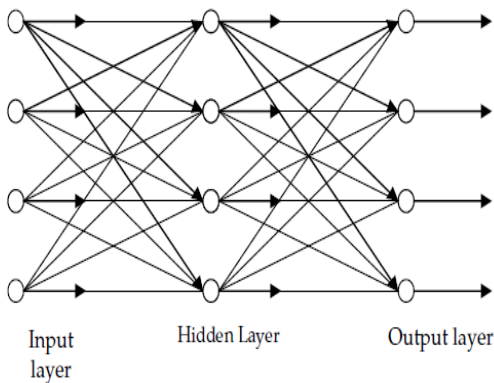


Figure 2 : General architecture of three layered ANN [6]

There are 4 steps for the implementation of pattern recognition to classify the ECG data:

- ✓ Import the data set to workspace of MATLAB R2017a.

- ✓ Let categorised the data set as input and target.
- ✓ Use ANN tool for creating and training the pattern recognition model.
- ✓ Get the final result of confusion graph

**B. Naive -Bayes classifier:**

Naive-Bayes classification method is named after Thomas Bayes who proposed the Bayes theorem which has been studied extensively since 1950s.It represents a supervised learning method as well as a statistical method for the classification and it assumes that the value of a particular feature is independent irrespective to any other features. Naïve-Bayes classifier is an easy and fast method to predict the class of dataset and is very useful for large dataset. It also performs the multi class prediction and real time prediction. Till now most of the application of the method is reported for text classification, spam filtering and also for sentiment analysis [7].

Naïve-Bayes classifier classifies the data in two simple steps: training step and the prediction step. In training step, the training data is used and an estimation of the probability distribution parameter is obtained and assuming that the predictors are conditionally independent given the class. In prediction step it computes the posterior probability of sample belonging to each class of the test data and then it classifies these data according the largest posterior probability [8].

The word naive means assumption of all variables  $X_i$ , where  $X_i$  is the distribution variable of set of  $n$  variables  $\{X_1, X_2, \dots, X_n\}$ . Let  $X_i$  be denoted as  $\pi_i$  set of nodes.

In conditional probability distribution, the common formula is:

$$P(X_1, \dots, X_n) = \prod_{i=1}^n P(X_i | \pi_i) \dots \dots \dots (1)$$

Thus,  $X_i$  are mutually independent given a special variable  $C$ .

According to the joint distribution:  $P(C, X_1, \dots, X_n) = \prod_{i=1}^n P(X_i|C)$ . When the variable C is observed in training data, Naïve-Bayes classifier can be used for classification after that it can be clustered [9]

**C. Support Vector Machine**

Support Vector Machine (SVM) also known as Support Vector Network first introduced by Vladimir Vapnik, in 1995.[10], [11]. SVM is originally designed for Binary Classification and it is a kernel-based supervised learning algorithm. It is a popular class of machine learning algorithms which specialized in both classification and pattern recognition purposes. SVMs are based on the idea of creating a hyperplane between datasets to show which class it belongs to. For best result the hyper plane should have the largest distance to the nearest training data points of any class. The support vectors are the data points that are nearest to the separating hyperplane. However, SVM has been widely used and studied for ECG beat classification and optimization. SVM is very accurate and works better on smaller and cleaner datasets because for a larger data sets the training time can be high [12][13].

Let there be m training examples  $(x_i, y_i), y_i = \pm 1, i = 1, 2, 3 \dots m$ .

Then there exist a hyper plane  $w \cdot x + b = 0$ , which separates the positive and negative training examples using the decision function :

$$f(x) = \begin{cases} -1, & \text{if } x < 0 \\ 0, & \text{if } x = 0 \\ 1, & \text{if } x > 0 \end{cases}$$

(2)

Where w and b are known as weight vector and bias respectively. We see that  $y_i(w \cdot x_i + b) > 0$ , for all  $i = 1, 2, 3, \dots, m$ . [10][11].

Figure 3 shows the maximum-margin linear classifier which is an example of a simple linear SVM classifier

with the maximum margin. The data points on the margin are called the support vectors.

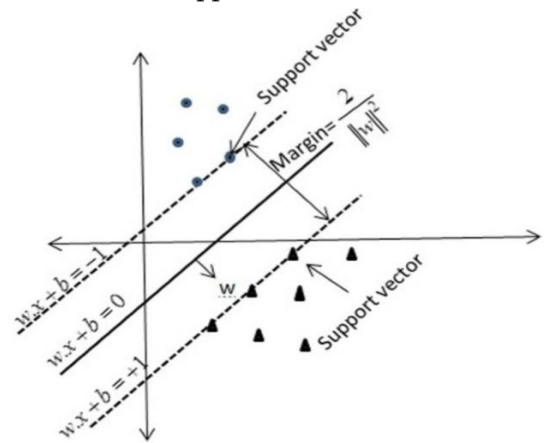


Figure 3 : Maximum Margin Hyper plane [10]

For mathematical calculations we have implicitly define  $(w, b)$  such that  $(w \cdot x + b) = 1$  for positive class and  $(w \cdot x + b) = -1$  for negative class (figure 3). From figure there are two hyperplane and the space between the two hyperplane is called the margin band, given by  $\frac{2}{\|w\|^2}$  which is to be maximize or minimize  $\frac{1}{2} \|w\|^2$  subject to the constraints :

$$y_i(w \cdot x_i + b) \geq 1, \text{ for all } i = 1, 2, 3, \dots, m \quad \dots \dots \dots (3)$$

The primal problem is converted into dual problem and applying Karush-Kuhn-Tucker (KKT) conditions we obtain

$$w = \sum_{i=1}^m a_i y_i x_i \quad \dots \dots \dots (4)$$

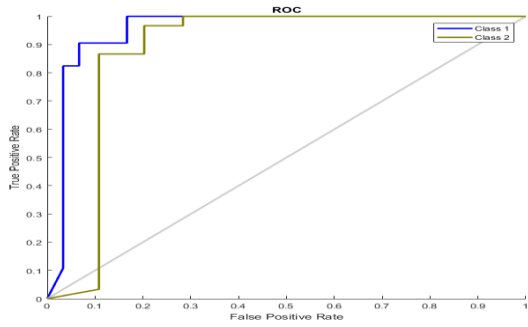
Using the kernel function decision, function becomes

$$f(x) = \text{sign}(\sum_{i \in S_V} a_i y_i K(x, x_i) + b) \quad \dots \dots \dots (5)$$

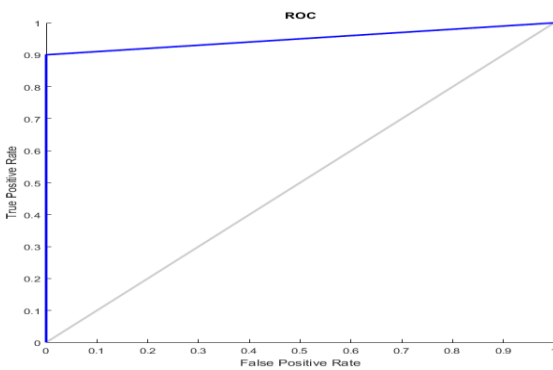
Maximize  $w(\alpha) = \sum_{i=1}^m a_i - \frac{1}{2} \sum_{i,j=1}^m a_i a_j y_i y_j K(x_i, x_j)$ , for all  $i = 1, 2, 3, \dots, m$   $\dots \dots \dots (6)$

with  $a_i \geq 0, \sum a_i y_i = 0$  where  $K(x_i, x_j) = \phi(x_i) \cdot \phi(x_j)$ ,  $\phi(x)$  is called Kernel function defined by inner product in feature space. [10][11][12]

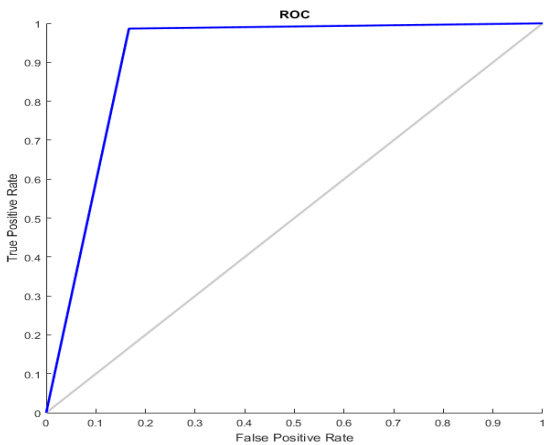
**IV. RESULTS AND DISCUSSIONS**



**A**



**B**



**C**

Figure 4 : Receiver Operating Characteristics of A.

Pattern Recognition B. NBC C. SVM

In the fig 4 , the coloured lines represents ROC curves which is a plot of true positive rate versus false

positive rate as the activation threshold is varied, therefore, the value of TPR should be higher as possible ideally it should be 1 that is 100 % TPR. As per the results obtained and presented in figure 5(A), (B), and (C) Pattern Recognition shows 80% sensitivity and 80% specificity, NBC shows 99% sensitivity and 90% of specificity and SVM shows 90% sensitivity and 90% of specificity. Also upon observing the area under the curve for each classifier, NBC covers the maximum area under the curve. These findings indicate that NBC performance better in classification of ECG signals as compared to the SVM and Pattern recognition.

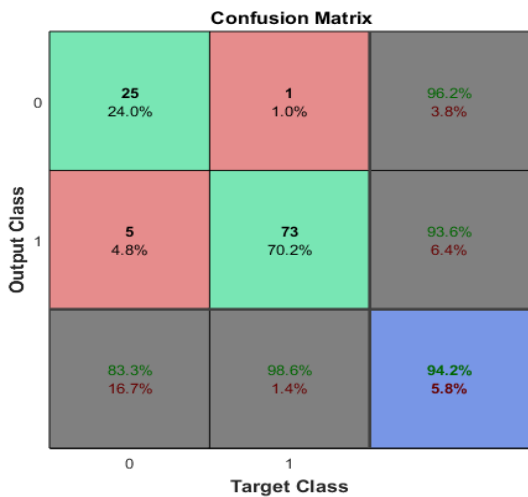
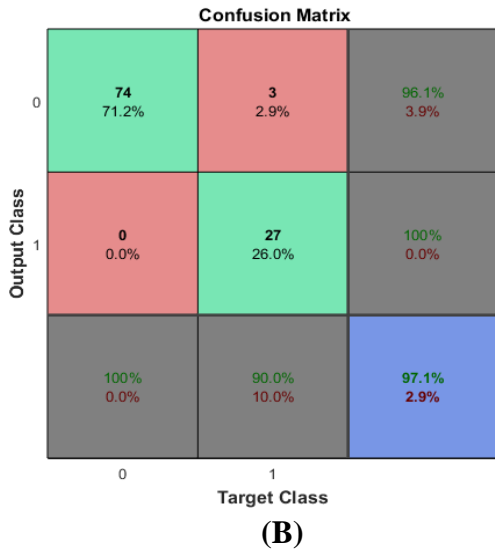
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**Confusion Matrix**

		Target Class	
		1	2
Output Class	1	72 69.2%	5 4.8%
	2	2 1.9%	25 24.0%
		97.3% 2.7%	83.3% 16.7%
		93.5% 6.5%	92.6% 7.4%
		93.3% 6.7%	

**(A)**





The confusion matrices for all three techniques are shown in figure 5 (A), (B) and (C). To test the trained classifiers, we have used a dataset which consists of 104 instances out of which 74 are patients and 30 are healthy subjects. From figure 5A we can conclude that pattern recognition was able to successfully classify 72 patients and 25 healthy subjects out of which 2 patients and 5 healthy subjects are misclassified respectively. Figure 5B presents confusion matrix for NBC, NBC successfully classifies all 74 patients and 27 healthy subjects out of which 3 healthy subjects are misclassified. Similarly confusion matrix shown in figure 5C shows the classification results in case of SVM classifier, SVM successfully classify all 73 patients and 25 healthy subjects out of which 1 patient and 5 healthy subjects are misclassified. Thus, pattern recognition, NBC and SVM accuracy comes out to be 93.3%, 97.1% and 94.2% respectively. Therefore we can conclude that NBC is a better classifier than pattern recognition and SVM. The result is summarised in table 1.

METHOD	PATTERN RECOGNITION		NBC		SVM	
CLASS	NORMAL	ABNORMAL	NORMAL	ABNORMAL	NORMAL	ABNORMAL
CLASSIFIED	25	72	27	74	25	73
MISCLASSIFIED	5	2	3	0	5	1
PERCENTAGE ACCURACY(%)	93.3		97.1		94.2	

### V. CONCLUSION

In our study, we have found that Naïve Bayes Classifier performs better when assumption of independence holds but in real life, it is almost impossible to get a set of predictors which are completely independent and NBC works best with larger datasets. Pattern recognition and

SVM can be used for both regression and classification purposes. However, Pattern recognition works best with more data points (more inputs) whereas SVM works well on larger datasets as training time with SVMs can be high for larger datasets.

## VI. REFERENCES

1. World Health Organization. "Cardiovascular diseases (CVD). Fact sheet# 317." WHO Media centre, <http://www.who.int/mediacentre/factsheets/fs317/en/index.html>, accessed Dec 9 (2013).
2. Resources for Types of Arrhythmia Diseases. [http://www.heart.org/HEARTORG/Conditions/Arrhythmia/Arrhythmia\\_UCM\\_002013\\_SubHomePage.jsp](http://www.heart.org/HEARTORG/Conditions/Arrhythmia/Arrhythmia_UCM_002013_SubHomePage.jsp)
3. <http://www.cse.unr.edu/-bebis/MathMethods/NNs/lecture.pdf>
4. Computational techniques for ECG analysis and interpretation in light of their contribution to medical advances: Aurore Lyon<sup>1</sup>, Ana Mincholé<sup>1</sup>, Juan Pablo Martínez<sup>2</sup>, Pablo Laguna<sup>2</sup> and Blanca Rodríguez<sup>1</sup>
5. <https://cs.stanford.edu/people/eroberts/courses/soco/projects/neural-networks/History/history1.html>
6. <https://www.omicsonline.org/telecommunication/artificial-neural-network-latest-research-papers.php>
7. Naive Bayes Models for Probability Estimation: Daniel Lowd LOWD@CS.WASHINGTON.EDU Pedro Domingos PEDROD@CS.WASHINGTON.EDU Department of Computer Science and Engineering, University of Washington, Seattle, WA 98195-2350, USA
8. Analytical Modeling and Artificial Neural Network (ANN) Simulation of Current-Voltage Characteristics in GrapheneNanoscroll Based Gas Sensors M. Khaledian<sup>1</sup> Razali Ismail<sup>1</sup> Elnaz Akbari<sup>1</sup>
9. [http://www.let.rug.nl/-tiedeman/ml05/03\\_bayesian\\_handout.pdf](http://www.let.rug.nl/-tiedeman/ml05/03_bayesian_handout.pdf)
10. Bernhard Scholkopf, and Alexander J. Smola. Learning with kernels: support vector machines, regularization, optimization, and beyond. MIT press, 2001.
11. Burges C., "A tutorial on support vector machines for pattern recognition", In "Data Mining and Knowledge Discovery". Kluwer Academic Publishers, Boston, 1998, (Volume 2).
12. V. Vapnik, S. Golowich, and A. Smola. Support vector method for function approximation, regression estimation, and signal processing. In M. Mozer, M. Jordan, and T. Petsche, editors, Advances in Neural Information Processing Systems 9, pages 281-287, Cambridge, MA, 1997. MIT Press.
13. Rosaria Silipo and Carlo Marchesi, "Artificial Neural Networks for Automatic ECG Analysis", IEEE Transactions on Signal Processing, 46(5): 1417-1425, 1998.

# An Effective QoS based Route Optimization Model in MANET using Machine Learning

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## ABSTRACT

Mobile Ad hoc network is a network which is dynamic where the mobile nodes form a temporary network in the deficiency of centralized administration, i.e. A MANET is an autonomous group of distributed mobile nodes. Due to the absence of centralized administrator in a network, routing in mobile ad hoc network (MANET) becomes the primary issue which reduces the selection of an optimal path for routing. Specific performance parameters such as latency, overhead, and packet delivery ratio (PDR) are affected unfavorably for which various techniques such as Machine Learning approach are encouraged that enhances the selection of the efficient and stable path. In our, Proposed Research works our attempt is made to select the optimal route i.e. which supports to identify the pattern for Link failure in communication and Optimized routing path for better communication to achieve the QoS for MANET environment using knowledge-based learning algorithm. The optimal path will possess the highest average sum of relay nodes and will be considered as the most optimal and reliable path. We also anticipated that analysis of throughput and PDR is better as compared to the traditional methods.

**Keywords :** Routing Protocols, Internal Attacks, External Attacks, Manets

## I. INTRODUCTION

There are research contribution exist in routing mechanisms of MANETS by considering the QoS parameters.

- ✓ Ant Colony Based QoS Routing Algorithm for Mobile AdHoc Networks is an on-demand QoS routing algorithm [1] proposed by P.Deepalakshmi. This algorithm is adaptive in nature and reduces the end to end delay in high mobility cases. But the other QoS constraints i.e. other network layer or link layer metrics like energy, jitter, link stability etc. are not considered here. Furthermore, here link failure is not handled properly.
- ✓ Metrics in Mobile Ad Hoc Networks proposed by R. Asokan [2] and it performs well in route discovery phase with dynamically changing

- topology and produces better throughput and low delay variance. Again flooding of route request may potentially reach all nodes in the network, so bandwidth wastage increases and efficiency degrades. Besides this, it is a collision and contention prone routing protocol. Thus, packet delivery ratio decreases, congestion increases and throughput also become very poor in case of multimedia. The routing overhead is also increased.
- ✓ An on-demand routing protocol Ant-E [3] is introduced by Srinivas Sethi which is based on Blocking Expanding Ring Search (Blocking-ERS) to control the overhead and local retransmission to improve the reliability. It resumes its route Discovery process to discover a route to the destination node from the place where it ended in

the last round following a failure. More energy is consumed because of this routing process.

- ✓ S.Kannan has projected a multi agent ant based routing algorithm for MANET [4]. It is a hybrid algorithm which combines the concepts of multi agents and ant algorithm. This technique increases node connectivity and decreases average end to end delay and increase packet delivery ratio. But complex optimization problems are not considered in algorithm.
- ✓ B. R. Sujatha has proposed a PBANT algorithm [5] which optimizes the route discovery process by considering the position of the nodes which can be obtained by GPS receiver but here energy parameter is not taken into account.

### Routing Protocols:

Initially, the optimization property of ACO algorithms has attracted much attention. Inspired by it, researchers have been motivated to apply ACO algorithms to find optimized routes for network communications. There are many approaches that belong to this category. Here we present the most famous ones in chronological order.

#### AntNet

Di Caro and Dorigo [30] have proposed AntNet, which is the first representative ACO-based algorithm for solving the problem of internet routing. In AntNet, each node proactively sends out Forward ANTs (FANTs) to discover a path to a randomly chosen destination node. Once FANTs reach the destination, Backward ANTs (BANTs) are sent back to the source node following the reverse path. BANTs update the local models of the network status and the local routing table at each intermediate node. The performance of AntNet is evaluated in three different wired network scenarios.

#### ARA

Another representative ACO-based routing protocol for MANETs, ARA was proposed by Günes et al. [31]. ARA is an on-demand routing algorithm, which is based on a simple ant colony optimization meta-heuristic algorithm. The whole routing algorithm consists of three phases: a route discovery phase, a route maintenance and a route failure handling. The route discovery phase in ARA is designed in a similar way to AntNet. FANTs and BANTs are used in the route discovery phase. FANTs are broadcasted by the sender. Duplicate FANTs are identified by their sequence numbers and are deleted by intermediate nodes. Once FANTs reach their destination nodes, BANTs are created and sent back to the source nodes. Different from AntNet [30], ARA uses data packets to maintain the route to avoid the overhead caused by using periodic ants. If a node recognizes a link failure, it first sets the pheromone value of this link to zero to deactivate it. Then it searches for an alternative link. If this fails, it informs its neighbors. This process is repeated until an alternative route has been found or the source node receives a route error message. In the latter case, the source node will initiate a new route discovery phase if there are still packets to be sent.

#### PERA

Baras and Mehta [32] have proposed PERA, a proactive routing protocol. PERA uses ant-like agents to discover the network topology and maintain routes in dynamic networks such as MANETs. PERA uses three kinds of ants: regular FANTs, uniform FANTs and BANTs. Regular and uniform FANTs are sent out proactively. These ants explore and reinforce available routes in the network. Uniform FANTs are routed in a different way than regular FANTs. Instead of using the routing table at each node, uniform FANTs choose the next hop node with uniform probability. Uniform FANTs help avoid that previously discovered paths become overloaded. BANTs are used to adjust the routing tables and statistic tables at each node, according to the information gathered by FANTs. The

authors have compared PERA with AODV [2]. The results indicate that PERA has lower delay in all cases. However, the throughput of PERA at the higher speed is slightly less than AODV and the goodput of PERA is lower than AODV in high mobility scenarios.

### **AntHocNet**

Di Caro et al. [33] have presented a hybrid multi-path routing algorithm, AntHocNet. In AntHocNet there are 6 different kinds of ants: Proactive FANTs (PFANTs), Proactive BANTs (PBANTs), Reactive FANTs (RFANTs), Reactive BANTs (RBANTs), RePair FANTs (RPFANTs) and RePair BANTs (RPBANTs). In the reactive route setup process, if a source node has no routing information about the requested destination node, it broadcasts RFANTs. Otherwise, it unicasts. When this RFANT reaches the destination, a RBANT is sent back to the source. Along its journey, the RBANT collects quality information about each link in the path and updates the pheromone table at each intermediate node. Once the first route is constructed, AntHocNet starts the proactive route maintenance process. Here, source nodes send out PFANTs to their destination nodes. PFANTs consider both regular and virtual pheromone for choosing the next hop node at each intermediate node. Once a PFANT reaches the destination node, it is converted to a PBANT. PBANTs update the regular pheromone table on their way back to the source node. In case of a link failure, RPFANTs and RPBANTs are used to handle the problem. The authors have implemented the protocol in QualNet [34] and investigated its performance using various simulations and comparing the results to AODV [2].

### **PACONET**

Osagie et al. [35] have proposed an improved ACO algorithm for routing called PACONET. In PACONET, a source node reactively broadcasts FANTs in a restricted manner to explore the network. Each FANT records the total time it has traveled and maintains a list of all visited nodes. At each intermediate node the

FANT updates the pheromone value. Once a FANT arrives at the destination, a corresponding BANT is generated. The BANT uses the list of visited nodes recorded by the FANT to travel back to the source node. Along the way, the BANT also updates the pheromone value in the reverse direction. Different from the AntNet, PACONET let both FANTs and BANTs update the pheromone. The performance of PACONET has been compared with AODV [2]. The results show that PACONET has less end to end delay and routing control overhead than AODV, but the packet delivery ratio is nearly the same.

### **ACO-AHR**

Yu et al. [36] have proposed a hybrid routing algorithm ACO-AHR, which includes reactive routing setup and proactive routing probe and maintenance. There are two kinds of agents: ant agents and service agents. The ant agents are FANTs and BANTs as in other ACO based routing algorithms. In the reactive routing setup process, a source node broadcasts FANTs. Along the trip, each FANT records all the nodes it has visited in order to avoid cycles in the path. Each BANT carries all the information collected by the corresponding FANT. It calculates the delay from one intermediate node to the destination node. Once a BANT ant reaches the source node, a service agent is created. The service agent updates the routing table at intermediate nodes by using the information gathered by the BANT. In the proactive routing maintenance process, proactive FANTs are sent out while the data session is ongoing. The proactive FANTs are normally unicasted, but they could be broadcasted with a small probability. In the latter case, the FANTs may be able to find new paths.

### **HOPENT**

HOPENT is proposed by Wang et al. [37]. It is based on the zone routing framework, combined with an ACO algorithm. HOPENT performs local proactive route discovery within a node's neighborhood and reactive communication between neighborhoods.

HOPENT is simulated on GlomoSim [38] and the authors have compared HOPNET with several famous routing protocols, such as AODV [2], AntHocNet [33], and ZRP [39]. The results indicate that HOPNET is highly scalable for large networks in comparison with AntHocNet [33]. Moreover, the author also varied the zone radius in the experiments and results indicate that the selection of the zone radius has considerable effect on the performance.

**ANT-E**

Sethi and Udgata [40] have proposed an ACO-based on-demand routing protocol Ant-E. Ant-E uses Blocking Expanding Ring Search (Blocking-ERS) [41] to limit overhead and controls local retransmission to improve the Packet Delivery Ratio (PDR). The authors compared Ant-E with AODV [2] and DSR [3]. The results show that Ant-E performs better.

**OUTLINE :**

Here we have introduced some of the representative protocols which were proposed in the early stage of ACO based routing protocols. The First ACO based routing protocol, AntNet, proposed in 1998, gave a good example of how to apply the ACO algorithm in communication networks. In the following ten years, many subsequent researchers proposed various ACO based routing protocols for MANETs based on this idea. Protocols in this category aimed for Finding the optimal routes in dynamically changing networks and their performance indicated that ACO is a promising solution for routing problems in MANETs. This further encouraged researchers to design novel ACO based routing protocols which consider other issues, such as Quality of Service (QoS), energy consumption and so on.

Table 1. Design parameter overview of basic ACO routing protocols.

Protocol	Routing Approach	Tran. Type	FANT	Ph. Activator
AntNet [30]	proactive		unicast	BANTs
ARA [31]	reactive		broadcast	FANTs, BANTs, DPs
PERA [32]	proactive		unicast	BANTs
AntHocNet [33]	hybrid		both	RBANTs, PBANTs
PACONET [35]	hybrid		broadcast	FANTs, BANTs
ACO-AHR [36]	hybrid		both	service agents
HOPENT [37]	hybrid		unicast	FANTs, BANTs
Ant-E [40]	reactive		broadcast	FANTs, BANTs, DPs

TABLE 2. Pheromone parameter overview of basic ACO routing protocols.

Protocol	Design Goals	Ant Types	Pheromone	
			Reinforcement	Evaporation
AntNet [30]	distributed, robust, multi-path routing	FANT, BANT	goodness of trip time	goodness of trip time
ARA [31]	reduce overhead	FANT, BANT	hop count	constant rate
PERA [32]	reduce overhead	FANT, BANT, uniform FANT	delay, hop count, trip time	delay, hop count, trip time
AntHocNet [33]	efficient routing	PFANT, PBANT, RFANT, RBANT, RPFANT, RPBANT	hop count, delay	constant rate
PACONET [35]	efficient dynamic routing	FANT, BANT	travel time, run time parameter	constant rate
ACO-AHR [36]	apply multi-agents to reduce expense	FANT, BANT	travel time, ant release ration	constant rate
HOPENT [37]	high scalability, less overhead	IFANT, EFANT, BANT, NANT, EANT	travel time	constant rate
Ant-E [40]	control overhead, improve reliability	FANT, BANT	hop count	constant rate

**QoS AWARE ACO ROUTING PROTOCOLS**

QoS has always been a focus of attention in mobile ad hoc networks. It is a challenging problem when transmitting packets via multiple paths in a dynamic network. At the same time, the pheromone concept from ant colony algorithms also inspires many authors to use QoS parameters for selecting routes.

**1) ARAMA**

ARAMA is an early proactive routing algorithm proposed by Hussein and Saadawi [42]. The FANTs in ARAMA gather both local and global path information, which could be the Quality of Service (QoS) parameters such as the remaining battery energy, delay, numbers of hops, etc. ARAMA defines a local normalized link index which is a good measure for overall path information. Once the FANT reaches the destination, the path grade is calculated based on this path index. A BANT follows the reverse path to the source node and updates the pheromone table at each hop.

## 2) SAMP-DSR

SAMP-DSR is proposed by Khosrowshahi-Asl et al. [43], which aims to solve the shortcomings of both ACO and DSR [3] algorithms. In SAMP-DSR, each node can operate in two modes, called 'local mode' and 'global mode'. Depending on the rate of network topology change, nodes switch between the two modes, in order to help the ants converge efficiently.

## 3) QAMR

QAMR is a QoS-enabled ant colony based multipath routing protocol for MANETs which is proposed by Krishna et al. [44]. It selects paths based on Next Hop Availability (NHA) and the path preference probability. The NHA is defined as the availability of nodes and links for routing on a path, considering both mobility and the energy factors. In order to find the best path that satisfying the QoS constraints, QAMR uses a path preference probability which measures different parameters such as delay, bandwidth and hop count. However, there are many extra control messages for estimating the quality of outgoing links.

## 4) QoRA

Al-Ani and Seitz [45] have introduced a QoS Routing protocol for multi-rate ad hoc networks based on Ant colony optimization (QoRA). In order to reduce the overhead when collecting information from multiple paths and to avoid congestion during data transmission, this paper uses the Simple Network Management Protocol (SNMP) [46] to estimate QoS parameters locally. The proposed mechanism consists of two components: the QoRA entity and the SNMP entity. The QoRA entity runs on every node to identify a suitable route that meets the specified QoS requirements, while the SNMP entity collects detailed information about the characteristics of the outgoing links such as bandwidth, delay and packet loss. More specifically, the QoRA entity consists of five components: the neighbor table, the routing table, the

ant Management, the decision engine and the QoS manager. While the two tables are common components of a routing protocols, the other three components are specially designed for QoRA. The ant management is responsible for generating FANTs, BANTs and EANTs, all of which contain specific information necessary to provide QoS-aware routing and to identify pheromone deposits. The QoRA decision engine is a vital part which decides which of the different ants are to be sent and which updates the neighbor and routing table. The QoS manager acts as a command generator and notification receiver application. It also calculates QoS parameters locally based on communication with the SNMP entity. QoRA consists of five phases regarding route discovery and route maintenance. The first phase is the forward phase. The source node broadcasts a FANT to the network to find the best route to the destination. Before forwarding the packets, each intermediate node checks the FANTStack to avoid loops and whether the given QoS requirements are satisfied. In the packet forwarding phase, intermediate nodes read the flow information and randomly forward the packets based on a probability roulette-wheel selection scheme [47] using the data in its routing table. The Backward phase starts after the destination node receives FANTs. The destination node calculates the residual QoS values and sends a BANT back to its neighbors. The BANT collects route quality information, refreshes the routing table, updates the pheromone and computes the QoS threshold. The Monitoring phase is mainly used for avoiding congestion problems by monitoring decreasing transmitting speeds. For each flow, QoRA communicate with the SNMP entity to calculate QoS parameters locally. If the required QoS is not satisfied in a certain period time (MonitoringWindow), the affected node broadcasts an EANT to inform the previous nodes about the congestion problem. When a node detects the loss of a link to a neighboring node, it deletes the information about this neighbor node from the neighbor table and updates the route table

by Finding an alternative path using EANTs. The QoRA protocol does not require either exchanging additional control packets or synchronizing nodes with the help of the SNMP entity. It computes QoS parameters locally to reduce overhead. The computation of QoS parameters is all loaded to the SNMP entity which allows the QoRA protocol to reduce end-to-end delay. Although it is clear that the QoRA entity requires less overhead, the communication between the QoRA entity and SNMP entities consumes more energy and bandwidth.

**OUTLINE :** Here we discussed five representative protocols which focus on QoS fulfillment. QoS has always been a vital task for data transmission in MANETs. The approaches focus mainly on the parameters: link stability and hop count. Other common QoS related improvements are a reduction in overhead produced by control messages and the ability to eschew the requirement of time synchronization. Many other QoS parameters such as link delay, remaining battery energy, end to end reliability and bandwidth are treated as pheromone reinforce factors in above protocols.

**Quality of Service is the primary mission for data transmission and communication in MANETs.**

TABLE 1. Design parameter overview of QoS aware ACO routing protocols.

Protocol	Routing Approach	Tran. Type	FANT	Ph. Activator
ARAMA [42]	proactive	unicast	BANTs	
SAMP-DSR [43]	hybrid	unicast	RREQs	
QAMR [44]	reactive	broadcast	BANTs, FANTs	
QoRA [45]	reactive	broadcast	BANTs	

TABLE 2. Pheromone parameter overview of QoS aware ACO routing protocols.

Protocol	Design Goals	Ant Types	Pheromone	
			Reinforcement	Evaporation
ARAMA [42]	Optimize hop counts and QoS, energy efficient	FANT, BANT	queue delay, remaining battery energy, link's signal to noise ratio, bit error, path grade	path grade
SAMP-DSR [43]	Solve the shortcoming of ACO and DSR	FANT, RREQ	end to end reliability, the trip time	unknown
QAMR [44]	Achieve link stability	FANT, BANT	bandwidth, delay, hop count	constant
QoRA [45]	less further control messages or without synchronization	FANT, BANT, EANT	constant	constant

TABLE 3. Pheromone parameter overview of energy aware ACO routing protocols.

Protocol	Design Goals	Ant Types	Pheromone	
			Reinforcement	Evaporation
ACO-EEAODR [48]	increase network lifetime	RREQ, RREP	remaining battery power	unknown
EAAR [49]	less energy consumption, multi-path transmission	FANT, BANT	MBR, hop count	constant rate
AntHocMMP [50]	path robustness, extend network lifetime	FANT, BANT	energy path cost	constant rate
ACECR [51]	extend network lifetime	FANT, BANT	avg. & min. energy, hop count	constant rate
Hybrid ACO [52]	secure, energy efficiency	FANT	predefined constant	constant rate

**SECURITY AWARE ACO ROUTING PROTOCOLS**

Other than QoS and energy efficiency, security is another hot topic in routing protocols which attracts many researchers' attention. As is well-known there exist many security threats in the network layer, such as black hole attacks, wormhole attacks, Flooding attacks and so on. When these attacks are launched during the routing process, this usually leads to strong harmful effects on the network. In the worst cases, an attacker might even make the communication in the network impossible. Therefore, mechanisms that help participants in a network to defend against the potential attacks are necessary. However, the scope of security is wide. Different researchers have their own ideas about how to best build defense systems. In this section, an overview about existing security aware ACO based routing protocols is presented.

**1) SAR-ECC**

Vijayalakshmi and Palanivelu [62] have proposed a secure ant based routing algorithm for cluster based ad hoc networks using Elliptic Curve Cryptography (ECC [63]), which we abbreviate as SAR-ECC from here on.



This approach makes use of two basic processes: one is estimating the trust value between neighbor nodes. The other uses the AntNet routing mechanism for route discovery and ECC for mutual authentication between the source and destination. In the network, each node in the cluster keeps trust values for all its neighbors. A trust value is calculated based on a measurement of uncertainty and is an increasing function that correlates with the probability of successfully transmitting each packet. During route establishment, the source node tries to find multiple routes using AntNet [30]. Then it gathers the trust values of all nodes in the paths. Based on the trustworthiness of nodes, it selects a trustworthy route for data transmission. The novelty of the protocol is using a trust value based on a measurement of uncertainty instead of the conventional pheromone. However, the updating mechanism for the trust value is not described and the benefits of combining a cluster structure with an ACO algorithm are not clearly described.

Due to the prevalence of security threats in the networks, security is also a hot topic that attracts many researchers' attention. Common attack types are, for example, black hole and wormhole attacks. Different researchers have proposed various ideas about how to ensure security in their routing protocols. In this section, we compare a selection of security aware ACO based routing protocols. These protocols use several methods to ensure secure routing. From Table 4, we observe that all surveyed protocols in this subsection use reactive approaches, thus avoiding the higher overhead commonly associated with proactive methods. For example, besides the regular proactive routing table maintenance, if a malicious node is detected in proactive approaches, all nodes in the network need to put the malicious node into black lists and update their routing tables to avoid routes including the reported malicious node. Table 5 shows that most of the security aware ACO routing protocols aim to ensure finding secure and reliable

routes. Some of them such as DBA-ACO [73] and ANTNET [74] focus on defending against certain attack types, while others are interested in detecting malicious or anomalous nodes in the network. All the listed protocols use the basic ant types, except ABPKM [75] which has two other special ant types, namely Repair ANTs (RANTs) and Update ANTs (UANTs). Although some of the proposed protocols have not described their pheromone related parameters clearly, we can still observe that there are various pheromone reinforcement factors, which are applied in this subsection. Besides a trust value, which is the most common parameter, there are also other parameters used for reinforcing the pheromone values, such as traveling time, distance, trails and attractiveness. In contrast to the reinforcement factors, most of the protocols use a constant rate to evaporate the pheromone over time. From these research contributions it is clearly evident that still the scope exists for proposing a routing mechanism by achieving the QoS parameter such as delay, jitter, scalability, performance, throughput, energy consumption etc.

TABLE 4. Design parameter overview of security aware ACO routing protocols.

Protocol	Routing Approach	Tran. Type	FANT	Ph. Activator
SAR-ECC [62]	reactive	unicast		unknown
SPA-ARA [64]	reactive	both		BANTs
FTAR [71]	reactive	broadcast		FANTs
SBDT [72]	reactive	unknown		unknown
DBA-ACO [73]	reactive	unknown		unknown
ANTNET [74]	reactive	unknown		ANTs
ABPKM [75]	reactive	unicast		BANTs

TABLE 5. Pheromone parameter overview of security aware ACO routing protocols.

Protocol	Design Goals	Ant Types	Pheromone	
			Reinforcement	Evaporation
SAR-ECC [62]	secure routing	FANT, BANT	trust value	unknown
SPA-ARA [64]	energy efficiency, detect malicious nodes	FANT, BANT	distance, traveling time	constant rate
FTAR [71]	trusted routing	FANT, BANT	constant rate	constant rate
SBDT [72]	detect malicious nodes	FANT, BANT	unknown	unknown
DBA-ACO [73]	detect and prevent black hole attack	FANT, BANT	unknown	unknown
ANTNET [74]	detect and prevent black hole attack	ANT	trails, attractiveness	unknown
ABPKM [75]	secure self-organized authentication routing	FANT, BANT, RANT, UANT	trust value	constant rate

Table 6. Simulation parameter overview of ACO based routing protocols.

	Protocol	Compare with	Simulator	DDR	Delay	Overhead	Special
Basic	AntNet [30]	OSPF,SPF,BF, Q-R,PQ-R, Daemon	own simulator [30]	NO	YES	YES	YES
	ARA [31]	AODV, DSDV,DSR	NS2 [78]	YES	NO	YES	NO
	PERA [32]	AODV	NS2	NO	YES	NO	YES
	AntHocNet [33]	AODV	QualNet [34]	YES	YES	YES	YES
	PACONET [35]	AODV	GloMoSim [38]	YES	YES	YES	NO
	ACO-AHR [36]	AODV	NS2	YES	YES	YES	NO
	HOPENT [37]	AODV,ZRP, AntHocNet	GloMoSim	YES	YES	YES	YES
	Ant-E [40]	AODV,ZRP, AntHocNet	NS2	YES	YES	YES	NO
	ARAMA [42]	without	OPNET [79]	YES	NO	NO	YES
	SAMP-DSR [43]	EMP-DSR,MP-DSR, AODV,AntHocNet	OMNet++ [80]	YES	YES	YES	NO
QoS aware	QAMR [44]	AODV, ARMAN	NS2	YES	NO	YES	YES
	QoRA [45]	AODV, CLWPR	NS-3 [81]	YES	YES	NO	YES
	ACO- EEAODR [48]	EEAODR	GloMoSim	NO	NO	NO	YES
Energy aware	EAAR [49]	AODV,MMBCR, AntHocNet	GloMoSim	NO	NO	NO	YES
	AntHocMMP [50]	AntHocNet,LAR, R-ACO1,MMP	NS2	YES	YES	YES	YES
	ACECR [51]	AOMDA, EAAR	NS2	YES	YES	NO	YES
	Hybrid ACO [52]	Normal ACO	unknown	NO	YES	NO	YES
Security aware	SAR-ECC [62]	without	NS2	NO	NO	NO	YES
	SPA-ARA [64]	AODV,DSR,ARA	SWANS [85]	NO	NO	NO	YES
	FTAR [71]	ANT-U	NS2	YES	YES	YES	YES
	SBDT [72]	CAPMAN	NS2	YES	YES	NO	YES
	DBA-ACO [73]	without	NO	NO	NO	NO	NO
	ANTNET [74]	without	NS2	NO	NO	NO	YES
	ABPKM [75]	without	QualNet	YES	YES	YES	YES

**Routing Protocols:**

Some of the representative protocols which were proposed in the early stage of ACO based routing protocols. The First ACO based routing protocol, AntNet, proposed in 1998, gave a good example of howto apply theACO algorithm in communication networks.In the following ten years, many subsequent researchers proposed various ACO based routing protocols for MANETs based on this idea. Protocols in this category aimed for Finding the optimal routes in dynamically changing networks and their performance indicated that ACO is a promising solution for routing problems in MANETs. This further encouraged researcher to design novel ACO based routing Protocols which consider other issues,

such as Quality of Service (QoS), energy consumption and so on.

**QoS AWARE ACO ROUTING PROTOCOLS :**

QoS has always been a vital task for dat transmission in MANETs .The proposed method was a new energy and delay-aware routing protocol that combines cellular automata (CA) with the hybrid genetic algorithm (GA) and African Buffalo Optimization (ABO) to optimize the path selection in the ad-hoc on-demand distance vector (AODV) routing protocol.

**AN EFFICIENT ENERGY AND DELAY ROUTING PROTOCOL :**

Our proposed research attempt to establish a robust path and get fulfill the QoS requirement as energy and delay. Our research comprised two stages to achieve our objective,

The proposed method was a new energy and delay-aware routing protocol that combines **cellular automata (CA)** with the **hybrid genetic algorithm (GA)** and **African Buffalo Optimization (ABO)** to optimize the path selection in the ad-hoc on-demand distance vector (AODV) routing protocol.

In the first stage we used CA to discover all possible paths based on minimum time, the second stage selects the path based on highest energy level for each node in the path by using **hybrid algorithm GAABO**. We proposed **hybrid techniques** that will enable the discovery of routes in MANETs which satisfy both the delay constraints and some simple energy constraints (every node on a path has a minimum energy level). Aforementioned, the **CA** generate the paths from source to destination nodes based on the minimum delay, the RREQ message that sends by CA content a threshold term to ensure all paths achieve the requirement of delay. Subsequently, the Hybrid Algorithm Gaabo.

### Discovering Routes by CA

To find out a path with delay as the QoS constraint. There exists no hierarchy among the nodes, and the network plane is found to be fully homogeneous (i.e. all nodes consist of the same characteristics). Our approach involves the broadcasting of the RREQ message that constitutes the delay requirement of the connection request [maximum delay ( $D_{max}$ )] by the source node to its communicating neighbors. All the nodes at the right, left, top, and down side are involved in this, as depicted in Figure 2.

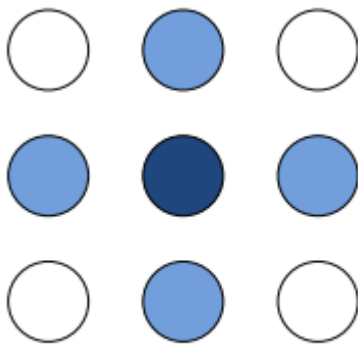


Figure 2: CA mechanism

The message re-broadcast by the intermediate nodes to their neighbors, which also establish a reverse path to the sender. Certain nodes, when given a delay constraint, turn into a wave, take in a wave node to their neighbors, re-broadcast the message, and establish a reverse path to the nodes from which they had obtained the message. This activity continues till the message is collected by the destination node or the delay faced by the packet outstrips the limit  $D_{max}$ . The destination obtains many RREQ messages for the same sender when there are more paths from the sender to the destination. Consequently, reply to some of the RREQ messages is done by the destination through sending an RREP message through the reverse path that is established when the RREQ messages are passed on. The entire set of nodes observed along these routes amidst the source and the destination constitute the path nodes. Each and every communication between the source and the

destination from this juncture happens through this path till the topology of the network gets modified.. Algorithm for two-way dimensional of CA for the initial and shortest path.

- i. Input the radius of the CA  $K=1$ ;
- ii. Put loop for the loop for discovering and checking loop for checking both side route from sn-dn and dn-sn
- iii. checking the neighbours of CN node ,which  $[r,c]= \text{find}(O == CA)$
- iv. storing path created by nag node with concatenating original sn node
- v. concatenating dn to created path

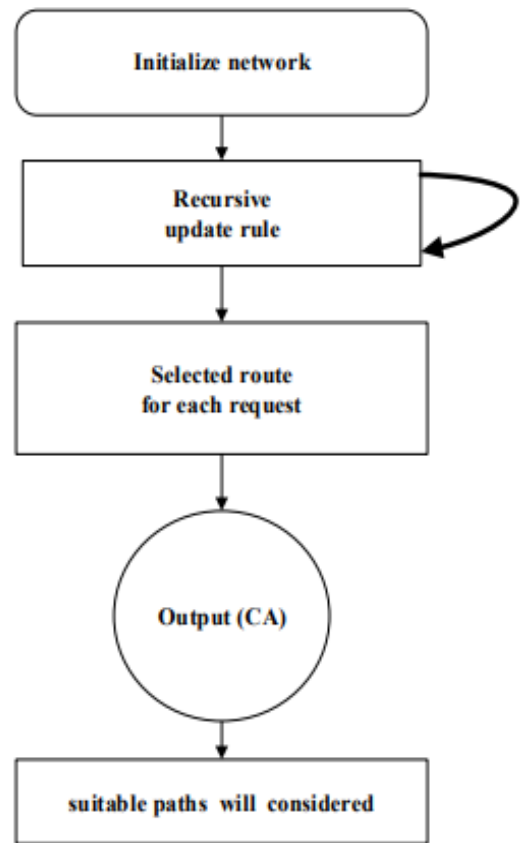


Figure The Process rule for short path selection

### A. hybrid GAABO with CA:

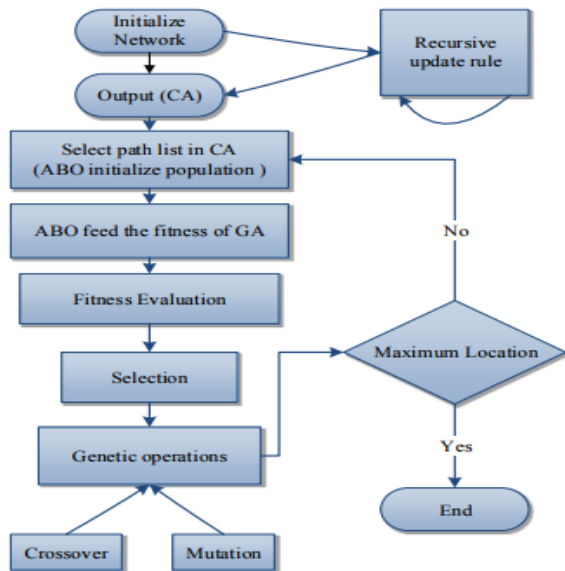


Fig : The process of CA with hybrid algorithm

Backbone Based Quick Link Failure Recovery Multicast Routing Protocol :

An Efficient Backbone Based Quick Link Failure Recovery Multicast Routing Protocol is a hybrid protocol with the features of tree based and mesh based routing protocols. The proposed protocol overcomes the limitations of existing protocols. It has four phases: Group Formation, Backbone Construction, On-Demand Route Discovery and Route Maintenance. At the inception every node exchange HELLO packets with the neighbour nodes and compute 1-hop neighbouring count, the node which possess the highest count of 1-hop neighbor nodes will be elected as the core node and send core request to 1-hop neighbouring cores. Upon receiving reply from neighbouring cores backbone will be formed. When a source intends to transmit data packets firstly it checks its route cache if route found directly transmits data packets to destination. Else initiate the route discovery process and once route is found multicast data packets. In the transmission path of data packets if any link failure is encountered, upstream node initiates route discovery to generate an alternate path towards destination.

The main aim of the proposed protocol is to construct an efficient robust backbone to overcome the limitations of existing protocols and to provide a mechanism for the quick recovery of link failures by generating an alternate path from the point of failure to the destination, which can be adoptable in any sort of environment.

Energy Efficient Routing based on Route Segmentation :

The proposed energy efficient routing based on route segmentation (EER-RS) provides a scalable and energy saving routing model for MANETs. This maintains small route segments for the active routes. The functionality of route discovery of EER-RS is comparable to DSR where multiple routes are discovered to reach the target node, and the shortest and optimal route is used for routing. In the case of longer routing, the shortest route might have a few hops to reach the target node. These hops, when segmented into w node, make v route segments. The process of construction segmentation is described below.

Route Segmentation Mechanism:

The intention of segmenting route is to make EER-RS scale for the bigger network. The distribution of network in MANET is into regions based on the node ranges as shown in Fig.1. The two highlighted node in the figure makes a 2-hop segment. One can decide the number of hops based on the route hops length.

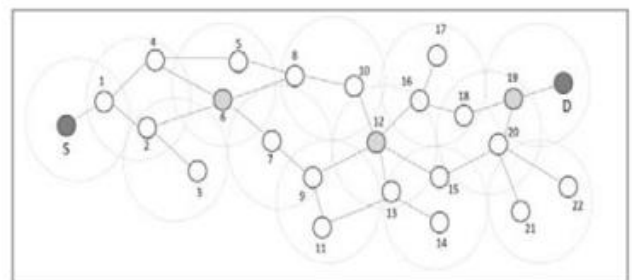


Figure 1: A general network with regions and 1-hop nodes

Let's consider a route discovery process of node S, identifies two prominent routes to reach D as shown below.

Route1: S→1→4→6→8→10→12→16→18→19→D

Route2: S→1→2→6→7→9→12→15→20→19→D

If the segment length,  $w=2$ , then each route will be divided  $w$  segments having a segment head which maintain the segment path to reach segment end node as shown in Table-1.

Table 1: Node Segment routes

S	6	12	19
1→4→6	8→10→12	16→18→19	D
1→2→6	7→9→12	15→20→19	

The advantage of these route segment supports in low energy utilization in maintenance in case of broken links. It can be present locally at the stage of a segment. Fixing a failure route within a segment broadens the life span of the route and accumulate energy through minimizing frequent route discoveries process. Thus, this mechanism will substantially help in reducing the routing overhead and energy consumption and improve the performance. Even varying segment length,  $w$  can support the adaptive routing scheme, which will be important for MANETs. Utilizing these segments we compute the minimum energy required to route data over it which will save the energy further.

**Energy Saving Mechanism:**

Even though segmenting route save quite an amount of energy through minimizing routing overhead, but is essential to route data in an energy efficient route. As mention in Table-1 that each node in a route maintains its own segment path, eventually identifying the best energy sufficient path for routing can make the segment life longer and throughput efficiency can be achieved. To compute the energy level of each segment path we enhance the algorithm

CMMBCR [24] ("Conditional Min-max Battery Capacity Routing") which recognize the routes that have an adequate left over energy of a battery and then choose the routes with lowest total transmission power .

Let's represent a routing structure by a graph  $V = (N, E)$ , where, N is "the set of nodes" and E is "the set of communication edges".

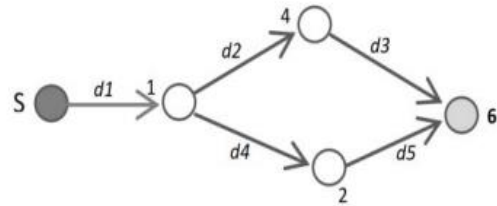


Figure 2: A graph model of node S to reach Node-6 Based on fig.2, the node S has to send a packet to N6, which has two paths to reach and the energy needed to send a message to each hopping node is directly comparative to the square of its distance. If the first path distance,  $p1$  have a distance is,  $p1=(d1+d2+d3)$  then the energy required for transmitting is,  $e1=(p1)^2$ . Since, node S also have another path for transmitting and its distance is,  $p2 = (d1+d4+d5)$ , and its energy required is,  $e2 = (p2)^2$ . In this case, if  $e1 \geq e2$  then, S transmit data through  $p2$  instead of  $p1$  to save energy.

The minimum energy, B required between nodes S to next node n to send the message can be computed using the equation-1 as follows,

**EER-RS Based Routing Mechanism :**

In EER-RS, the nodes in the primarily discovered path are selected as segment end point based on the configured segment length. The advantage of the proposal is that when a node-link fails or a routing node moves out it does not discard the entire path, only the segment has to discover a new path to reach segment end. This provides a clear energy saving and low overhead performance. Based on functionality it

routes the data packets in energy efficient route as described in Alogorithm-1 below.

**Algorithm-1: EER-RS Based Routing Algorithm**

**Inputs:**

$W(n) \rightarrow$  number of segments for nodes  $n$ .  
 $d_s \rightarrow$  segment end node.

//-- Before forwarding the packets  
 A source node S forwards a request packet

**for** each node  $n \neq d$ , that have received Request packet **do**  
 Compute remaining energy  $B_n(t)$ ;  
 $B_n(t) = B_n - (B_{Tx} + B_{Rx} + B_{Idle})$ ;  
 $B_n = B_n(t)$ ;  
 Node  $n$  send a reply packet with  $B_n$ ;  
**for end;**

//-- On receiving Reply packets  
**for** each segment path  $p_i$  **do**  
**for** each node  $n$  to destination node  $d$ , **do**  
 Compute energy efficient path,  $E(p_i)$ ,  
 $E(p_i) = \sum B_n$ ;  
**for end;**  
**for end;**  
 Select the path having maximum  $E(p_i)$ ;

**SECURITY ATTACKS IN MOBILE AD-HOC NETWORK :**

MANET’s has lots of security problems. Links are open and actively movable here thus bad-natured intruder can easily intrusion this network. Attacks matching to specific layer are displayed in table 1. The particular attacks are usually of two types i.e. internal and external attacks [4].

**Attacks Matching to MANET Layers**

LAYERS	ATTACKS
Transport Layer	Hijacking
Physical Layer	Eavesdropping, Jamming, Interference
Network Layer	Black Hole, Worm Hole, Spoofing, Sink Hole, Sybil
Application Layer	Code Attacks, Viruses
Data Link Layer	Denial-of-Service, Malicious Behaviour of Nodes

**Internal Attacks**

- ✓ Timing Attack
- ✓ Modification Attack
- ✓ Dropping Attack
- ✓ Fabrication Attack

**External Attacks**

**Active Attacks:** -It harms or alters the computer resources and involves modification of the information stream.

- ✓ Denial of Service Attack
- ✓ Spoofing
- ✓ Man-in-the-Middle
- ✓ ARP poisoning
- ✓ Ping Flood
- ✓ Smurf Attack
- ✓ Buffer Overflow
- ✓ Heap Overflow
- ✓ Formatting String Attack

**Passive Attacks:** -This type of attacks does not affect the system resource; they only observe or monitor the communication. The aim of this type of attack is to obtain information that is being transmitted [5]. These can be following

- ✓ Wiretapping
- ✓ Port Scan
- ✓ Idle Scan

**Layer Attacks**

- ✓ Gray Hole Attack
- ✓ Byzantine Attack
- ✓ Rushing Attack
- ✓ Partitioning Attack
- ✓ Black Hole Attack Worm Hole Attack
- ✓ Link Withholding Attack
- ✓ Sybil Attack
- ✓ Location Disclosure Attack
- ✓ Replay Attack
- ✓ Spoofing Attack

## SOLUTIONS FOR SECURING MANET ROUTING PROTOCOLS :

To secure routing protocols from attacks lots of solutions are proposed by researchers like AODV, DSDV, DSR, OLSR and FSR etc. As routing is a significant task for Ad-hoc network, thus this should be more secure as viable. A protocol might be enough to please security problems and working terms. Below are few solutions .

- ✓ SAR (Security Aware Ad-hoc Routing)
- ✓ SAODV (Secure Ad-hoc on Demand Distance Vector)
- ✓ ARAN (Authenticated Routing for Ad-hoc Network)
- ✓ ARIADNE
- ✓ SRP (Secure Routing Protocol)
- ✓ SEAD (Secure Efficient Ad-hoc Distance Vector)
- ✓ SLSP (Secure Link State Routing Protocol)
- ✓ DSDV (Destination-Sequenced Distance Vector Protocol)
- ✓ DSR (Dynamic Secure Routing)

## II. REFERENCES

1. P. Deepalakshmi and Dr.S.Radhakrishnan, 'Ant colony based QoS routing algorithm for mobile ad hoc networks,' International Journal of Recent Trends in Engineering, vol. 1, no. 1, May 2009, pp. 459-462.
2. Asokan, R. Natarajan, A. Nivetha, ' A swarm based distance vector routing to support multiple quality of service (QoS) metrics in MANETs,' J. Comput. Sci., vol. 3, 2007, pp. 700-707.
3. S. Sethi and S. Udgate, 'The efficient ant routing protocol for MANET,' International Journal on Computer Science and Engineering, vol. 02, no. 07, 2010, pp. 2414-2420.
4. S. Kannan, T. Kalaikumaran, S. Karthik and V. Arunachalam, 'Ant colony optimization for routing in mobile ad hoc networks,' International Journal of Soft Computing, vol. 5, Iss. 6, 2010, pp. 223-228.
5. B.R.Sujatha and Dr. M.V. Sathyanarayana, 'PBANT Optimized ant colony routing algorithm for manets,' Global Journal of Computer Science and Technology, vol. 10, Iss. 2, April 2010, pp. 29- 34.
6. P Venkata Krishna, V. Saritha, G. Vedha, A. Bhiwal and A. Bhiwal, Quality of service enabled ant colony based multipath routing for mobile ad hoc networks, IET Commun., vol. 6, Iss. 1, 2012, pp. 76-83.
7. E. Bonabeau, M. Dorigo, and G. Theraulaz, Swarm Intelligence: From Natural to Artificial Systems. Oxford, U.K.: Oxford Univ. Press, 1999.
8. J Bishop, "Stochastic searching networks," in Proc. 1st IEE Int. Conf. Artif. Neural Netw. (Conf.), 1989, pp. 329\_331.
9. R Poli, J. Kennedy, and T. Blackwell, "Particle swarm optimization," Swarm Intell., vol. 1, no. 1, pp. 33\_57, Jun. 2007, doi: <https://doi.org/10.1007/s11721-007-0002-0>.
10. M. Dorigo, "Optimization, learning and natural algorithms," Ph.D. dissertation, Politecnico di Milano, Milan, Italy, 1992.
11. H. Zhang, X. Wang, and D. Hogrefe, "A survey of location aware ant colony optimization routing protocols in MANETs," in Proc. 10th EAI Int. Conf. Bio-Inspired Inf. Commun. Technol. (BIONETICS), 2017. [Online]. Available: <http://bionetics.org/2017/show/accepted-papers>
12. C. S. Moreau, C. D. Bell, R. Vila, S. B. Archibald, and N. E. Pierce, "Phylogeny of the ants: Diversification in the age of angiosperms," Science, vol. 312, no. 5770, pp. 101\_104, 2006.
13. B. Hlldobler and E. O. Wilson, The ANTS. Cambridge, MA, USA: Harvard Univ. Press, 1990.
14. G. F. Oster and E. O. Wilson, Caste and Ecology in the Social Insects. Princeton, NJ, USA: Princeton Univ. Press, 1978.
15. T. Flannery, Here on Earth: A Natural History of the Planet. New York, NY, USA: Grove, 2011.

16. C. Anderson, G. Theraulaz, and J.-L. Deneubourg, "Self-assemblages in insect societies," *Insectes Sociaux*, vol. 49, no. 2, pp. 99\_110, 2002.
17. N. J. Mlot, C. A. Tovey, and D. L. Hu, "Fire ants self-assemble into waterproof rafts to survive floods," *Proc. Nat. Acad. Sci. USA*, vol. 108, no. 19, pp. 7669\_7673, 2011.
18. P. C. Foster, N. J. Mlot, A. Lin, and D. L. Hu, "Fire ants actively control spacing and orientation within self-assemblages," *J. Experim. Biol.*, vol. 217, no. 12, pp. 2089\_2100, 2014.
19. N. Fujiwara-Tsujii, N. Yamagata, T. Takeda, M. Mizunami, and R. Yamaoka, "Behavioral responses to the alarm pheromone of the ant *camponotus obscuripes* (hymenoptera: Formicidae)," *Zool. Sci.*, vol. 23, no. 4, pp. 353\_358, 2006.
20. H. Ahmed and J. Glasgow, "Swarm intelligence: Concepts, models and applications," *School Comput., Queens Univ., Kingston, ON, Canada, Tech. Rep. 2012-585*, 2012.
21. F. Moyson and B. Manderick, *The Collective Behavior of Ants: An Example of Self-organization in Massive Parallelism*, Vrije Univ. Brussel, Ixelles, Belgium, 1988.
22. S. Goss, S. Aron, J.-L. Deneubourg, and J. M. Pasteels, "Self-organized shortcuts in the Argentine ant," *Naturwissenschaften*, vol. 76, no. 12, pp. 579\_581, 1989.
23. M. Dorigo and L. M. Gambardella, "Ant colony system: A cooperative learning approach to the traveling salesman problem," *IEEE Trans. Evol. Comput.*, vol. 1, no. 1, pp. 53\_66, Apr. 1997.
24. B. Bullnheimer, R. F. Hartl, and C. Strau, "A new rank based version of the ant system\_A computational study," *Central Eur. J. Oper. Res. Econ.*, vol. 7, pp. 25\_38, 1997. Accessed: Oct. 26, 2017. [Online]. Available: <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.49.4735>
25. V. Maniezzo, "Exact and approximate nondeterministic tree-search procedures for the quadratic assignment problem," *INFORMS J. Comput.*, vol. 11, no. 4, pp. 358\_369, 1999.
26. T. Sttzle and H. H. Hoos, "MAX\_MIN ant system," *Future Generat. Comput. Syst.*, vol. 16, no. 8, pp. 889\_914, 2000.
27. C. Blum and M. Dorigo, "The hyper-cube framework for ant colony optimization," *IEEE Trans. Syst., Man, Cybern. B, Cybern.*, vol. 34, no. 2, pp. 1161\_1172, Apr. 2004.
28. M. Dorigo and T. Sttzle, *Ant Colony Optimization*. Cambridge, MA, USA: MIT Press, 2004.
29. D. W. Corne, A. Reynolds, and E. Bonabeau, "Swarm intelligence," in *Handbook Natural Computing*. Berlin, Germany: Springer, 2012, pp. 1599\_1622, doi: 10.1007/978-3-540-92910-9\_48.
30. G. Di Caro and M. Dorigo, "AntNet: Distributed stigmergetic control for communications networks," *J. Artif. Intell. Res.*, vol. 9, pp. 317\_365, Dec. 1998.
31. M. Gunes, U. Sorges, and I. Bouazizi, "ARA-the ant-colony based routing algorithm for MANETs," in *Proc. Int. Conf. Parallel Process. Workshops*, 2002, pp. 79\_85.
32. J. S. Baras and H. Mehta, "A probabilistic emergent routing algorithm for mobile ad hoc networks," in *Proc. Modeling Optim. Mobile, Ad Hoc Wireless Netw. (WiOpt)*, 2003, p. 10.
33. G. Di Caro, F. Ducatelle, and L. M. Gambardella, "AntHocNet: An adaptive nature-inspired algorithm for routing in mobile ad hoc networks," *Eur. Trans. Telecommun.*, vol. 16, no. 5, pp. 443\_455, 2005.
34. *QualNet 5.2.0 Programmer's Guide*, SCALABLE Netw. Technol., Inc, Culver, CA, USA, 2011.
35. E. Osagie, P. Thulasiraman, and R. K. Thulasiram, "PACONET: Improved ant colony optimization routing algorithm for mobile ad hoc networks," in *Proc. 22nd Int. Conf. Adv. Inf. Netw. Appl. (AINA)*, 2008, pp. 204\_211.



36. W.-J. Yu, G.-M. Zuo, and Q.-Q. Li, "Ant colony optimization for routing in mobile ad hoc networks," in Proc. Int. Conf. Mach. Learn., vol. 2. 2008, pp. 1147\_1151.
37. J. Wang, E. Osagie, P. Thulasiraman, and R. K. Thulasiram, "HOPNET: A hybrid ant colony optimization routing algorithm for mobile ad hoc network," Ad Hoc Netw., vol. 7, no. 4, pp. 690\_705, 2009.
38. A. Kathirvel, Introduction to GloMoSim. Saarbrücken, Germany: LAP Lambert Academic Publishing, 2011.
39. Z. J. Haas, M. R. Pearlman, and P. Samar, "The zone routing protocol (ZRP) for ad hoc networks," IETF, Fremont, CA, USA, Tech. Rep. draftietf-manet-zone-zrp-04, 2002. Accessed: Oct. 26, 2017. [Online]. Available: <https://tools.ietf.org/html/draft-ietf-manet-zone-zrp-04>
40. S. Sethi and S. K. Udgata, "The efficient ant routing protocol for MANET," Int. J. Comput. Sci. Eng., vol. 2, no. 7, pp. 2414\_2420, 2010.
41. I. Park, J. Kim, and I. Pu, "Blocking expanding ring search algorithm for efficient energy consumption in mobile ad hoc networks," in Proc. 3rd Annu. Conf. Wireless On-Demand Netw. Syst. Services (WONS), 2006, pp. 191\_195.
42. O. Hussein and T. Saadawi, "Ant routing algorithm for mobile ad-hoc networks (ARAMA)," in Proc. IEEE Int. Perform., Comput., Commun. Conf., Apr. 2003, pp. 281\_290.
43. E. Khosrowshahi-Asl, M. Noorhosseini, and A. S. Pirouz, "A dynamic ant colony based routing algorithm for mobile ad-hoc networks," J. Inf. Sci. Eng., vol. 27, no. 5, pp. 1581\_1596, 2011.
44. P.V. Krishna, V. Saritha, G. Vedha, A. Bhiwal, and A. S. Chawla, "Quality of service-enabled ant colony-based multipath routing for mobile ad hoc networks," IET Commun., vol. 6, no. 1, pp. 76\_83, 2012.
45. A. D. Al-Ani and J. Seitz, "QoS-aware routing in multi-rate ad hoc networks based on ant colony optimization," Netw. Protocols Algorithms, vol. 7, no. 4, pp. 1\_25, 2016.
46. J. D. Case, M. Fedor, M. L. Schoffstall, and J. Davin, "Simple network management protocol (SNMP)," IETF, Fremont, CA, USA, Tech. Rep. rfc1157, 1990. [Online]. Available: <http://www.rfceditor.org/info/rfc1157>
47. T. Back, Evolutionary Algorithms in Theory and Practice: Evolution Strategies, Evolutionary Programming, Genetic Algorithms. Oxford, U.K.: Oxford Univ. Press, 1996.
48. I. Woungang, M. S. Obaidat, S. K. Dhurandher, A. Ferworn, and W. Shah, "An ant-swarm inspired energy-efficient ad hoc on-demand routing protocol for mobile ad hoc networks," in Proc. IEEE Int. Conf. Commun. (ICC), Jul. 2013, pp. 3645\_3649.
49. S. Misra, S. K. Dhurandher, M. S. Obaidat, P. Gupta, K. Verma, and P. Narula, "An ant swarm-inspired energy-aware routing protocol for wireless ad-hoc networks," J. Syst. Softw., vol. 83, no. 11, pp. 2188\_2199, 2010.
50. P. Vijayalakshmi, S. A. J. Francis, and J. A. Dinakaran, "A robust energy efficient ant colony optimization routing algorithm for multi-hop ad hoc networks in MANETs," Wireless Netw., vol. 22, no. 6, pp. 1\_20, 2015.
51. J. Zhou, H. Tan, Y. Deng, L. Cui, and D. D. Liu, "Ant colony-based energy control routing protocol for mobile ad hoc networks under different node mobility models," EURASIP J. Wireless Commun. Netw., vol. 2016, no. 1, p. 105, Dec. 2016, doi: <https://doi.org/10.1186/s13638-016-0600-x>.
52. S. B. Prabakaran and R. Ponnusamy, "Secure and energy efficient MANET routing incorporating trust values using hybrid ACO," in Proc. Int. Conf. Comput. Commun. Informat. (ICCCI), 2016, pp. 1\_8.

53. P. Misra and P. Enge, *Global Positioning System: Signals, Measurements and Performance*, 2nd ed. Lincoln, MA, USA: Ganga-Jamuna Press, 2006.
54. S. Kamali and J. Opatrny, "POSANT: A position based ant colony routing algorithm for mobile ad-hoc networks," in *Proc. 3rd Int. Conf. Wireless Mobile Commun. (ICWMC)*, 2007, p. 21.
55. D. Kadono, T. Izumi, F. Ooshita, H. Kakugawa, and T. Masuzawa, "An ant colony optimization routing based on robustness for ad hoc networks with GPSs," *Ad Hoc Netw.*, vol. 8, no. 1, pp. 63\_76, 2010.
56. S. L. O. B. Correia, J. Celestino, and O. Cherkaoui, "Mobility-aware ant colony optimization routing for vehicular ad hoc networks," in *Proc. IEEE Wireless Commun. Netw. Conf.*, Mar. 2011, pp. 1125\_1130.
57. M. Killat and H. Hartenstein, "An empirical model for probability of packet reception in vehicular ad hoc networks," *EURASIP J. Wireless Commun. Netw.*, vol. 2009, no. 1, p. 721301, Dec. 2009, doi: <https://doi.org/10.1155/2009/721301>.
58. J. Herri, C. Bonnet, and F. Filali, "Kinetic mobility management applied to vehicular ad hoc network protocols," *Comput. Commun.*, vol. 31, no. 12, pp. 2907\_2924, 2008.
59. H. Rana, P. Thulasiraman, and R. K. Thulasiram, "MAZACORNET: Mobility aware zone based ant colony optimization routing for VANET," in *Proc. IEEE Congr. Evol. Comput.*, Jun. 2013, pp. 2948\_2955.
60. S. Balaji, S. Sureshkumar, and G. Saravanan, "Cluster based ant colony optimization routing for vehicular ad hoc networks," *Int. J. Sci. Eng. Res.*, vol. 4, no. 6, pp. 26\_30, Jun. 2013.
61. M. H. Eiza, T. Owens, and Q. Ni, "Secure and robust multi-constrained QoS aware routing algorithm for VANETs," *IEEE Trans. Depend. Sec. Comput.*, vol. 13, no. 1, pp. 32\_45, Jan. 2016.
62. V. Vijayalakshmi and T. Palanivelu, "Secure antnet routing algorithm for scalable adhoc networks using elliptic curve cryptography," *J. Comput. Sci.*, vol. 3, no. 12, pp. 939\_943, 2007.
63. V. Kapoor, V. S. Abraham, and R. Singh, "Elliptic curve cryptography," *Ubiquity*, vol. 2008, no. 5, pp. 7:1\_7:8, May 2008, doi: [10.1145/1378355.1378356](https://doi.org/10.1145/1378355.1378356).
64. S. Mehfuz and M. N. Doja, "Swarm intelligent power-aware detection of unauthorized and compromised nodes in MANETs," *J. Artif. Evolution Appl.*, vol. 2008, Nov. 2008, Art. no. 236803. [Online]. Available: <http://dx.doi.org/10.1155/2008/236803>
65. H. Krawczyk, R. Canetti, and M. Bellare, "HMAC: Keyed-hashing for message authentication," IETF, Fremont, CA, USA, Tech. Rep. rfc2104, 1997. [Online]. Available: <https://tools.ietf.org/html/rfc2104>
66. P. Papadimitratos and Z. J. Haas, "Secure routing for mobile ad hoc networks," in *Proc. SCS Commun. Netw. Distrib. Syst. Modeling Simulation Conf. (CNDS)*, San Antonio, TX, USA, Jan. 2002, pp. 193\_204.
67. S. J. Mirabedini and M. Teshnehlab, "FuzzyAntNet: A novel multiagent routing algorithm for communications networks," *Comput. Sci. Telecommun.*, vol. 12, no. 1, pp. 45\_49, 2007.
68. S. J. Mirabedini, M. Teshnehlab, and A. Rahmani, "FLAR: An adaptive fuzzy routing algorithm for communications networks using mobile ants," in *Proc. Int. Conf. Converg. Inf. Technol.*, 2007, pp. 1308\_1315.
69. S. J. Mirabedini, M. Teshnehlab, M. Shenasa, A. Movaghar, and A. M. Rahmani, "AFAR: Adaptive fuzzy ant-based routing for communication networks," *J. Zhejiang Univ. Sci. A*, vol. 9, no. 12, pp. 1666\_1675, 2008.
70. M. Goswami, R. Dharaskar, and V. Thakare, "Fuzzy ant colony based routing protocol for mobile ad hoc network," in *Proc. Int. Conf.*

- Comput. Eng. Technol. (ICCET), vol. 2. 2009, pp. 438\_444.
71. S. Sethi and S. K. Udgata, "Fuzzy-based trusted ant routing (FTAR) protocol in mobile ad hoc networks," in Proc. Int. Workshop Multi-Disciplinary Trends Artif. Intell., 2011, pp. 112\_123.
  72. G. Indirani and K. Selvakumar, "Swarm based detection and defense technique for malicious attacks in mobile ad hoc networks," Int. J. Comput. Appl., vol. 50, no. 19, pp. 1\_6, 2012.
  73. K. Sowmya, T. Rakesh, and D. P. Hudedagaddi, "Detection and prevention of blackhole attack in MANET using ACO," Int. J. Comput. Sci. Netw. Secur., vol. 12, no. 5, p. 21, 2012.
  74. S. Pal, K. Ramachandran, I. D. Paul, and S. Dhanasekaran, "A review on anomaly detection in manet using antnet algorithm," Middle-East J. Sci. Res., vol. 22, no. 5, pp. 690\_697, 2014.
  75. P. Memarmoshre\_, H. Zhang, and D. Hogrefe, "Investigation of a bioinspired security mechanism in mobile ad hoc networks," in Proc. WiMob, 2013, pp. 709\_716.

# A Voltage Boost NPC Multilevel Inverter using LC Impedance Network

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## ABSTRACT

For many industrial applications, a voltage boost neutral point clamped (NPC) multilevel inverter is a preferred choice due to its advantages such as low cost, light weight and small in size as compared to a conventional inverter. As this inverter has the boosting property which makes it more suitable for low and medium power renewable energy system. The voltage boost multilevel Z-source inverter and quasi-Z-source inverter have been proposed for dc to ac power conversion with improved power quality. Multilevel ZSI and quasi-ZSI (QZSI) uses more number of passive components in the intermediate impedance network, which increases the system size and weight. So here in this proposed voltage boost neutral-point clamped multilevel (three-level) inverter with LC impedance network uses comparatively less number of passive components and only single dc source required, at the same time it provides all the advantages of multilevel ZSI/QZSI. This proposed inverter has the ability to boost the input dc voltage and provide required three level ac output voltage in a single stage using a shoot through state. Modulation technique adopted for the proposed inverter is unipolar pulse width modulation (PWM) technique to investigate its performance. The prototype has been made and tested using Simulink and DS1104 R&D controller board dSPACE. The results analysis has been done using MATLAB/Simulink software package.

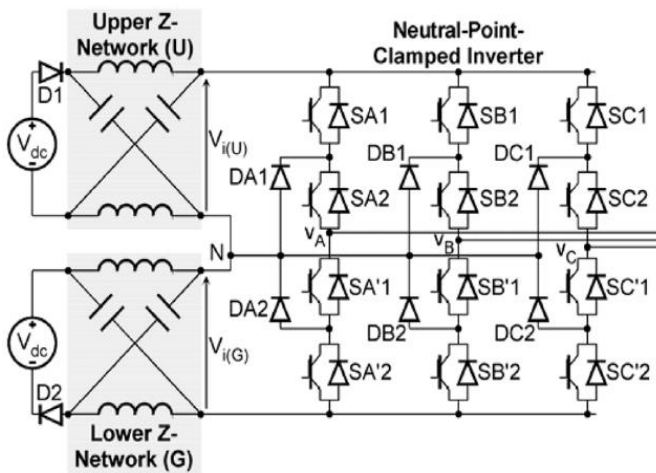
**Keywords :** Neutral point clamped inverter, Boost inverter, LC impedance network, PWM scheme, shoot through state.

## I. INTRODUCTION

Recently the modern power electronics equipment has attracted the attention in many industrial applications. Most of the industrial applications need high power equipment, such as motor drives, hybrid electric vehicles, renewable energy system, etc.[1]. Some industries require medium voltage and high power, so for these purposes, the multilevel inverter has been introduced. The multilevel inverter provides high power rating and enables the use of renewable energy sources [2]. The multilevel inverter available with different topologies. Each of three main topologies provides some advantages over conventional two-level inverters such as the use of

high switching frequency, improve efficiency and power quality of outputs with some limitations. The neutral point clamped (NPC) inverter topology can be applied to three level or higher-level inverters. Because of industrial developments over the past several years, now the three-level NPC inverter has been used extensively in industrial applications [3-5]. In conventional system, DC-DC boost converter was used before inverter or step up transformer after the inverter to get required AC output voltage from low input voltage. Due to this the power conversion stages increases, system efficiency decrease and the system becomes complex [6]. The Z-source converter identifies all the above limitation of conventional converter and to overcome these limitations provides

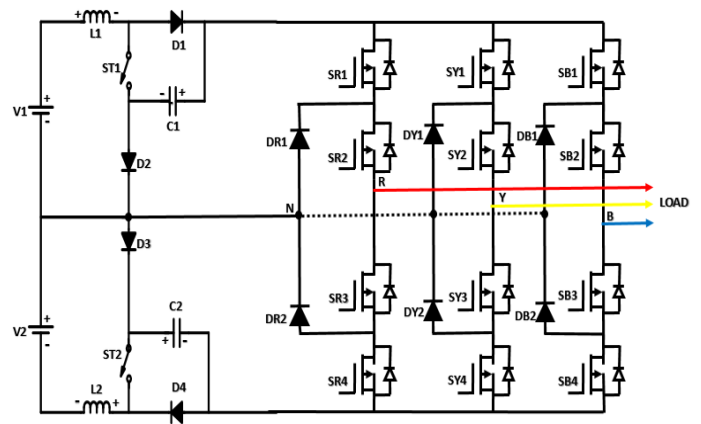
a new power conversion method. Z-source converter which uses LC impedance network has been utilised for AC-DC, DC-AC, DC-DC power conversion. This Z source network is uses in between supply source and converter main circuit [7-9]. Conventional voltage source inverter (VSI) operated in active state and zero state while the Z-source Neutral point clamped (NPC) multilevel inverter can operates with one additional state i.e. active state, zero state and shoot through state. Shoot through state means turning on all the switches of one or all legs of inverter. Using this shoot through state the input DC voltage gets boosted and provides expected AC output voltage.



**Fig -1:** Conventional three level NPC Z-source inverter

Conventional NPC Z-source inverter utilizes four inductors, four capacitors, two diodes in its LC impedance network as shown in figure-1. This conventional inverter needs two isolated DC voltage sources to get expected output [10]. Similarly, the three-level dual Z-source inverter uses one diode, two inductors, two capacitors and open end winding line frequency transformer to get desired output. But the use of open-end winding line frequency transformer and more number of passive elements makes system complex and bulky. The input current of this Z-source inverter is discontinuous and making it continuous requires equal inductor and capacitor pair in its LC impedance network. It has been difficult to get the equal value of inductor and capacitor pair while

making this system in practice [11]. Quasi Z-source multilevel inverter provides continuous input current, but it also required more number of passive elements and isolated DC source supply [12]. Similarly, a cascaded three-level NPC Quasi Z-source multilevel inverter utilizes more number of passive elements and two or more isolated dc sources supply for better quality. But the use of more number of passive elements and multiple isolated dc power supply increases the system size, weight so the overall cost [13-14].



**Fig -2:** Proposed voltage boost NPC multilevel inverter using LC impedance network

This paper presents proposed work on a voltage boost NPC multilevel inverter using LC impedance network. This inverter uses impedance network comprises of two inductors, two capacitors, four diodes, and two intermediate switches (shoot through switches) between NPC inverter legs and DC source supply. It requires comparatively less number of passive elements while providing all the advantages of conventional available inverter. These features of this proposed inverter making it reliable and system weight and size are reduced. This inverter can be used in medium or low power application where weight and size are main constraints.

Rest of the paper is arranged as follows. The operational principle of the proposed inverter with its different operating state is presented in Section II. Design consideration and mathematical formulation of L and C are presented in Section III. Modulation

scheme use for this proposed inverter is discussed in Section IV. Simulation and prototype results are discussed in Section V and conclusion of this proposed work in presented in Section VI.

## II. PROPOSED VOLTAGE BOOST NPC INVERTER AND OPERATIONAL PRINCIPLE

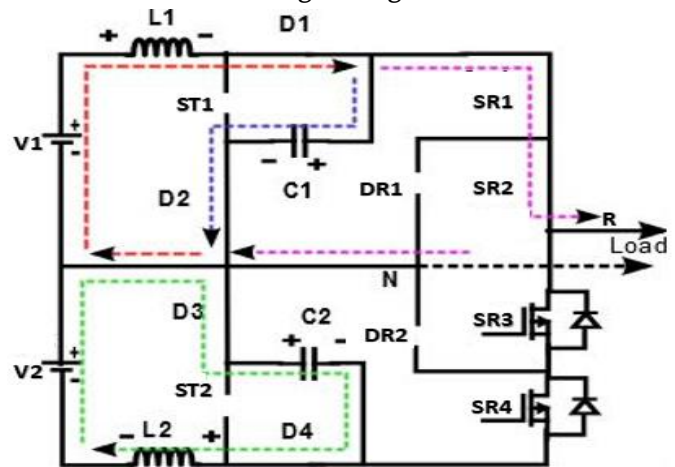
The proposed voltage boost NPC inverter is able to boost the input DC source supply (V) and provide required multilevel AC voltage. The schematic circuit diagram of proposed voltage boost NPC inverter using minimal count of L and C in impedance network is as shown in figure-2. Here input to this inverter is a simple dc input voltage source. This DC source supply can be fed from the dual power supply as two DC source. Another way is DC source can be split into two by providing required DC voltage in parallel to two series connected capacitor, where the center point between two capacitors considered as a neutral point. This input is then provided to upper and lower part of this proposed inverter. The inverter is consists of three legs, one per phase, each containing two series connected high-side switches and two series connected low-side switches. The center of each device pair is clamped to the neutral through clamping diodes.

In this inverter, the impedance network comprises of one inductor (L1), two capacitors (C1 and C2), four diodes (D1, D2, D3, and D4) and two active intermediate switches (ST1 and ST2). This impedance network is placed between input DC source supply and NPC inverter legs. As compared to the conventional three-level Z-source inverter this proposed inverter utilizes almost half of the number of passive elements. Hence the size and the weight is reduced, so overall cost also reduces. Conventional VSI operated in only in two states while the proposed inverter can operate in three states i.e. active state, zero state, and the shoot through state. Using this third additional state the input voltage has boosted.

The detail working of all possible mode of this inverter is discussed as follows.

### A. Active state (Non-shoot through state)

In this mode of operation, the power is transferred from DC supply side to AC load side. It is same as the active state of traditional NPC VSI. In this state, the AC load gets either “+Vdc” or “-Vdc” voltage level with respect to a neutral point “N”. Here for simple understanding, only one leg from three legs of three-phase NPC inverter is considered as the normal constant current flowing through it.



**Fig-3:** Operating circuit of proposed inverter to get “+Vdc”

For attaining the “+Vdc” (positive half cycle) across the load the switches Sx1 and Sx2 are turned ‘ON’ while switches Sx3, Sx4, ST1, and ST2 are turned ‘OFF’. As a result diodes D1, D2, D3 and D4 are getting forward biased while Dx1 and Dx2 (where x = R, Y, and B) are get reversed biased, as shown in figure-3. In this mode of operation both upper DC voltage source ‘V1’ and energy stored in inductor ‘L1’ supplies the power to the AC load as well as energizing the capacitor ‘C1’. Similarly lower DC voltage source ‘V2’ and energy stored in inductor ‘L2’ energizing the capacitor ‘C2’ to ‘+VC1’ as shown in the figure above. So, the voltage appears across the AC load in this period is ‘+VC1’.

Similarly, for attaining the “-Vdc” (negative half cycle) across the load the switches Sx3 and Sx4 are turned

'ON' while switches  $S_{x1}$ ,  $S_{x2}$ ,  $ST1$ , and  $ST2$  are turned 'OFF'. As a result diodes  $D1$ ,  $D2$ ,  $D3$ , and  $D4$  are getting forward biased whereas diodes  $D_{x1}$  and  $D_{x2}$  (where  $x = R, Y, \text{ and } B$ ) are get reversed biased, as shown in figure-4. In this mode of operation both lower DC voltage source 'V1' and energy stored in inductor 'L2' supplies the power to the AC load and energizing the capacitor 'C1'. Similarly lower DC voltage source 'V1' and energy stored in inductor 'L1' energizing the capacitor 'C1' to '+VC2'. So, the voltage appears across the AC load in this period is '+VC2'.

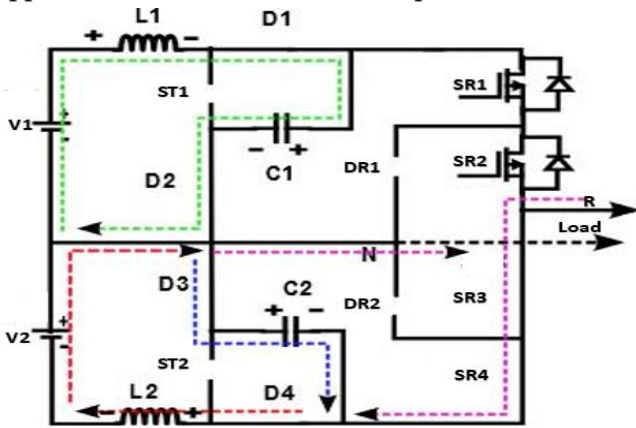


Fig -4: Operating circuit of proposed inverter to get “-Vdc”

**B. Zero state**

Figure-5 shows the zero state of the proposed inverter. In this mode of operation, switches  $S_{x2}$ ,  $S_{x3}$  are turned 'ON', whereas switches  $ST1$ ,  $ST2$ ,  $S_{x1}$  and  $S_{x2}$  (where  $x = R, Y, \text{ and } B$ ) are turned 'OFF', and diodes  $D1$ ,  $D2$ ,  $D3$ , and  $D4$  are forward biased. So voltage appears across the load is zero. It simply means that no power is transferred to load from DC source to load side. Here upper DC voltage source 'V1' and energy stored in inductor 'L1' energizing the capacitor 'C1', whereas lower DC voltage source 'V2' and energy stored in inductor 'L2' energizing the capacitor 'C2', same as in case of the active state operation.

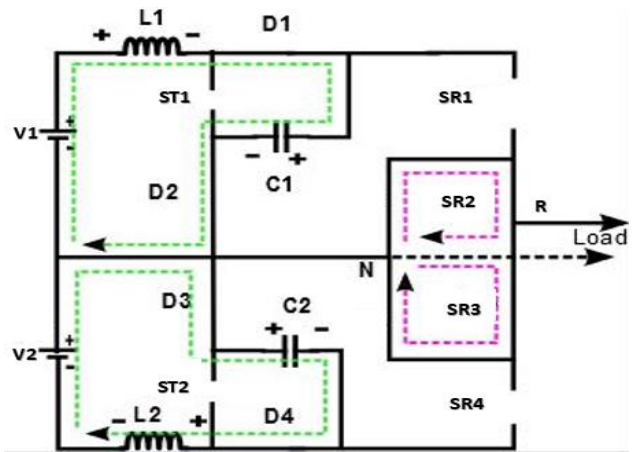


Fig -5: Operating circuit of proposed inverter during zero state “0 V”

**C. Shoot through state**

In the multilevel inverter, the shoot-through means switching on all the switches in the inverter leg results in the dead short circuit of the source in the conventional inverter, which can be avoided by using the proper dead band. Here the shoot-through state is utilized to get an additional level along with passive reactive element to boost the input dc voltage.

In this state of operation, all the switches of one or more inverter leg i.e.  $S_{x1}$ ,  $S_{x2}$ ,  $S_{x3}$ , and  $S_{x4}$  as well as switches  $ST1$  and  $ST2$  are turned 'ON'. Due to this, diodes  $D1$ ,  $D2$ ,  $D3$ , and  $D4$  are reverse biased as shown in figure-6. During this state stored energy in the capacitor 'C1' along with upper DC voltage source 'V1' energizes the inductor 'L1'. Similarly, stored energy in the capacitor 'C2' along with lower DC voltage source 'V2' energizes the inductor 'L2'.

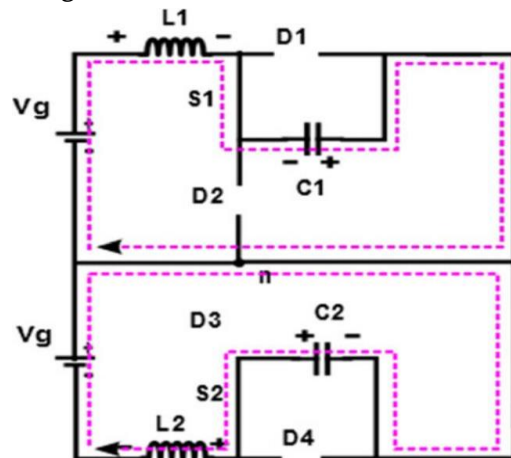


Fig-6: Operating circuit of proposed inverter during shoot through state

During both zero state and non-shoot through state in  $(1-Dst)*Tst$ :

$$VL1 = V1 - VC1 \quad (1)$$

$$VL2 = V2 - VC2 \quad (2)$$

While during shoot through state in  $(Dst*Tst)$

$$VL1 = V1 + VC1 \quad (3)$$

$$VL2 = V2 + VC2 \quad (4)$$

Where,

$V1$  and  $V2$  = Input DC voltage sources

$VL1$  and  $VL2$  = Voltage across inductor  $L1$  and  $L2$

$VC1$  and  $VC2$  = Voltage across capacitor  $C1$  and  $C2$

$Dst$  = Duty ratio during shoot through state

$Tst$  = Switching period of switches in the inverter

Now, using equation (1) and (3) under volt-sec balance condition,

$$(V1 - VC1)(1-Dst)*Tst + (V1 + VC1) Dst*Tst = 0 \quad (5)$$

From equations (5), voltage across  $C1$  is

$$VC1 = \frac{V1}{1-2Dst} \quad (6)$$

Similarly, using equation (2) and (4) under volt-sec balance condition,

$$(V2 - VC2)(1-Dst)*Tst + (V2 + VC2) Dst*Tst = 0 \quad (7)$$

From equations (7), voltage across  $C2$  is

$$VC2 = \frac{V2}{1-2Dst} \quad (8)$$

From equation (6) and (8), it can be seen that both the values of  $V1 = V2 = V$ ,

Therefore,  $VC1 = VC2 = VC$

$$VC1 = VC2 = VC = \frac{V}{1-2Dst} \quad (9)$$

From equation (9), it can be observed that the voltage across capacitors  $C1$  and  $C2$  are balanced. Let consider  $M$  is modulation index on which the inverter is operated. So, the relation between  $M$  and output phase voltage (AC peak value) will be,

$$\hat{V}_M = M*VC = \frac{MV}{1-2Dst} \quad (10)$$

The boost factor ( $B$ ) of this inverter given by

$$B = \frac{1}{1-2Dst} \quad (11)$$

Comparing equation (10) and (11) we get,

$$\hat{V}_M = M*B*V \quad (12)$$

Voltage gain factor ( $G$ ) is a factor by which the input voltage  $V$  becomes  $VC$  and is given by,

$$G = \frac{M}{1-2Dst} \quad (13)$$

$$G = M*B \quad (14)$$

So, by choosing proper values of  $M$  and  $Dst$ , this inverter can be used as boost inverter to get required output voltage. To get proper switching with this additional shoot through state the  $Dst$  and  $M$  should be,  $M+Dst \leq 1$ .

### III. DESIGNING CONSIDERATION OF THE L AND C AND MATHEMATICAL FORMULATION

For boosting purpose the value of inductor  $L$  and capacitor  $C$  should be properly selected. The designing of an inductor not easy and its selection is based on some typical criteria. It is typically larger and more expensive than the other circuit components and the most difficult of them to specify. Minimization of its inductance, size, and cost has become a very important factor while designing. The value of inductor for the boost converter has been selected on the basis of the inductor current ripple. With the help of some Texas Instrument datasheet [15-16], the calculation for inductor  $L$  has been done.

$$L = \frac{V \times (V_o - V)}{\Delta I_L \times f_s \times V_o} \quad (15)$$

Where,



$V$  = typical input voltage

$V_o$  = desired output voltage

$f_s$  = minimum switching frequency of the converter

$\Delta I_L$  = estimated inductor ripple current

For estimating the inductor ripple current, following equation is used

$$\Delta I_L = (0.2 \text{ to } 0.4) \times I_o(\max) \times \frac{V_o}{V} \quad (16)$$

$\Delta I_L$  = estimated inductor ripple current

$I_o(\max)$  = maximum output current

Inductor ripple current ( $\Delta I_L$ ) is normally 20%-40% of inductor current (IL).

The following equations can be used to calculate the capacitor values for a desired output voltage ripple

$$C = C_o(\min) = \frac{I_o(\max) \times D}{f_s \times \Delta V_{out}} \quad (17)$$

$C = C_o(\min)$  = minimum output capacitance

$I_o(\max)$  = maximum output current

$D$  = duty cycle

$f_s$  = minimum switching frequency of the converter

$\Delta V_o$  = desired output voltage ripple

$$\Delta V_o = ESR \times \left( \frac{I_o(\max)}{1-D} + \frac{\Delta I_L}{2} \right) \quad (18)$$

$ESR$  = equivalent series resistance of capacitor

#### IV. MODULATION SCHEME FOR A VOLTAGE BOOST NPC MULTILEVEL INVERTER

As there are total twelve switches, four switches per phase leg for this three-phase NPC inverter are available. For simple understanding here only four switches (Sx1 to Sx4) of one leg and two intermediate shoot through switches (ST1 and ST2) are considered. Here for generating gate control signal for each of inverter leg switch, the conventional sine-triangle comparison based pulse width modulation (PWM)

with unipolar voltage switching scheme is used. Here, for each phase, two modulating sine waves  $V_m(t)$  and  $-V_m(t)$  of  $180^\circ$  phase displacement are compared with triangular carrier signal  $V_{tri}(t)$  having a high frequency as shown in figure-7. When the modulating signal is greater than carrier signal the gate pulse is generated. For three phases, these modulating signals  $V_m(t)$  and  $-V_m(t)$  are phase displaced by  $120^\circ$  and compared with a triangular carrier signal to generate gate control signal for the inverter leg switches. The shoot through gate control signals are generated by comparing the high-frequency carrier signal  $V_{tri}(t)$  with two constant signals  $V_{st}$  and  $-V_{st}$  of amplitude  $(1-D) \times V$ . When the upper carrier signal is greater than the  $V_{st}$  and the lower carrier signal is less than  $-V_{st}$  the shoot through signal is generated.

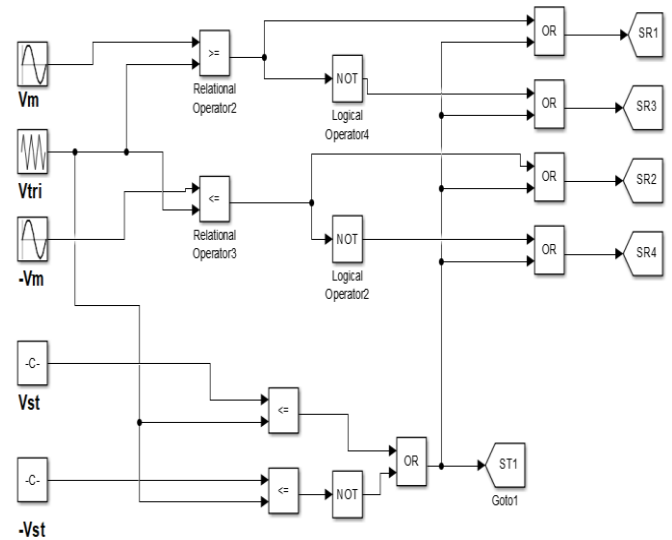
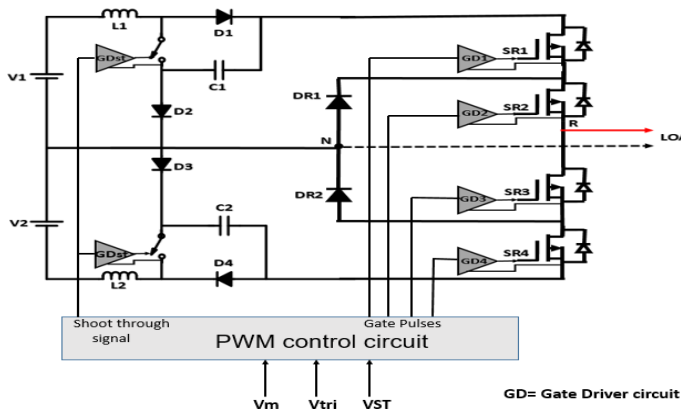


Fig -7: Unipolar PWM gate signal generation

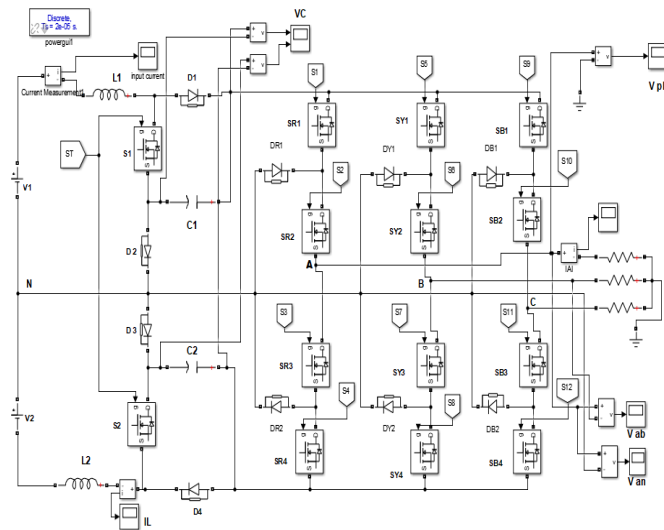
The gate control signals generated by using this unipolar PWM scheme are logically compared with the shoot through control signal and the combination of these signals fed to the switches of the inverter legs. These control signals are provided using dSpace controller board and gate driver circuit as shown in figure-8.



**Fig -8:** Actual PWM gate signal provide using gate driver circuit

**V. SIMULATION AND PROTOTYPE RESULTS**

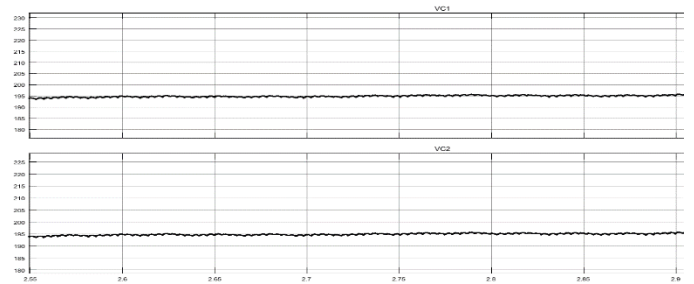
The analysis of this proposed inverter has been done using MATLAB/Simulink. For simulation purpose, the parameters have been chosen using above calculations. The parameters are as, input DC voltage source  $V1=V2=30\text{ V}$ , inductor  $L1=L2=3.33\text{ mH}$ , capacitor  $C1=C2\geq 470\text{ }\mu\text{C}$ , fundamental frequency  $f=50\text{ Hz}$ , while switching frequency  $f_s=2000\text{ Hz}$ , load/phase= $350\text{ }\Omega$ , and AC output voltage  $V_M=64\text{ V rms}$ . The MATLAB simulation circuit of the proposed inverter as shown in figure-9.



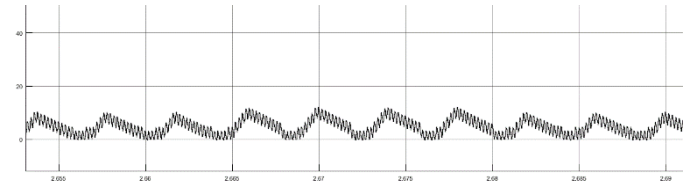
**Fig -9:** MATLAB simulation of proposed inverter

After simulating the proposed inverter in MATLAB Simulink with shoot through duty ratio ( $D_{st} = 40\%$ ) and modulation index have found to be ( $M = 0.6$ ), the

following results have come. When the input voltage to the inverter is  $30\text{ V DC}$ , the voltage across both the capacitors has found to be same, it means the capacitor voltages are balanced ( $V_{C1}=V_{C2}\approx 200\text{ V}$ ) as shown in figure-10. Current flowing through the inductor during the working of the inverter is comes as nearly equals to  $4\text{ A}$ , with  $40\%$  current ripple. This current is as shown in figure-11.

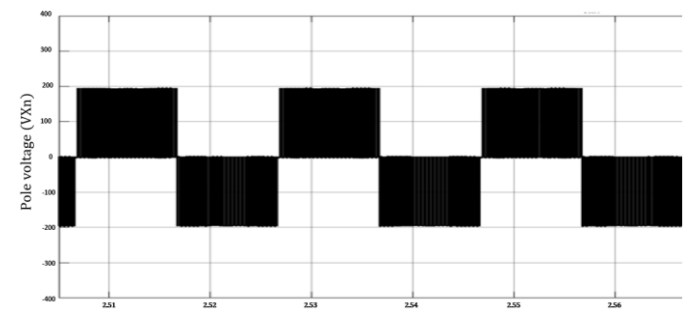


**Fig -10:** Voltage across the capacitor C1 and C2



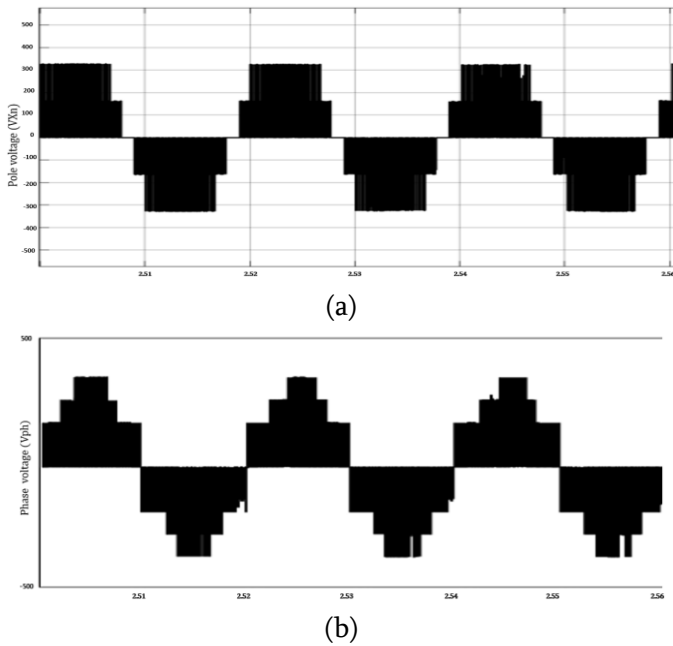
**Fig -11:** Inductor current

The three-level pole voltage (the voltage of one phase leg with respect to neutral point)  $V_{xN}$  has been seen in in the figure-12. It is seen that this pole voltage has three levels  $+200\text{ V}$ ,  $0\text{ V}$  and  $-200\text{ V}$ .



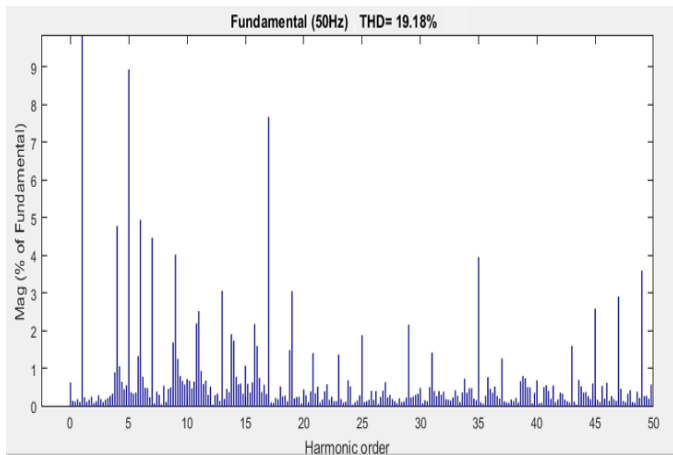
**Fig -12:** Pole voltage  $V_{xN}$

Similarly, the line to line voltage and phase voltage output waveform also as shown in following figure-13. It can be observed that the line to line voltage is approximately 1.73 times the pole voltage.



**Fig -13:** (a) Line to line voltage, (b) Phase voltage

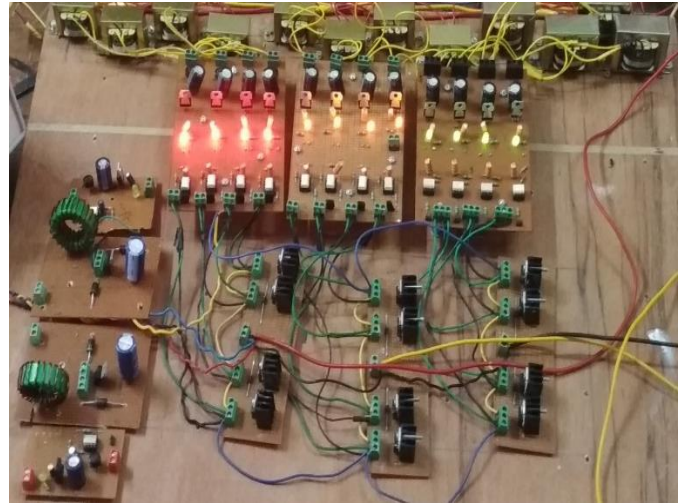
After doing the FFT analysis the total harmonic distortion (THD) of the output phase voltage has found to be nearly 19%, as shown in figure 14.



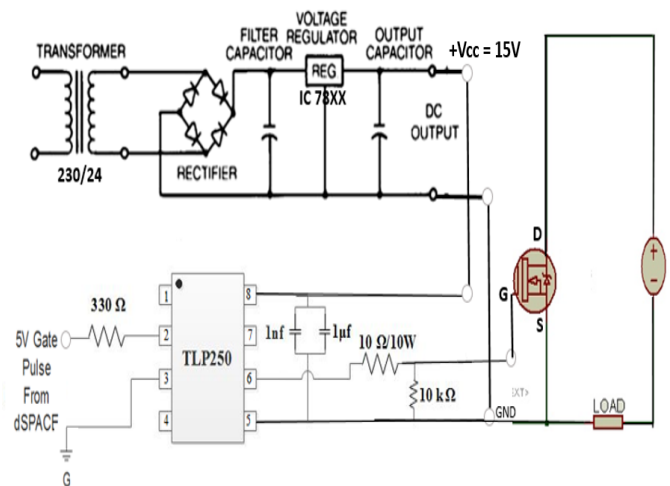
**Fig -14:** THD spectrum of proposed inverter

The prototype of this proposed inverter has been developed. Figure 15 shows the prototype of proposed inverter. The parameters for this voltage boost NPC multilevel inverter using LC impedance network are same as in case of simulation. Inductor and capacitor are selected on the basis of calculation. Modulating gate control signals have been generated using dSPACE R&D control Board 1104. Gate driver IC TLP

250 has been used here, which required  $+V_{cc}=15V$  for its operation. This gate driver circuit provides a gate signal to G terminal for the switch as shown in figure-16.

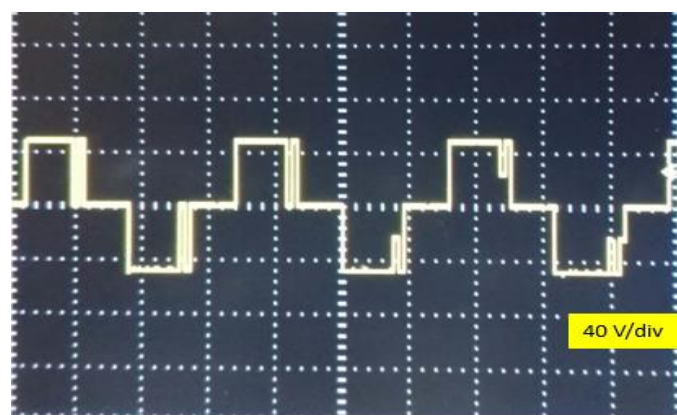


**Fig -15:** Hardware prototype of proposed inverter

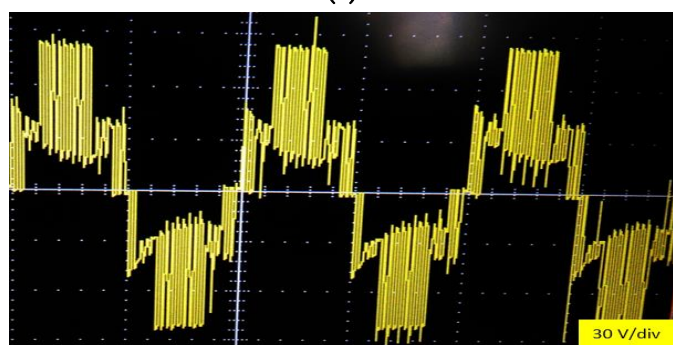


**Fig -16:** Complete control circuit for gate pulse generation

The prototype is initially run with low voltage and gradually its input voltage has been increased. When the input voltage set to 15 V the three-level pole voltage has been observed. The input 15 V to the proposed inverter has first being boosted to 46 V and same voltage have been fed to inverter legs. The output waveforms of pole voltage and line to line voltage are as shown in figure 17.



(a)



(b)

**Fig -17:** Pole voltage and line to line voltage of prototype

## VI. CONCLUSION

The proposed voltage boost multilevel NPC inverter using LC impedance network is able to boost the input dc voltage and provide required three-level ac output in a single stage. It uses the shoot through state for boosting up the voltage. It retains all the advantages of the multilevel Z-Source inverter and multilevel quasi Z-Source inverter using comparatively less number of passive reactive elements, so the weight, size, and cost are reduced. The most important part while designing this inverter is to design LC impedance network properly. If the values of L and C selected properly then the performance of this proposed inverter will be better and more efficient. Otherwise, the inductor may get saturated and performance will degrade. Unipolar PWM technique adapted for the proposed single inverter had been discussed which is simple and easy to implement. The inverter operation is analyzed by simulation using MATLAB/Simulink.

## VII. REFERENCES

- [1] J. Rodriguez, J.-S. Lai, and F. Z. Peng, "Multilevel inverters: A survey of topologies, controls, and applications," *IEEE Trans. Ind. Electron.*, vol. 49, no. 4, pp. 724–738, Aug. 2002.
- [2] J. Rodriguez, S. Bernet, B. Wu, J. O. Pontt, and S. Kouro, "Multilevel voltage-source-converter topologies for industrial medium-voltage drives," *IEEE Trans. Ind. Electron.*, vol. 54, no. 6, pp. 2930–2945, Dec. 2007.
- [3] Bin Wu, *High-Power Converters and AC Drives*, A John Wiley & Sons, Inc., Publication, New York, NY, USA: Wiley, 2006.
- [4] M. H. Rashid, *Power electronics handbook: Devices, circuits, and applications handbook*, third edition, Butterworth-Heinemann publications, USA, 2011.
- [5] M. R. Gour, S. S. Vanamane, "A Comparative Analysis of Multilevel Inverter: A Theoretical Review," *Int. Conf. on Recent Development in SEMH-18*, pp. 105–114, Jan. 2018.
- [6] P. Biczal, "Power electronic converters in dc microgrid," in *Proc. IEEE Compat. Power Electron. Conf. (CPE)*, 2007, pp. 1–6.
- [7] F. Z. Peng, "Z-source inverter," *IEEE Trans. Ind. Appl.*, vol. 39, no. 2, pp. 504–510, Mar/Apr 2003.
- [8] F. Z. Peng, M. Shen, and Z. Qian, "Maximum boost control of the Z-source inverter," *IEEE Trans. Power Electron.*, vol. 20, no. 4, pp. 833–838, Jul. 2005.
- [9] Soumya Shubhra Nag, S Mishra, "Current-Fed Switched Inverter," *IEEE Trans. Ind. Electron.*, vol. 61, no. 9, pp. 4680–4690, Sept. 2014.
- [10] P. C. Loh, S. W. Lim, F. Gao, and F. Blaabjerg, "Three-level Z-source inverters using a single LC impedance network," *IEEE Trans. Power Electron.*, vol. 22, no. 2, pp. 706–711, Mar. 2007.
- [11] P. C. Loh, F. Gao, and F. Blaabjerg, "Topological and modulation design of three-level Z-source

- inverters,” *IEEE Trans. Power Electron.*, vol. 23, no. 5, pp. 2268–2277, Sep. 2008.
- [12] Y. Liu, B. Ge, H. Abu-Rub and D. Sun, "Comprehensive Modeling of Single-Phase Quasi-Z-Source Photovoltaic Inverter to Investigate Low-Frequency Voltage and Current Ripple," in *IEEE Transactions on Industrial Electronics*, vol. 62, no. 7, pp. 4194-4202, July 2015.
- [13] D. Sun et al., "Modeling, impedance design, and efficiency analysis of quasi-source module in cascaded multilevel photovoltaic power system," *IEEE Trans. Ind. Electron.*, vol. 61, no. 11, pp. 6108–6117, Nov. 2014.
- [14] Manoranjan Sahoo, S. Keerthipati, "A Three-Level LC-switching-Based Voltage Boost NPC inverter," *IEEE Trans. Ind. Electron.*, vol. 64, no. 4, pp. 2876-2883, Apr. 2017.
- [15] Texas Instruments, "TPA2013D1 Boost Converter Component Selection," SLOA127 datasheet, Mar. 2009.
- [16] Texas Instruments, "How to Select a Proper Inductor for Low Power Boost Converter," SLVA797datasheet, Jun. 2016

# A Study of Living Roofs and Walls In Indian Context with a Sustainable Approach

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## ABSTRACT

Due to urbanization and industrialization, increased population is leading to shortage of green spaces. Due to this the world started facing some problems such as – Urban heat island, carbon foot print, storm water runoff etc. Living roofs and walls significantly contribute to sustainability by increasing energy efficiency of a building, helping our cities to mitigate the effect of heat island, provide sound insulation, give us a new ecology for various species and turn the wasted roof into various types of amenities. They are emerging as important addition into the palette of construction techniques. This paper shows the benefit of Living roofs and walls over conventional roofs and walls. Although Living roofs are initially more expensive to construct than conventional roof, they can be more economical over the life span because of the energy saved and the longevity of roof membranes. Green roofs are considered as a solution to improve the urban environment and are an ideal tool as the building choice to increase the environmental sustainability in urban setting. This paper aims to deal with living roof and wall techniques based on the strategies of sustainable development in architecture and its impact on environment and finding solution to the barriers in implementation of living walls and roof.

**Keywords :** Environmental Sustainability, Living Roofs, Living Walls.

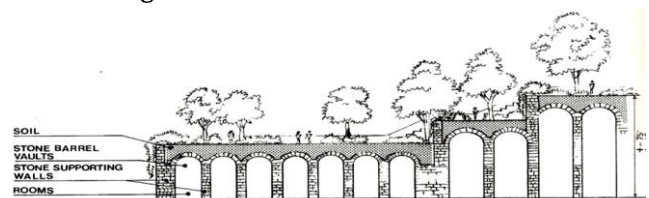
## I. INTRODUCTION

Living roofs and walls plays an important role in sustainability through its contribution to the natural ecosystem. The objectives of this study are to identify the barriers in implementation of green roofs and walls and finding out suitable solution to these barrier while implementation. Removing these barriers will contribute not only to the aesthetics but also to the environment.

### A. Evolution of Vertical Landscape

History reveals that purpose of vegetated roof were diverse. The earliest documented garden in the 7<sup>th</sup> century B.C. was the hanging garden of Babylon In Mesopotamia, near river Euphrates. They are called Hanging Garden because of plants hanging down over the year and looks like floating in the air. In more recent times, Green roof were seen to be as turf roof,

which provide insulation and it keeps their home cool in summer and warm in winter. After a lot of researchers taken place, this phenomenon was developed in Germany in 1960 which really help on understanding green roof. After this, further research on different components was carried out including studies on root repelling agents, water proofing membrane growing media, drainage etc. In India the concept has gained popularity only in the metropolitan cities where the horizontal spaces are not meeting the environmental needs.



**Figure 1** The section drawing of the Hanging Garden of Babylon, circa 500 B.C based on archeologist Robert Koldewey's description.

**SOURCE:** Roof Gardens: History, Design, and Construction by Theodore Osmundson. (Copyright © 1999 by Theodore Osmundson. Used by permission of W.W. Norton & Company, Inc)

**B. Current Scenario**

In India the only solution to live with plants in metropolitan cities like Delhi, Mumbai etc. was to save horizontal surface for public Garden or to grow vertical Garden. Recently vertical garden seen on the pillars of Bangalore Metro station which will help to ease pollution in city and enhance the aesthetic of the city. <sup>1</sup>Experts claim that pillars on which vertical gardens are erected lead to a drop of 2 degrees Celsius in the area. According to the Union environment ministry, Delhi generates over 131 tonnes of dust each day. Besides city aesthetics, these gardens also reduce the urban heat island effect. The Delhi-Meerut Expressway is the first bridge in the country as well as the world which has vertical gardens with solar power system and drip irrigation. Delhi is becoming more and more urbanized and so vertical gardens serve the dual purpose of improving air quality by trapping dust and pollutants and absorbing heat from the surroundings to provide a cooling effect. While it is easier to reduce the temperature of a building internally, you require large-scale implementation of such gardens across the capital to regulate external temperatures. But it is found that implementation of vertical gardening is very slow and facing many barriers.

**II. MATERIAL AND METHOD**

**A. Living Roof**

A roof which is covered with the vegetation and soil.. Living roof or green roof consist of several layers, including water proofing, drainage, insulation with

soil substrate, and actively growing plants. There is different type of green roof based on the depth and type of medium soil, Intensive green roof system characterized by deeper soil, high cost with professional maintenance and a regular irrigation system. Extensive green roofs are modern modification of roof – garden concept. They have comparatively shallower substrate, low cost with less maintained

Table - 1 Difference between intensive and extensive green roofing system

Characteristics	Extensive Roof	Intensive Roof
Structure	Roof does not require reinforcement	Structural improvement is necessary
Substrate type	Lightweight , suitable for large areas, low organic matter	Greater weight, deeper soil
Plant type	Low – growing communities of plants , vegetation grow spontaneously	Greater diversity of plants and habitats
Maintenance	Little or no maintenance required	More maintenance is necessary
Cost	Relatively inexpensive	High cost, more complex system and need expertise.
Efficiency	Less energy efficiency and storm water retention benefits.	More energy efficient – storm water management, thermal insulation.

<sup>1</sup> Source : Paras Singh, Times of India; How green was my Delhi : Vertical gardens withering my heat , jun 8, 2018, 01:12 IST

Green roof consist of Roof structure, waterproof membrane act as root repellent, Drainage, Insulation, substrate and plants. One of the most important elements in a roof is the bearing structure. Green roofs must typically support 25 to 100 pounds more load per square foot than conventional flat roofs. The roof's membrane needs protection, primarily from damage during green roof installation, but also from fertilizers and possible root penetrations. For this purpose generally large sized soft PVC foils are used. It is desirable to store water in green roofs to help plants survive through periods of dry weather. Excessive water drained from the plant zone. Rapid drainage can be provided by several water storing drainage product and its thickness depends on the type and vegetation of Green Roof. Beneath the growing media & above the drainage system, the filter fabric keeps the media from clogging up the drainage while allowing water to flow freely. The uppermost layer is growing medium which hold the vegetation.

**B. Living Walls**

Living wall systems are composed of pure vegetated, vertical modules or planted blankets that are fixed vertically to a structural wall or frame. It can be grown and supported in two ways without soil ( hydroponically) and with soil. Soil based wall are rarely used due to their heavy weight. Hydroponics (the process of growing plants in sand, gravel, or liquid wth added nutrients but without soil.) Hydroponically living walls are available in three system – Modular Panel system, Container and trellis and Felt system. Living wall consist of waterproofing membrane, Growing media ,vegetation, irrigation system and drip trays. These wall filter the air and provide thermal insulation. A variation of this concept could be applied to green façade systems as well, and there is potential to apply a hybrid of systems at a large scale.

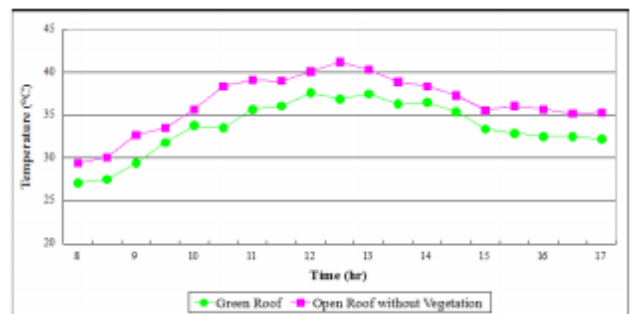
**III. ROLE OF VERTICAL LANDSCAPE IN SUSTAINABLE DEVELOPMENT**

Sustainability is a term first time coined in Brandt Land’s commission defines –“Meets the need of present generation without compromising and providing better environment for future generation”. Sustainability stands on three pillar – environment, social and economic. This research focuses on environment, social and economic benefits of Green roof and walls. Vertical landscape provides both public and private benefit. These are developed with the concern of environmental factors like Temperature and humidity, Wind, Rainfall and irrigation, solar radiation and orientation etc. It replaced the footprint of building with Green roof with no net loose of green open spaces or habitat. They contribute to the reduction of number of air particles and reduce carbon di oxide in the atmosphere reduces the heat island effect.

**A. Environmental Benefits**

i. Reduces Urban Heat Island Effect

Urban areas have large number of reflective surface which absorbs solar radiation and reflect this heat back into the atmosphere. Roof and walls are a significant part of urban hard surfaces. Green roofs and walls absorbs heat and pollution. This results in reduction of urban temperatures and improvements in air temperature. A Regional simulation model using 50% green roof coverage distributed evenly throughout Toronto showed temperature reductions as great as 2°C.



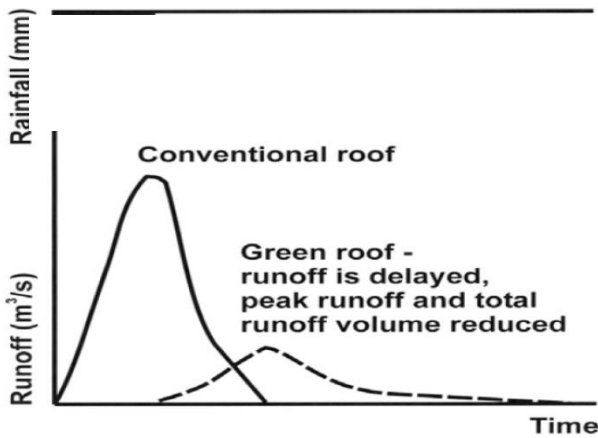
**Figure 2** Rainfall runoff response of the green roof and conventional roof



**SOURCE:** Jurnal Teknologi, Urban heat island mitigation using green roof approach , Published online on 1 April 2018

ii. Storm Water Management

Green Roofs are ideal for storm water management because roofs contribute to heavy runoff due to hard and non porous surfaces which leads to sewage overflow into lakes and rivers. Green roofs absorb and retain water helps in reducing amount of runoff. It store water in plant's foliage and evaporates off the substrate surface. The type of plant species, depth of growing substrate and structure of drainage layer, slope of the site and rainfall patterns affect the rate of runoff.



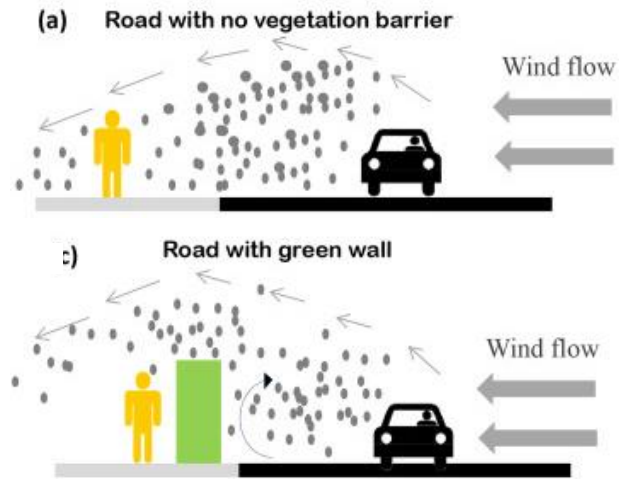
**Figure 3** Rainfall runoff response of the green roof and conventional roof

**SOURCE:** Muhammad Shafique, Reeho Kim and Kwon Kyung-Ho, Green Roof for Stormwater Management in a Highly Urbanized Area: The Case of Seoul, Korea, 26 December 2017; Accepted: 21 February 2018; Published: 26 February 2018

iii. Improved Air Quality

Due to urbanization, industrialization, population and number of vehicles increased which leads to air pollution.. Green walls reduce number of polluting air particle. Plants are natural filter absorbs carbon di oxide from the atmosphere and block the dust particle by filtering the air . It plays a important role in improving air quality. Studies have shown that urban

streets with trees have less dust particles than streets without trees. It also improves indoor air quality.

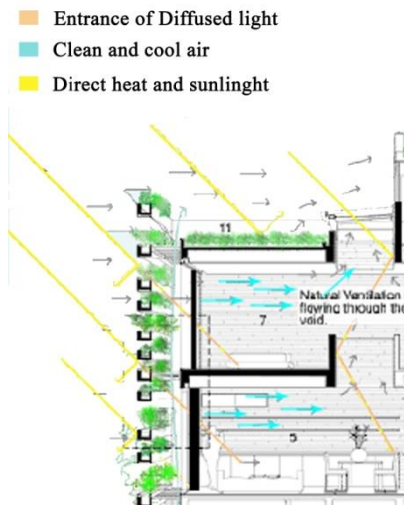


**Figure 4** Dispersion patterns of road pollutants under open road configurations (a) without vegetation barrier (b) with green wall.

**SOURCE:** Review article Air pollution abatement performances of green infrastructure in open road and built-up street canyon environments - A review, Atmospheric Environment, ELSEVIER

iv. Improved Thermal Performance

Living roof and wall reduces the amount of heat transferred through the roof and energy consumption of urban buildings through cooling the city. It provide insulation between indoor and outdoor environment. Green wall can reduce temperature up to 15 F , so that cooling load is also reduced by 10 % for the entire building. Green roof reduce heat flux through the roof by evapotranspiration, physically shading the roof. In winter, it also reduces conventional heat loss from the building.



**Figure 5** Thermal performance of Building  
**SOURCE:** (<http://www.dezeen.com> 2013).

v. Increase in Green Spaces and Urban Habitat

Green space provide ecological function, visually softening the built environment, supporting biodiversity, improve human health. Green roofs are commonly inhabited by various insects, ants, bugs, used by nesting birds. These findings have mobilized local and national conservation organization to promote green roof habitat.

Green roof if implemented in small scales but serving and involvement of large section of society. The various study carried out and confirmed that green roofs have more sustainable advantages than convention roof. The following table 2 compares the positive aspects of a green roof installation with a conventional roof.

Table 2: A comparison of benefit between a green roof and a conventional roof. Basic formwork is courtesy (Peck, 2008),

Benefit	Green Roof	Conventional Roof
Storm water volume retention	10-35% during wet season, 65-100% during dry season	None
Temperature	In hot season	Achieved

mitigation		with insulation
Improved water quality	Retains atmospheric deposition and retards roof material degradation. Reduced volume reduce pollutant loadings	None
Urban Heat Island Mitigation	Prevents temperature increases	With Light colored roof ,e.g. white roofs
Air Quality	Filters air and increases evapotranspiration	None
Energy Conservation	Insulate building roof	Through Addition of insulation, light colored roof and shading reduction in energy consumption may be achieved.
Vegetation	Allows seasonal evapotranspiration; photosynthesis,	None
Green Space	Replaces green spaces lost to due to the building footprint	None
Habitat	For bird and insects	None

Other advantages None	Buffers noise, alternative aesthetic, passive recreation offers	None
Cost offsets	Reduced storm water facilities, energy savings, higher rental values, increased property values, reduced need for insulation materials, reduced waste to landfill	None
durability	Waterproof membrane protected from solar and temperature exposure lasts more than 36 years; membrane protected from maintenance damages.	With Little protection and exposure to elements, roofs may last less than 20 years.

#### IV. DISSCUSSION

##### A. Barrier to Implementation

The main objective of this study is to implement sustainable technique like green roof and wall in order to improve the quality of life, make sustainable cities, urban areas that are jungle. But as a new technology, green roofs and walls face many barriers. The major barriers to the more rapid diffusion of these sustainable development are technologies are lack of

knowledge and awareness people don't know about green roof and walls, lack of specialized products on the market; few examples of roof and vertical garden installations; and no industry technical standards for green roofs, which means no standards in building codes. There is also a risk associated with uncertainty. Cost on the other side a big barrier to implementation of green roof. Cost is affected by the system of roofing, market development, in this process of implementing green roof and walls, it is also necessary to fight against false areas ideas or misconception. Due to lack of knowledge people believe that green roof and wall cost more and requires costly maintenance. Many of these barriers represent fairly standard challenges facing the adoption of new technologies. The significant environmental benefits are attainable, in the absence of government policy, do not find expression in the market place.

##### B. Solution to these Barriers

It also seen that green roof installation needs to be done by professionals. There should be national policy for encouraging the living roofs and walls. Global awareness should be increased with increase in number of international seminar and conferences. In Indian context, some small incentives for developer can be put for increasing them, due to lack of demand and supply, cost of green roof is also high.

Make it mandatory through legislation, planning instruments to the building code to fit new building with green roofs and vertical garden technologies. Aware people and builders to use wasted spaces in the normal flat roofs of the building by making it green roof in order to enhance more sustainable environment. There is also a perceived need of decision- makers to enter long – term investment that often yield the greatest degree of public benefit. Standardization and certification of green roof product and the introduction of complete process.

## V. CONCLUSION

Increased pollution, temperature threatens the health of people in big cities, considering the environmental effect green walls and roofs are necessary. Researchers should be carried out more on native plants around the world so that the use of green roofs can become more successful, gain more acceptance. Green roofing is an important factor that cannot be neglected when trying to achieve sustainable environments because of its numerous importance to urban areas and the world at larger scale.

## VI. REFERENCES

- [1] Green roofs as urban ecosystem: Ecological structures, Functions and services, American institute of building science, Bioscience article, November 2007/vol. 57No. 10
- [2] Flavie Mayrand and philippe Clergeau, Green Roofs and Green walls for Biodiversity conservation : A contribution to urban connectivity ? MDPI, sustainability 2018, volume 10, issue 4
- [3] Peter M. Philippi , How to get cost reduction in green roof construction , Fourth Annual Greening Rooftops for sustainable communities conference 2006
- [4] Suruchi Modi, Vertical Landscaping – A Tool for sustainable Tall Buildings in Tropical Climates, International journal of Landscape Planning and Architecture , Vol 3: Issue 1
- [5] HamidrezaShokati and Feridoun Nahidiazar, Implementation of Green Roofs and Walls in Tourist Residential Centers; A New Approach in Architecture and Aroused From the concepts of sustainable Development , Research Journal of Recent Sciences , Vol.4(1) , 135-139, January ( 2015)
- [6] Rufai Mohammed Ahmed and Asst. Prof. Dr. Halli Z Alibaba, An Evaluation of Green roofing in Buildings, International Journal of scientific and Research Publications, Volume 6 ,Issue 1, January 2016
- [7] Ar. Ankit Kumar, Vertical gardens for India Social, Architecture Acceptance & Practice, International Journal of emerging technologies ( Special Issue – 2017), 8(1): 18-24(2017)
- [8] Vinod Kumar V, Dr. A.M. Mahalle, An experimental Assessment of the Influence of Extensive Green Roofs on energy conservation, International journal of Applied Engineering Research ISSN0973-4562 Volume 11, November 8 (2016) pp 5879-5874
- [9] Steven W. Peck and Chris Callaghan, Greenbacks from Green roof: forging a new industry in Canada, Environmental adaptation research group , Environment Canada , pg:
- [10] Rohini Shrivastava, Green Roof Design and Practices : A case study of Delhi
- [11] Graeme Hopkins, Christine Goodwin, Living Architecture : Green roofs and walls
- [12] Dr. Samar Sheweka, Arch, Nourhan Magdy, The Living walls as an Approach for a Healthy Urban Environment, Energy Procedia 6(2011) 592-599
- [13] Mohammad Mehdi Sadeghian, Green Roof, A Review of History and Benefits, International Journal of Scientific Research and Techology, volume 3, Issue 3, Print ISSN : 2395- 6011
- [14] Mohammad Mehdi Sadeghian, A Review on Green wall, classification and function, International Journal of Scientific Research and Techology, volume 2, Issue 2, Print ISSN : 2395- 6011
- [15] Blanc, Patrick, The vertical Garden ; From Nature to the City. New York : W. W. Norton . 2008
- [16] “The International Green roof & Green wall Projects Database” Greenroofs.com

- [17] Francis R.A. and Lorimer, J. (2011) Urban reconciliation ecology : The potential of living roofs and walls, *J. Environ. manage.*, 92(6), 1429-1437
- [18] S. Brenneisen. 2006. Space for Urban Wildlife: Designing Green Roofs as Habitats in Switzerland, *Urban Habitats*, 4(1): 27-36.
- [19] J. Mentens, D. Raes, M. Hermy. 2006. Green roofs as a tool for solving the rainwater runoff problem in the urbanized 21st century? *Landsc Urban Plan*, 77:217-226.
- [20] S.S.G. Hashemi, H.B. Mahmud, M.A. Ashraf. 2015. Performance of green roofs with respect to water quality and reduction of energy consumption in tropics: a review. *Renew Sustain Energy Rev*, 52:669-679.
- [21] Green Roofs for Healthy Cities, Available at: [www.greenroofs.org](http://www.greenroofs.org).
- [22] Elliott, R. M. (2015). *Vegetated Infrastructure for Urban Stormwater Management: Advances in Understanding, Modeling and Design* (Doctoral dissertation, COLUMBIA UNIVERSITY).
- [23] Stater, D. (2008). Green roofs: Sustainability from top down. Retrieved 3rd December 2015 from <http://lda.ucdavis.edu/people/2008/DStater.pdf>
- [24] The Green Roof and Green Wall Project database. Retrieved from <http://www.greenroofs.com/projects/plist.php> 11th November 2015.
- [25] D.B. Rowe. 2011. Green roofs as a means of pollution abatement. *Environ Pollut*, 159:2100- 2110.
- [26] Oke, TR. (1982). "The energetic basis of the urban heat island." *Quarterly Journal of the Royal Meteorological Society* 108: 1-24.
- [27] Magill, J. D., Midden, K., Groninger, J., and Therrell, M. (2011). *A History and Definition of Green Roof Technology with Recommendations for Future Research*. Retrieved on 12th December 2015 [http://opensiuc.lib.siu.edu/gs\\_rp/91](http://opensiuc.lib.siu.edu/gs_rp/91)
- [28] Bass B, Krayenhoff ES, Martilli A, Stull RB, Auld H. 2003. The impact of greenroofs on Toronto's urban heat island. Pages 292-304 in *Proceedings of the First North American Green Roof Conference: Greening Rooftops for Sustainable Communities*; 20-30 May, Chicago. Toronto (Canada): Cardinal Group
- [29] M. Razzaghmanesh, S. Beecham, F. Kazemi. 2014. Impact of green roofs on storm water quality in a South Australian urban environment. *Sci Total Environ*, 470:651-659
- [30] Gaffin S, Rosenzweig C, Parshall L, Hillel D, Eichenbaum-Pikser J, Greenbaum A, Blake R, Beattie R, Berghage R. 2006. Quantifying evaporative cooling from green roofs and comparison to other land surfaces. Paper presented at the *Fourth Annual Greening Rooftops for Sustainable Communities Conference, Awards and Trade Show*; 11-12 May 2006, Boston.
- [31] Wong NH, Chen Y, Ong CL, Sia A. 2003. Investigation of thermal benefits of rooftop garden in the tropical environment. *Building and Environment* 38: 261-270.
- [32] Theodosiou TG. 2003. Summer period analysis of the performance of a planted roof as a passive cooling technique. *Energy and Buildings* 35: 909-917.
- [33] Lisa, K., Robert, R., 2007. "Comparative environmental life cycle assessment of green roofs", *Building and Environment* 42, 2606-2613.
- [34] Ray, S., Glicksman L., 2010. *Potential Energy Savings of Various Roof Technologies. Buildings XI Conference -- Proceedings ASRAHE*
- [35] Liu, K.K.Y., Baskaran, B., 2003. Thermal performance of green roofs through field evaluation. *Proceedings for the first North American green roof infrastructure*

conference, awards, and trade show, Chicago, IL, May 29–30. pp. 1–10.

- [36] Muhammad Shafique, Reeho Kim and Kwon Kyung-Ho, Green Roof for Stormwater Management in a Highly Urbanized Area: The Case of Seoul, Korea , 26 December 2017; Accepted: 21 February 2018; Published: 26 February 2018
- [37] Jurnal Teknologi, Urban heat island mitigation using green roof approach , Published online on 1 April 2018

# Analysis of Road Accident Locations Using DBSCAN Algorithm

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## ABSTRACT

Road and traffic accidents are one of the important problems in India. However, as accidents are unpredictable and can occur in any type of situation, there is no guarantee that this trend will sustain in future also. Therefore, the identification of different geographical locations where most of the accidents have occurred and determining the various characteristics related to road accidents at these locations will help to understand the different circumstances of accident occurrence. In this paper we apply data mining algorithms on accident dataset as an attempt to address this problem. Association rules were discovered by Apriori algorithm, clusters containing accident prone areas were formed by DBSCAN Algorithm, an android application using fragments was developed to alert the user when he/she enters cluster regions i.e. accident prone areas (ARP) by sending user popup message.

**Keywords :** Association Rule Mining, DBSCAN algorithm, Apriori Algorithm

## I. INTRODUCTION

In recent years, because of too much travel speed of road traffic, the accidents have been increasing on yearly basis. Road accidents happen quite frequently and they claim too many lives every year. Sometimes, it is found that road accident occurrences are more frequent at certain specific locations. The analysis of these locations can help in identifying certain road accident features that make a road accident to occur frequently in these locations.

Data mining uses many different techniques and algorithms to discover the relationship in large amount of data. It is considered one of the most important tool. Association rule mining algorithm is a popular methodology to identify the significant relations between the data stored in large dataset and also plays a very important role in frequent item set mining. A classical association rule mining method is the Apriori Algorithm whose main task is to find

frequent item sets, which is the method we use to analyse data.

Clustering is a process of making a group of abstract objects into classes of similar objects. One of the common clustering method is the DBSCAN algorithm is used. It is a density based clustering algorithm: given a set of points in space, it groups together points with many nearby neighbours.

Using Map Activity we created maps in android studio. GPS of the user is tracked using user's latitude and longitude. Using Marker, position of the user is marked. Clusters (Accident prone areas) are also marked in application.

We used an accident dataset ,refer to fig 1 which is provided by Traffic police control office. It contains details of accidents that occurred between 2010 and 2017.The dataset contains 11596 records.

	E	F	G
Location		Latitude	Longitude
near MM Hospital, Asifnagar Road		17.39338	78.44462
opposite to HDFC Bank Malakpet		17.37227	78.50961
At Mettuguda Signal, Mettuguda, Secunderabad		17.43615	78.51876
At Mettuguda Signal, Mettuguda, Secunderabad		17.43615	78.51876

Fig 1: Dataset

## II. RELATED WORKS

Liling Li and Sharad Shrestha [1] applied statistics analysis and data mining algorithms on the fatal accident dataset. It is an attempt to give road safety suggestions. They discovered Association rules by Apriori algorithm, classification model was built by Naive Bayes classifier, and clusters were formed by K-means clustering algorithm. The relationship between fatal rate and other attributes including light condition, collision manner, surface condition, weather, and drunk driver were investigated. They used the Fatal Accidents Dataset that contains all fatal accidents on public roads in 2007.

Sachin Kumar and Durga Toshniwal [2] used data mining techniques to identify high-frequency accident locations and further analyzing them to identify various factors that affect road accidents at those locations. They first divided the accident locations into k groups based on the accident frequency counts using k-means clustering algorithm. Then association rule mining algorithm is applied on these to reveal the correlation between different attributes in the accident data and understand the characteristics of these locations.

Amira A. El Tayeb, Vikas Pareek, Abdelaziz Araar [3] used association rule mining algorithms to deliver rules from larger dataset. First data preprocessing is applied on collected records. They collected 1887 traffic records from Dubai police authority then they applied association rules to find frequent pattern sets. They used Data mining software, Weka tool to get these association rules.

Deepthi Jayan.K and B.Ganeshkumar [4] an effort was made to identify the accident hotspots, it was an GIS based implementation for Kannur District, Kerala. For this they used the 2006, 2007, 2008 road accident data set. The data set included attributes like date, location, type of vehicle involved, number of persons injured or died. To identify the accident-prone areas Density function available in the spatial analyst extension of the Arc GIS software was applied. Map scanning, Geo referencing, Digitizing were used.

Dipo T. Akomolafe, and Akinbola Olutayo [5] used data mining tool to predict the likely occurrence of accident on highways, the likely cause of the accident and accident prone locations was proposed using Lagos –Ibadan highway as a case study. WEKA software was used to analyze accident data gathered along this road. The results showed that causes of accidents, specific time/condition that could trigger accident and accident prone areas could be effectively identified. Decision Tree was proposed to model data from road accident database to determine causes of accidents and accident prone locations using historical data collected from Ibadan-Lagos express road as reference point. Attribute importance analysis was carried out to rank the attribute by significance using information gain. Finally, correlation based feature subset selection (cfs) and consistency subset selection (COE) filter algorithm were used to rank and select the attribute that are most useful.

Ali Moslah Aljofey and Khalil Alwagih [6] analysed times of accident frequencies for highway locations. The proposal framework consists of clustering technique and classification trees. The k-means algorithm is applied to a set of frequencies of highway locations accidents within 24 hours to find out when and where accidents occur frequently. These frequencies were extracted from 358,448 accident records in Britain between 2013 and 2015. As a result of clustering technique, four clusters were ranked in descending order according to the accidents rate for



location within the cluster. After that, the decision tree (DT) algorithm is applied to the resulting clusters to extract the decision rules as the cluster name represents the class value for all tuples contained.

Geurts K, Wets G, and Brijs T, Vanhoof K [7] identified and profiled black spots and black zones (geographical locations with high concentrations of traffic accidents) in terms of accident-related data and location characteristics must provide new insights into the complexity and causes of road accidents, which, in turn, provide valuable input for governmental actions. Association rules were used to identify accident-related circumstances that frequently occur together. Furthermore, these patterns were analyzed and compared with frequently occurring accident-related characteristics at low-frequency accident locations. The strength of this approach lies with the identification of relevant variables that make a strong contribution toward obtaining a better understanding of accident circumstances and the discerning of descriptive accident patterns from more discriminating accident circumstances to profile black spots and black zones. This data-mining algorithm is particularly useful in the context of large data sets for road accidents. The results showed that human and behavioural aspects are of great importance in the analysis of frequently occurring accident patterns. These factors play an important role in identifying traffic safety problems in general. However, the accident characteristics that were the most discriminating between high-frequency and low-frequency accident locations are mainly related to infrastructure and location.

Divya Bansal, Lekha Bhambu [8] elaborates upon the use of association rule mining in extracting patterns that occur frequently within a dataset and shows the implementation of the Apriori algorithm in mining association rules from a dataset containing crimes data concerning women. As for this WEKA tool is used for extracting results. For this one dataset is taken from

UCI repository and other data is collected manually from the session court of sirsa to collect data on heart melting crimes against women. The main motive to use UCI is to first check the proper working of dataset and then apply Apriori on real dataset against crimes on women which extracts hidden information that what age group is responsible for this and to find where the real culprit is hiding. faster than Predictive Apriori Algorithm.

Kim[9] developed a log-linear model to clarify the role of driver characteristics and behaviours in the causal sequence leading to more severe injuries. They found that driver behaviours of alcohol or drug use and lack of seat belt use greatly increase the odds of more severe crashes and injuries.

Bedard [10] applied a multivariate logistic regression to determine the independent contribution of driver, crash, and vehicle characteristics to drivers' fatality risk. It was found that increasing seatbelt use, reducing speed, and reducing the number and severity of driver side impacts might prevent fatalities.

Abdel-Aty [11] used the Fatality Analysis Reporting System (FARS) crash databases covering the period of 1975-2000 to analyze the effect of the increasing number of light truck vehicle (LTV) registrations on fatal angle collision trends. They investigated the number of annual fatalities that result from angle collisions as well as collision configuration (car-car, car-LTV, LTV-car, and LTV-LTV).

Ossiander [12] used Poisson regression to analyse the association between the fatal crash rate (fatal crashes per vehicle mile travelled) and the speed limit increase and found that the speed limit increase was associated with a higher fatal crash rate and more deaths on freeways.

### III. METHODOLOGY

The approach we took for our study follows:

#### A. Apriori Algorithm

In case of road accident data, an association rule can identify the various attribute values which are responsible for an accident occurrence. The data we considered for association rule mining is assumed data. An arff file is created considering the attributes that are shown in table 1.

After applying apriori algorithm with minimum support=0.2 and minimum confidence=0.9 in weka, association rules were generated. The best 10 rules are shown in Fig 2. We could see that more no. of accidents are occurring due to 2-wheelers. Strong rules with high lift value disclose that curves at markets are main locations where accidents have occurred.

Attribute Name	Type	Values
Accident Category	Nominal	2-wheeler, 3-wheeler, 4-wheeler, pedestrian-hit, multi-vehicular-incident
Location_No	Nominal	A, B, C, D, E, F, G, H, I, J
Lighting on road	Nominal	daylight, streetlight, nolight
Roadway feature	Nominal	curve, slope, intersection
Accident Severity	Binary	critical, non-critical
Area Around	Nominal	hospital, hill, market, agriculture-land
Road Type	Nominal	highway, non-highway

Table 1: Attributes

#### Apriori Algorithm:

Step1: Scan the data set and find the support(s) of each item.

Step2: Generate length (k+1) candidate item sets from length k frequent item sets to generate the set of candidate k - item set.

Step3: Scan the candidate k item set and generate the support of each candidate k - item set.

Step4: Add to frequent item set, until C=Null Set.

Step5: For each item in the frequent item set generate all non empty subsets.

Step6: For each non empty subset determine the confidence. If confidence is greater than or equal to this specified confidence. Then add to Strong Association Rule

- Min\_support=0.2
- Min\_conf=0.9

#### B. Clustering

To find out which areas are accident prone areas, DBSCAN algorithm is applied. It requires two values. One is epsilon value, which specifies how close points should be to each other to be considered a part of cluster and other is minPts, which specifies how many neighbours a point should have to be included into a cluster.

DBSCAN is performed based on two attributes (latitude and longitude). The result contains clusters (each cluster contain group of accident areas). These clusters are marked on map as shown in fig 3.

#### DBSCAN Algorithm:

Let  $X = \{x_1, x_2, x_3, \dots, x_n\}$  be the set of data points. DBSCAN requires two parameters:  $\epsilon$  (eps) and the minimum number of points required to form a cluster (minPts).

Step1: Start with an arbitrary starting point that has not been visited.

Step2: Extract the neighbourhood of this point using  $\epsilon$  (All points which are within the  $\epsilon$  distance are neighbourhood).

Step3: If there are sufficient neighbourhood around this point then clustering process starts and point is marked as visited else this point is labelled as noise (Later this point can become the part of the cluster).

Step4: If a point is found to be a part of the cluster then its  $\epsilon$  neighbourhood is also the part of the cluster.

Step5: A new unvisited point is retrieved and processed, leading to the discovery of a further cluster or noise.

Step6: This process continues until all points are marked as visited.

**C.Android Application**

After clustering is performed an android application is developed that sends a popup message to the user when he/she enters accident prone area. Map activity is used to get maps.

Steps performed to send a message to the user follows:

- Creating a map (using map activity)
- Getting GPS of the user ,see in fig 4 (using location listeners)
- Display Accident Prone Areas in map (which are obtained from clustering see in fig 5)
- Finding out user entering that region (using latitudes and longitudes)
- Popup message (send pop up message when user enters cluster area)

**IV. RESULTS**

1. Area\_around=market 21 ==> Road\_type=non-highway 21
2. Area\_around=hill 20 ==> Road\_type=non-highway 20
3. Roadway\_feature=curve Area\_around=market 18 ==> Road
4. Accident\_severity=critical Area\_around=market 16 ==>
5. Accident\_category=2-wheeler Area\_around=market 14 ==>
6. Accident\_category=2-wheeler Area\_around=hill 13 ==>
7. Accident\_severity=critical Area\_around=hill 13 ==> R
8. Roadway\_feature=curve Accident\_severity=critical Area\_around=market 12 ==>
9. Accident\_category=2-wheeler Roadway\_feature=curve Area\_around=hill 11 ==>

Fig 2: Association rules

The above screenshot contains 10 best rules found in weka by applying apriori algorithm.

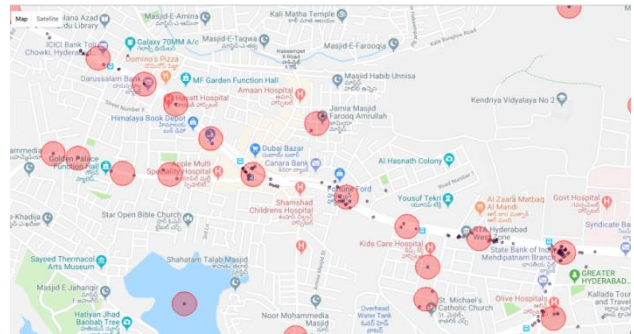


Fig 3: Clusters

In the above figure black points are accident areas and red circles are clusters formed.

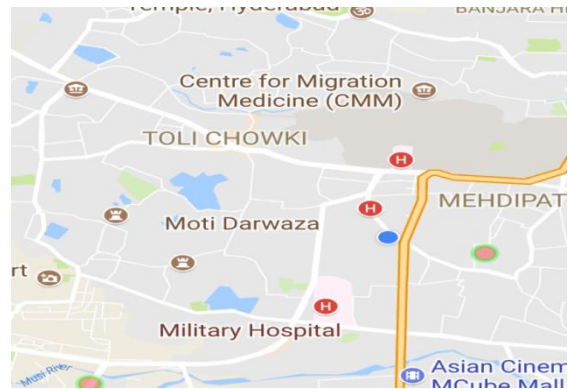


Fig 4: User location

The above figure contains blue mark which is user location. The above figure contains blue mark which is user location

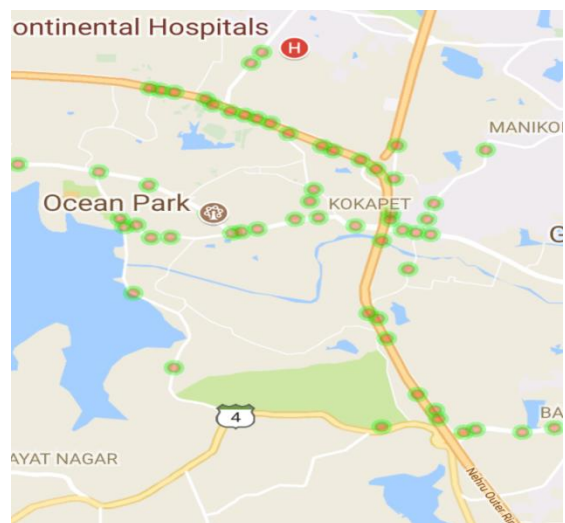


Fig 5: clusters marked in app

The above figure contains accident prone areas. These are obtained from clustering.

## V. CONCLUSION

Various data mining techniques such as clustering, association rule mining are widely used in the system to identify reasons that affect the severity of road accidents. Association rule mining is a very popular technique that can be used to identify the relationship among different sets of attributes that frequently occur together when an accident takes place. In our system, we applied association rule mining algorithm on different groups of accident locations. The rules generated for every group exposed the various factors associated with road accidents in these locations. The results obtained from DBSCAN clustering gives the cluster of accident areas. The user is notified when he/she enters accident area. Thus accidents can be decreased to an extent.

## VI. REFERENCES

- [1]. Liling Li, SharadShrestha, Gongzhu Hu, " Analysis of Road Traffic Fatal Accidents Using Data Mining Techniques", IEEE, Vol.10, 2017, No.11-09.
- [2]. Sachin Kumar, DurgaToshniwal, "A Data mining approach to characterize road accident locations", J. Mod. Transport, Vol.24, 2016, No.1,62-72.
- [3]. Amira A. El Tayeb, VikasPareek, AbdelazizAraar" Applying Association Rules Mining Algorithms for Traffic Accidents in Dubai", IJSCE, Vol.5,2015.
- [4]. DeepthiJayan.k, B.Ganesh Kumar "Identification of Accident Hot Spots: A Gis Based Implementation for Kannur District, Kerala " IJGG, Vol.1, 2010.
- [5]. Dipot.Akomolafe, Akinbola Olutayo, " Using Data Mining Technique to Predict Cause of Accident and Accident Prone Locations on Highways", American Journal of Database Theory and Application ,Vol:2012, No.1(3): 26-38
- [6]. Geurts K, Wets G, Brijs T, Vanhoof K, " Pro?ling of high frequency accident locations by use of association rules". Transport Research Vol.10,2013
- [7]. Ali Moslah Aljofey and Khalil Alwagih "Analysis of Accident Times for Highway Locations Using K-Means Clustering and Decision Rules Extracted from Decision Trees." ISSN, Vol .7,2018.
- [8]. Divya Bansal and Lekha Bhambhu. Execution of Apriori algorithm of data mining directed towards tumultuous crimes concerning women"". International Journal of Advanced Research in Computer Science and Software Engineering, 3(9), September 2013.
- [9]. Kim, K., Nitz, L., Richardson, J., & Li, L., Personal and Behavioral Predictors of Automobile Crash and Injury Severity"" Accident Analysis and Prevention, Vol. 27, No. 4, 1995, pp. 469-481.
- [10]. Bedard, M., Guyatt, G. H., Stones, M. J., & Hireds, J. P., "The Independent Contribution of Driver, Crash, and Vehicle Characteristics to Driver Fatalities". Accident analysis and Prevention, Vol. 34, 2002, pp. 717-727.
- [11]. Abdel-Aty, M., & Abdelwahab, H., "Analysis and Prediction of Traffic Fatalities Resulting From Angle Collisions Including the Effect of Vehicles-Configuration and Compatibility" Accident Analysis and Prevention, 2003.
- [12]. Ossiander, E. M., & Cummings, P., "Freeway speed limits and Traffic Fatalities" in Journal of Computer Applications, Vol II, No.4, Oct - Dec 2009 Page 37 Washington State. Accident Analysis and Prevention, Vol. 34, 2002, pp. 13-18.

# Face Spoofing Detection Techniques using Biometrics

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## ABSTRACT

The modern biometric technologies provides us better convenience and security features. Face Recognition Biometric systems are being used and deployed in applications such as surveillance, forensic investigation etc., but it is vulnerable mostly in case of face spoofing attacks. Such spoofing can be done by means of video frames, printed photo. To detect these types of attacks, the liveness of face detection is being developed, and also being deployed in face recognition biometric systems. If these methods don't exist in the face recognition biometric systems, it may give permission to a malicious person to masquerade as authentic users to the data file system. To address these problems, it's important to develop a secure biometric recognition system. The current method and approach to detect the liveness within the facial biometrics by making use of the feature extraction methods, includes Local Binary Pattern (LBP), Color Moment Features (CMF). In the proposed system combining two or three features proposed mainly, Histogram of Oriented Gradients (HOG), Spectral Information Divergence (SID), Binarized Statistical Image Features (BSIF), Weber Local Descriptor (WLD) and Local Phase Quantization (LPQ). Support Vector Machine (SVM) classifier gives the result as whether the image is spoofed or real. Done detailed survey on face spoof detection methods, feature methods and algorithms that are existing today and being used for the detection of spoof images. Based on the facts gathered, the execution with minimum and simple use of hardware makes biometric systems better secured and robust.

**Keywords:** Face Anti-Spoofing, Spoof Detection, LBP, CMF, SVM, SID, LPQ, BSIF, HOG and WLD.

## I. INTRODUCTION

Biometric techniques uses the behavioural features or biological features for authenticating the user. The traditional authentication techniques like passwords, pin numbers etc. has lesser convenience and worst security compared with the biometric technologies. However, one of the challenging factors in biometric technique is to identify theft, which is commonly known as spoofing attacks.

The spoofing attack occurs generally when an aggressor seek to bypass the face biometric system by using a fake face image in front of an authenticating

camera [7]. The attacker tries to masquerade as authorized user or someone else through data malfunction and achieving unauthorized access. Thus, the biometric system is exposed to the possibility of being harmed by many attacks, mainly print attacks, reply attack and 3D masking [1].

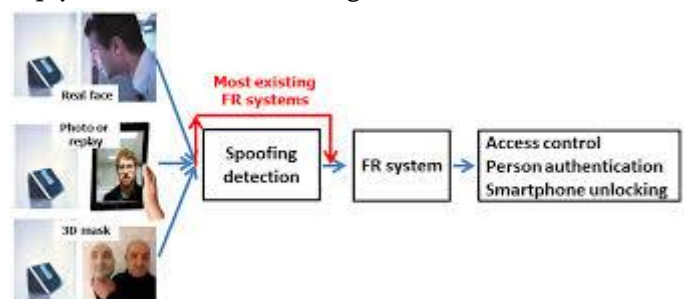


Fig. 1. FR with Spoof Detection [4].

When we compare face recognition with other biometric systems or techniques, face recognition is mostly user convenient due to its accessibility, as it doesn't require any hardware additionally, as in the case of other biometric technique. Face Recognition (FR) systems are used in areas like employee identification, banking domain etc. So, face spoof detection biometric system has to be deployed along with the face recognition system, thereby providing security by preventing the unauthorized users by detecting their identity in less response time and preventing their access to the system

Face Recognition technique is being used rapidly now a days, based on its convenience and also the user-friendly interface provided to users. In modern society, biometrics has increased in its significance. Main agenda of security systems is verifying the identity of individual [6]. Thereby, preventing the sacred resources from being accessed by impersonators. Impersonators try to gain access to the system through spoofed biometrics. So, we make use of liveness detection in order to improve biometric system performance. Liveness detection mechanism is one of the challenging issues faced, that confirms the biometric security systems truthfulness against spoof attacks [8].

The first section of this paper gives an introduction to the biometrics. The second section is regarding what all methods, features are being used in face spoof detection to determine the spoof and real images. The third section is about the proposed system architecture. The fourth section is about the experimental results obtained while carrying out the proposed methodology. The final section discusses the conclusion and future work.

## II. METHODS AND FEATURES

This section describes the basic methods, feature descriptors that are used for determining whether an

image is spoof or real one. The various features that are used in this spoof detection system are discussed:

### A. Classifiers

1) Support Vector Machine(SVM): Support Vector Machine has high classification accuracy and is a widely used pattern classification method. Kernel based SVM uses non-linear maps to transform the data from low dimensional space to high dimensional space. Thus, any linearly non-separable data can become linearly separable. The efficiency of SVM depends on inner product between pair of observations.

Support Vector Machine is supervised machine learning algorithm, which is meant to use for classification or regression problems. Kernel trick used by this technique for transforming data, based on this, leads to determining the boundary between possible outputs. Support Vector Machine classifier is good in most challenging scenario of comparisons [2].

$$K(x, y) = \sum_{i=1}^n \min(x_i, y_i) \quad (1)$$

Where, x & y are LBP histograms. n denotes dimension numbers in LBP histogram.

### B. Histograms

1) Color Histogram: Color Histogram is a well-organized representation of image color content as if color pattern is unique compared with rest of data set. Color Histogram is much easier to compute and characterizes effectively both local and global color distribution in an image. It is robust to rotation and translation about view axis & changes with viewing angle, occlusion and scale.

In histogram, each component is defined based upon the number of pixels distributed for each quantized bin. More bins initiate more discrimination power. But more number of bins increases the computational cost drastically and may not be appropriate for

making indexes suited for image database. To reduce the bin numbers, use opponent color space that enables the histogram brightness to down sample. The color histogram can be generated for any sort of color space, broadly utilized for three-dimensional spaces like HSV or RGB.

For digital image, it represents pixels number having colors in each of fixed list of color image, set of possible color which span image color space. For monochromatic image, intensity histogram is used. For multi-spectral image, each pixel is represented by arbitrary measurement number. Color histogram is N-dimensional, N denotes measurement number. The color histogram can be displayed and represented as smooth function which defined over color space that approximates pixel counts. In color histogram, while computing different color pixels in an image, if color space is large, it then divides the color space into certain number of small intervals called bin. This process called color quantization. Count of the number of pixels in each of bins gives color histogram of image [10].

2) HSV Color Histogram: HSV Color Histogram separates the luminance pixel color component from chrominance. Chrominance includes saturation, hue, and value. The RGB color components are described in terms of HSV, consists of hue, saturation and value. Hue describes true color property. Saturation describes the intensity value and also measures the degree diminished by white light to pure color. Color strength can be altered through saturation. Value describes the brightness value and possess the average value of RGB color component. Color information provided by hue and saturation is explained by color circle.

It is a perfect tool for progressing image processing algorithm. HSV histogram process initiated through RGB model conversion to HSV color space and after that histogram is processed and evaluated. Results in a graphical representation of image color [10].

### C. Descriptors

1) Local Binary Pattern: Local Binary Pattern is a powerful and excellent image representation which extracts the information in texture which is changed to local gray-scale variation. LBP is a powerful descriptor used to represent the local structures [9].

In the LBP operations, every pixel image is considered as threshold to its neighbor in order to get binary bit string which can be used to form round number [5]. In real applications, images are usually classified into many small non-overlapping blocks of same size, to maintain spatial relation of objects. LBP is combined with Histogram of Oriented Gradients(HOG) descriptor, which improves detection performances on image datasets[3]. LBP has lots of importance in real world applications due to its robustness to monotonic gray-scale changes and its computational simplicity makes it possible to figure out challenging real-time settings in the image [2].

$$LBP_{P,R}(x,y) = \sum_{p=0}^{P-1} s(f(x,y) - f(x_p, y_p)) 2^p \quad (2)$$

Where, variables P, R are defined as, P : no. of neighbourhood // R : radius

$$s(z) \text{ denotes threshold function. } s(z) = \begin{cases} 1, & z \geq 0 \\ 0, & z < 0 \end{cases}$$

2) Color Moments: Color Moments are measures, which characterize the distribution of color in an image. It's mostly used for color indexing purposes as features in image retrieval applications. Single image is compared with image dataset with features pre-computed to find and retrieve similar image.

In image retrieval applications, only first three color moments are used as features and most color distribution information contained in low-order moments. Color moments can be used under lighting changing condition that encodes color and shape information, but never changes with respect to rotation and scale [10].

Color moments can be computed for any color model. Three color moments computed per channel. For example, nine moments for RGB color moments and twelve for CMYK color moment. Color moments are computed in a similar way as moments probability distribution are computed [5].

Color moments can be computed by using the following terms:

(a) Mean: The average color in image is taken as mean, the first color moments [5]. Formula is as follows,

$$E_i = \sum_{j=1}^N \left( \frac{1}{N} P_{ij} \right) \quad (3)$$

Where, N denotes pixel numbers in image.  $P_{ij}$  denotes value of  $j^{th}$  pixel image at  $i^{th}$  color channel.

(b) Standard Deviation: Standard Deviation is obtained by taking the variance square root of color distribution, the second color moments [5]. Formula as follows,

$$\sigma = \sqrt{\frac{1}{N} \sum_{j=1}^N (P_{ij} - E_i)^2} \quad (4)$$

Where,  $E_i$  denotes mean value or 1<sup>st</sup> color moment for  $i^{th}$  color channel of image.

(c) Skewness: Skewness measures the asymmetric color distribution and gives the shape information of color distribution, the third color moments [5]. Formula used to calculate the skewness is as follows,

$$s_i = \sqrt[3]{\frac{1}{N} \sum_{j=1}^N (P_{ij} - E_i)^3} \quad (5)$$

Where,  $E_i$  denotes mean value or 1<sup>st</sup> color moment for  $i^{th}$  color channel of image.

(d) Kurtosis: Kurtosis taken as the fourth color moment, has resemblance to the skewness. It

provides color distribution shape information and also, it's a measure of how tall or fault distribution is while compared with normal distribution [7].

(e) Higher-order Color Moments: Higher-order color moments are not used as a part of color moments set because it requires more data for good estimation of value. Lower-order color moments provides enough information which are necessary [5].

3) Spectral Information Divergence(SID): Spectral Information Divergence is mainly a spectral classification method for hyperspectral images, which make uses the divergence measure in order to match the pixels to the reference spectra. The pixels are similar for the smaller divergence. It can't classify the pixel measurement that is greater than specified threshold maximum divergence. The endmember spectra used by SID is from ASCII files. SID make uses the endmember spectra which is from special libraries or ASCII files and also it's possible to extract directly from image as ROI average spectra.

4) Local Phase Quantization(LPQ): Local Phase Quantization is an image descriptor which is useful for characterizing the underlying image texture. It is robust to centrally symmetric blur. It is insensitive to the image blur, so it is efficient in face recognition from sharp images and blurred images.

5) Histogram of Oriented Gradients(HOG): Histogram of Oriented Gradients is a feature descriptor used for detecting the object in image processing. It counts the gradient orientation occurrence in the image localized portions. HOG is somewhat similar to shape contexts, edge orientation histogram and scale invariant feature transform descriptor. HOG is computed on dense grid of uniformly spaced cells and for accuracy improvanace make use of overlapping local contrast normalization. The main advantage of using HOG is that it is operated on local cells, also it's invariant to



photometric transformation and geometric transformation, but not for object orientation. Thus changes would reflect only in larger spatial regions.

6) Binarized Statistical Image Features(BSIF): Binarized Statistical Image Features is one among local image descriptors which encodes the texture information for image region representation which is suitable for histogram. BSIF computes, for each pixels the binary code by linearly projecting local image patches onto a particular subspace, where the basis vectors are from natural images via independent component analysis and binarizing coordinates via thresholding. The basis vectors determines the length of binary code string.

7) Weber Local Descriptor(WLD): Weber Local Descriptor is a simple, powerful and robust local descriptor. The patterns that percept from human not only depends on stimulus change such as light, sound but also based on original intensity of stimulus. WLD is basically derived from the Weber's Law. In Weber's Law, any change can be recognized only if the ratio of change of stimulus to original stimulus is large enough. WLD and LBP have similar advantages in the computation efficiency, because both are dense descriptors that are computed for every pixel. It depends on center pixel's intensity and also on local intensity variations. WLD performs excellent in face detection and texture classification. For texture classification, the normalized histogram metric is used for comparing the distance between histograms.

#### D. Filter

1) Median Filter and Averaging Filter: The Median filter and Averaging filter is used for removing the salt and pepper noise from the images. These filters set values corresponding to input values for output pixels to neighborhood average pixel values. The median filter set the output pixel values to the neighborhood pixels median which determines the output pixel value rather than by mean. The extreme

values called outliers, mean is very much sensitive where median is less sensitive. So Median filter is better convenient to remove extreme values without affecting image sharpness. Median filter is also called as Rank filtering, because median filter is a specific case order statistic filtering.

2) Linear Filtering: Linear filtering is used for removing the noise in the image. It can be used to remove noises mainly Gaussian Noise Salt and Pepper Noise. There are other filters like Gaussian Filter or Averaging Filter which are suited for removal of noise. This can be explained by illustrating an example, the Averaging Filter is used for grain noise removal from the photo graph. In this filter, each pixels gets set to pixels average in neighborhood, local variations affected by grains reduced drastically. The Gaussian Filter is used mainly for reducing the noise level in images.

### III. PROPOSED SYSTEM

To develop an improved live face spoof detection system to prevent face spoofing based on the feature extraction process and system being trained using image dataset, thus by preventing spoofing attacks occurrence. The main vulnerability of face authentication system is attacks based on spoofing, to address this issue with face authentication system, the only solution is that the deployment of a Secure Face Detection System, the primary step is to design and deploy it.

The work is based on detecting spoof images and real images and thus giving the access to authorized users only. Here, many features are being taken for detection of spoof images and real ones. All the features are considered by combining two or three features for the spoof detection. It's done based on Local Binary Pattern (LBP) and Color Moments

which are for face texture and image quality respectively.

The proposed method is useful for detecting the real ones and spoof ones with effective methods of approaches. Here focusing on extraction of features mainly Color Moment Feature (CMF), Local Binary Pattern (LBP), Histogram of Oriented Gradients (HOG), Spectral Information Divergence (SID), Binarized Statistical Image Features (BSIF), Local Phase Quantization (LPQ) and Weber Local Descriptor (WLD). The proposed methods goal is to give a robust and simple approach for face spoof detection. Datasets are collected from various available images from different sources consisting of real ones and also spoof ones.

The Framework of Proposed Methodology is shown in the figure below

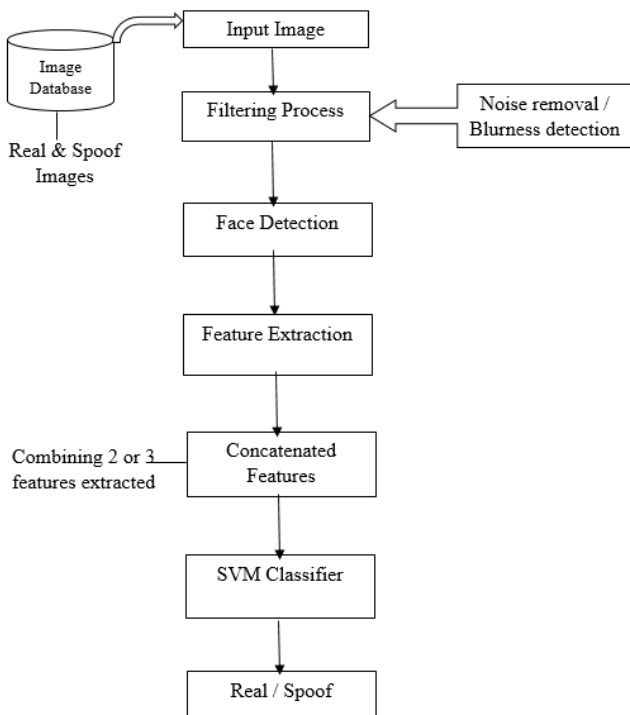


Fig. 2. Framework of Proposed Methodology.

The proposed Face Spoof Detection System's High Level System Architecture is shown below

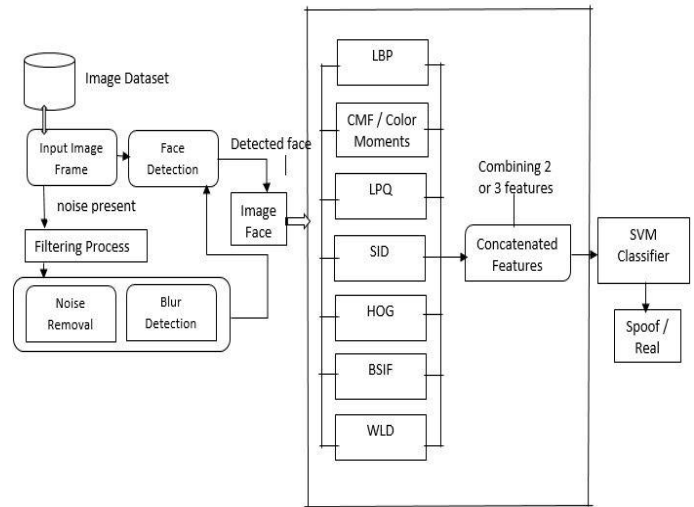


Fig. 3. High Level System Architecture.

#### IV. RESULT AND DISCUSSION

The proposed face spoof detection system is implemented by using MATLAB and also to verify the system accuracy and performance. The testing phase consists of gathered dataset consisting of spoof images as well as real images. This image dataset is used for the system training process and also for system testing process. For the system training, around 100 percent of dataset images are used and for testing around 75 percent are used. In this proposed face spoof detection system work, the extra features that are mentioned in the work are extracted from the images in order to specify the image as spoof or real one in much more accurate manner. Then the Support Vector Machine (SVM) is used as the classifier, in order to classify the image as spoof or real. The classifier is selected based on the comparative study and practice work done. SVM and ANN classifier are compared based on the accuracy obtained after feature extraction process. SVM provides better accuracy than ANN classifier.

### A. Experimental Setup

The following setup is to implement the face spoof detection system, for performing the experiments and to record the analyzed results.

- MATLAB
- Webcam
- Desktop with 4GB

### B. Result

1) System Training Process: System Training process uses the image dataset consisting of real and spoof images. For system training, around 100 percent of dataset images are used.

2) Face Detection: System Training is performed using the image dataset-consisting of real as well as spoof images and input face image detected by Viola-Jones Algorithm.

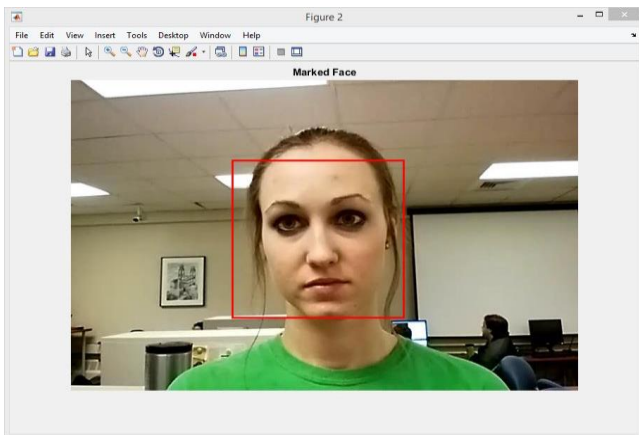


Fig. 4. User Face Detected from Input Image

3) SVM Training Process: In SVM Training process, training the system with Support Vector Machine by using linear support vector machine classifier for classifying the image as spoof or real.

4) System Testing Process: System Testing process also uses the same image dataset consisting of real as well as spoof images and required features are selected.

For testing around 75 percent of dataset images are used.

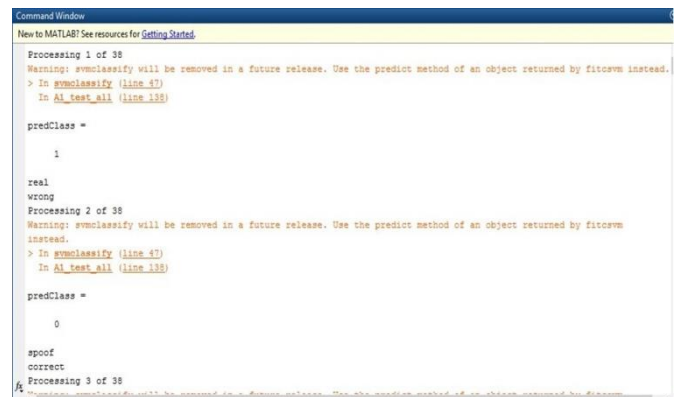


Fig. 5. System Testing.

3) Image in LBP & HSV: Face detected from input image is represented, grey scale image in Local Binary Pattern (LBP) and RGB image in Hue Saturation and Value (HSV).

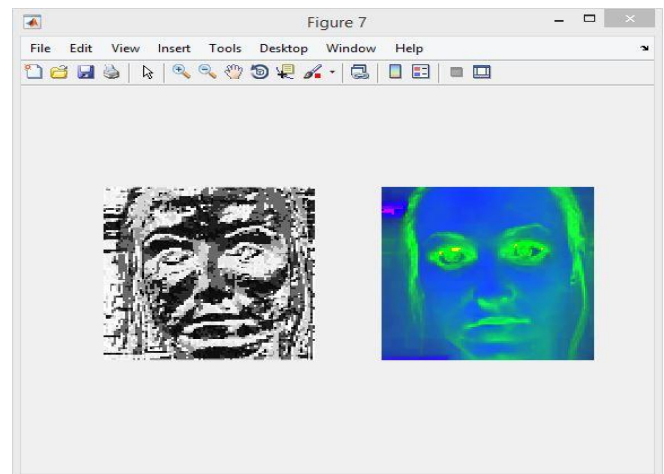


Fig. 6. Detected Face Image in LBP and HSV.

4) Feature Extraction Process: In the feature extraction process all features are extracted, the proposed features consists of Local Binary Pattern (LBP), Color Moment Features (CMF), Histogram of Oriented Gradients (HOG), Spectral Information Divergence (SID), Binarized Statistical Image Features (BSIF), Weber Local Descriptor (WLD) and Local Phase Quantization (LPQ).

For concatenated feature, combination of two or more features are selected and single feature are also taken for analysis purposes.

Here concatenated feature and individual features are selected in order to determine the accuracy of each features illustrated as proposed work. The result is been noted down and also illustrated a graph representing the accuracy of all features in the proposed face spoof detection system.



Fig. 7. Graphical representation of accuracy of all features proposed

5) Noise & Blur Detection: Noise and Blur are detected from input image by using Median Filter for noise removal and Winer Filter for blur detection.

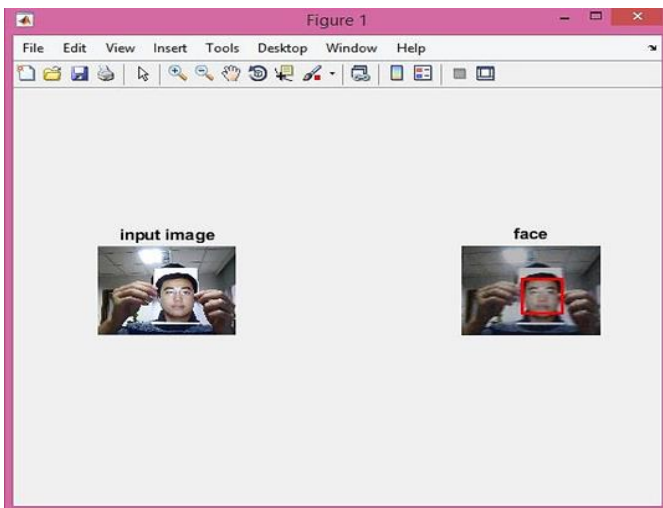


Fig. 8. Noise & Blur detection from Input Image.

The figure below shows the input image and denoised input image after noise is removed from the image through noise removal process.

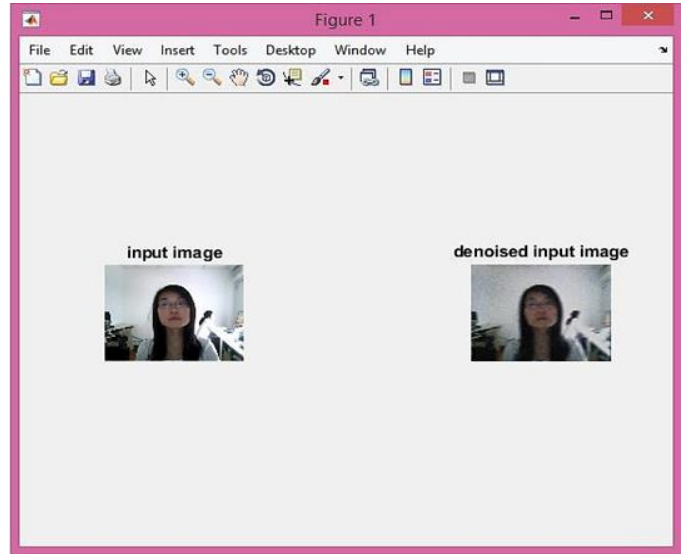


Fig. 9. Input Image and Denoised Input Image.

Graph representing the prediction accuracy for noise and blur detection from input image using Median Filter for noise removal and Winer Filter for blur detection.

Concatenated feature of LBP, CMF and HOG are selected.

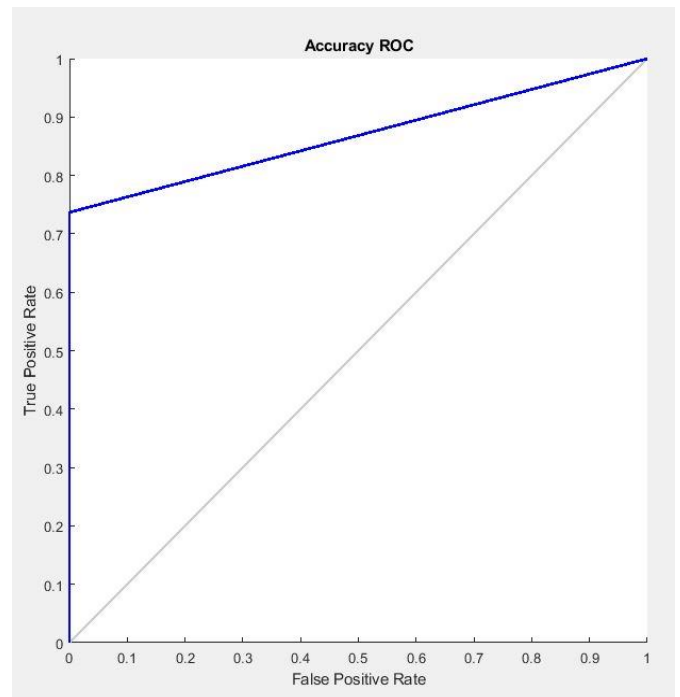


Fig. 10. Accuracy Graph

6) Live Demo: In Live Demo section in the proposed system, determines the live face of the user through the webcam, whether the input image is real or spoof one. Focusing on how efficiently system analysis the input image in live scenario.

Concatenated feature of LBP, CMF and HOG are selected.

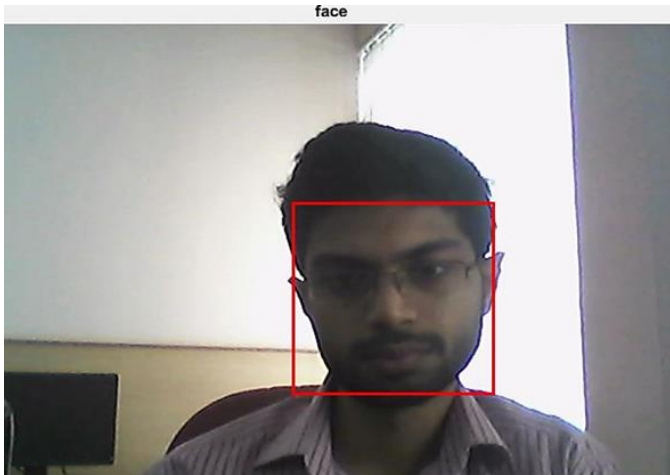


Fig. 11. Face detected in live demo

Determining the live face of the user by identifying the user face. The detected face represented in LBP and RGB and also showing the result, identified as real or spoof.

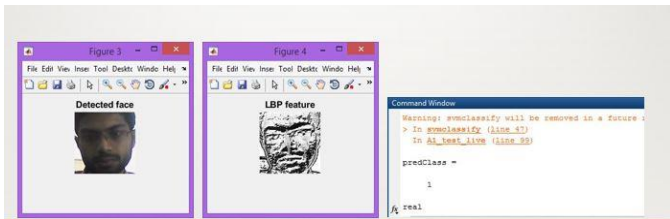


Fig. 12. Identified as real image.

7) Sample for Real Image: Determining the real image by identifying the face of the user. Concatenated feature of LBP, CMF and HOG are selected.

Figure below represents the input image and detected face of the user from input image.



Fig. 13. Sample for real image.

Screenshot of the face detected from input image represented in RGB and LBP.

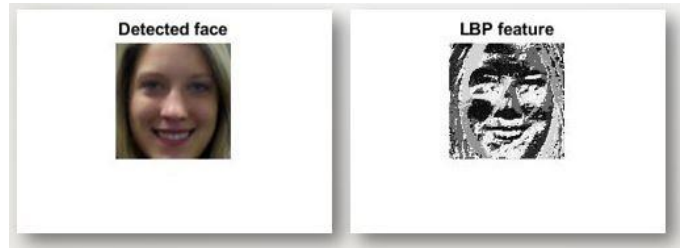


Fig. 14. Sample for real image with detected face in RGB and LBP

Screenshot of input image detected as real one and correctly predicted as real one.

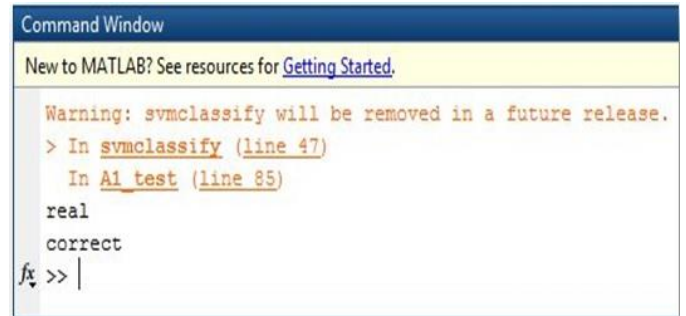


Fig. 15. Screenshot of input image detected as real one.

8) Sample for Spoof Image: Determining the real image by identifying the face of the user. Concatenated feature of LBP, CMF and HOG are selected.

Figure below represents the input image and detected face of the user from input image.



Fig. 16. Sample for spoof image.

Screenshot of face detected from input image represented in RGB and LBP.



Fig. 16. Sample for spoof image with detected face in RGB and LBP

Screenshot of input image detected as spoof one and correctly predicted as spoof one.

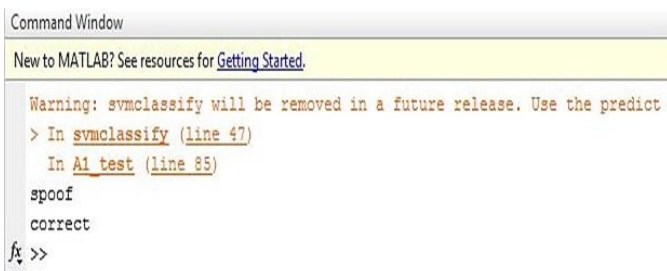


Fig. 17. Screenshot of input image detected as spoof one.

## V. CONCLUSION

The face recognition systems are being used widely in many applications as a security feature. So, it needs to be secure from all vulnerabilities like spoofing attacks. Brief information regarding the methods and classifiers that are used in face spoof identification is discussed. Based on the comparison among classifiers performed and based on the facts gathered, SVM classifier is much suited to classify the image as real or spoof one. Based on the survey on different methods that are existing in-order to determine the spoof image, proposing strong

mechanism for biometric system to be more robust to spoof through the variety selection and combination of different methods such as Local Binary Pattern (LBP), Color Moment Features (CMF), Reflection, Histogram of Oriented Gradients (HOG), Spectral Information Divergence (SID), Binarized Statistical Image Features (BSIF), Weber Local Descriptor (WLD), Local Phase Quantization (LPQ) etc. Classifier being used for differentiating the image as spoof or real one. Based on the comparison done SVM classifier is much better and suited, than other classifiers like ANN for determining image is real or spoof as SVM results in better accuracy than ANN.

## VI. FUTURE WORK

The future work should work on proposing efficient method to capture quality images which will help to have more accurate output as well as test cases should be analysed and also working on video streams as an input to the Face Recognition System. Thus by, avoiding the misuse of user data by means of unauthorized access through spoofing.

## VII. REFERENCES

- [1] K. Patel, Hu Han, Anil K. Jain, "Secure Face Unlock: Spoof Detection on Smartphones.", IEEE Trans. Inf. Forensics Security, vol. 11, no. 10, Oct 2016.
- [2] D. Windridge, N. Suki, S. Tirunagari, A. Iorliam, A. Ho and N. Poh, "Detection of face spoofing using visual dynamics.", IEEE Trans. Inf. Forensics Security, vol. 10, no. 4, pp. 762-777, Apr. 2015.
- [3] V.Ravibabu, Dr.N.Krishnan, "A Vary Approach to Face Recognition Veritable Mechanisms for Android Mobile against Spoofing.", IEEE International Conference on Computational Intelligence and Computing Research, Dec 2014.

- [4] A. K. Jain, G Ott, K. Patel and H. Han, "Live face video vs. spoof face video: Use of moir patterns to detect replay video attacks.", in Proc. ICB, pp. 98-105, May 2015.
- [5] Aniati Murni Arymurthy and Retno Kusumaningrum, "Color and Texture Feature for Remote Sensing Image Retrieval System: A Comparative Study.", *IJCSI International Journal of Computer Science Issues*, Issue 5, vol. 8, no. 2, September 2011.
- [6] H. Han, D. Crouse, A. K. Jain, D. Chandra and B. Barbelo, "Continuous authentication of mobile user: Fusion of face image and Inertial measurement unit data.", in Proc. ICB, pp. 135–142, May 2015.
- [7] Jukka Komulainen, Zinelabidine Boulkenafet and Abdenour Hadid, "Face anti-spoofing based on color texture analysis.", *IEEE International Conference on Computational Intelligence and Computing Research*, 2015.
- [8] Jianwei Yang, Zhen Lei, Shengcai Liao, Stan Z.Li, "Face Liveness Detection with Component Dependent Descriptor.", *IEEE International Conference on Computational Intelligence and Computing Research*, 2013.
- [9] Ivana Chingovska, Andre Anjos and Sebastien Marcel, "On the Effectiveness of Local Binary Patterns in Face Anti-spoofing.", *IEEE International Conference on Computational Intelligence and Computing Research*, 2013.
- [10] Ruchi Kapadia, Swarndeeep Saket J, "Hybrid Approach For Effective Feature Extraction Technique In Content Based Image Retrieval.", *IJARIE-ISSN(O):2395-4396*, 2017.
- [11] Ms. Rekha P.S and Mrs. R.Sumathi, "Spoofing Face Recognition using Neural Network with 3D Mask.", *International Journal of Emerging Technology in Computer Science and Electronics (IJETCSE)*, ISSN: 0976-1353, vol. 14, Issue 1, April 2015.

# A Laboratory Platform for The Induction Drive System Using LabVIEW

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## ABSTRACT

Significant technological advances in software and industrial electronics, contributed to the development of industrial automation systems dramatically, particularly in the area of drive induction motors with squirrel cage induction motor and used in practical applications that require variable speed systems which were used DC motors, for these purposes using (Variable Frequency Drive (vector drive)) which enabled the vector control without sensor (sensorless vector control) with squirrel cage induction motor . In this work we presented a review of the methods of driving the induction motors used by these vector drive to control the motors of both traditional (scalar) and vector control and discussed the specifications of the vector drives that used in driving the motors, including features and schemes of delivery We used labview to control the vector drive that drives the induction motor directly without programmable logic control, aurdino. etc, in order to reduce the cost, and use the same vector drive as a controller for communication between the computer and the vector drives.

**Keywords** : Industrial Automation, Induction Motors, Labview, Vector Drive.

## I. INTRODUCTION

With the great technological development, the relationship between induction motor and industrial control processes has increased. These motors are now the mainstay of the current industry, especially after the development of the methods of driving these motors through the use of VFD, which provided solutions to the problems of driving these motors at variable speed thanks to the techniques of v/f control ,vector control and sensorless vector control are used for motor control [1].

At present, NI has introduced a powerful virtual program architecture, used to control complex tools and processes that collects, processes and analyzes data quickly and simulates hardware with its advanced software [2]. Through this work, we introduced an induction motor platform driven by vector drive, and we designed a control and monitoring interface for the motor using the

LABVIEW program, via a vector drive that receives commands from the program via the USB / RS485 adapter and analyzes these commands and uses them to drive the motor. The objective was to provide a miniature model of the induction motor drive at the lowest possible cost and with the simple equipment available to us, using effective and flexible control programs [3].

## II. METHODS AND MATERIAL

### INDUCTION MOTORS

Induction motors are the nucleus of engineering systems, used in all types of industries and are also known as asynchronous machines. It is called induction motors because the effort is incited in the rotor and therefore there is no need for brushes. The rotor can have a squirrel cage or a wound rotor. In this way, the induction motors are classified as induction motors with a wound rotor or a squirrel



cage [4] the squirrel cage induction motor is simpler, more economical and more durable. The squirrel induction motors are of constant speed if they are connected to a constant voltage and frequency source of power. This is appropriate for fixed-speed driving systems, On the other hand, many industrial applications require variable speeds or require regulation on a specific range of speeds. DC motors are usually used in these driving systems but are expensive and require compressors, so we prefer squirrel cage motors because they are cheap and robustness and do not require The presence of filters and suitable for high speed applications, as the modern control techniques provided the possibility of using these motors in the changing speed systems. [5] Induction motors have the following advantages that make them play an important role in most industrial applications

1. The ability to produce high torque at low speeds, including zero speed.
- 2 - High efficiency in the field of speeds and greatness.
3. High robustness for various operating conditions.
4. A quick speed torque response.
- 5- The operation of the motor and the driving circuits on the entire field of speed efficiently and reliability, and less failures.

Speed control in induction motors is much more difficult than speed control in DC motors because the relationship between the motor current and the torque is nonlinear, and requires strong and controlled control algorithms to achieve control purposes in the wide operational area. There are two basic approaches to controlling the induction motor: analog: It depends on the direct measurements of the machine parameters (rotor speed) which are compared with the reference via the closed loop. Digital: It is based on estimating the parameters of the machine in a method called sensor less control without relying on speed sensors.

## DRIVING METHODS OF INDUCTION MOTORS

The scalar control method was the most common motor control method. If the specified frequency is to be reduced at a particular feeding voltage, the airgap flux will tend to saturate, causing an excessive increase in the stator current and distortion of the flux wave. Therefore, the reduction in frequency should be accompanied by constant voltage reduction in order to keep the airgap flux constant. If the voltage to frequency ratio is constant, the flux will remain constant, but by changing voltage and frequency the torque and speed will change[6].

The purpose of the  $v / f$  technique is to keep the air gap flux constant for the induction motor to achieve higher operating time efficiency, as the constant flow demand is proportional to the constant voltage to frequency ratio. If this ratio is constant, it is stable and the motor's torque will depend only on the sliding of the frequency. In this technique of the driving system, the sliding characteristics are usually low, i.e., the resistance of the circuit is low and therefore gives high efficiency. The absence of the sudden surge current reduces the tension and thus increases the effective life of the motor[.]. Variable speed driving operates with a control mode (Low variable voltages) at low frequencies and therefore low voltage curves show a significant reduction in peak torque, at low frequencies (and therefore low voltages), the low impedance prevents adequate voltage availability. In order to maintain sufficient torque at low frequencies, Relative voltage at low speeds. Using this technique, it is possible to obtain good good starting torque and good stable condition. In short, this method is to supply the motor with the required voltage in proportion to the equivalent frequency of the required speed, regardless of the mechanical motor load and the actual speed of the motor. But in reality the actual speed is less than that and the (VFD) does not receive a feedback signal from the actual speed of the motor. Therefore, it cannot be used in applications with high

sensitivity to speed, but under dynamic conditions this type of control is inadequate and we need more sophisticated techniques.

## VECTOR CONTROL

In the scalar control we deal with amplitude of the amounts and the current or voltage are control variables, In the case of voltage control, for example, the flux and torque are dependent on voltage and frequency. This connection impedes the acquisition of good dynamic performance of the machine. A technique called vector control is used to change the speed of the induction motor on a wide range. In the vector control diagram, the complex current is assembled from two quadrilateral components. The first is responsible for the production of the flux and the second is responsible for producing torque in the motor. Precise speed, high dynamic response [7].

Vector control depends on two basic ideas: First, the flow and torque produce currents; the induction motor can be more simply modeled and thus easier to control using square currents than using the three phase currents applied to the motor. These currents are called the direct current  $I_d$  and  $I_q$ , which are responsible for producing flux and torque in order. Of course, the actual voltage applied to the motor and the current currents are in the three-phase familiar system. The transition between the fixed reference frame and the reference frame which rotates Synchronously with rotor flux is the problem. This leads to the second basic idea of the vector control: The second idea is about the reference frames and the idea is how to convert the sinus quantities in one frame to a constant value in the reference frame that is rotates at the same frequency.

The sinus quantity is converted to a fixed value by a precise selection of the reference sentence, then this quantity can be controlled in a conventional way by the PI controllers.

When the induction motor is presented as a mathematical system with inputs and outputs, it can be analyzed and described in various ways, taking into account different reference coordinates and state space variables [8]. vector control is usually performed by speed measurement or position recognition, but speed and position sensors require increased costs and areas and reduced reliability. sensorless vector control means that no encoder, tachometer or reverse feeding signal is used, which is an improved V / F method that uses field-oriented technology to achieve high performance. This method is based on estimating the speed from the voltages and the currents of the on the motor terminals, and the field estimation is also done using open loop or closed adaptive systems (MARS) techniques. The adaptive reference system model, Different from the controls and guesses that rely on artificial intelligence techniques, and this gives us great benefits such as dynamic performance and increased accuracy in addition to the feature of regulation of the torque [9].

## VECTOR DRIVE

The vector drive was known as variable frequency drive(VFD) and also called the variable speed drive, this device consisting of active/passive power electronic components, a high speed central processing unit and sensors. The main function of the drive is to generate variable frequency to change the motor speed, especially used to control of the three phase induction motor. The variable frequency drive is a system that is capable of controlling the rotational speed of the AC motor by controlling the frequency and the voltage of the electric power that feeds the motor. Modern technologies have enabled the development of variable frequency drive to models called vector drive, which have allowed the use of AC motors in applications requiring high torque and low speeds that were previously exclusive to expensive DC motors. Vector control technology is a technique that mimics those used in DC motors. It has a design

similar to that used in conventional variable frequency drives, but uses an advanced closed control loop to handle the control algorithms. This type of switch provides excellent control of the speed, torque and energy of the motor and its ability to provide full torque at zero speed and rapid response to load changes, but the initial cost is high compared to conventional switches.

### III. RESULTS AND DISCUSSION

#### LABVIEW

LabVIEW is a programming language that uses icons and symbols instead of linear programming (Virtual Instrumentation Engineering Workbench (LabVIEW)) is a software environment and an integrated development tool produced by National Instruments, a leading manufacturer of microelectronics and embedded systems, It relies on visual programming, where it uses the language G, known as its graphical capabilities, which is called Data Programming Language, which specifies the implementation of the instructions in the structure of a box diagram rather than in line orders similar to other languages, and takes the executable in this Language: (LV-Source Code) The contract is implemented by the contract as long as it has current income data for implementation. As this performance creates the possibility of multiple income situations at the same time this software language has the ability to process and execute parallel data and peripherals, and is used academically and industrially in data collection, automation and industrial control. [10].

It consists of a control and monitoring program designed using the LabVIEW program that sends commands via the USB / RS485 converter, which is used to convert the USB interface signals to the RS485 interface signals, and then the commands reach the variable frequency drive that we analyze and send to control of the motor or read from the registers and

resend the information to The program that is displayed on the front panel of LABVIEW. [11].We design the interface through the following steps:

- 1- Configure serial port according to communications address in VFD.
- 2- Using visa write to send command to the serial port that we configure
- 3- Write ASCII (American Standard Code for Information Interchange) characters to the port , Communication Data frame For ASCII character consists of : first Start character (:) , Communication address for VFD , Command code (write or read from registers ) , Contents of data, Longitudinal Redundancy Check( LRC) check sum, finally End characters.
- 4- When we want to read from registers we have to use property node and configure it with serial bytes to port then we use VISA read to receive information from VFD.

### IV. CONCLUSIONS

The LabVIEW program was successfully used to control the vector drive directly by using the USB / rs485 converter and monitoring motor parameters (actuator current and real frequency at the output terminals connected to the motor, estimated torque ratio, DC bus voltage ,motor speed, frequency command and Output voltage). Programs implemented by simple Vis and visa read / write. This research is based on the study of the protocol of the variable frequency drive used and how it is programmed to deal with incoming commands via the RS485 cable and how to use LABVIEW tools to achieve the required programs. Later, the motor can be loaded and programmed to operate in the traditional control mode, then in the vector control mode and compare the results to observe the characteristics of the vector control.

## V. ACKNOWLEDGMENT

The research that has led to this work has been supported In part by the Tartous University Enterprise (RM5/2017).

## VI. REFERENCES

- [1] Dharkar, A. (2017, February 1). CONTROL OF VARIABLE FREQUENCY DRIVES. *International Journal of Electrical Engineering & Technology* , pp. 45–51.
- [2] G.kOHLRUSZ. (2011). comparision of scalar and vector control strategies of induction motor. HONGARIAN JOURNAL OF INDUSTRIAL CHEMISTRY VESZPREM , pp. 265-270..
- [3] Glumineau, A. (2015). *Sensorless AC Electric MOTOR CONTROL*. The University of Nantes Angers Le Mans: France .
- [4] Gunabalan, R. (2014). Simulation of Inverter Fed Induction Motor Drive. Engineering and Technology International Journal of Electrical and Computer Engineering , pp. 84-88.
- [5] Holts, J. (2002, aug 8). sensorless control of induction machine. *IEEE* , pp. 1359-1394.
- [6] Joseph, R. A. (2013). *Automated Efficiency Measurement of Three phase induction motor using labview*. INDIA: International Conference on Computer Communication and Informatics
- [7] others, K. M. (2015). Performance and Analysis of Direct Torque Control Induction Motor FED PWM Inverter Drives. *International Electrical Engineering Journal*.
- [8] others, P. H. (2012). Motor Parameter Measurement and Testing System Based on Labview. Zhejiang.
- [9] Zhang, M. (2013). *Investigation of Switching Schemes for Three-phase Four-Leg Voltage Source Inverters*. Newcastle University.
- [10] Bishnu Prasad Satpathy, D. K. (2016, june). speed control of Three Phase Induction motor by Using PLC and VFD. *Dept.of EEE, Bharati Vidyapeeth Deemed*.
- [11] Birch, R. G. (1997). Plant transformation: problems and strategies for practical application. Annual review of plant biology, 48(1), 297-326..

# Hamiltonian Approach for Finding Shortest Path

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## ABSTRACT

Hamiltonian problem is important branch of graph theory in mathematics and computer science. Need of finding shortest path is increased. The aim of the work is to find the shortest Hamiltonian path from a weighted complete graph. It is easy to understand and very useful in real life such as shortest route on road from home to hospital, social network, pizza delivery, mail delivery, gas delivery, tour travel and school bus travel etc. Due to exact timing delivery, the popularity of enterprise is increased and boom the clients, offerings and earnings. The objective of the work is to find shortest path using Hamiltonian technique from a weighted graph.

**Keywords :** Hamiltonian Circuit, Shortest Path, Time, Cost

## I. INTRODUCTION

In day to day life, Hamiltonian graph plays a vital role in graph theory which has popular attention. Graph theory has been used not only in mathematics but also in computer science, electrical engineering and some other scientific areas. In a graph Hamiltonian circuit is a circuit that visits every vertex once with no repeated vertex and the circuit starts and ends at same vertex[6]. Hamiltonian problem can be used to solve pipeline crossing, road intersection, and communication network vertex/cities [2], time scheduling and NP-complete problem. The problem of the proposed work is to find the minimum cost or shortest path Hamiltonian circuit and certain criteria must be satisfied for existence of a Hamiltonian circuit in a graph.

General method to solve the Hamiltonian problem is

- ✓ List all possible Hamiltonian circuits with each vertex visiting once.
- ✓ Find the cost or weight of each circuit.
- ✓ Find the circuit with least cost or weight.

Applications of Shortest Hamiltonian circuit:

- ✓ In Google Maps, GPS finds the shortest route from one origin to another destination. Hamiltonian path can also efficiently determine the shortest path.
- ✓ Social networks connect friends and viral videos. Hamiltonian path can also connect friends where friends are vertices connections are edges.
- ✓ Colleges and schools can also use Hamiltonian technique to pick up the students from their station to school/college. Here station or stops are vertex routes are edges.

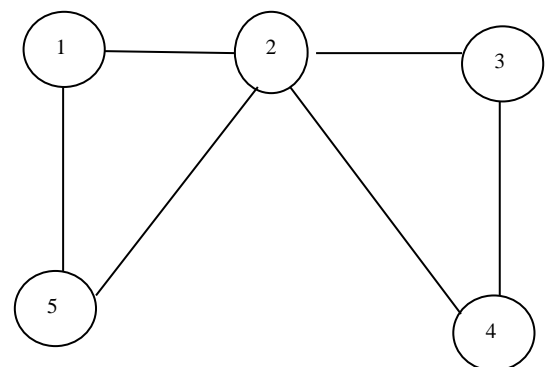


Figure 1: Not Hamiltonian cycle.

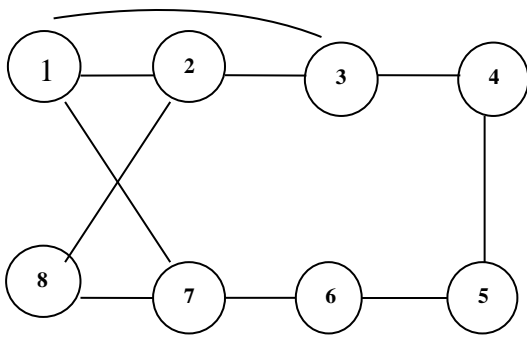


Figure 2 : Hamiltonian Cycle

The remaining of this work is organized as follows; section II deals with the literature review, section III deals with the proposed work, and section IV deals with the results & discussions section V deals with the conclusion of the work.

## II. LITEACTURE REVIEW

Dipak et al [3] discussed the backtracking approach to solve Hamiltonian cycle and Travelling Salesman Problem. Aim of this work is to identify the minimum path of Hamiltonian circuit. Directed and Undirected weighted graphs are represented in form of matrix. The weights are non negative as they represent distance between two cities. Using brute force method  $N!$  permutation of the vertex/cities are generated and tested to identify Hamiltonian circuit. In weighted graph each vertex/city is examined and every possible combination is identified. The length of the Hamiltonian cycle is computed and compared with the previously calculated minimum Hamiltonian cycle length. Here the optimal solution is obtained using efficient backtracking algorithm.

Dajin Wang et al [4] discussed the embedding of Hamiltonian cycle in the Crossed Cube. Aim of this work is to design the network topology in efficient manner using the Hamiltonian cycle. This is attained by crossing the straight links of a hypercube and proposed an algorithm for Hamiltonian facilitating permutation. Due to the loss of link-topology

regularity in crossed cube, producing Hamiltonian cycles in a crossed cube is more complex process than in a regular hypercube. The proposed algorithm works on link permutation of the given Hamiltonian cycle. The candidate networks balancing regularity, competence, suitability and performance criteria for choosing an interconnection network is proposed.

Wadee Alhalabi et al [1] discussed about handshaking theorem to solve Hamilton cycle of a complete graph. Purpose of this work is to find the optimal Hamiltonian cycle. The result of Peterson graph is a  $n$ -factor graph which is not Hamiltonian. The proposed  $n$ -factors graph detects the extra edges and deletes it. If is necessary the edges are added to the  $n$ -factor graph. Using java applet Peterson graph is developed to add more constraints to the destroyer and the connector.

Vidhi Sutaria et al [5] discussed about step by step making a Hamiltonian and Eulerian cycles. Aim of this work is to design the framework of telecom topology using Hamiltonian and Eulerian cycles. The Hamiltonian is Dirac's theorem can be used this work. The theorem to find NP complete finished problem with the proof and condition. The optimal algorithm output is an optimal algorithm. Euler's cycles using the Routing problem defined and found ways to delivery of good services (i.e. mail, news paper)

## III. PROPOSED SHORTEST PATH METHOD

Aim of this work is to find the shortest path of Hamiltonian circuit. Consider  $G(V, E)$  be a weighted complete graph.  $V(G)$  is the vertex set and  $E(G)$  is the Edge set. Here vertices are represented as cities and edges are represented as weight or cost from one city to another city. In this work six numbers of vertices has been taken for cities and six edges has been taken for path/cost. The graph of the problem is represented in the following diagram. To find the shortest path using Hamiltonian circuit, a matrix is constructed

with number of vertices as row and column numbers. The weight of the edge is taken the values inside the matrix connecting one vertex/city to another. Since, the problem is six vertex, a 6x6 matrix is constructed to find the shortest path using Hamiltonian approach.

The matrix is filled with zero values where there is no edge connected. The Hamiltonian path can be generated starting from any vertex. Hence, let the path finding starts from vertex 0. The shortest path is built from vertex 0 to all other vertices occurring only one. From the graph a 6x6 matrix is shown below.

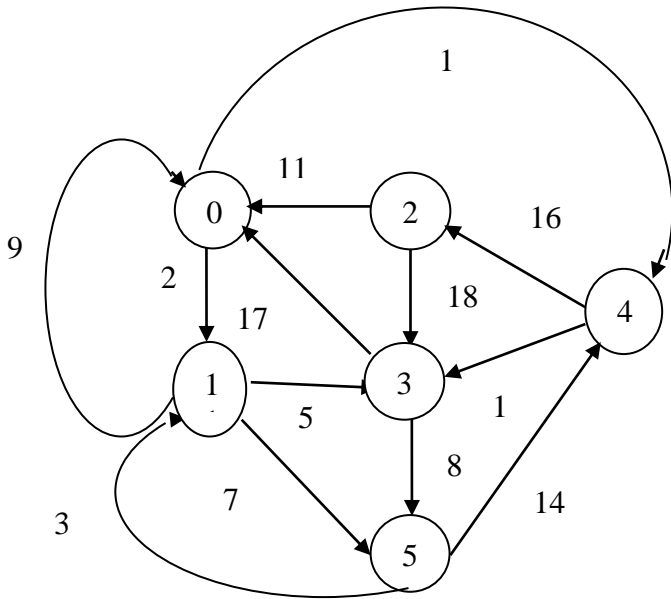


Figure 3: Hamiltonian cycle

The weights of edges between cities are

- {0, 1} = 2, {0, 4} = 12,
- {1, 3} = 5, {1, 5} = 7,
- {2, 0} = 11, {2, 3} = 18,
- {3, 0} = 17, {3, 5} = 8,
- {4, 2} = 16, {4, 3} = 1,
- {5, 1} = 3, {5, 4} = 14}

The remaining weights are 0 since their edges are not connected.

TABLE I. DISTANCE MATRIX

	0	1	2	3	4	5
0	0	2	0	0	12	0
1	9	0	0	5	0	7
2	11	0	0	18	0	0
3	17	0	0	0	0	8
4	0	0	16	1	0	0
5	0	3	0	0	14	0

The principle behind the shortest path is to find sum of weights of circuits satisfying the Hamiltonian criteria. Here the possibilities of circuits are starting from node 0, node 2, node 4 and node 5. Hence, the sum of weights from node 0 to all other nodes is found.

Case (i)

$$\{(0,1),(1,3),(3,5),(5,4),(4,2),(2,0)\}$$

$$=(0 \rightarrow 1 \rightarrow 3 \rightarrow 5 \rightarrow 4 \rightarrow 2 \rightarrow 0)$$

$$=2+5+8+14+16+11 =56$$

Case (ii)

$$\{(0,1),(1,5),(5,4),(4,2),(2,3),(3,0)\}$$

$$=(0 \rightarrow 1 \rightarrow 5 \rightarrow 4 \rightarrow 2 \rightarrow 3 \rightarrow 0)$$

$$=2+7+14+16+18+17 =74$$

Case (iii)

$$\{(0,4),(4,2),(2,3),(3,5),(5,1),(1,0)\}$$

$$=(0 \rightarrow 4 \rightarrow 2 \rightarrow 3 \rightarrow 5 \rightarrow 1 \rightarrow 0)$$

$$=12+16+18+8+3+9 =66$$

Sum of weights from node 2 to all other nodes

$$\{(2,3),(3,5),(5,1),(1,0),(0,4),(4,2)\}$$

$$=(2 \rightarrow 3 \rightarrow 5 \rightarrow 1 \rightarrow 0 \rightarrow 4 \rightarrow 2)$$

$$=18+8+3+19+12+16 =66$$

Sum of weights from node 4 to all other nodes

$$\{(4,2),(2,3),(3,5),(5,1),(1,0),(0,4)\}$$

$$=(4 \rightarrow 2 \rightarrow 3 \rightarrow 5 \rightarrow 1 \rightarrow 0 \rightarrow 4)$$

$$=16+18+8+3+9+12 =66$$

Sum of weights from node 5 to all other nodes

Case (i)

$$\{(5,1),(1,0),(0,4),(4,2),(2,3),(3,5)\},$$

$$=(5 \rightarrow 1 \rightarrow 0 \rightarrow 4 \rightarrow 2 \rightarrow 3 \rightarrow 5)$$

$$=3+9+12+16+18+8 =66$$

Case(ii)

$$\{(5,4),(4,2),(2,3),(3,0),(0,1),(1,5)\}$$

$$=(5 \rightarrow 4 \rightarrow 2 \rightarrow 3 \rightarrow 0 \rightarrow 1 \rightarrow 5)$$

$$=14+16+18+17+2+3 =70$$

### 3.1 Hamiltonian Path Algorithm

Algorithm Hamiltonian (k)

```
{
  Repeat
  {
    Next Value (k)
    If (x[k]=0) then return
    else
      Hamiltonian (k+1);
  }
  Until (false)
}
```

Algorithm Next Value (k)

```
{
  Repeat
  {
    X[k]=x[k+1];
    If ( x[k]=0) then return
    Sum=0
    for j=1 to k-1 do
    {
      sum=sum[k] then break;
      If (x[j] =x[k]) then break;
    }
    Return (x[k].....x[k-1][xk])
  }
  Until (false)
}
```

## IV. RESULTS AND DISCUSSIONS

It is seen that there are seven cases raised from the six vertex problem.. Various paths from starting from different nodes are found. The shortest paths are defined below. It is noted that three of them are starting from 0 to remaining all other nodes, one path from starting node 2 to all other nodes, one path from node 4 to remaining other nodes and two possible paths from starting node 5 to all other nodes.

TABLE II

HAMILTONIAN PATHS

Starting Node	Path	Sum Weight
0	<b>0→1→3→5→4→2→0</b>	56
0	0→1→5→4→2→3→0	74
0	0→4→2→3→5→1→0	66
2	2→3→5→1→0→4→2	66
4	4→2→3→5→1→0→4	66
5	5→1→0→4→2→3→5	66
5	(5→4→2→3→0→1→5)	70

Out of these seven paths, it found that the path stating from 0 to all other nodes is shortest and the route of path is denoted as

$$\mathbf{0 \rightarrow 1 \rightarrow 3 \rightarrow 5 \rightarrow 4 \rightarrow 2 \rightarrow 0}$$

## V. CONCLUSION

This work discusses the shortest path to travel one place to other place using the Hamiltonian cycle theory. A problem of six vertices is considered for discussion. The weights of edges starting from one node and ending at the same node are calculated and listed. There are some path which are not meeting the criteria of Hamiltonian circuit. Hence such paths are omitted. It is observed that out of the seven possibilities, only one path is optimum giving minimum total weight. Hence such a path is considered as the shortest path. The advantages of this approach preserves cost and time of problems depending on distance or costs of transportation.



## VI. REFERENCES

- [1]. Wadee Alhalabi , Omar Kitannah , Amira Alharbi, Zain Balfakin and Akila Sarirete., “Efficient solution for finding Hamiltonian cycles in undirected graph”, SpringPlus(2016), 5:11:92.
- [2]. M Radhika ., “A Comparative Study Between Eulerian And Hamiltonian Graphs”, IJETST-Vol.03,Issue,05,Page 435-439,May,ISSN 2348-9480,2016.
- [3]. Dipak Patel,Nishant Doshi,Shakthi Patel,Dishant Soni., “Hamiltonian cycle and TSP:A backtracking approach”,InternationalJournal on Computerscience and Engineering(IJCSE),Vol.3,No.4,Apr 2011.
- [4]. Dajin Wang., “On Embedding Hamiltonian Cycles in Crossed Cubes”, IEEE Transaction on Parallel and Distributed Systems”, Vol.19, No.3, March 2008,
- [5]. Vidhi Sutaria., “Hamiltonian and Eulerian Cycles”, International Journal of Trend in Research and Development,Vol.3,ISSN:2394-9333.
- [6]. Ref:Courses.Lumenlearning Visited on 19:5:18
- [7]. ANagoor Gani and S.R.Latha., “A new algorithm to find fuzzy Hamiltonian cycle in a fuzzy network using adjacency matrix and minimum vertex degree”,SpringPlus(2016).
- [8]. MSohel Rahman,M.Kaykobadn and Jesun Sahariar Firoz., “New Sufficient Conditions for Hamiltonian Paths”,Hindawi Publishing Corporation Scientific World Journal,Vol 2014.
- [9]. Mushtaq Ahmad Stah., “A study on hypo Hamiltonian graphs”,African journal of Mathematics and Computer Science Research,Vol.6(2),pp.16-19,February 2013.
- [10]. Dr.G.Nirmala,M.Vijaya., “Hamiltonian fuzzy Cycles on  $k 2n+1$  Fuzzy Graphs”,Internatonal journal of scientific and Research Publications,Volume 2,Issue 11,November 2012.

# New Approach for Text Based Image Compression

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## ABSTRACT

The world is governed by internet and people's most of their work are depending on Internet For authentication, images are most used for currency transactions. So everywhere images are used and occupy more spaces for storage. Preserve more images is becoming essential in future trends. To achieve space domination by images ,image compression is vital. Though there are several image compression techniques available, improvement over existing methods are welcome. In an attempt to improve ratio of image compression, a novice approach is tried. The proposed methodology first compresses the given image and compressed image is then transformed into ASCII file based on the pixel values. Then text compression is applied to string the size of the text file. Again the reduced text file is reverted to pixel file using ASCII character values. Finally, a compressed image is generated targeting the size of file small. The experimental result of the proposed work is achieving the intended goal.

**Keywords:** JPEG image, Text Compression, Image Compression , ASCII Set, Pixel Extraction.

## I. INTRODUCTION

Image compression is a type of data compression applied to digital image to reduce the cost of storage or transmission. Image compression may be lossy or lossless. Lossless compression is preferred for historical purposes and often medical imaging, technical drawings, clip art, or comics are collected. Lossy compression methods, especially when used at low bit rates, introduce compression artifacts. Lossy methods are especially suitable for natural images such as photographs in applications where minor loss of data is acceptable to achieve a substantial reduction in bit rate. Lossy compression that produces negligible differences may be called visually lossless. For applying compression techniques, digitally stored images are used. Mostly TIFF, JPEG, GIF, PNG & raw image files formats are available to preserve digital images. JPEG, Joint Photographic

Experts group, is most popular image format used for Image processing. The proposed work uses JPEG image since it is small in size and web friendly and helpful for image processing.

## II. EXISTING METHODS

Hema Suresh Yaragunti & T.Bhaskara Reddy [2] has discussed about lossless image compression techniques viz Text Based Image Compression using Hexadecimal Conversion (TBICH). This approach has worked as follows: firstly a photo is coded and converted into a text file by using hexadecimal numbers and LZ77 textual content compression is applied and this encoded record is used to reduce size. The important concept is to increase the redundancy of records provided with a photograph to get the best compression. This paper results the size of image without loss and provide security.

Pallavi M.Sune[1] has discussed about image classification, wavelet compression and converted into image an array format using Delphi image control tool. Image manipulate are used to show a graphical image icon, bitmap, meta document, GIF, JPEG and so on. Then an algorithm is created in Delphi to put into effect of Huffman coding.

Leon Bottou[3] has discussed about new image compression technique with “DJVu”.The compression advantages are high resolution, high quality images of scanned document in colour and the image over low speed the connections, reproducing the visual component the document, colour, fonts, pictures and paper texture.

### III. PROPOSED METHODOLOGY

This work elaborates text based image compression technique along with the existing methodologies adopted by researchers for image processing. First part of the work is done to obtain compressed form of given image. In the second step, pixels are extracted from the RGB values of compressed image. In the third part, characters are placed according to the ASCII value for pixel numbers. In the fourth step, a text file is formed with these alphanumeric characters. In the fifth step, text file is compressed using **text compression algorithm**. Again pixel values are extracted from the compressed text file. Finally an image is generated which is the objective of the proposed work. It is foreseen that this principle can produce a better compressed image against the existing methods.

The proposed method considers a sample color image of 28.68 KB. It is then converted to grayscale image. The grayscale image is used to generate pixel values and applying ASCII characters a text file is created. Then text compression and pixel conversion to the compressed text file are used to produce required compressed image.

#### A. Image

JPEG –Joint Photographic Experts Group, this is the most popular one used for image formats. It is a commonly used method of lossy compression for digital images, particularly for those images produced by digital photography. JPEG is the most common image format used by digital cameras and other photographic image capture devices; along with JPEG/JFIF, it is the most common format for storing and transmitting photographic images on the World Wide Web. JPEG supports a maximum image size of 65,535×65,535 pixels. A JPEG image consists of a sequence of segments, each beginning with a marker, each of which begins with a 0xFF byte followed by a byte indicating what kind of marker it is. This work uses a JPEG file for proposed compression.



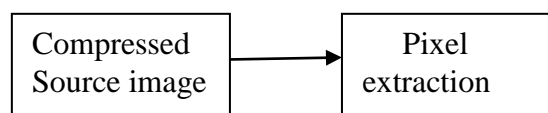
Figure 1: Input Image

#### B. ASCII Character Set

The color The ASCII character set has alphanumeric characters with a weight to each character. This set is used for converting the image’s pixel value into ASCII character in order to obtain a text file for the image.

#### C. Compression Process

The stages of compression process are depicted in the following diagram. It has seven stages starting from input image till yielding compressed image.



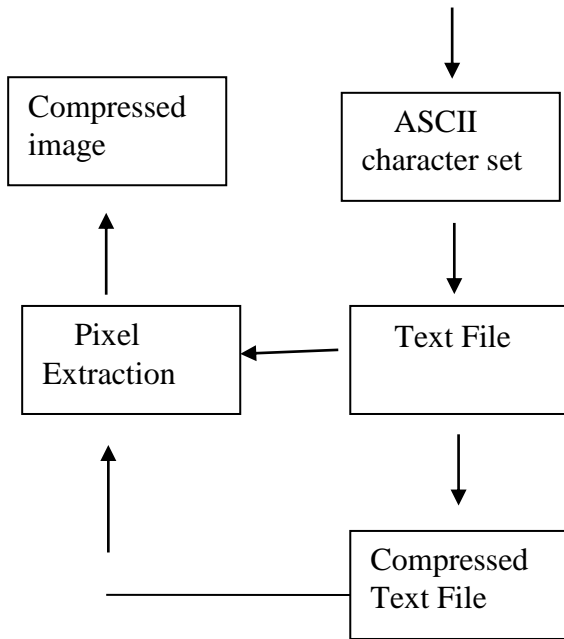


Figure 2: Compression process

The proposed image compression starts from getting compress image to input to the proposed system. The compressed file is then transformed into grayscale image using pixel value ranging from 0 to 255. The pixel value is representing the brightness of the pixel in the grayscale image.



Figure 3: Grayscale Image

Then a text file is formed replacing each pixel value by a character of ASCII set producing required text file. Next the text file is compressed by text compression algorithm(DCT) to yield compressed text file which is again manipulated to produce a file for extracting pixel values.

TABLE I  
ASCII VALUES

This file is reverted to issue final compressed image.



Figure 4: Compressed Image

#### D. Decompression process

In the decompression process, it initiates the processing from resultant compressed image file and goes through the same intermediate process to reach original image file.

#### E. Evaluation Metrics

It is used to measure the quality of an image and the execution time of the algorithm. The metrics are calculated as follows:

##### 1) Image Size:

The proposed work by novice compression technique has reduced the size of the image from 28.68 KB to 3.06 KB. The reduction rate is achieved by 88% and the proposed approach is much beneficial for JPEG image compression.

##### 2) Algorithm Execution Time:

The algorithm uses image processing toolkit Matlab 2014 and the execution time is evaluated. It is observed on the basis of number of iterations needed for the algorithm to encrypt and decrypt an image. Time complexity is a total number of primary

arithmetic operations occurring in the function where input variables are processed in an algorithm.

$$\text{Time Complexity} = K * C \rightarrow (1)$$

Time Complexity= Elapsed time is 0.596186 seconds. Where K is the total number of arithmetic operations and C is a constant depending upon the platform on which the algorithm executes.

Space complexity summarizes amount of space static memory space and dynamic data space. The dynamic space includes the space occupied by image, pixel file, text file etc and individual primitive types of data involved in solving the problem. The space complexity is usually denoted by O(S).

#### IV. EXPERIMENTAL RESULTS

The text based image compression using ASCII conversion is used to reduce the image size and image storage in the secondary devices. A sample image of size 28.68 KB is considered for processing and the reduced is occupying only 458 bytes. The compression ratios of other three algorithms are depicted in Table II. The proposed compression ratio is indicating 62.2 which is seemed better to compress image file.

TABLE II. COMPARISON OF IMAGE COMPRESSION

Sl.No.	Compression Technique	Compressed image size	Compression Ratio
1	LZW Comp. Based	50.39 MB	4.42
2	Huffman based	10.20 MB	4.49
3	LZW	99.42 MB	12.5
4	Delta Encoding <b>Proposed Method</b>	<b>28.68 KB</b>	<b>458 Bytes (62.6)</b>

#### V. CONCLUSION

The proposed method for image compression is implemented in MatLab 8.4 software and the result produced by the tools is enclosed. It is seen that the proposed approach has increased the compression ratio when compared to other three methods taken for comparison.

#### VI. REFERENCES

- [1]. Pallavi M.Sune., "Image Compression Techniques based On Wavelet and Huffman Coding".International Journal of Advanced Research in Computer Science and Software Engineering,ISSN:2277 128X,Volume 3,Issue 4, April 2013.
- [2]. Hema Suresh Yaragunti and T.Bhaskara Reddy., "Text Based Image Compression using Hexadecimal conversion". Oriental Journal of Computer Science & Technology.ISSN:0974-6471, Vol.8,No.(3):Pgs.216-221,December 2015.
- [3]. Leon Bottou,Patrick Haffner,Paul G.Howard ,Patrice simard,Yoshua Bengio,Yann Lecun., "High quality document image compression with "DjVu"".Journal of Electronic Imaging.Pgs.410-425, haffner@research.att.com,Vol.7(3),July 1998.
- [4]. Sidhu,Meenakshi Garg., "Research Paper on Text Data Compression Algorithm using Hybrid Approach".International Journal of Computer Science and Mobile Computing,IJCSCMC,Vol.3,ISSN 2320-088X,Issue.12,December 2014,pg.01-10.
- [5]. V Mary Kiruba Rani, et al" A Mathematical Modelling for Quality Based Ultrasound Breast Cancer Image Using Color Properties" Australian Journal of Basic and Applied Sciences, 10(2) Special 2016, Pages: 44-51
- [6]. SShanmugasundaram and R.Lourdusamy, "IIDBE: A Lossless Text Transform for Better

- Compression”.International Journal of Wisdom Based Computing, Vol.1 (2), August 2011.
- [7]. Mamta Rani,Vikram Singh,”An Enhanced Text Compression System Based on ASCII Values and Huffman Coding”.International Journal of Computer Science Trends and Technology(IJCST)-Volume 4 Issue3,May-Jun 2016.
- [8]. SShanmugasundaram and R.Lourdusamy,”A Comparative Study of Text Compression Algorithm”.International Journal of Wisdom Based Computing, Vol.1(3).Dec 2011.

# Performance Evaluation and Prevention of Black hole attack in MANET

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## ABSTRACT

Mobile Ad-hoc NETWORK (MANET) is a collection of mobile nodes which are wire-less, self-organized and infrastructure-less where communication between the nodes is through radio waves. Therefore, security becomes a highly challenging issue in MANET's. Malicious nodes in the network may lead to security breach and degrades the performance of the network. In black hole attack, malicious node will advertise itself as having a fresh route towards destination and starts dropping the packets thereby degrading the performance and reliability of the network. In this paper, the performance metrics of a MANET such as Throughput, Packet Delivery Ratio and Packet Loss are evaluated using single and multiple malicious nodes. A fake routing protocol is proposed to prevent black hole attacks imposed by both single and multiple black hole nodes. Simulation results show that the proposed protocol provides better performance in terms of packet delivery, throughput and packet loss in presence of black holes and helps in prevention of black hole attack.

**Keywords :** Black hole, Fake routing protocol, MANET, Network Animator, NS2.

## I. INTRODUCTION

MANET is suitable for Military networking requirements, safety/rescue operations, wearable computing and communications, satellite-based information delivery and finally in scenarios requiring rapidly-deployable communications with survivable, dynamic networking mobile data exchange (RFC 2501). There are many issues in MANET such as Routing, Attack, Topology Management, Context awareness, Identity Management, Power Management, etc. Due to the openness in network topology and the absence of centralized administration in management, MANETs are vulnerable to attacks from Black hole nodes. The packet loss due to the Black hole nodes has been detected and to be isolated from the mobile ad-hoc network to increase the reliability of the network. The proposed work is to prevent attacks from Black hole nodes and improve the security performance of the whole network, especially in terms of packet delivery ratio, average end-to-end delay. To overcome this, a Dynamic trust prediction model is proposed.

This model is used to calculate the trust value, which is based on the nodes historical behavior as well as the future behavior. By using this, one can detect the untrustworthy nodes, obtain a reliable packet delivery route and alleviate the attacks from Black hole nodes that provide a flexible and feasible approach to choose the shortest route that meets the security requirements of data packet transmission.

## II. RELATED WORKS

Fan-Hsun Tseng et al., [1] provided a survey of attacks and countermeasures in MANET. The countermeasures are features or functions that reduce or eliminate security vulnerabilities and attacks. First, they have given an overview of attacks according to the protocol layers, and to security attributes and mechanisms. Then they presented preventive approaches following the order of the layered protocol layers. They also put forward an overview of MANET intrusion detection systems (IDS), which are reactive approaches to thwart attacks and used as a second line

of defense.

Rakesh Kumar Singh et al., [2] provided an overview about the security issues and available detection techniques in Mobile ad hoc networks. They identified the existent security threats an ad hoc network faces, the security services required to be achieved and the countermeasures for attacks.

Sushama singh et al., [3] introduced trusted AODV routing protocol whose trust value is calculated using tangent hyperbolic function. The results showed performance improvement as compared to standard AODV protocol.

Vimal Kumar et al., [4] proposed a technique that uses coming route reply table (CRRT) to detect black hole attack. This table is maintained by source node and it stores destination sequence number and ID of replied node. This information is used for detecting black hole attack in MANETs. The simulation result of proposed technique improves PDR and throughput of network.

Sandeep Dhende et al., [5] proposed a secure AODV protocol (SAODV) for detection and removal of black hole and gray hole attacks in MANET. The proposed method simulated using NS-2 and the proposed methodology is more secure than the existing one.

Arvind Dhaka et al., [6] proposed a scheme that uses Cseq and Rseq packets to identify and prevent black hole and gray hole attack in MANETS. If Rseq is equal to Cseq then and then only the source node allows connection to the network layer. If Rseq is not equal to Cseq then the sender of Rseq is detected as malicious node. The simulation result showed that the PDR increases and delay decreases by significant amount.

Meenakshi Sharma, et.al, [7] designing mechanism for eliminating effect of multiple black hole nodes by using novel scheme. In this scheme, detection is possible using fake RREQ message and modified RREP message. When the black hole node gets RREQ

message it replies to the source node with minimum hop count. In case, the source identify black hole node and tells its neighbor node that it is malicious node. The analyzing result shows the comparison between novel scheme and standard AODV. After prevention more number of packets will be transmitted so, throughput of novel scheme is higher and end to end delay is lower than original AODV.

### III. METHODOLOGY

The steps involved in the proposed algorithm for performance evaluation are:

1. Create a MANET
2. Implementation of AODV routing protocol [8,9]
3. Insert nodes into the network
4. Introduce malicious node into the network
5. Send packets from source to destination
6. Display moment of nodes and packets in NAM
7. Evaluate performance metrics
8. Generate graphs using Xgraph

The steps involved in proposed algorithm for black hole prevention are:

1. Create MANET
2. Implement Fake routing protocol
3. Insert mobile nodes and malicious nodes into the network
4. Source broadcasts RREQ (Route Request message) with its own ID (SSN (Source Sequence number)) [10] in place of DSN (Destination Sequence Number)
5. Intermediate Nodes sends RREP (Route Reply message) packet having highest SSN
6. If  $(RREP(SSN) > RREQ(SSN))$  [10] is true then node is blacklisted and other nodes are notified. Otherwise normal routing process of AODV is involved
7. Display results in NAM and terminal



The proposed multiple black hole nodes detection mechanism algorithm:

1. The source node broadcasts the fake RREQ packet with its own source sequence number and address in the destination sequence number and destination address in the RREQ packet fields respectively [11].
2. When legitimate nodes receive the fake RREQ packet, it will compare the source sequence number in fake RREQ packet it received with the sequence number of the source described in the table.
3. As the source node sends its own sequence number, it will be more obvious that it will be the latest or fresh one. The intermediate node will have the source sequence less than the described in fake RREQ packet. So it will not reply with RREP packet.
4. But, if there exists any black hole node in the network then it will reply with the RREP packet and advertises itself as having the shortest path with highest source sequence number.
5. The source node will then detect the black hole nodes exist in the network. And then send the packet [12] having the list of black hole nodes to the rest of the nodes.

### Network Simulator-2 (NS-2)

NS-2 is a packet –level simulator and essentially a centric discrete event scheduler to schedule the events such as packet and timer expiration.

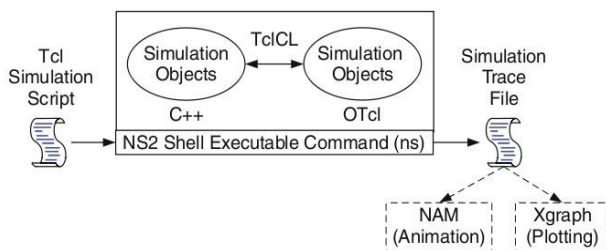


Fig 1. Working of NS-2

### Network Animator (NAM)

NAM provides a visual interpretation of the network topology created. The application was developed as part of the VINT project. Its features are as follows. Displays the NAM application and its components. Provides the visual interpretation of the network created. Can be executed directly from a tcl script. Controls include play, stop, ff, rw, pause, a display speed controller and a packet monitor facility.

It presents information such as throughput, number packets on each link. Provides a drag and drop interface for creating topologies.

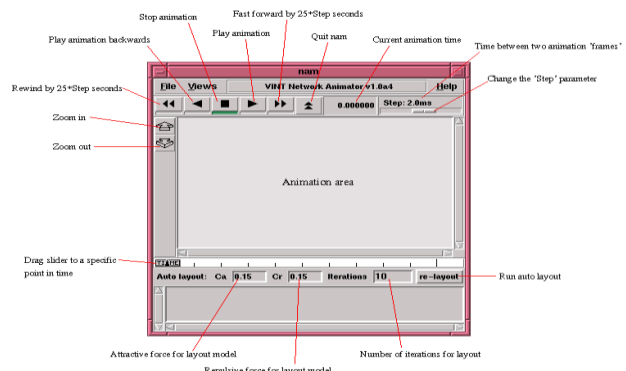


Fig 2. Network Animator

## IV. RESULTS

### Performance Evaluation

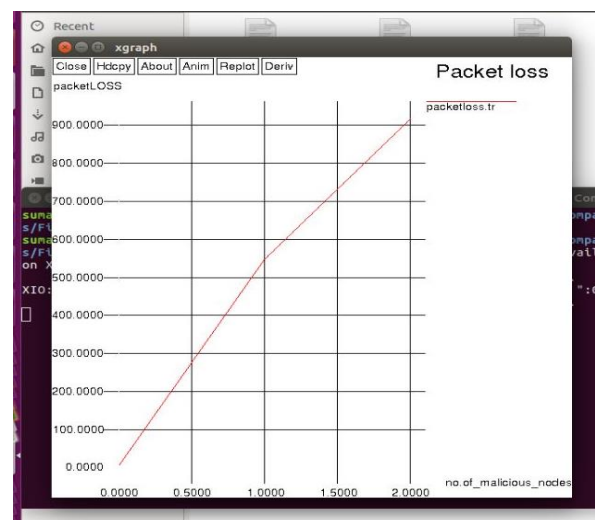


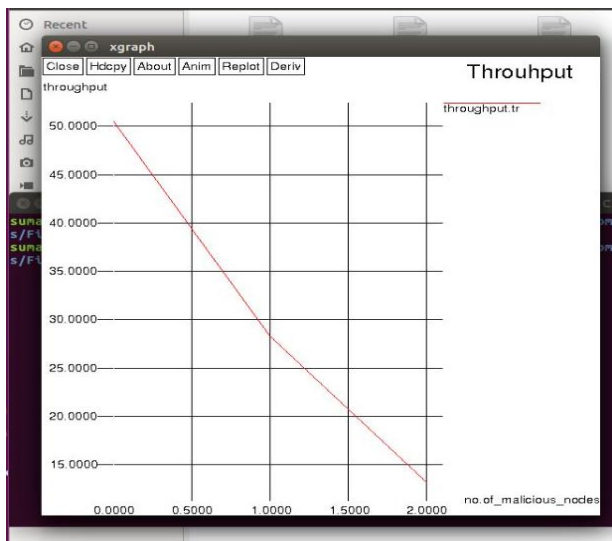
Fig 3. Malicious nodes X Packet loss

The above figure is a graph drawn between number of malicious nodes and packet loss, it is observed that as the number of malicious nodes in the network increases, the packet loss increases. When there is no malicious node at all the packet loss is almost zero, when there is a single malicious node the loss gradually increased to around 500 packets, when there is another malicious node the packet loss increased very rapidly to 900.

Packet loss= No. of packets sent – No. of packets received

**Table 1.** Packets dropped by one and two malicious nodes

No of nodes in the network	Packets dropped by 1 malicious node	Packets dropped by 2 malicious nodes
20	742	976
50	1187	1226
100	1094	1119



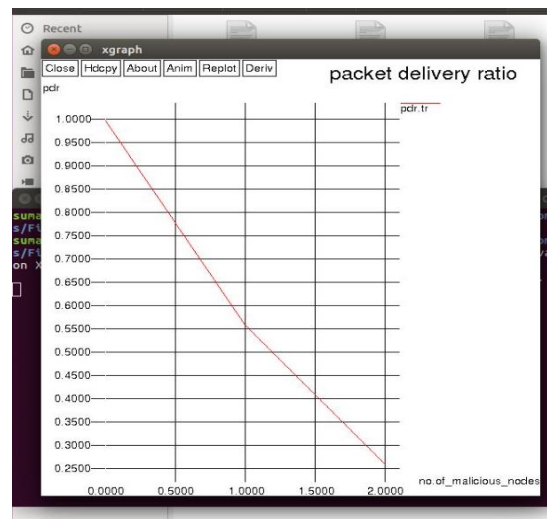
**Fig 4.** Malicious nodes X Throughput

Throughput = No. of packets received/Simulation time  
Throughput is inversely proportional to time, so as the time taken to a packet to reach destination increases, throughput decreases. When there is no malicious

node the throughput is very high around 50, when there is a single malicious node throughput has decreased to 28. When there are two malicious nodes there is no enough throughput, it is decreased below 15.

**Table 2.** Throughput in the presence of one and two malicious nodes

No of nodes	Throughput for 1 malicious node	Throughput for 2 malicious nodes
20	1782	943
50	186.48	146.62
100	520	430



**Fig 5.** Malicious nodes X PDR

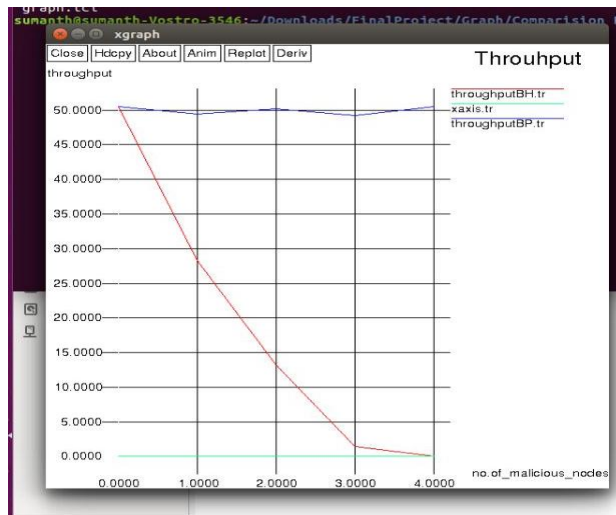
Packet Delivery Ratio (PDR) = number of packets received/number of packets sent

When every packet reaches the destination from source then the packet delivery ratio is one as number of packets sent is equal to number of packets received. It is observed from the graph that when there is no malicious node the packet delivery ratio is maximum to one, which means all the packets are reached from source to destination. As the malicious nodes in the network increased the packet delivery ratio gradually decreased, when there are two malicious nodes the delivery ratio is below 0.25.

**Table 3.** PDR in presence of one and two malicious nodes

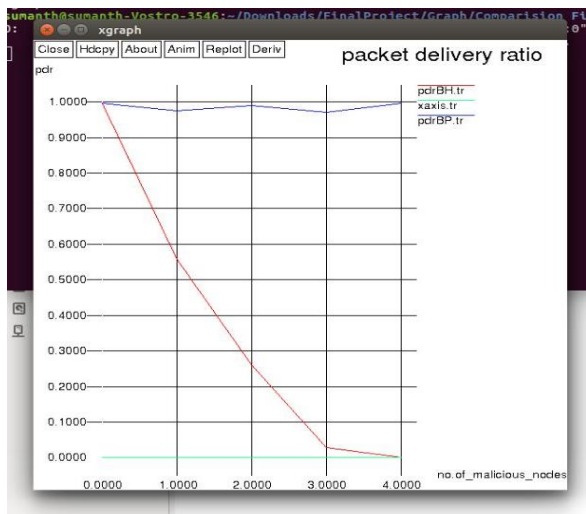
No of nodes	PDR for single malicious node	PDR for two malicious node
20	40.02	21.2
50	4.19	1.04
100	11.70	9

**Prevention Evaluation**



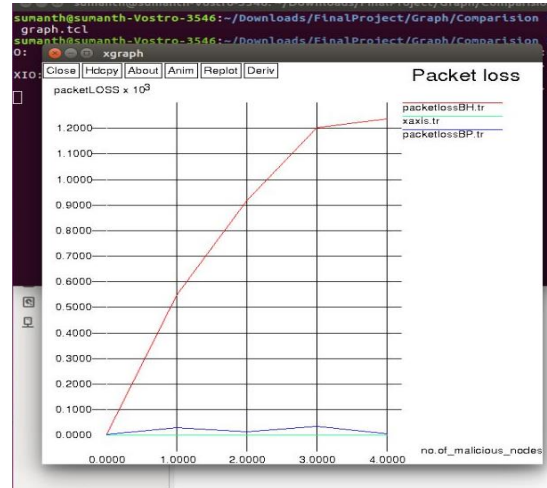
**Fig 6.** No. of malicious nodes X Throughput

From the above graph it is observed that the throughput is decreasing when there is a blackhole attack which is shown by red color line. When prevention is done throughput is good which is shown by a blue line.



**Fig 7.** No. of malicious nodes X packet delivery ratio.

From the above graph it is observed that the packet delivery ratio is decreasing when there is a blackhole attack which is shown by red color line. When prevention is done packet delivery ratio is good which is shown by a blue line.



**Fig 8.** No. of malicious nodes X packet loss

From the above graph it is observed that the packet loss is increasing when there is a blackhole attack which is shown by red color line. When prevention is done packet loss is very less which is shown by a blue line.

**IV. CONCLUSION**

Black hole attack in MANET is analyzed using AODV routing protocol. The main criteria is analyzing the system performance with no black hole, single black hole and multiple black holes and at the end preventing the black hole attack from consuming the packets thereby increasing the performance of the network.

The following parameters were evaluated to measure the performance of the MANET:

- (a) Throughput
- (b) Packet Delivery Ratio
- (c) Packet loss

It is observed that the routing of data Packets in the mobile ad hoc networks using AODV routing protocol

is affected when there is a Black hole attack due to which the efficiency of the network degrades. In the prevention of black holes this technique assumes that the source node is an intelligent node which uses the sequence number concept to detect the multiple black hole nodes in MANET. This detection mechanism is effectively implemented using NS 2.35.

## V. REFERENCES

1. Fan-Hsun Tseng, Li-Der Chou and Han-Chieh Chao, "A Survey of Attacks and Countermeasures in Mobile Ad Hoc Networks", Human-centric Computing and Information Sciences, Springer, New York, pp. 1-16, 2011.
2. Rakesh Kumar Singh, Rajesh Joshi and Mayank Singhal, "Analysis of Security Threats and Vulnerabilities in Mobile Ad Hoc Network (MANET)", International Journal of Computer Applications (0975 – 8887) Volume 68– No.4, April 2013.
3. Sushama Singh, Atish Mishra and Upendra Singh, "Detecting and Avoiding of Collaborative Black hole attack on MANET using Trusted AODV Routing Algorithm", Symposium on Colossal Data Analysis and Networking (CDAN), 2016.
4. Vimal Kumar and Rakesh Kumar, "An Adaptive Approach for Detection of Blackhole attack in Mobile ad hoc Network", Procedia Computer Science, vol. 48, pp. 472–479, 2015.
5. Sandeep Dhende, Sandeep Musale, Suresh Shirbahadurkar and Anand Najan, "SAODV: Black Hole and Gray Hole Attack Detection Protocol in MANETs", IEEE WiSPNET Conference, 2017.
6. Arvind Dhaka, Amita Nandal, and Raghuvveer S. Dhaka, "Gray and Black hole attack identification using Control Packets in MANETs", Procedia Computer Science, vol. 54, pp. 83–91, 2015.
7. Meenakshi Sharma and Davinderjeet Singh, "Implementation of a Novel Technique for a Secure Route by Detection of Multiple Blackhole Nodes in Manet", International Journal of Current Engineering and Technology, vol. 4, no.1, pp. 56-59, February-2014.
8. Nishu Kalia and Harpreet Sharma, "Detection of Multiple Black hole nodes attack in MANET by modifying AODV protocol", International Journal of Computer Science and Engineering, 2016.
9. Uma Rathore Bhatt, Abhishek Dangarh, Akanksha Kashyap, Aishwarya Vyas "Performance analysis of AODV & DSR Routing protocols for MANET", Fourth International Conference on Communication Systems and Network Technologies, 2014.
10. Umang, B V. R. Reddy and M .N. Hoda, "MNI-AODV: Analytical Model for Attack mitigation using AODV routing in ad hoc networks", International Conference on Computing for Sustainable Global Development (INDIACom), 2014.
11. Chang Wu Yu, Tung-Kuang Wu and Rei Heng Cheng, "A Distributed and Cooperative Blackhole Node Detection and Elimination Mechanism for Ad Hoc Network", PAKDD Workshops, Nanjing, China, 22-25, pp. 538-549, 2007.
12. E.A. Mary Anita and V. Vasudevan, "Blackhole Prevention in Multicasting Routing Protocols for Mobile Ad hoc Networks using Certificate Chaining", International Journal of Computer Applications, Volume 1, pp. 21-28, 2011.

# Linguistic Schemes Encoding Text Message

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## ABSTRACT

Today websites and mobile applications are attacked by malicious, Ransom ware software designed to block information. It means sharing of websites and mobile apps information has low security. Cryptography is an art of providing security to messages before sharing them on insecure communication lines. The main aim of the paper is to propose a innovative encryption method adopting multilingualism approach where text message symbols are replaced by linguistic characters. An Unauthorized person cannot recognize the encrypted data while data transmission occurs. This method uses characters of four Indian languages Tamil, Hindi, Telugu, and Malayalam. This method encrypts plaintext and produces unintelligible linguistic codes. The outcome of encryption has a mixture of linguistic characters which cannot be understood by individual. Further, the initial experiments and results have shown a promising security level for proposed multilingualism technique. The proposed method is language-dependent approach providing new perspective with excellent potential for yielding secret codes.

**Keywords:** Encryption, Text Mixing, Linguistic Characters, Secret Message.

## I. INTRODUCTION

Since the rise of the Internet, one of the most important factors of information technology and communication has been the security of information. Cryptography is the practice and study of hiding information. Modern cryptography intersects the disciplines of mathematics, computer science and electrical engineering. Cryptography has provided techniques for securing vital information and sharing them to others over insecure communication media. Though many different methods have been developed for securing messages, still there requires new principles to keep the contents of a message secret. Applications of cryptography include ATM cards, computer passwords and electrical commerce. Information security uses cryptography to transform usable information into a form from that sender alone

can understand and others cannot realize the secret codes. A generic model of encryption process is shown below.

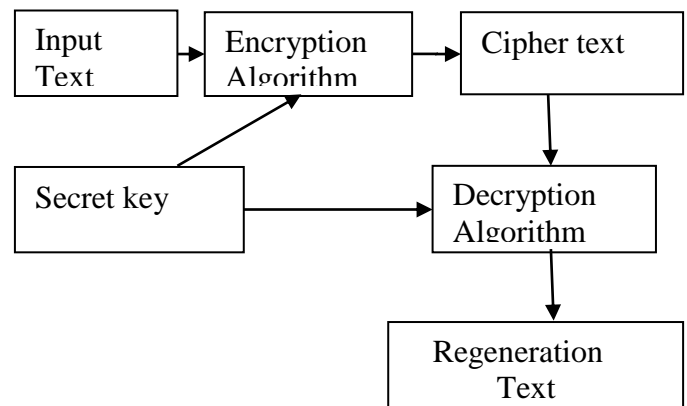


Figure 1: Generic Secret Key Encryption

It is obvious that a Multilingual person can talk in more than one language, either actively (through

speaking, writing, or signing) or passively (through listening, reading, or perceiving). More specifically, the terms bilingual and trilingual are used to describe comparable situations in which two or three languages are involved. A multilingual person is generally referred to as a polyglot. The proposed work considers text messages and converts them to multilingual symbols. These multilingual symbols are treated as the characters of a secret code for the given input text message.

## II. LITERATURE SURVEY

The existing encryption techniques are mainly dealt with European languages like English, French, Germany etc. The Indian languages are used in the proposed work of encryption technique to generate a secret message.

Arafat Awajan et al [3] implemented a coding system that provides a unique number for every character irrespective of the platform, program and language. The existing encryption techniques mainly deal with European languages like English, French, German etc.,. The major disadvantage is that many characters are wrongly decoded in the decryption process.

B. Vijayalakshmi et al [4] discussed about the character encoding based on Tamil characters. It is based upon the text characters. The limitation of this method is that, it is insufficient to represent all Tamil characters, store, transmit and retrieve the documents.

Md. Ahsamar Rahman et al [6] develops an algorithm for Bengali letters where the letters are encoded and the weights retain the same order as the letters. And, compares the bit strings instead of weight strings which does not change the output. An ordering is maintained and Bengali letters are taken as basic input.

## III. UNICODE MAPPING

The Unicode Standard is a character coding system designed to support the worldwide interchange, processing, and display of the written texts of the diverse languages and technical disciplines of the modern world and creates the foundation of global software for recognition of characters. In addition, it supports classical and historical texts of many written languages. For example, The Tamil Unicode range is U+0B85 to U+0B95. The Unicode for the character 'அ' is 0B85; the Unicode for the character 'ஊ' is 0B95.

The Hindi Unicode range is U+0905. The Unicode for the character 'अ' is 0905. The Unicode standard reflects the basic principle which emphasizes that each character code has a length of 16 bits. Unicode text is simple to parse and process and Unicode characters have well defined semantics. Hence, Unicode is chosen as the encoding scheme for the proposed work. After classification the characters are recognized and a mapping table is created in which the Unicode for the corresponding characters are mapped.

## IV. PROPOSED METHOD

The proposed encryption technique is based on a multilingual approach. It accepts input text and replaces each character by multilingual characters which are displayed as the outcome of a secret code. It is the requisite cipher text. Initially, the functional part collects all text characters in an array whose index locations are taken as the weight of each text symbol. Similarly, the multilingual characters are collected in another array whose index value is referred for outputting a linguistic character. For a given input text, the weight of each character is applied to the function  $f(x)=(2x+1)$ . The functional value is again considered as a weight to look into a linguistic table to

provide resultant cipher character. Say, A, the input character is stored in an array whose index = 0 ( $x=0$ ), then the functional value of  $f(x)=(2x+1)$ , giving value 1 indicates the location of lingual array denoting linguistic character **அ**. This method uses four south Indian regional letters namely Tamil, Hindi, Malayalam and Telugu for collecting lingual characters. The functional process of the proposed work is depicted in Figure 2.

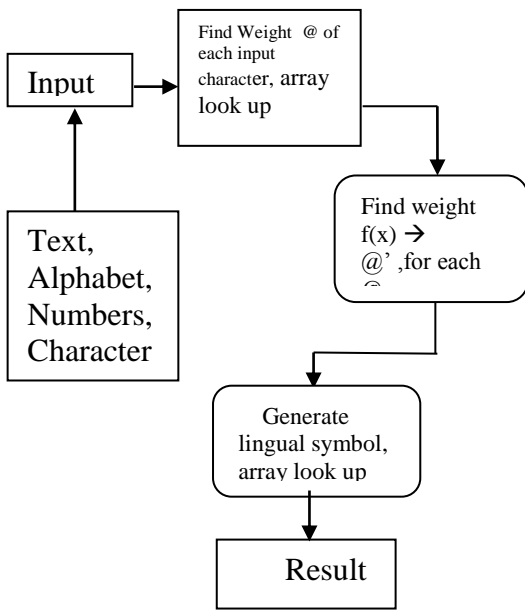


Figure 2: Functional Structure

Table 1. Tamil – Unicode Symbol

S. No	Input value	Input text	Unicode	Cipher text
1	0	A	"\u0B85",	அ
2	1	B	"\u0B86",	ஆ
3	2	C	"\u0B87",	இ
4	3	D	"\u0B88",	ஈ
5	4	E	"\u0B89",	உ

Table 2. Hindi – Unicode Symbol

S. No	Input value	Input text	Unicode	Cipher text
1	5	F	"\u0905",	अ
2	6	G	"\u0906",	आ
3	7	H	"\u0907",	इ
4	8	I	"\u0908",	ई
5	9	J	"\u0909",	उ

S. No	Input value	Input text	Unicode	Cipher text
1	11	K	"\u0C05",	క
2	12	L	"\u0C06",	ల
3	13	M	"\u0C07",	ఇ
4	14	N	"\u0C08",	ఈ
5	15	O	"\u0C09",	ఉ

Table 3. Telugu - Unicode Symbol

S. No	Input value	Input text	Unicode	Cipher text
1	16	P	"\u0D05",	అ
2	17	Q	"\u0D06",	ఆ
3	18	R	"\u0D07",	ఇ
4	19	S	"\u0D08",	ఱ
5	20	T	"\u0D09",	ఉ

Table 4. Malayalam - Unicode Symbol

S. No	Input value	Input text	Unicode	Cipher text
1	21	U	"\u0E01",	അ
2	22	V	"\u0E02",	ആ
3	23	W	"\u0E03",	ഇ
4	24	X	"\u0E04",	ഈ
5	25	Y	"\u0E05",	ഉ

The above tables show a sample of few Tamil, Hindi, Telugu and Malayalam characters with Unicode.





# A Prototype Implementation of Bus Attendance System

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## ABSTRACT

A lot of children need to commute between homes to school daily. In recent days safer transportation of school children has been a critical issue. Lots of cases have been reported of late where due to lack of information about whereabouts of the child has led to fatal accidents resulting to deaths also. In presence of a proper entry exit system it would be possible to track the location of the child and may be tracked quickly and often impending mishaps can be avoided. This project intends to find yet another solution to solve these problems by developing a bus safety system that will control the entry and exit of students from the buses through an advanced methodology. The proposed system uses RFID (Radio Frequency Identification), and GSM to send notification to parents regarding students entry and exit in the school. In this work we have been able to implement the partial prototype which is capable of reading the RFID tag and identify it.

**Keywords :** Radio Frequency Identification, SM, NAVYYA, AIDC

## I. INTRODUCTION

Traditionally, the security of kindergartens is highly relied on the human's effort and attention like guardians and teachers. However, if there is no active informing service provide by kindergartens usually, parents have no idea of when and whether their children safely arrive in their classroom after they are picked up by school bus. Every morning the student attendance offers the first hand information of children safety. But sometimes it is complicated to exactly track the attendance since the children arrive in a period of time in the morning and some of them come with their parents and some come by school bus. So we develop an active RFID attendance system to overcome the barriers and mistakes of manually taking attendance and combine the wireless GSM message service to provide real time responses to their parents' cellular phone. Parents can check the message and understand when their children are safely arrived. On the contrary, a noticing message will be broadcasted to administrators and parents if the

children do not show up in a class on time so that the adults have the enough time to check out these particular children and prevent accident happens. Another main purpose of the system is used to relieve the traffic jam around the kindergarten after class, parents drive to school to pick up their children at the same time. Many cars would get stuck by the kindergarten because they all temporarily park in front of the school and wait the guardians to find out their children and bring them out. The traffic chaos is more serious especially on rainy days or the kindergarten is located on a busy district. With the prior distributed RFID tags carried by parents, the system can detect the approaching cars in a specific distance and identify the children who would be picked up next. Thus, the school broadcasting system would read the children name and guardians could bring them out so that these parent cars can pick up their children without additional waiting.

## History And Development

School buses transfer lot of children daily in various countries around the world. While there are many problems that might disturb the parents regarding the safety transportation of school going children, the paper is looking into introducing the bus controlling system that will help the school children in a secure and safer way. The supervision of the regularity of students during their entry and exit from the bus is difficult for the drivers, which led to endangering child safety. It has been increasing significantly in the recent year's. This project, through entry and exit recordings, aims to create a suitable environment by following certain set of criteria of security and safety for school bus that will have a positive impact on the student and their family. In this prototype, GSM module, RFID Tag which will exchange the data with the RFID reader via radio waves and displaying each student names and roll no into the LCD Display.

## II. LITERATURE REVIEW

Literature [1] Author adopted RFID Technology to safe children from wrong identification their destination location, method to curtail the students sleeping in the bus itself without leaving to classes. This paper also focused to provide the security to the children from starting location to the destination point with applied RF technology Also described the security of the children at Zone premises. This paper adopted a wireless sensor network methodology to identify the vehicle license plate number.

Literature [2] Author proposed that a mechanism which will trace the missed student by using GSM-GPS technology. An ARM 7 is used to process the given information and to send the appropriate location of the missed student by adopting the GSM technology. The Missed student Latitude and Altitude locations are determined by adopting the GPS Technology.

Literature [3] Author proposed a RFID –GSM technology to provide the security to the school children. The RFID tags that are attached to the school children bags for tracking and GSM is used to send the messages to the respective parents. M. NAVYYA et.al Proposed GSM-GPS technology to track children students. GPS is used for identifying the student location. GSM is used to send the information to the parent android mobile. Monitoring database is provided at the control room of the school.

Literature [4] Author proposes another solution to solve these problems by developing a bus safety system that will control the entry and exit of students from the buses through an advanced methodology. The proposed system uses RFID (Radio Frequency Identification), GSM to send notification to parents regarding student and proximity sensor monitoring the speed of bus and alcoholic sensor is used to detect alcoholic consumption of the driver.

## III. METHODS AND MATERIAL

### RFID AND WIRELESS CHANNEL TECHNIQUE

A detailed experimental procedure adopted in this investigation is presented in this chapter. In addition, the theoretical formulations involved in the computation of various acoustic parameters are also discussed.

#### 3.1 Introduction to RFID

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically-stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight

of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC).

### 3.1.1 Tags

A radio-frequency identification system uses tags, or labels attached to the objects to be identified. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response. RFID tags can be either passive, active or battery-assisted passive. An active tag has an on-board battery and periodically transmits its ID signal. A battery-assisted passive (BAP) has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. However, to operate a passive tag, it must be illuminated with a power level roughly a thousand times stronger than for signal transmission. That makes a difference in interference and in exposure to radiation.

### Readers

RFID systems can be classified by the type of tag and reader. A Passive Reader Active Tag (PRAT) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only). The reception range of a PRAT system reader can be adjusted from 1–2,000 feet (0–600 m), allowing flexibility in applications such as asset protection and supervision. An Active Reader Passive Tag (ARPT) system has an active reader, which transmits interrogator signals and also receives authentication replies from passive tags. An Active Reader Active Tag (ARAT) system uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal.

### GSM Communication

GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation digital cellular networks used by mobile devices such as tablets.

The network is structured into a number of discrete sections:

- Base station subsystem – the base stations and their controllers explained.
- Network and Switching Subsystem – the part of the network most similar to a fixed network, sometimes just called the "core network".
- GPRS Core Network – the optional part which allows packet-based Internet connections.
- Operations support system (OSS) – network maintenance.

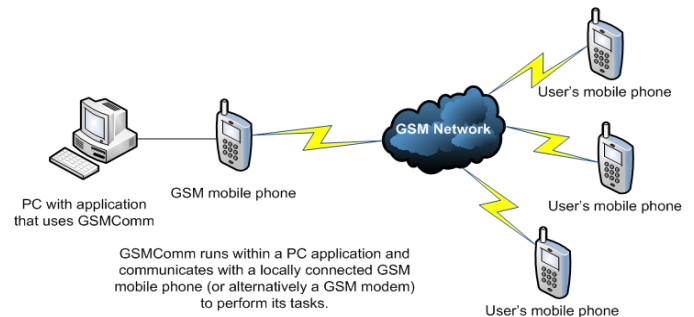


Figure 3.2: GSM Architecture

Mobile communication is an emerging technology these days. GSM is the acronym for Global System for Mobile Communication. GSM module is wireless modem that transmits data using radio waves. GSM architecture is similar to the mobile architecture. GSM modems are generally used in many electronic applications and they are required to interface with the microcontrollers. The following AT commands are frequently used to control the operations of GSM modem.

#### Command – Operation

- AT+CSMS – Select message service.
- AT+CMGF – Message format.

AT+CMGR – Read message.  
 AT+CMGS – Send message.



Figure3.3: GSM Module

#### IV. RESULTS AND DISCUSSION

##### SYSTEM DESIGN AND SIMULATION

###### Block Diagram

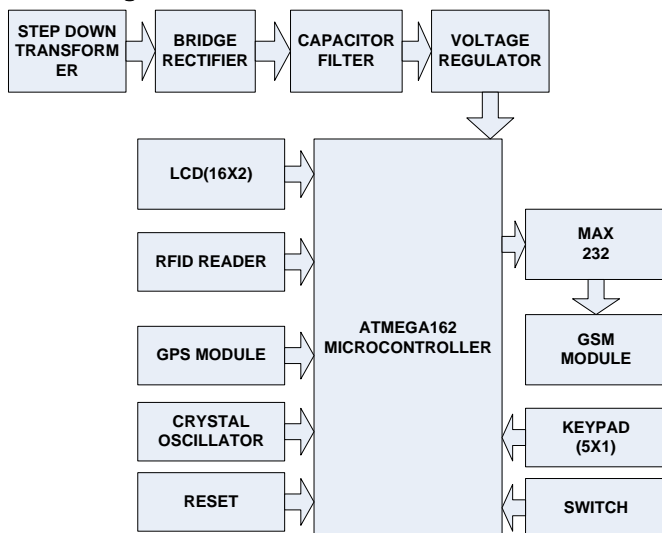


Figure 4.1. Block Diagram of Transmitter

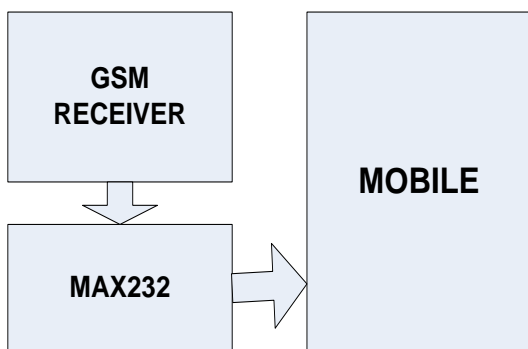


Figure 4.2. Block Diagram of Receiver

The aim of this project is to design an RFID Technology based Attendance System using 8051 microcontroller, in which the attendance of students or employees is automatically recorded with the swipe of a card. The working of the project is explained here. When this circuit is powered ON, initially the microcontroller will display the message as Swipe the card on the LCD display. When the RFID reader detects the ID card, it will send the unique card no to the microcontroller via serial terminal. With the help of suitable programming, we need to compare the received card no. with the numbers that are already stored in the microcontroller or any database. Once, if any of these numbers are match with the received card no., then the corresponding name stored in that no. is displayed on the LCD display and also the attendance for the name stored in the corresponding number is marked. By pressing the button, the attendance recording will be closed and the details are displayed on the LCD repeatedly until the microcontroller has been reset.

##### HARDWARE DESIGN AND IMPLEMENTATION

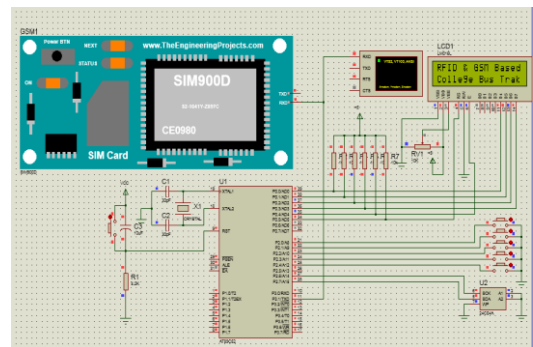


Figure 5.1. Circuit Diagram of Proposed System

The hardware used in the prototype include the following

- 1) Power Supply
- 2) Transformer
- 3) Bridge rectifier
- 4) Voltage Regulator
- 5) Filter

- 6) ATMEGA162 Microcontroller
- 7) Liquid Crystal Display (LCD)
- 8) GSM AND GPS

### 5.1 VERIFICATION AND TEST RESULTS

To test the operation of the system prototype including several RFID readers by using one prototype board of the RFID reader, it changes the value of the on-board DIP switch to stimulate different room locations. RFID reader device is used to sense the identification tags of participants and transmit the information to the remote server. Figure bellow shows the implemented hardware of the proposed system

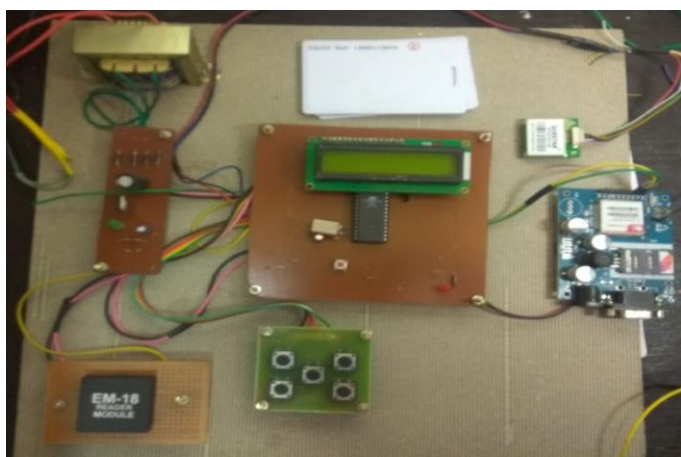


Figure 5.2 : Hardware Implementation of Proposed System

### V. CONCLUSION AND FUTURE WORK

This paper demonstrates how an automation of attendance system can be implemented using RFID, Biometric, and GSM Modem. Also the paper presents the successful development and prototyping of a low-cost event attendance and tracking management system. It is based on the use of RFID technology combined with the use of wireless communications and data analytics delivered by the system server. We have been able to implement the partial prototype which is capable of reading the RFID tag and identify it. The remaining work includes forwarding the details of attendance using a GSM Modem.

The future enhancements in the system can be that the doors of the classrooms, laboratories etc. are managed by the system itself and are unlocked and locked accordingly. Software can be made for the mobile phones and then using the mobile phones GPS (Global Positioning System) the location of the student can be known all over the place and not only the campus. The same ID card can also be used for other functionality of the university like the library card for issuing of books and for example the exam identification card.

### VI. REFERENCES

- [1] H. Wegleiter, B. Schweighofer, et al. (2011). "Automatic Antenna Tuning Unit to Improve RFID System Performance." IEEE Trans. on Instrumentation & Measurement, 60 pp.2797-2803.
- [2] X. Yao, K. Sungwook, et al. (2009). "Optimum ASK Modulation Scheme for Passive RFID Tags Under Antenna Mismatch Conditions." IEEE Trans. on Microwave Theory & Techniques, 57, pp. 2337-2343
- [3] X. Zhu, S. K. Mukhopadhyay, H. Kurata. (2012). "A Review of RFID Technology and its Managerial Applications in Different Industries." J. Eng. & Techn. Management 29, pp. 152-167.
- [4] K. Finkelzeller. (2010). "RFID Handbook: Fundamentals and Applications in Contactless Smart Cards, Radio Frequency Identification and Near-Field Communication". 3rd Ed., Wile.
- [5] J. S. Lee, Y.W. Su, C. C. Shen (2007). "A Comparative Study of Wireless Protocols: Bluetooth, UWB, Zigbee and Wi-Fi", 33rd Annual Conference of the IEEE Industrial Electronics Society, pp. 46-51.
- [6] Qiu Jinghui Sun Bo You Qidi, "Study on RFID Antenna for Railway Vehicle Identification", 6th International Conference on ITS Telecommunications Proceedings, 2006.

- [7] A.A.Pandit, Jyot Talreja, Ankit Kumar Mundra, "RFID tracking system for vehicles (RTSV)", First International Conference on Computational Intelligence, Communication Systems and Networks, 2009.
- [8] Xiaoqiang Zhang, Vasileios Lakafosis, Anya Traille and Manos M. Tentzeris, "Performance Analysis of FastMoving RFID Tags in State-of-the-Art High-speed Railway Systems", IEEE International Conference on RFID-Technology and Applications, 17 - 19 June Guangzhou, China, 2010.
- [9] Md. Aminul Islam, Yixian Yap, Nemai Karmakar and A K M Azad, "Orientation Independent Compact Chipless RFID Tag", IEEE International Conference on RFID - Technologies and Applications (RFID - TA) 2012. [5] Y. F. Weng, S. W. Cheung, T. I. Yuk, and L. Liu, "Design of chipless UWB RFID system using a CPW multiresonator", IEEE Antennas and Propagation Magazine, vol. 55, no. 1, pp 78-82, February 2013.

# A Fully Functional Prototype Implementation of Bus Attendance System

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## ABSTRACT

A lot of children need to commute between homes to school daily. In recent days safer transportation of school children has been a critical issue. Lots of cases have been reported of late where due to lack of information about whereabouts of the child has led to fatal accidents resulting to deaths also. In presence of a proper entry exit system it would be possible to track the location of the child and may be tracked quickly and often impending mishaps can be avoided. This project intends to find yet another solution to solve these problems by developing a bus safety system that will control the entry and exit of students from the buses through an advanced methodology. The proposed system uses RFID (Radio Frequency Identification), and GSM to send notification to parents regarding students entry and exit in the school. In this work we have been able to implement a fully functional prototype which is capable of reading the RFID tag and identify it and forwarding the details on the registered number through the GSM Modem

**Keywords :** Radio Frequency Identification, SM, NAVYYA, Operations Support System, Voltage Regulator, Bridge Rectifier, Transformer, ATMEGA162 Microcontroller

## I. INTRODUCTION

Traditionally, the security of kindergartens is highly relied on the human's effort and attention like guardians and teachers. However, if there is no active informing service provide by kindergartens usually, parents have no idea of when and whether their children safely arrive in their classroom after they are picked up by school bus. Every morning the student attendance offers the first hand information of children safety. But sometimes it is complicated to exactly track the attendance since the children arrive in a period of time in the morning and some of them come with their parents and some come by school bus. So we develop an active RFID attendance system to overcome the barriers and mistakes of manually taking attendance and combine the wireless GSM message service to provide real time responses to their parents' cellular phone. Parents can check the message

and understand when their children are safely arrived. On the contrary, a noticing message will be broadcasted to administrators and parents if the children do not show up in a class on time so that the adults have the enough time to check out these particular children and prevent accident happens. Another main purpose of the system is used to relieve the traffic jam around the kindergarten after class, parents drive to school to pick up their children at the same time. Many cars would get stuck by the kindergarten because they all temporarily park in front of the school and wait the guardians to find out their children and bring them out. The traffic chaos is more serious especially on rainy days or the kindergarten is located on a busy district. With the prior distributed RFID tags carried by parents, the system can detect the approaching cars in a specific distance and identify the children who would be picked up next. Thus, the school broadcasting system

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### **RFID AND WIRELESS CHANNEL TECHNIQUE**

A detailed experimental procedure adopted in this investigation is presented in this chapter. In addition, the theoretical formulations involved in the computation of various acoustic parameters are also discussed.

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energy from a nearby RFID reader's interrogating radio waves. Active tags have a local power source (such as a battery) and may operate hundreds of meters from the RFID reader. Unlike a barcode, the tag need not be within the line of sight of the reader, so it may be embedded in the tracked object. RFID is one method for Automatic Identification and Data Capture (AIDC).

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Tags may either be read-only, having a factory-assigned serial number that is used as a key into a database, or may be read/write, where object-specific data can be written into the tag by the system user. Field programmable tags may be write-once, read-multiple; "blank" tags may be written with an electronic product code by the user.

### Readers

RFID systems can be classified by the type of tag and reader. A Passive Reader Active Tag (PRAT) system has a passive reader which only receives radio signals from active tags (battery operated, transmit only). The

reception range of a PRAT system reader can be adjusted from 1–2,000 feet (0–600 m)[citation needed], allowing flexibility in applications such as asset protection and supervision. An Active Reader Passive Tag (ARPT) system has an active reader, which transmits interrogator signals and also receives authentication replies from passive tags. An Active Reader Active Tag (ARAT) system uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal.

### Overview of RFID

The RFID tag can be affixed to an object and used to track and manage inventory, assets, people, etc. For example, it can be affixed to cars, computer equipment, books, mobile phones, etc.

RFID offers advantages over manual systems or use of bar codes. The tag can be read if passed near a reader, even if it is covered by the object or not visible. The tag can be read inside a case, carton, box or other container, and unlike barcodes, RFID tags can be read hundreds at a time. Bar codes can only be read one at a time using current devices.

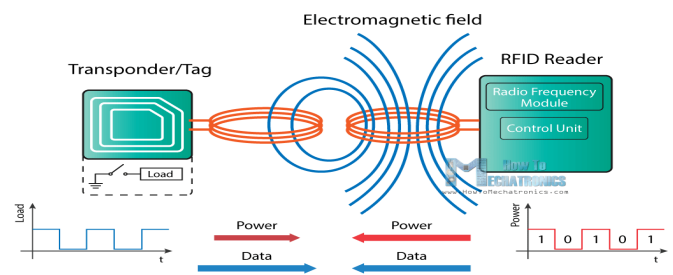


Figure 3.1: RFID Working Principle

### RFID Working

Radio waves are used to transfer data between the RFID tag and the read/write device (interrogator), which are tuned to the same frequency. The interrogator sends out a signal, which is received by

all tags tuned to that frequency that are present in the RF field.

Tags receive the signal with their antennas, and selected tags respond by transmitting their stored data. The tag can hold many types of data about the item, such as its manufacturer, product number, serial number, configuration instructions, what time the item traveled through a certain zone, even temperature and other data provided by sensors.

The interrogator receives the tag signal with its antenna, decodes it and transfers the data to the host computer system.

RFID tags can be attached to virtually anything – from a semi tractor, to a pallet, to a case, to an item on a store shelf. If multiple tags are present in the field, more efficient RFID implementations have anti-collision algorithms, which determine the order of response so that each tag is read once and only once.

### ***GSM Communication***

GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation digital cellular networks used by mobile devices such as tablets.

**The network is structured into a number of discrete sections:**

- Base station subsystem – the base stations and their controllers explained.
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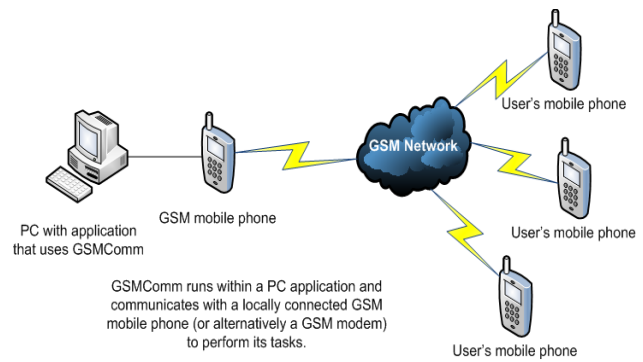


Figure 3.2: GSM Architecture

Mobile communication is an emerging technology these days. GSM is the acronym for Global System for Mobile Communication. GSM module is wireless modem that transmits data using radio waves. GSM architecture is similar to the mobile architecture. GSM modems are generally used in many electronic applications and they are required to interface with the microcontrollers. The following AT commands are frequently used to control the operations of GSM modem.

#### **Command – Operation**

- AT+CSMS – Select message service.
- AT+CMGF – Message format.
- AT+CMGR – Read message.
- AT+CMGS – Send message.



Figure3.3: GSM Module

## **IV. RESULTS AND DISCUSSION**

### **System Design and Simulation**

**Block Diagram**

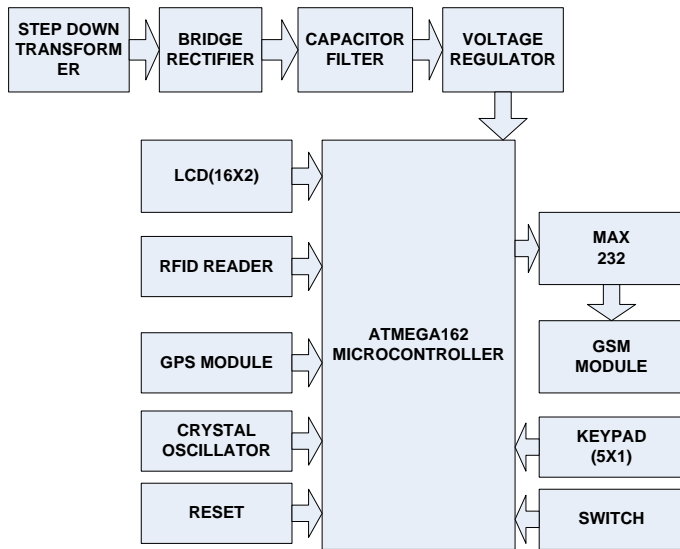


Figure 4.1. Block Diagram of Transmitter

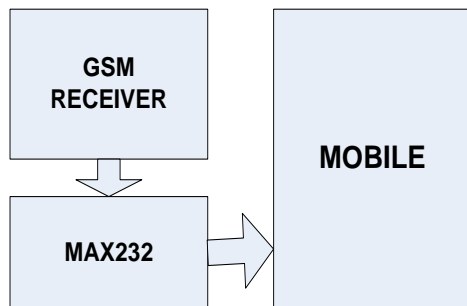


Figure 4.2. Block Diagram of Receiver

The aim of this project is to design an RFID Technology based Attendance System using 8051 microcontroller, in which the attendance of students or employees is automatically recorded with the swipe of a card. The working of the project is explained here. When this circuit is powered ON, initially the microcontroller will display the message as Swipe the card on the LCD display. When the RFID reader detects the ID card, it will send the unique card no to the microcontroller via serial terminal. With the help of suitable programming, we need to compare the received card no. with the numbers that are already stored in the microcontroller or any database. Once, if any of these numbers are match with the received

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**HARDWARE DESIGN AND IMPLEMENTATION**

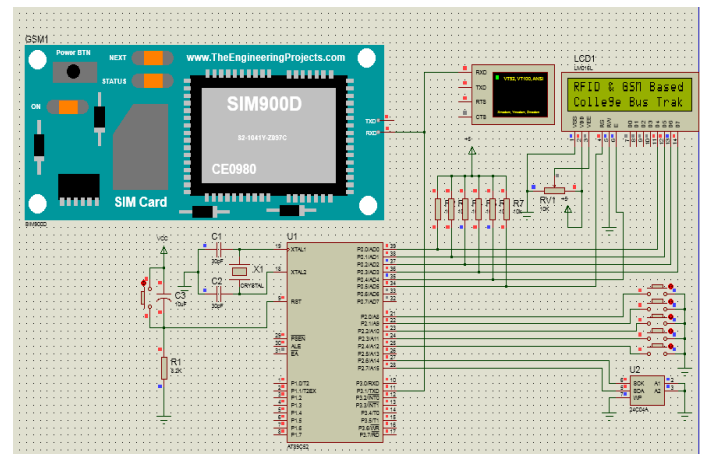


Figure 4.3. Circuit Diagram of Proposed System

The hardware used in the prototype include the following

- 1) Power Supply
- 2) Transformer
- 3) Bridge rectifier
- 4) Voltage Regulator
- 5) Filter
- 6) ATMEGA162 Microcontroller
- 7) LIQUID CRYSTAL DISPLAY (LCD)
- 8) GSM AND GPS

**VERIFICATION AND TEST RESULTS**

To test the operation of the system prototype including several RFID readers by using one prototype board of the RFID reader, it changes the value of the on-board DIP switch to stimulate different room locations. RFID reader device is used to sense the identification tags of participants and transmit the information to the remote server. Figure bellow shows Proteus simulation of proposed system

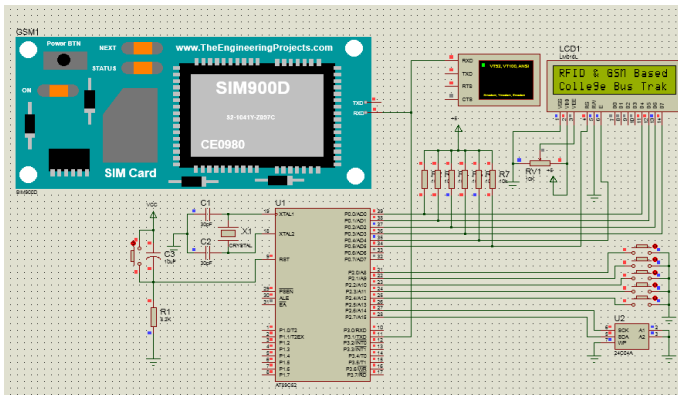


Figure 4.4 : Proteus Simulation of Proposed System

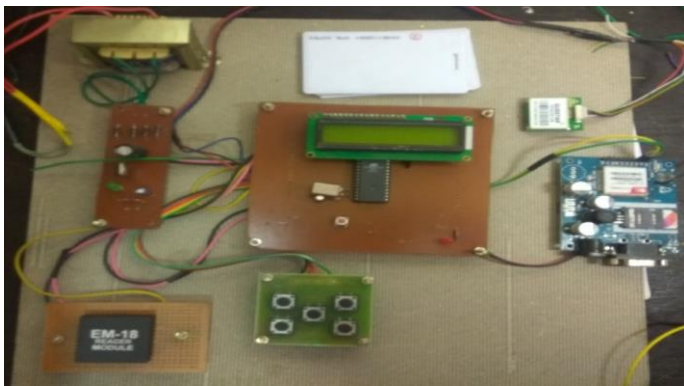


Figure 4.5 : Hardware Implementation of Proposed System

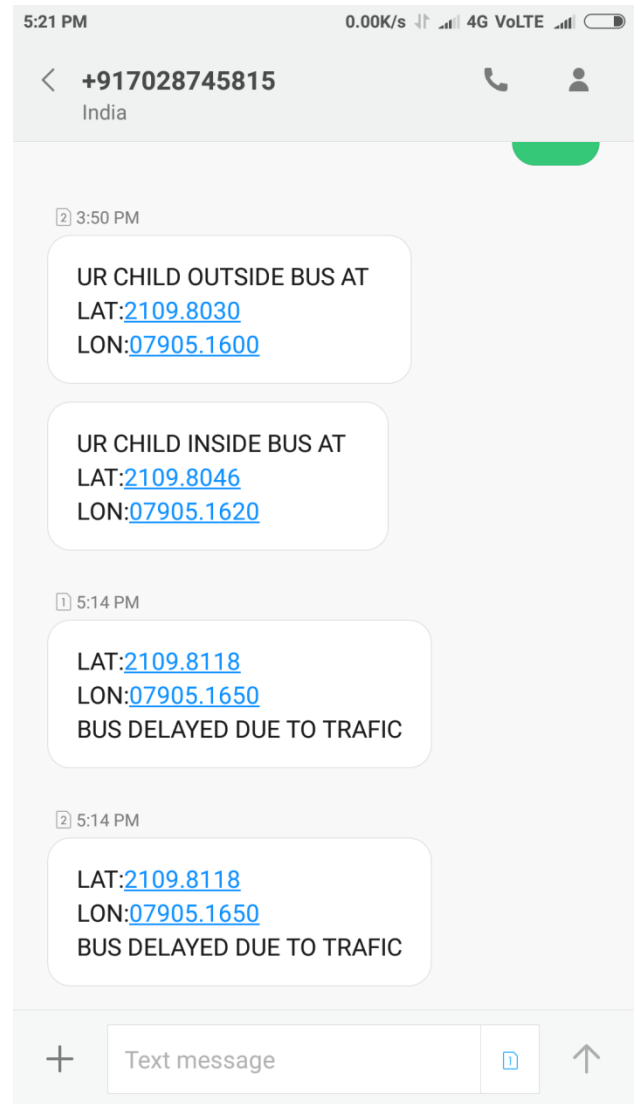


Figure 4.6 : Screen shots of the messages forwarded by the GSM Modem

### V. CONCLUSION AND FUTURE WORK

This paper demonstrates how an automation of attendance system can be implemented using RFID, Biometric, and GSM Modem. Also the paper presents the successful development and prototyping of a low-cost event attendance and tracking management system. It is based on the use of RFID technology combined with the use of wireless communications and data analytics delivered by the system server.

The future enhancements in the system can be that the doors of the classrooms, laboratories etc. are managed by the system itself and are unlocked and locked accordingly. Software can be made for the

mobile phones and then using the mobile phones GPS (Global Positioning System) the location of the student can be known all over the place and not only the campus. The same ID card can also be used for other functionality of the university like the library card for issuing of books and for example the exam identification card. In this work we have been able to implement a fully functional prototype which is capable of reading the RFID tag and identify it and forwarding the details on the registered number through the GSM Modem

## VI. REFERENCES

- [1] H. Wegleiter, B. Schweighofer, et al. (2011). "Automatic Antenna Tuning Unit to Improve RFID System Performance." IEEE Trans. on Instrumentation & Measurement, 60 pp.2797-2803.
- [2] X. Yao, K. Sungwook, et al. (2009). "Optimum ASK Modulation Scheme for Passive RFID Tags Under Antenna Mismatch Conditions." IEEE Trans. on Microwave Theory & Techniques, 57, pp. 2337-2343
- [3] X. Zhu, S. K. Mukhopadhyay, H. Kurata. (2012). "A Review of RFID Technology and its Managerial Applications in Different Industries." J. Eng. & Techn. Management 29, pp. 152-167.
- [4] K. Finkelzeller. (2010). "RFID Handbook: Fundamentals and Applications in Contactless Smart Cards, Radio Frequency Identification and Near-Field Communication". 3rd Ed., Wile.
- [5] J. S. Lee, Y.W. Su, C. C. Shen (2007). "A Comparative Study of Wireless Protocols: Bluetooth, UWB, Zigbee and Wi-Fi", 33rd Annual Conference of the IEEE Industrial Electronics Society, pp. 46-51.
- [6] Qiu Jinghui Sun Bo You Qidi, "Study on RFID Antenna for Railway Vehicle Identification", 6th International Conference on ITS Telecommunications Proceedings, 2006.
- [7] A.A.Pandit, Jyot Talreja, Ankit Kumar Mundra, "RFID tracking system for vehicles (RTSV)", First International Conference on Computational Intelligence, Communication Systems and Networks, 2009.
- [8] Xiaoqiang Zhang, Vasileios Lakafosis, Anya Traille and Manos M. Tentzeris, "Performance Analysis of FastMoving RFID Tags in State-of-the-Art High-speed Railway Systems", IEEE International Conference on RFID-Technology and Applications, 17 - 19 June Guangzhou, China, 2010.
- [9] Md. Aminul Islam, Yixian Yap, Nemai Karmakar and A K M Azad, "Orientation Independent Compact Chipless RFID Tag", IEEE International Conference on RFID - Technologies and Applications (RFID - TA) 2012. [5] Y. F. Weng, S. W. Cheung, T. I. Yuk, and L. Liu, "Design of chipless UWB RFID system using a CPW multiresonator", IEEE Antennas and Propagation Magazine, vol. 55, no. 1, pp 78-82, February 2013.
- [10] STEPHEN B. MILES, SANJAY E. SARMA, JOHN R. WILLIAMS

# Removal of Reactive Scarlet Dye and COD Using Cylindrical Iron Rod Anodes In A Semi-Continuous Reactor

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## ABSTRACT

The cylindrical iron electrochemical reactor for electrocoagulation (EC) of reactive scarlet dye was studied. In the study, 0.5 L synthetic wastewaters with a dye concentration of 200 mg/L and chemical oxygen demand of 620 mg/L (COD) prepared in laboratory treated for 90 minutes of EC. The effects of operational parameters such as current density (10 - 30 mA/cm<sup>2</sup>), initial pH (5 - 9), flow rate (100 - 400 mL/min) and the supporting electrolyte concentration (0.05 - 0.2 M Na<sub>2</sub>SO<sub>4</sub>) were investigated. For each operation parameter, dye stuff concentration and chemical oxygen demand has been measured for removal efficiencies after treatment duration. To estimate the operating cost, the electrical energy consumption was calculated. It has been observed that current density has positive effect on removal efficiencies. Moreover adequate dye stuff removals has been achieved in short process time and low current efficiencies. When effect of the initial pH value of the wastewater was examined, it was observed that the optimum pH value was 7.1. When investigating the influence of flow rate it was found that higher flow rates has negative effect by breaking up the aggregates. The lowest electrical energy consumptions has been established in 0.2 M Na<sub>2</sub>SO<sub>4</sub> concentration for the effect of supporting electrolyte concentration. Effluent COD concentration of 22 mg/L with a removal efficiency of 96.5% and effluent dye concentration of 1.08 mg/L with a removal efficiency of 99.46% was obtained with an electrical energy consumption of 4.28x10<sup>-4</sup> kWh/mg COD<sub>removed</sub>. Additionally, the sludge produced at electrocoagulation was characterized and maghemite (Fe<sub>2</sub>O<sub>3</sub>) was found as most common species.

**Keywords :** COD Removal, Decolorization, Electrochemical Treatment, Iron Electrode, Reactive

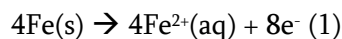
## I. INTRODUCTION

Increasing population and industrialization can affect human life and the environment either positively or negatively. Engineering science is able to formulate the necessary precautions to ensure a sustainable environment and natural life. In the last few decades, new developments in treatment technologies have been seen. Development in wastewater treatment is essential for lessening the harmful effects of industrial waste on the environment. Electrocoagulation (EC), in conjunction with wastewater treatment processes, has become prominent in recent years. EC is an electro-

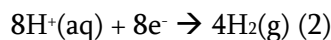
chemical process in which electrically oxidized metals have the ability to form coagulants by combining with electrolyzed water, in situ. In fact, in EC, not only do metal hydroxides form as coagulants, but other mechanisms also occur. Floating and electro-chemical reactions are amongst these treatment mechanisms. Aluminum and iron electrodes are mostly used in EC because of their cost of effectiveness, availability and effectiveness in the formation of coagulants. The ion charge of oxidized metal can be different depending on the voltage applied. Reactions occurring with iron electrodes are shown below [1];

*Mechanism I*

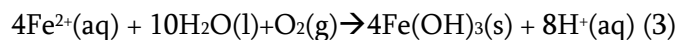
At anode:



At cathode:

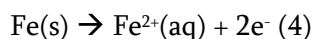


In Solution:

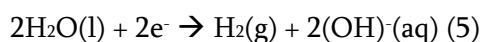


*Mechanism II*

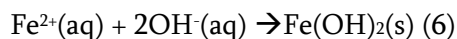
At anode:



At cathode:



In solution:



The formation of metal hydroxides may vary due to the pH of the wastewater.  $\text{Fe}(\text{H}_2\text{O})_6^{3+}$ ,  $\text{Fe}(\text{H}_2\text{O})_5(\text{OH})_2^+$ ,  $\text{Fe}(\text{H}_2\text{O})_4(\text{OH})_2^{2+}$ ,  $\text{Fe}_2(\text{H}_2\text{O})_8(\text{OH})_2^{4+}$  and  $\text{Fe}_2(\text{H}_2\text{O})_6(\text{OH})_4^{4+}$  in EC reference to pH [2]. Also, certain by products, such as hematite ( $\alpha\text{-Fe}_2\text{O}_3$ ), maghemite ( $\gamma\text{-Fe}_2\text{O}_3$ ), magnetite ( $\text{Fe}_3\text{O}_4$ ), lepidocrocite ( $\gamma\text{-FeOOH}$ ) and goethite ( $\alpha\text{-FeOOH}$ ) may be formed [3].

Dyes are used widely in the textile industry for dyeing and screwing processes [4]. Dyes are complex organic compounds and have resistance to biological degradation. Textile industry dyes are accepted as hazardous waste [5]. Biological, physical and chemical treatment can be applied to wastewater containing dyes. Also, certain neo-advanced treatment techniques have been tried out to treat this kind of wastewater in order to reduce operating costs and for more efficient removal of pollutants. At this point, electrocoagulation shows its worth proving that it is a cost-effective technology for the treatment of dye containing wastewater and textile industry wastewater. In the literature, electrocoagulation treatment has been successfully applied for the treatment of synthetic wastewater prepared using

different dyes. The electrocoagulation of dye using two parallel plate electrodes has been studied for the removal of acid yellow 220 [6], acid green 50 [7], basic red 46 and basic blue 3 [8], acid red 14 [9], and reactive red 141 [10]. Six parallel plate electrodes were also used for the removal of direct red 81 [11]. Though several researchers have evaluated electrocoagulation of dye in the literature, the majority have used a similar electrode configuration albeit with different sizes and materials.

The main dissimilarity of this study from those reported in the literature is the use of a tube type iron electrochemical reactor with cylindrical rod anodes for dye removal. The aim of this study is to determine the performance of this reactor and to obtain direct dischargeable effluent. For these purposes, several operational parameters, such as initial pH, current density and supporting electrolyte concentration have been investigated and their effects on the removal efficiency of reactive scarlet dye and COD were determined using this unique reactor. Additionally, electrical energy consumption was calculated in order to estimate the operating cost. The sludge produced at electrocoagulation was also characterized.

## II. METHODS AND MATERIAL

### A. Wastewater

0.5 L model wastewater was prepared using reactive scarlet dye and distilled water. The reactive scarlet was obtained from a local textile factory, in Eskisehir Turkey, is a mix of reactive dyes. The wastewater contains a dye concentration of 200 mg/L and has a Chemical Oxygen Demand (COD) of 620 mg/L, pH of 7.1 and a conductivity of 441  $\mu\text{S/cm}$ . To obtain a higher conductivity,  $\text{Na}_2\text{SO}_4$  as a supporting electrolyte, was added to wastewater. The initial pH of the solution was adjusted using 0.1 M  $\text{H}_2\text{SO}_4$  or 0.1 M NaOH.

### B. Experimental Setup

The cylindrical iron reactor was 40 cm in height and

3.5 cm in diameter and was used as a cathode. The anode was three iron rods with a height of 34 cm and a diameter of 1.25 cm. It was located triangularly in the center of the reactor. The experimental setup is shown in Fig.1. At the start of the experiment, a sample solution was fed into the reactor from a reservoir which contained 0.5 L of wastewater via a peristaltic pump. The experiments were carried out in a semi-continuous mode. A power supply was connected to the electrodes, and a constant current was applied for 90 min for each run.

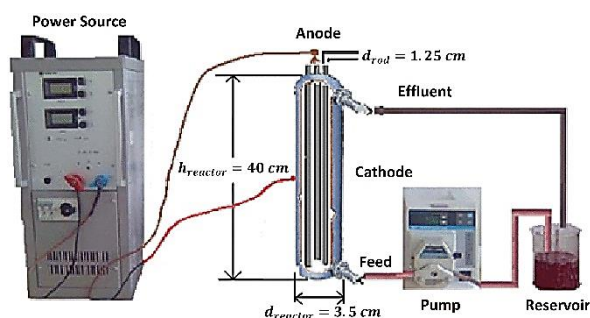


Figure 1. Experimental Setup

### C. Analyses

At the beginning, and at certain intervals, samples were taken from the solutions and centrifuged to remove floc using a centrifuge (Hettich EBA 20). The supernatant was analyzed to determine the residual COD and dyestuff. The samples' pH and the conductivity were monitored during the process using a pH meter (Hanna 301) and a conductometer (Radiometer Pioneer 30), but were not controlled. The absorbance values of the effluent were determined using a double beam spectrophotometer (Shimadzu UV 1700). Dye stuff concentrations were determined using a calibration curve prepared at a wavelength of 510 nm with a high correlation coefficient ( $R^2 = 0.9996$ ). A COD analysis was carried out by a close reflux method, which includes the use of potassium dichromate, sulfuric acid and mercuric sulfate and an incubation process at 150 °C in a COD reactor (Lovibond ET 125 SC) for 120 min.

The iron ion concentration in the treated wastewater was determined using an Atomic Absorption

Spectrophotometer (Varian Spectra A250 Plus). The sludge produced during the electrocoagulation process was dried in an oven at 80 °C to eliminate moisture. Careful sampling and homogenizing were employed to assure a reasonable consistency in the sludge. The chemical composition of the sludge was determined using an X-Ray Fluorescence Spectrometer (XRF) (RIGAKU, Rix 2000). The phases present in the sludge were determined using an X-Ray Diffractometer (XRD) (RIGAKU, D/Max-IIIC) with Ni-filtered, Cu  $K_{\alpha}$  radiation with a goniometer speed of 1°/sec.

### D. Calculations

Calculation of specific electrical energy consumption (SEEC) is as follows;

$$SEEC = \frac{U I t}{(C_0 - C) V} \quad (7)$$

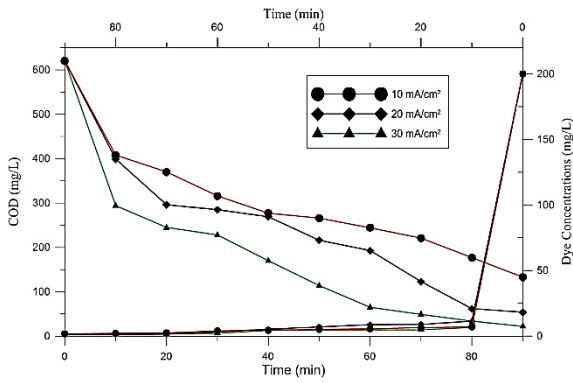
Where; U is Average voltage (V), t is Retention time (min), V is Volume of the sample (mL).

## III. RESULTS AND DISCUSSION

### A. Effect of Current Density

Current density is the applied current per unit area of the anode. It is the most important parameter in EC because it directly controls the production of coagulants and also proves the further economic value of EC due to its optimum electricity-coagulant production value. The effect of current density was determined using current densities of 10, 20 and 30 mA/cm<sup>2</sup> with an original pH of 7.1 and Na<sub>2</sub>SO<sub>4</sub> concentration of 0.1 M, and a wastewater circulation rate of 200 mL/min. As it can be seen from Fig. 2, removal of the COD is directly proportional to the current density and previous studies [5, 12, 13] support this fact.





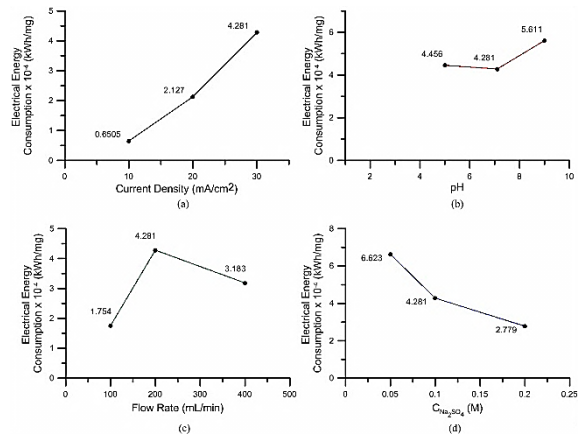
**Figure 2.** Variation of effluent COD and dye concentrations with time at different current densities. (pH: 7.1, Na<sub>2</sub>SO<sub>4</sub> conc.:0.1 M, flow rate:200 mL/min)

The initial COD concentration of 620 mg/L was reduced to 133, 54 and 22 mg/L with removal efficiencies of 78.5, 91.3 and 96.5% at the current densities of 10, 20 and 30 mA/cm<sup>2</sup>, respectively. The discharge standards of the COD for the cotton textiles industry is 250 mg/L for 2 hours composite sample according to Turkish National Legislation [14]. As a result of the experiments, the requirements were met after 60, 50 and 20 minutes of EC at 10mA/cm<sup>2</sup>, 20 mA/cm<sup>2</sup> and 30 mA/cm<sup>2</sup> respectively. As can be seen from Fig. 2, the greater portion of dye was removed during the first 10 min. After further electrocoagulation of the wastewater to 90 min. initial dye concentration of 200 mg/L was reduced to 1.6, 1.3 and 1.1 mg/L with removal efficiencies of 99.19 %, 99.33 % and 99.46 % at current densities of 10, 20 and 30 mA/cm<sup>2</sup>, respectively. It can be concluded that dye removal can be achieved easily even through a high current density value is not used. Removal of dye from wastewater can also be observed by naked eye as seen from Fig. 3.



**Figure 3.** Dye stuff removal

The electrical energy consumption calculated using Eq. 1 is shown in Fig. 4(a). Although the calculated electrical energy consumption after 90 min EC was 0.65x10<sup>-4</sup>, 2.13x10<sup>-4</sup> and 4.28x10<sup>-4</sup> kWh/mg COD<sub>removed</sub> respectively, the applied energy consumption will be lower because the national standard COD values were obtained earlier than 90 min.

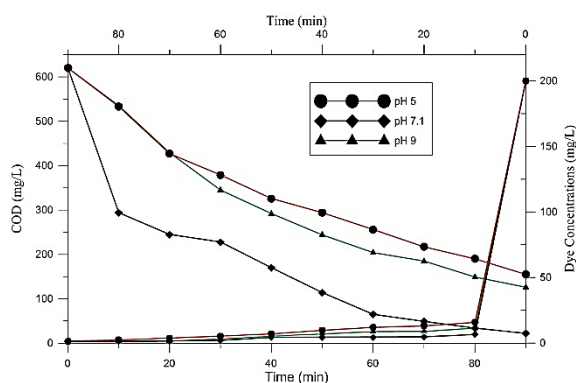


**Figure 4.** Effect of current density on electrical energy consumption (pH: 7.1, Na<sub>2</sub>SO<sub>4</sub> conc.: 0.1 M,flow rate: 200 mL/min) (b) The effect of pH on electrical energy consumption. (i: 30 mA/cm<sup>2</sup>, flow rate: 200 mL/min, Na<sub>2</sub>SO<sub>4</sub> conc.: 0.1 M) (c) The effect of flow rate on electrical energy consumption (i: 30 mA/cm<sup>2</sup>, Na<sub>2</sub>SO<sub>4</sub> conc.: 0.1 M and pH: 7.1) (d) Effect of supporting electrolyte (Na<sub>2</sub>SO<sub>4</sub>) concentrations on electrical energy consumption. (i: 30 mA/cm<sup>2</sup>, flow rate: 200 mL/min and pH: 7.1)

**B. Effect of Initial pH**

In the EC process, pH is considered as a significant parameter, because pH decides the formation of coagulants which will be the main removal mechanism in the electrochemical process. The effect of initial pH was investigated using a current density of 30 mA/cm<sup>2</sup>, a flow rate of 200 mL/min and a Na<sub>2</sub>SO<sub>4</sub> concentration of 0.1 M. Previous studies present the effect of initial pH of wastewater to the removal efficiency of EC. Some researchers obtained optimum removal efficiencies of between pH 5-10 for the

treatment of Cr (VI) containing synthetic wastewater [15]. Other results give more efficient removal efficiency values of between 5.5 - 8.5 for basic red 46 and basic blue 3 contaminated wastewater [8], while other researchers [16] obtained maximum removal efficiencies with a more acidic medium for wastewater containing Cr(IV). However, contrary to these research projects, El-Ashtoukhyand Amin [7] found no significant influence of the initial pH on the color removal of acid green containing wastewater, so the effect of the initial pH on EC depends on the type of wastewater. As shown in Fig. 5, a maximum COD reduction was obtained at pH 7.1. A final COD concentration reached 155 mg/L for pH 5, 22 mg/L for pH 7.1 and 126 mg/L for pH 9. In all the initial pH trials, dye concentrations had similar abatement and decreased by almost 100% as shown in Fig. 5. This may be due to the different species formed at different pH levels.  $\text{Fe}(\text{OH})_2^+$ ,  $\text{Fe}(\text{OH})_2^{2+}$  and  $\text{Fe}(\text{OH})_3$  can occur in an acidic medium, whereas in alkaline conditions  $\text{Fe}(\text{OH})_6^-$  and  $\text{Fe}(\text{OH})_4^-$  may present [2]. The original pH of the wastewater has the most appropriate COD removal and dye concentration reduction. The electrical energy consumption was calculated and is shown in Fig 4(b). These were 4.46 kWh/mg for pH 5, 4.28 kWh/mg for pH 7.1 and 5.61 kWh/mg for pH 9.

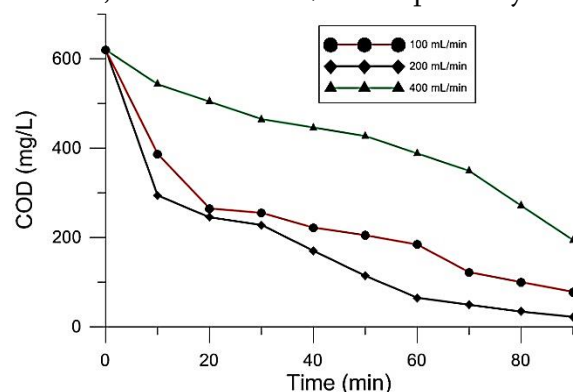


**Figure 5.** Variation of effluent COD and dye concentrations with time at different pH's. (i: 30 mA/cm<sup>2</sup>, flow rate: 200 mL/min, Na<sub>2</sub>SO<sub>4</sub> conc.: 0.1 M)

### C. Effect of Flow Rate

In this section of the study, wastewater was fed into a

reactor with flow rates of 100, 200 and 400 mL/min to determine the effects at fixed operational parameters: 30 mA/cm<sup>2</sup>, 0.1 M Na<sub>2</sub>SO<sub>4</sub> and pH 7.1. The results can be seen in Fig. 6 and 4(c) for the COD reduction, and energy consumption respectively. After 90 minutes of EC, the COD values were measured as 78 mg/L for 100 mL/min, 22 mg/L for 200 mL/min and 194 mg/L for 400 mL/min flow rates. The dye concentration decreased to 0.66, 1.08 and 3.40 mg/L respectively. A 200 mL/min flow rate had the most appropriate treatment efficiency with 96.45% COD removal. Increasing the flow rate from 100 to 200 mL/min had a positive effect because of the reduction of the anode passivation which is a major issue in electrocoagulation. Electrode passivation is the formation of an inhibiting layer, usually an oxide, on the electrode surface which prevents metal dissolution and electron transfer, thereby limiting coagulant formation in solution [17]. However a further increase in the wastewater flow rate to 400 mL/min had a negative effect on the removal efficiency. Higher wastewater flow rates can cause the breakup of aggregates formed through the turbulence of wastewater. When these issues are taken into account, 200 mL/min seems to be the optimum level for the wastewater flow rate. The calculated electrical energy consumption was 1.75x10<sup>-4</sup>, 4.28x10<sup>-4</sup> and 3.18x10<sup>-4</sup> kWh/mg COD<sub>removed</sub> for the wastewater flow rates of 100, 200 and 400 mL/min respectively.



**Figure 6.** Variation of effluent COD concentration with time at different flow rates. (i: 30 mA/cm<sup>2</sup>, Na<sub>2</sub>SO<sub>4</sub> conc.: 0.1 M and pH: 7.1)

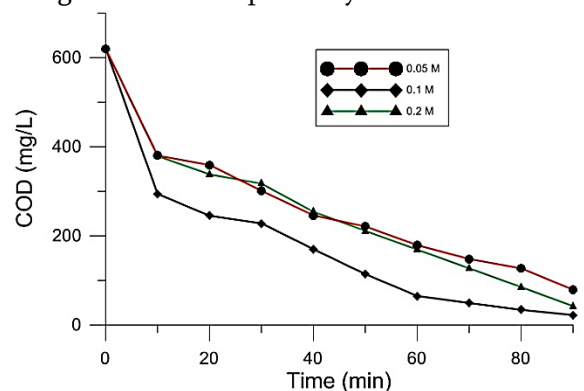
#### D. Effect of Supporting Electrolyte (Na<sub>2</sub>SO<sub>4</sub>)

##### Concentration

Adding a support electrolyte to the solution increases the conductivity of the wastewater which has the effect of decreasing the voltage and thus lowering electrical energy consumption. Many types of salts, such as NaCl [18], NaNO<sub>3</sub> [19] and Na<sub>2</sub>SO<sub>4</sub> can be used as a supporting electrolyte in the EC process. It should also be noted that, to decrease the costs of EC, low cost chemicals should be used as supporting electrolytes. Although several authors have demonstrated that using NaCl as a supporting electrolyte causes an increase in removal efficiency due to the participation of active chlorine, in the form of chlorine, hypochlorous acid and hypochlorite, regenerated on the anode surface. However chlorinated by-products, which are a major health concern because of their carcinogenic properties, were observed by Solana et al. [20] when using chloride ions as an electrolyte.

In this study, Na<sub>2</sub>SO<sub>4</sub> was selected as a supporting electrolyte and 0.05, 0.1 and 0.2 M Na<sub>2</sub>SO<sub>4</sub> concentrations were experienced at a current density of 30 mA/cm<sup>2</sup>, and a wastewater flow rate of 200 mL/min and pH of 7.1. The results obtained can be seen in Figs.6 and 4(d). The COD values after 90 minutes of EC for 0.05, 0.1 and 0.2 M Na<sub>2</sub>SO<sub>4</sub> concentrations were 79, 22 and 42 mg/L respectively. The dye stuff removal was greater than 99 % for all the Na<sub>2</sub>SO<sub>4</sub> concentrations which corresponded to concentrations smaller than 1.5 mg/L. The maximum removal of the COD and dye were found in a 0.1 M supporting electrolyte concentration. Increasing the supporting electrolyte concentration to 0.2 M may cause an increase in the passivation of the electrode. On the other hand, a lower supporting electrolyte concentration may not support the transportation of ions because of insufficient conductivity which effects the EC process adversely. In order to reduce the cell voltage and consequently energy consumption, the conductivity of the wastewater should be sufficiently high. Therefore, a minimum electrical energy

consumption of 2.78x10<sup>-4</sup> kWh/mg COD<sub>removed</sub> was obtained using a 0.2 M Na<sub>2</sub>SO<sub>4</sub> concentration. The electrical energy consumption for the 0.1 and 0.05 M Na<sub>2</sub>SO<sub>4</sub> concentrations were 4.28x10<sup>-4</sup> and 6.62x10<sup>-4</sup> kWh/mg COD<sub>removed</sub> respectively.



**Figure 6.** Variation of effluent COD concentration with time at different supporting electrolyte (Na<sub>2</sub>SO<sub>4</sub>) concentrations. (i: 30 mA/cm<sup>2</sup>, flow rate: 200 mL/min and pH: 7.1)

#### E. Waste Sludge Characterization

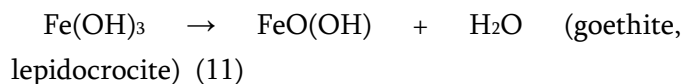
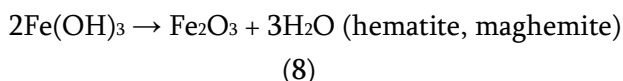
The amount and character of sludge is an important issue for its handling. EC is a more preferred technology among other advanced treatment processes because it produces small amounts of sludge [21] which are easily settable. The characterization of sludge also gives us an idea about the main mechanism which takes place in the electrocoagulation process. The sludge produced at 30 mA/cm<sup>2</sup>, pH 7.1, 0.05 M Na<sub>2</sub>SO<sub>4</sub> and a flow rate of 200 mL/min was collected, dried and analyzed using an X-ray fluorescence spectrophotometer (XRF, Rigaku ZSX Primus). Table 1 shows the composition of sludge. As seen from Table 1, the main component of the sludge was Fe<sub>2</sub>O<sub>3</sub> with a weight percentage of 94.65 %.

**Table 1** Waste sludge composition

Component	Percent (%wt)
Na <sub>2</sub> O	1.9043
MgO	0.0941
Al <sub>2</sub> O <sub>3</sub>	0.1108
SiO <sub>2</sub>	0.5380

SO <sub>3</sub>	1.5153
CaO	0.1090
Cr <sub>2</sub> O <sub>3</sub>	0.1246
MnO	0.6662
<b>Fe<sub>2</sub>O<sub>3</sub></b>	<b>94.6491</b>
NiO	0.1017
CuO	0.1868

Further analysis was performed to determine the phase diversity of the waste sludge produced for the same experiment using an X-ray diffractometer (RigakuRint 2200). In the EC process, ferric and ferrous hydroxides formed according to equations 3-6, and these hydroxides further reacted to form electrocoagulation by-products : Hematite ( $\alpha$ -Fe<sub>2</sub>O<sub>3</sub>), maghemite ( $\gamma$ -Fe<sub>2</sub>O<sub>3</sub>), rust, magnetite (Fe<sub>3</sub>O<sub>4</sub>), lepidocrocite ( $\gamma$ -FeOOH) and goethite ( $\alpha$ -FeOOH) according to the reactions shown below [22]:



The result for phase diversity shows us that the peak of 100% (peak no:5) and all the other peaks (peaks 1, 3, 5, 7, 8, 10, 11, 13) belong to the maghemite (Fe<sub>2</sub>O<sub>3</sub>) as seen from Fig. 7. It can be deduced from the result that, in our reactor, ferric hydroxide was formed according to mechanism I (Eq. 1-3) and then further reacted to form maghemite (Eq. 10).

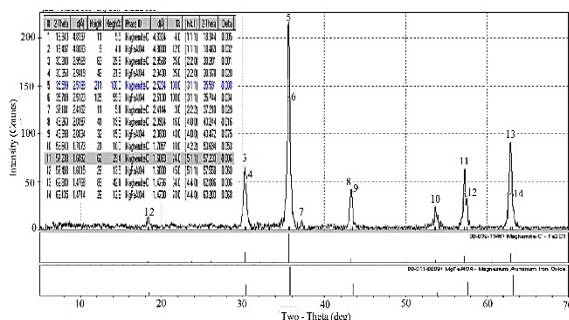


Figure 7. X-ray diffractometer results for waste sludge

## F. Residual Iron Concentration In Treated Wastewater

In the EC process, iron ions dissolved from the anode react to form iron hydroxides in the solution and then hydroxide precipitates are formed which leave the system. However, certain iron ions may possibility not form complexes thereby becoming a secondary pollutant. To determine the residual iron concentration in the solution a number of iron analyses were performed using a flame atomic adsorption spectrophotometer (ICP ; Varian Spectra A 250 Plus) at a current density of 30 mA/cm<sup>2</sup>, a supporting electrolyte concentration of 0.05 M Na<sub>2</sub>SO<sub>4</sub>, wastewater flow rate of 200 mL/min and a pH of 7.1. From the analyses, no iron ion concentration was found in the solution after 90 minutes of EC, while the COD was reduced from 620 to 79 mg/L.

## IV. CONCLUSION

- COD removal is directly proportional to current density. The initial COD concentration of 620 mg/L was reduced to 22 mg/L with removal efficiencies of 96.5% and an electrical energy consumption of  $4.28 \times 10^{-4}$  kWh/mg COD<sub>removed</sub> at a current density of 30 mA/cm<sup>2</sup> after 90 min EC
- In the evaluation of the effect of pH, a pH of 7.1, which is the natural pH of wastewater, was found to be the most appropriate pH for the removal of COD and dye. The removal efficiencies were decreased when the initial pH became more acidic or basic.
- In the experimental studies, wastewater was fed into the reactor at a semi-continuous mode from the reservoir. It was noted that increasing the flow rate from 100 mL/min to 200 mL/min had a positive effect because of the reduction of the anode passivation while a further increase in the wastewater flow rate to 400 mL/min had a negative effect on the removal efficiency because of the breakup of flocs.

- The presence of the supporting electrolyte also affected the removal efficiency. The maximum removal of the, COD and dye was found in 0.1M of Na<sub>2</sub>SO<sub>4</sub> supporting electrolyte concentration. Adding support electrolyte to the solution decreased the electrical energy consumption.
  - According to the results, the discharge standards of the COD of 250 mg/L for the cotton textiles industry, based on Turkish national legislation [14], was met after 60, 50 and 20 minutes of EC at 10 mA/cm<sup>2</sup>, 20 mA/cm<sup>2</sup> and 30 mA/cm<sup>2</sup> respectively. A high dye removal efficiency, such as 99.46% at the current densities of 30 mA/cm<sup>2</sup>, was also obtained.
  - The character of the sludge was determined and its main component was found to be Fe<sub>2</sub>O<sub>3</sub>, with a weight percentage of 94.65 % and a phase diversity belonging to the maghemite (Fe<sub>2</sub>O<sub>3</sub>).
- [6]. Pajootan E., et al., Binary system dye removal by electrocoagulation from synthetic and real colored wastewater. *Journal of the Taiwan Institute of Chemical Engineers* 2012. 43: p. 282-290.
- [7]. El-Ashtoukhy E-S. Z. & Amin N. K., Removal of acid green dye 50 from wastewater by anodic oxidation and electrocoagulation - a comparative study. *Journal of Hazardous Materials*, 2010. 179: p. 113-119.
- [8]. Daneshvar N., et al., Decolorization of basic dye solutions by electrocoagulation: an investigation of the effect of operational parameters. *Journal of Hazardous Materials*, 2006. B129: p. 116-122.
- [9]. Aloboyeh, A., et al., Optimization of c.i. acid red 14 azo dye removal by electrocoagulation batch process with response surface methodology. *Chemical Engineering and Processing*, 2008. 47: p. 827-832.

## V. REFERENCES

- [1]. Tezcan, U. U., et al., Hybrid processes for the treatment of cattle-slaughterhouse wastewater using aluminum and iron electrodes. *Journal of Hazardous Materials*, 2009. 164: p. 580 – 586.
- [2]. Babu, R. R., et al., Treatment of tannery wastewater by electrocoagulation. *Journal of the University of Chemical Technology and Metallurgy*, 2007. 42: p. 201-206.
- [3]. Parga J. R., et al., Arsenic removal via electrocoagulation from heavy metal contaminated groundwater in La Comarca Lagunera Mexico. *Journal of Hazardous Materials*, 2005. B124: p. 247-254.
- [4]. Gokkus, O., Dispers boyar madde iceren tekstil atikularinda renk giderimi (Color removal of textile wastewaters containing disperse dye). Master's Thesis, Cumhuriyet University, Graduate School of Sciences, Sivas, 2006.
- [5]. Zodi S., et al., Treatment of the textile wastewater by electrocoagulation: effect of operating parameters on the sludge settling characteristics. *Separation and Purification Technology*, 2009. 69: p. 29 -36.
- [10]. Zidane F., et al., Decolourization of dye-containing effluent using mineral coagulants produced by electrocoagulation. *Journal of Hazardous Materials*, 2008. 155: p. 153-163.
- [11]. Zodi S., et al., Direct red 81 dye removal by a continuous flow electrocoagulation/flotation reactor. *Separation and Purification Technology*, 2013. 108: p. 215-222.
- [12]. Timmes T. C., et al., Electrocoagulation pretreatment of seawater prior to ultrafiltration: pilot-scale applications for military water purification systems. *Desalination*, 2010. 250: p. 6-13.
- [13]. Irdemez S., et al., The effect of current density and phosphate concentration on phosphate removal from wastewater by electrocoagulation using aluminium and iron plate electrodes. *Separation and Purification Technology*, 2006. 52: p. 218-223.

- [14]. Turkish National Water Pollution Control Legislation [SKKY], 2004 Table 10: Discharge Limits for Textile Industry Wastewater, Turkey.
- [15]. Aber S., et al., Removal of Cr (VI) from polluted solutions by electrocoagulation : modeling of experimental results using artificial neural network. *Journal of Hazardous Materials*, 2006. 171: p. 484-490.
- [16]. Keshmirizadeh E., et al., An investigation on the new operational parameter effective in Cr (VI) removal efficiency : a study on electrocoagulation by altering pulse current. *Journal of Hazardous Materials*, 2011. 190: p. 119-124.
- [17]. Holt P. K., et al., The future for electrocoagulation as a localised water treatment technology. *Chemosphere*, 2005. 59: p. 355-367.
- [18]. Golder A. K., et al., Removal of trivalent chromium by electrocoagulation. *Separation and Purification Technology*, 2007. 53: p. 33-41.
- [19]. Phalakhornkule C., et al., Pretreatment of palm oil mill effluent by electrocoagulation and coagulation. *Scienceasia*, 2010. 36: p. 142-149.
- [20]. Solano A. M. S., et al., Decontamination of real textile industrial effluent by strong oxidant species electrogenerated on diamond electrode: viability and disadvantages of this electrochemical technology. *Applied Catalysis B: Environmental*, 2013. 130-131: p. 112-120.
- [21]. İlhan F., Kurt U., et al., Treatment of leachate by electrocoagulation using aluminum and iron electrodes. *Journal of Hazardous Materials*, 2008. 154: p. 381-389.
- [22]. Moreno-Casillas H. A., et al., Electrocoagulation mechanism for COD removal. *Separation and Purification Technology*, 2007. 56(2): p. 204-211

# New Approach for Reducing the Size of Ciphertext

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## ABSTRACT

Cryptography is a mathematical logic used to generate secret code for a given confidential input text for maintaining one's own secret or sending them to other intended person over internet. Cryptography basically requires key and encryption algorithm to prepare secret code and decryption algorithm to regenerate the original text from secret code. The encryption algorithm is a program that mixes input text with key values to produce secret code. Here the key value is either generated by random number or prepared by some other means. The mixing of input text and key produces unintelligible code called ciphertext. This ciphertext must be very difficult to understand and reproduce the original text. That is, the ciphertext has to hide the meaning of the input text to maintain the meaning of secret code.. The objective of this work is to create an encryption algorithm to produce secret code for a given input text as well as to reduce the size of the ciphertext / secret code. It is well known that private key / public key mechanism supports secret code writing in cryptography. The proposed work uses private (or secret key) key mechanism to implement the requirement of encryption algorithm. It is understood that a complicated key and a good encryption algorithm are needed to create better secret code and challenging to the hackers to understand the secret code.. Hence the intended work depends on the key construction and encryption algorithm. This paper introduces a new approach to construct the private key and an innovative algorithm doing the job of ciphertext generation. This approach inspects only half of the input text for secret code generation and key generation is done from the input text itself. It is designed to conserve space of storage as well as to reduce time of secret code generation for adding security to the input text. The implementation process deploys input text perplexing, segmentation, key construction and binary operation to meet the intended goal.

**Keywords :** Ciphertext, Private Key, Text Perplexing, Segmentation, Binary Operation

## I. INTRODUCTION

The purpose of cryptography is to protect data in the presence of an adversary. Cryptographic transformation of data is a procedure by which plaintext data is disguised and the resultant is an altered text, called ciphertext, that does not reveal the original input. The ciphertext can be reverse-transformed by a designated recipient so that the original plaintext can be recovered. The transformations are done by private or public key mechanisms.

### 1.1 Private Key Cryptography

In conventional cryptography also called *symmetric key* cryptography, one key(s) is used both for encryption and decryption. The Data Encryption Standard (DES) is an example of a conventional cryptosystem that is widely employed by the Federal Government of United States[1]. An extremely simple example of conventional cryptography is a substitution cipher. A substitution cipher substitutes one piece of information for another. This is most frequently done by offsetting letters of the alphabet. For example, if the word "SECRET" is encoded using

Caesar's key value of 3, it offsets the alphabet so that the 3rd letter down "D" begins for encoding. Hence, the input ABCDEFGHIJKLMNOPQRSTUVWXYZ is changed to DEFGHIJKLMNOPQRSTU VWXYZABC by sliding each character three positions down. Here the key value is 3. It is the encoded message to be shared with other recipient. Using this principle, the plaintext, "ENJOY" is encrypted as "HQMRB" [1].

## 1.2 Public key cryptography

Public key cryptography is an asymmetric cryptography where a *pair* of keys is used for encryption and decryption. They are public and private keys where public key encrypts data and a private key decrypts the encoded message to obtain the original text. Here public key is known to others where the private key is kept secret. Anyone with a copy of your public key can then encrypt information that only you can read even people never met. It is computationally infeasible to deduce the private key from the public key. Anyone who has a public key can encrypt information but cannot decrypt it. Only the person who has the corresponding private key can decrypt the information.

## II. LITERATURE REVIEW

Information security using cryptography is an important science[1]. cryptography is an important component of secure information and communications system. There is always a growing need for protection of information[2]. Cryptography has emerged as the main alternative to protect internet data. The crypto technique mark, transform and reformat the message to protect them from disclosure, change or both, making it safer on transit between computers.

During an encryption/decryption process a large amount of computing resources like CPU time, battery power and memory is consumed from the devices. In

some networks like mobile ad hoc networks, there is a constraint on power consumption, so there is a need to improvise the battery technology. So, it is essential to find a way to reduce the consumption of battery powered devices. This algorithm presents a potential solution of energy consumption in various handheld devices using commonly used symmetric key encryption algorithms. [3, 4] It was seen in Triple-DES after 600 encryptions using a 5 MB file the remaining battery power is 45%, which prevents the device from subsequent encryptions.

## III. PROPOSED METHODOLOGY

The proposed encryption system is a novice approach to reduce the size of the ciphertext. It is a secret system using two secret keys of same size but one key is operated at a time. The input text to the system is segmented into two halves. First half is considered as actual input to the encryption mechanism and other half is considered as key. The actual input is once again segmented to two halves namely seg1 and seg2. When the size of input text is odd, the odd character at the end of actual input is carried out with seg2 by adding a constant value to generate a cipher code. Similarly, the second half of the input text considered for key is once again divided into two halves namely key1 and key2. Then seg1 and key1 are combined by binary operation taking one character from seg1 and key1 to generate ciphercode C1i. Similarly seg2 and key2 are combined together as before to produce ciphercode C2i. The concatenation of all C1i is called ciphertext C1. The combination of all C2i is called ciphertext C2. The final outcome of the encryption is obtained by the concatenation of C1 and C2[3,4].

The merit of the system is to reduce the size of the ciphertext[2] by half the size of input text. This is useful to save storage size of the ciphertext and the length of the ciphertext may imitate to the hackers to produce some other original input. This anomaly may deceive hackers generating the original text. That is,



the resultant is an unintelligent code which cannot be easily reverted to the length of input text. Also half of the processing time is reduced by this method. But the key size is increasing when the size of the input increases. Further the key is dynamic which is not same for all types of input. It means, it has different key for different input text since the key is constructed from the input text only. Say for a block of 512 bytes the key size is 128 and for 1024 bytes, the key size is 256 byte. Also, the key value is not a simple a number but it is a core of alphabetic characters. So it is difficult to remember the key value. The sender and receiver must carefully share their secret keys and authentication may be checked by sharing the key two or three times. That is, to check hackers involvement, the ciphertext and key are shared again at different time interval for authorization. The value of C1 and C2 are

$$C1 = C11+C12+C13+.....C1m$$

$$C2 = C21+C22+C23+.....C2m$$

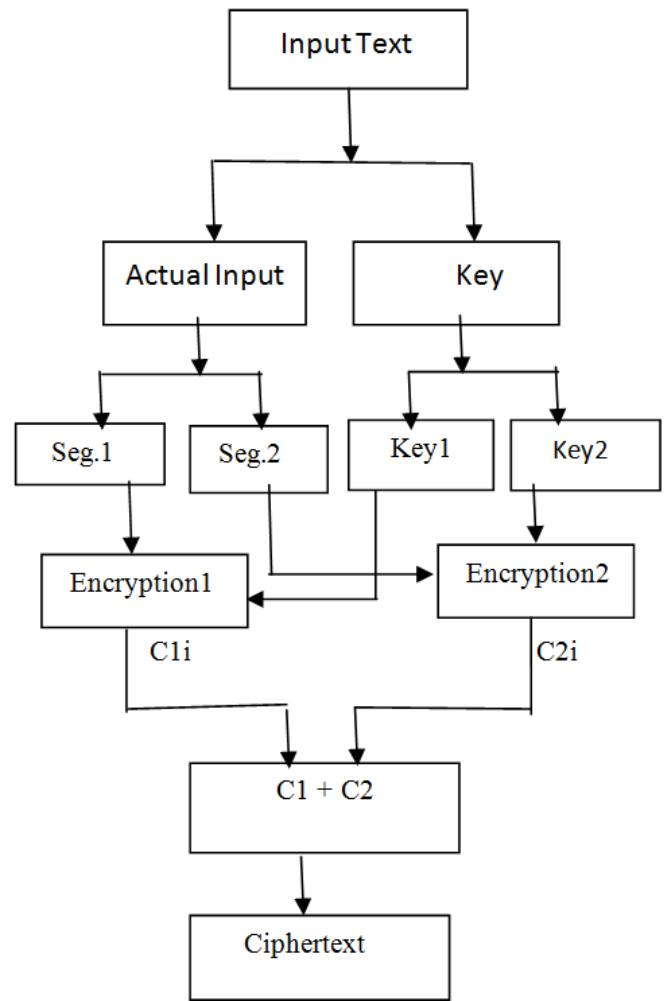


Figure1: Functional Block Diagram

#### IV. RESULTS AND DISCUSSIONS

The proposed approach is tested by several examples. For simplicity, three samples with their input text and ciphertext are tabulated. In the first example the size of the input text is thirteen and hence the key size is three with three characters of input text. Its ciphertext is only seven characters long. In the second example, the size of the input text is ninety two and hence the key size is twenty three and its corresponding ciphertext is forty six. Similarly, the size of input text to the third example is five hundred and seventy and key size is one hundred and forty two. Its corresponding ciphertext is two hundred and eighty five. The examples clearly show the size of the ciphertext reduced and thereby reducing processing



AES	570	18	768
DES	570	8	555
Proposed Mechanism	570	142	285

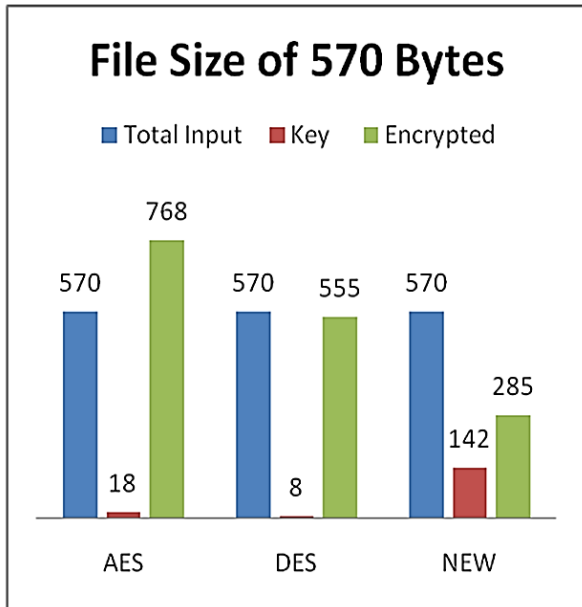


Figure 2: Notion of Ciphertext

### VI. CONCLUSION

The proposed approach has implemented with the base of functional diagram principle. The system is verified by a few examples and the results are met the stated goals. Further the objective of the desired work is compared with two familiar methods and the desired work is successful to maintain the size of ciphertext and time of processing. The essential security ingredients of e-business and enterprise computing can be achieved by the proposed work. The integrity and confidentiality can be verified by the size of key regenerated text.

### VII. REFERENCES

- [1]. William Stallings, "Cryptography and Network Security Principles and Practices, Fourth Edition", Prentice Hall, 2005.
- [2]. Rolf O, "Contemporary Cryptography", Artech House, Boston, London, 2005.
- [3]. Network Security: private Communications in a public world, second edition, 2002, c. Kaufman, R. Perlman, and M. Speciner, Prentice-Hall.
- [4]. Obaida Mohammad and Awad Al-Hazaimah, "A NEW APPROACH FOR COMPLEX ENCRYPTING AND DECRYPTING DATA", International Journal of Computer Networks & Communications (IJCNC) Vol.5, No.2, March 2013.

# Assessment of Challenges Associated with the Teaching and Learning of Science In Ghanaian Basic Schools

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## ABSTRACT

This study sought to assess the challenges associated with the teaching and learning of science in Ghanaian Basic schools. The sample consisted of 90 respondents made up of 50 Basic school science teachers and 40 Basic school pupils drawn from Cape-Coast Metropolis. A purposive sampling technique was used to select the sample for the study. Questionnaire and interview were the research instruments used for the study. The Basic school pupils revealed that inadequate science practical activities, lack of good learning materials and pupils' fear for science subject were the problems that hinder the learning of science. The science teachers also indicated that lack of teaching and learning materials, lack of science laboratories, overcrowded classrooms and presence of pupils' misconceptions about science were some of the problems that impede the teaching of science. It was recommended that government of Ghana and other related stakeholders in science education should build science laboratories/practical rooms in all Basic schools and equip them with needed TLMs to aid science teachers do more practical activities so as to demystify science and make it more interesting for the pupils.

**Keywords :** Assessment, Challenges, Associated, Teaching, Learning, Science.

## I. INTRODUCTION

Ghana education system has undergone several metamorphoses after its independence in 1957 with the aim of improving quality of education at all levels through various educational reforms. Currently, the Ghanaian education system is been regulated by Education Act, 2008 (Act 778) which puts education system into three progressive levels namely: Basic education, Secondary cycle Education and Tertiary Education (Amankwaah, 2014).

The Basic educational system consists of 2 years kindergarten; 6 years primary school and 3 years Junior High school (JHS). The 2 years kindergarten (pre-school) is not compulsory. However, the primary school and JHS are compulsory for all children between the ages of 6-14 years. The aim of the Basic

education is to produce well-balanced individuals with the requisite knowledge, skills, values, aptitudes and attitudes to become functional and productive citizens for the total development and democratic advancement of the nation (Amankwaah, 2014; Amoah, 2017).

In order to achieve this laudable aim, several subjects such as science, mathematics, English, and among others have been developed for the Basic (primary and JHS) pupils to study. Of all the subjects offered in the Ghanaian Basic schools, studies by (Karikari-Ababio, 2003; Akyeampong, 2007; Mitchell Group, 2009; Buabeng, Owusu & Ntow, 2014) have shown that science subject have been and continue to be difficult subject for these pupils resulting in declining academic performance and poor attitudes towards science subject.

Several pioneer studies (Odzen, 2007; Buabeng, Owusu & Ntow, 2014) have reported horrible results with regards to JHS (grades 7- 9) pupils' performance in science in Ghana. In a study, Odzen (2007) reported that out of 786, 284 JHS pupils who took secondary school education entrance exams in 2005; as many as 65,076 students scored zero percent (0%) in the science exams.

In a comparative study on Ghana's JHS 2 (grade 8) pupils' achievements in Trends in International Mathematics and Science Study (TIMSS) in 2003, 2007 and 2011, Buabeng, Owusu and Ntow (2014) concluded that although Ghana's JHS 2 pupils' achievement has shown some improvement, yet this achievement has been consistently poor relative to the TIMSS benchmarks since her participation in 2003. The study revealed that although Ghana's performance in 2007 was a significant improvement over that of 2003, but there was no significant improvement of the results as compared to that of 2007. The study further revealed that though there was slight improvement in 2011, Ghana's achievement was the lowest in Africa and the world at large. The study, concluded that Ghana's performance relative to other African countries gives some indications that Ghanaian Basic school pupils are not achieving at the levels expected when compared to pupils at comparable grade levels in different parts of world; and as such there is the need to assess the underlying causes of Basic school pupils' underperformance in science.

Odhiambo (2005) contended that there is a growing demand from the government and the public for teacher accountability. Heck (2009) also indicated that teachers should not escape a portion of blame when students perform poorly. This implies that teachers should be held responsible for every event that takes place in the teaching and learning process most especially when it comes to pupils' poor academic performance. Kimani, Kara and Njagi (2013) revealed

that while blaming teachers for the poor performance of pupils, it very imperative to assess the challenges teachers and their pupils face in the teaching and learning of subject (science).

In as study Appiahene, Opoku, Akweitley, Adoba and Kwarteng (2014) reported that mathematics teachers faced a lot of challenges in the teaching of mathematics; and this may be applied to science. In a similar study conducted in Turkey, Esme (2004) revealed that Turkish science teachers faced a lot of challenges in teaching science to pupils.

It is hoped that when challenges faced by teachers and students are brought to light, it would help improve science teaching and learning in Ghanaian Basic schools and elsewhere in the world thereby impacting positively on the students' performance and attitude towards science.

### **Statement of the Problem**

Science educators, parents and other stakeholders in science education have been worried about the poor performance of Ghanaian Basic school pupils in the BECE as well as TIMMS science results for quite some time now. The WAEC Chief Examiners Reports (1993-2014) revealed that the BECE science continues to yield poor results year after year. On his part, Bosson-Amedenu (2017) indicated that Ghana's Basic schools regularly fail to produce knowledgeable graduates, capable of pursuing further education due to declining academic performance in the BECE results.

As stated in the introduction, within the last decade, Ghana's JHS 2 (grade 8) pupils' continues to perform significantly below other African nations in cross-national comparisons in TIMSS 2003; 2007 and 2011 science results (Mitchell Group, 2009; Buabeng, Owusu & Ntow, 2014). For example, in 2003 TIMSS report, out of the 46 participating countries in JHS

category, Ghana placed 45<sup>th</sup> position in science with an average score of 255 as against the International Average Benchmark (IAvB) of 474. Again, in 2011, Ghana placed 42<sup>nd</sup> position in science with an average score of 306 as against the IAvB of 500 (Buabeng, Owusu & Ntow, 2014).

Studies (Medupe, 1999; Odzen, 2007) have attributed this poor performance in science to the challenges Basic school science teachers and pupils faced in the teaching and learning of science. For example, in a study, Medupe (1999) indicated that South Africa Basic school science teachers faced a lot of challenges including lack of equipment and overcrowding in schools.

Since poor academic performance in science among Basic school pupils have been attributed to the challenges faced by teachers and pupils globally, it is imperative to assess the challenges faced by Ghanaian Basic school science teachers and their pupils in the teaching and learning of science.

### **Purpose of the Study**

This study sought to assess the challenges associated with the teaching and learning of science in Ghanaian Basic schools. Specifically, the study intends to:

1. To examine the challenges faced by Basic school pupils in the learning of science.
2. To assess the challenges faced by Basic school science teachers in the teaching of science.

### **Research Questions**

The following two (2) investigative questions directed research activity in the study:

1. What challenges do Basic school students face in the learning of science?
2. What challenges do Basic school science teachers encounter in the teaching of science?

## **II. REVIEW OF RELATED LITERATURE**

It is very uncommon to work effectively and achieve better results when one faces challenges in his/her work place. Teaching is an act of imparting meaningful knowledge from a source (teacher) to the young ones (students). Effective science teaching and learning cannot take place when the science teaching and learning environment is faced with a lot of challenges (Bajah, 1982; Medupe, 1999; Riess, 2000). Thus, for a teacher to work and achieve better results, all the challenges that impede effective science teaching and learning in schools must be assessed and properly addressed.

In a study conducted in Nigeria, Bajah (1982) indicated that lack of:- physical facilities, classroom furniture, service points, teacher's demonstration table, equipment and apparatus, human resources, qualified science teachers are some of the challenges that hinder effective teaching and learning of science. In a similar study in South Africa, Medupe (1999) also mentioned lack of science equipment and laboratory, overcrowded schools, under-qualified teachers and lack of epistemological knowledge about science are some of the challenges confronting science teaching and learning.

In another study in Germany, Riess (2000) pointed out that students' lack of interest and motivation in the science subject, students' poor understanding of scientific concepts, as well as students' lack of comprehension of the epistemological role of science are some of the problems or challenges that impede the effective science teaching and learning in schools. It is obvious that literature is full of evidence to suggest that science teachers and pupils across the globe have been and continuously confronting with challenges that impede the teaching and learning of science in schools.

### III. METHODOLOGY

#### Research Design

The study employed descriptive survey research design. This design was used because it allows the use of multiple data collection tools in seeking to address the research questions in an in-depth manner. Again, was used because it emphasizes objective measurement and the statistical analysis of data collected through questionnaires or by manipulating pre-existing statistical data using computational techniques.

#### Research Instruments

Questionnaire and interview were the research instruments used to collect data from the respondents. Two (2) questionnaires namely Science Teachers' Questionnaire (STQ) and Pupils' Questionnaire (PQ) were developed and used for the study. The STQ was used to collect data from Basic school science teachers whereas the PQ was used to collect data from the pupils.

A semi-structured interview guide was used to gather additional information that was not provided for in the questionnaires. In addition, written documents such as diary notes and audiotapes were made to augment information obtained from the main instruments to ensure triangulation of data.

#### Data Collection Procedure

Permission was sought from the school authorities, teachers and the pupils of the selected schools to carry out the study. Upon series of engagements and meetings, a date and time were agreed. In all, five (5) days were used to collect data from the respondents. In the agreed date and time, the STQ was administered to the teachers whereas PQ was also given to the pupils in the selected school to answer in my presence. After the stipulated time, all the

questionnaires were collected and this process ensured 100% retrieval rate of all the questionnaires administered.

After, the administration of the questionnaires, focus-group interview sessions were done for respondents to obtain additional information on the topic under study.

#### Data Analysis Method

The study employed both quantitative and qualitative methods of data analysis. Data from the questionnaires were analysed quantitatively using descriptive statistics mainly frequency and percentages. Data from the interview sessions were also analysed qualitatively. The recorded conversations with the teachers and pupils were transcribed, analysed and summarised thematically.

### IV. RESULTS AND DISCUSSION

#### Analysis of the Results

The analyses of the results were done to answer the 2 research questions posed by the study.

#### Research Question 1: What challenges do Basic school pupils face in the learning of science?

In order to assess the challenges encountered by Basic school pupils in the learning of science, pupils' responses to PQ question items were analysed quantitatively using frequency and percentages and are orderly presented in Table 1 below:

**Table 1** : Pupils' Responses on Challenges They Face In Learning of Science

No.	Items on problems faced by pupils in learning science.	Frequency	Percentage
1	Lack of science	40	100

	laboratories / practical rooms.		
2	Lack of good learning materials.	39	97.5
3	Lack or inadequate science practical activities.	38	95.0
4	Pupils' fear for the science subject.	36	90.0
5	Use of abstract concepts in teaching science by teachers.	34	85.0
6	Lack of furniture and space in classrooms.	31	77.5
7	Lack of competent science teachers.	30	75.0
8	Poor attitude towards science teaching by some teachers.	28	70.0
9	Threatening teaching and learning environment.	23	57.5
10	Non-availability of relevant and appropriate textbooks.	20	50.0
11	Limited science periods.	15	37.5
	<b>Total</b>	<b>40</b>	<b>100</b>

Source: (Pupils' Questionnaire, 2018)

Responses in Table 1 show that several challenges impede the learning of science by Basic school pupils who took part in the study. From Table 1, some of the identified challenges include lack of science laboratories/practical rooms, lack of good learning materials, lack or inadequate science practical

activities, pupils' fear for the science subject, use of abstract concepts in teaching science by teachers, and lack of competent science teachers.

From Table 1, the most serious identified challenge was lack of science laboratories/practical rooms whereas the least challenge was the limited science periods. This is because, all the 40 pupils representing 100% agreed that lack of laboratories/practical rooms, whereas only 15 pupils representing 37.5% also indicated the limited science periods.

Other challenges that were mentioned by the pupils during the focus-group interview sessions include lack of parental support, teachers' absenteeism, laziness on the part of some science teachers and lack of computers and other resources for private studies at home.

#### **Research Question 2: What challenges do Basic school science teachers encounter in the teaching of science?**

In order to investigate challenges faced by Basic school science teachers in the teaching of science, all the 50 teachers' responses to STQ question items were analysed quantitatively using frequency and percentages and are presented orderly in Table 2 below:

Data in Table 2 reveals that Basic school science teachers who took part in the study face numerous challenges that impede effective teaching of science. From Table 2, some of the challenges identified by teachers include lack of TLMs, lack of science laboratories/practical rooms, overcrowded classrooms, presence of pupils' misconceptions about science, heavy teaching workload on the teachers, pupils' poor attitude towards science, and many others.

The most serious challenge identified in this study was lack of TLMs whereas insufficient science periods allocation on schools' time table was the least. For example, in Table 2, all the 50 teachers representing



100% agreed that lack of lack of TLMs while only 29 representing 58% indicated insufficient science periods allocation impede science teaching.

**Table 2** : Teachers' Responses on Challenges They Face in Teaching of Science

No	Items on problems faced by teachers in science teaching	Frequency	Percentage
1	Lack of teaching and learning materials (TLMs).	50	100
2	Lack of science laboratories/practical rooms.	48	96
3	Overcrowded classrooms.	47	94
4	Presence of pupils' misconceptions about science.	46	92
5	Lack of in-service training for Basic school science teachers.	45	90
6	Heavy teaching workload on the teachers.	42	84
7	Assessment mode using exams scores for achievement criterions.	41	82
8	Pupils' poor attitude towards science.	39	78
9	Pupils' inability to mention and explain science terminologies	37	74
10	Pupils' inability to communicate in the English language.	34	68
11	Lack of furniture in classrooms.	33	66
12	Insufficient science periods allocation on schools' timetable.	29	58
	<b>Total</b>	<b>50</b>	<b>100</b>

Source: (Teachers' Questionnaire, 2018)

Other challenges that were mentioned by the teachers during the focus-group interview sessions include non-availability of appropriate textbooks, influence of superstitions towards science teaching and insecure teaching environments.

## V. Discussion of the Results

The results of this study showed that several challenges impede effective learning of science by Ghanaian Basic school pupils who took part in the study. The most serious challenge that confronted pupils' learning of science was lack of science laboratories/practical rooms. This means that most Basic schools do not have science laboratories or practical rooms that can be used by pupils for the learning of science. This implies that pupils cannot perform and learn practical activities associated with various scientific concepts.

Other challenges identified by the pupils include lack or inadequate science practical activities, pupils' fear for the science subject, lack of parental support, teachers' absenteeism and lack of computers for private studies at home.

It was also found out that numerous challenges hinder effective science teaching by Basic school science teachers. The most serious challenge that hinders effective teaching of science was lack of TLMs. This means that teachers cannot organise activity-oriented lessons effectively for the pupils due to lack TLMs. Other challenges identified by the science teachers include but not limited to lack of science laboratories/practical rooms, overcrowded classrooms, presence of students' misconceptions about science, lack of in-service training, influence of superstitions towards science and insecure teaching environments.

The findings from this study lend credence to the findings of some pioneer researchers (e.g. Bajah, 1982; Medupe, 1999; Esme, 2004; Odzen, 2007) that science

teachers and pupils all over the world have been confronting with one or numerous challenges that impede the smooth and effective science teaching and learning in schools.

## VI. Conclusions

Based on the findings of the study, the following conclusions were drawn:

It can be concluded that Ghanaian Basic students faced a lot of challenges in the learning of science. The most serious challenge was lack of science laboratories or practical rooms. Other challenges identified by the students include lack or inadequate science practical activities, students' fear for the science subject, lack of parental support, teachers' absenteeism and lack of computers and other resources for private studies at home.

It can also be concluded that Ghanaian Basic schools science teachers encountered numerous challenges in the teaching of science. The most serious challenge was lack of teaching and learning materials whereas insufficient science periods allocation on schools' time table was the least. Other challenges identified by the teachers include but not limited to lack of science laboratories and practical rooms, overcrowded classrooms, presence of students' misconceptions about science, lack of in-service training, heavy teaching workload, students' poor attitude towards science, influence of superstitions towards science and insecure teaching environments.

## VII. Recommendations

Based on the findings and conclusions drawn, it is recommended that: -

1. This study should be replicated in other Regions in Ghana using a much larger sample. This would provide a basis for more generalisation of conclusions to be arrived at about the challenges

associated with the science teaching and learning in Ghanaian Basic schools.

2. The government of Ghana and other related stakeholders in science education should build science laboratories/practical rooms in all Basic schools and equip them with needed TLMs to aid science teachers to do more practical activities so as to demystify science and make it more interesting for the pupils.

## VIII. REFERENCES

- [1]. Amankwaah, A. B. (2014). Ghana NGOs coalition on the rights of the child (GNCRC) convention on the rights of children (CRC) report to UN committee on the rights of the child 2014, Ghana. Retrieved August 20, 2017 from <http://tbinternet.ohchr.org/Treaties/CRC/>.
- [2]. Amoah, A. K. (2017). What does education Act 778 mean for Ghana?. Retrieved October 2, 2017 from <https://www.ghanaweb.com/Ghana>.
- [3]. Akyeampong K. (2007). 50 years of educational progress and challenge in Ghana. *Journal of International Cooperation in Education* 7(1),41-52.
- [4]. Appiahene, P., Opoku, M., Akweitley, E., Adoba, E., & Kwarteng, R. (2014). Assessing challenges of learning and teaching of mathematics in second cycle institutions in Ghana. *International Journal of Innovation and Applied Studies*, 6 (3), 362-368
- [5]. Bajah, S. T., (2003). Sciencing with children; a solid foundation for our future scientists; Innovative. Faculty of Education lecture series. Unilag series.
- [6]. Bosson-Amedenu, Pre-SHS students' perception of difficult concepts in junior high school mathematics curriculum in Ghana. *Asian Research Journal of Mathematics*, 3(2), XX-XX.
- [7]. Buabeng, I., Owusu, A. K., & Ntow, D. F. (2014). TIMSS 2011 Science Assessment Results: A Review of Ghana's Performance. *Journal of Curriculum and Teaching*, 3 (2), 1-14.
- [8]. Esme, I. (2004). Fen ogretiminde sorunlar (problems in science education). *Ozel Okullar Birliđi Bulteni*, Maltepe University, Istanbul.

- [9]. Heck, R. H. (2009). Teacher effectiveness and student achievement. Investigating a multilevel cross-classified model. *Journal of Education Administration*, 7 (22), 227- 249.
- [10]. Karikari-Ababio, M. (2003). GES records significant improvement. Ghana News Agency, 3- 4.
- [11]. Kimani, G. N., Kara, A. M., & Njagi, W. L. (2013). Teacher factors influencing students' academic achievement in secondary schools in Nyandarua County, Kenya. *International Journal of Education and Research*, 1(3), 1-14.
- [12]. Medupa, R. (1999). A perspective on the problems of science education in South Africa, international symposium on astrophysics research and science education, Vatican observatory.
- [13]. Mitchell Group (2009). Education in Ghana: progress and problems.
- [14]. Odhiambo, G. (2005). Elusive search for quality education. the case of quality assurance and teacher accountability. *International Journal of Education Management*, 22 (5), 417-431.
- [15]. Odzen, M. (2007). Problems with science and technology education in Turkey. *Journal of Mathematics, Science & Technology education*, 3(2), 157-161.
- [16]. Riess, F. (2000). Problems with Germany science education. *Science and education*, 9, 327-331.
- [17]. West African Examination Council Chief Examiners Reports (1993- 2014). Chief Examiner's annual report on Basic Education Certificate Examination (BECE) science results.

# Assessment of Relevance and Challenges of the School Feeding Programme In Some Basic Schools In Mpohor-Wassa East District

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## ABSTRACT

This study sought to assess the relevance and challenges of the Ghana School Feeding Programme (GSFP) in some Basic schools in the Mpohor-Wassa East District. The study employed the descriptive survey research design. The purposive sampling procedure was used to select 21 respondents made up of one (1) coordinator of the GSFP; five (5) head teachers; five (5) caterers and ten (10) Basic school teachers (2 teachers each) from five (5) Basic schools where GSFP have been implemented for more than the past two (2) decades. Data was analysed using descriptive statistics mainly frequency and percentages. The study revealed that since the inception of the GSFP in the District there have been significant improvements in pupils' enrolment and attendance rates, leading to reduction in absenteeism and drop-out rates. It was also found out that GSFP did not cover all the Basic schools in the District but covers only few selected schools. It was also observed that the feeding cost per pupil per day was insufficient and also not released on time. Finally, it was observed that caterers did not have suitable kitchen for cooking and pupils' also did not have proper canteens and that they eat the food in open spaces. It was recommended that Ghana government should extend the GSFP to cover all the Basic schools so as to reduce short-term hunger of pupils during classes' hours; and also stakeholders should provide suitable kitchen for cooking and proper canteens for the pupils so as to avoid eating in unhygienic open spaces.

**Keywords :** Assessment, Relevance, Challenges, School Feeding, Programme, Relevance, Challenges.

## I. INTRODUCTION

Education in Ghana aims at producing well balanced individuals with the requisite knowledge, skills and attitudes to become functional and productive to themselves and society at large (Amoah, 2017). This means that investing in education is a smart and wise investment decision with both economic and social returns. Economically, education produces a well-balanced and trained work force with better cognitive and physical developments (Amoah, 2017). In furtherance to this laudable aim, it is no delusion to say that a healthy mind lives in a healthy body.

The cognitive and physical development of the future human resource is impeded by some issues such as poverty and hunger (Broca & Stamoulis, 2003). According to (Ghana Living Standard Survey, 2006) some of the school pupils in deprived communities are faced with incidence of hunger and they are hardly get the chance to be enrolled in basic schools not to talk of higher education.

The impact of poverty and hunger on the academic success cannot be overemphasized. Thus, a child cannot learn; grasp the needed concepts better and proceeds further on the academic ladder when he/she is hungry. This goes to attest to the sayings that "a

hungry man is an angry man". According to World Food Programme (2008), apart from providing vital nourishment, school meals act as a safety net for poor families and also help keep children in school.

Ghana governments over the years have implemented various policies to curtail the problems confronting the educational system in Ghana. One of such policies was the introduction of the GSFP. The GSFP, which is an innovative social intervention policy was initiated in 2005, allow children of school going age in public basic schools food to eat in schools and to reduce child malnourishment so as to effectively develop their capacity and enable them to contribute to the sustainable socio-economic development of the country (Tuffour, 2008; Government of Ghana (GoG), 2015).

This laudable programme started on a pilot basis in October, 2005, with 2000 children in ten (10) pilot schools, one in each administrative region of Ghana. As at 2008, the programme reached 1,695 public schools (656,600 children) in all the 170 districts (approximately 25% of all school going children). The plan was to scale up the program to benefit 1,040,000 pupils by the end of the first phase in 2010 (Tuffour, 2008). Moreover, the 2014 Budget Statement in Article 219 indicated that about 1,693,698 pupils in 4,881 schools per each school day were fed; and that in 2016, the programme would be expanded to cover 3,000,000 pupils nationwide (GoG, 2015).

Since the programme was introduced more than a decade ago, it is evident to assess the relevance and challenges faced by the programme. It is against this background that this study was undertaken to assess the relevance and challenges of the GSFP in some Basic schools in the Mpohor-Wassa East District.

### **Statement of the Problem**

The GSFP has been implemented since 2005 in the context of the Comprehensive African Agricultural

Development Programme (CAADP) Pillar III and in response to the first and second Millennium Development Goals (MDGs) on eradicating extreme poverty and hunger and achieving universal primary education (GoG, 2015).

The basic idea of the program has been to provide children in public primary schools and kindergartens with one hot nutritious meal, prepared from locally grown foodstuffs, on every school-going day. The broad policy objectives were that the GSFP would seek to improve school enrolment, attendance and retention among pupils in the most deprived communities in Ghana as a strategy; promote an increase in domestic food production and consumption; increase the incomes of poor rural households; and improve the health and nutritional status of the pupils (GoG, 2015).

After its implementation of the programme for the past two (2) decades, studies by (Tuffour, 2006; GoG, 2015) indicated that although the GSFP has chalked some successes, yet it is still facing some various degrees of challenges in Ghanaian Basic schools of which Mpohor-Wassa East District is of no exception. Some works have been done elsewhere but few or no work has been done in this District. It is in the light of this that this study was undertaken to assess the relevance and challenges of the GSFP in some selected Basic schools in the Mpohor-Wassa East District.

### **Purpose of the Study**

The purpose of the study was to assess the relevance and challenges of the GSFP in some Basic schools in the Mpohor-Wassa East District. Specifically, the study intends:

- 1) To assess the relevance of the GSFP in the Mpohor-Wassa East District.
- 2) To examine challenges facing the implementation of the GSFP in the District?

## Research Questions

The following two (2) research questions were formulated to guide the study:

- 1) What are the relevance of the GSFP in the Mpohor-Wassa East District?
- 2) What are the challenges facing the implementation of the GSFP in the District?

## II. REVIEW OF RELATED LITERATURE

This aspect seeks to review related literature associated with this study. The review was done briefly under brief introduction, relevance of GSFP and the challenges facing the GSFP

### Introduction

The GSFP was initiated as a social protection intervention and it is part of Ghana's efforts towards the attainment of the United Nations Millennium Development Goals (UN-MDG) on hunger, poverty and primary education (Ministry of Local Government and Rural Development (MLGRD), 2011). The Government of Ghana (GoG) with support from the Dutch Government commenced the implementation of the GSFP in 2005. Since its inception, the MLGRD was charged with its supervisory role. However, in 2015 the supervisory roles were transferred to the Ministry of Gender, Children and Social Protection (MoGCSP) and was charged to link social assistance to productive and social inclusion and synchronize school feeding with other efforts to improve the fortunes of disadvantaged families and production of local food crops (GoG, 2015).

### Relevance of the Ghana School Feeding Programme

The relevance of the school feeding programme (SFP) cannot be overemphasised in Ghana and elsewhere in the world where the programme has been implemented. MLGRD (2011) reported that in several parts of the world, school meals and SFP have been used as an effective mechanism for addressing child

nutrition, educational enrolment and retention as well as hygiene issues.

According to (MLGRD 2011; GoG, 2015) the main relevance of the GSFP is to provide children in selected public primary schools and kindergartens in the poorest areas of the country with one hot, nutritious meal per day, using locally grown foodstuffs. The study revealed that at present, the programme is providing one hot and adequately nutritious meal to 1,693,698 pupils in 4,881 schools per each school day. Moreover, MLGRD (2011) pointed out that the GSFP has effectively provided income-generation, employment and economic integration benefits to communities in which they have been implemented and that the programme employed about 20,000 caterers and cooks nationwide.

Studies by (Amoah, Asante & Amoah, 2009; Kamaludeen, 2014) revealed that the SFP increase school enrolment, attendance and retention; reduce hunger and malnutrition; and boost domestic food production. This is in support by (Grantham-McGregor, Chang & Walker, 1998) that giving children a daily breakfast at school may improve their scholastic achievement through by attending school regularly, increasing the time spent in school and improving nutritional status.

Several studies by (Broca & Stamoulis, 2003; Adelman, Gilligan & Lehrer, 2009; Jomaa, McDonnell & Probart, 2011) indicated that the GSFP can improve the nutritional status of school age children over time, and alleviate short-term hunger in malnourished school children. Studies (Grantham-McGregor, Chang & Walker, 1998) revealed that the SFP can improve cognitive functions and academic performance of pupils via reduced absenteeism and increased attention and concentration due to improved nutritional status and reduced short-term hunger.

According to (Amoah, Asante & Amoah, 2009) the GSFP has boosted local food production. The study revealed that most of the farmers in the communities where the GSFP have been implemented have increased their farm yields or food crops. They concluded the strategy to feed school children with locally prepared food that is nutritionally adequate will focus 80% of the programme spending on local foodstuff and therefore cutting down on post-harvest losses and provide markets for farm output, impacting the economy at the rural household and community levels.

### **Challenges Facing the Ghana School Feeding Programme**

Several pioneer studies (Amoah, Asante & Amoah, 2009; MLGRD, 2011; Kamaludeen, 2014; GoG, 2015) have reported that the GSFP has been confronted with several challenges since its implementation. In a study, Kamaludeen (2014) revealed that high rate of turnover of the caterers; delay in payments to caterers and non-availability of suitable kitchen and students' canteens were some of the major challenges facing the GSFP.

In a similar study, (MLGRD, 2011; GoG, 2015) also mentioned lack of institutional coordination and sustainability; financial challenges; inability to link the programme to small holder farmers and farmer-based organization; insufficient feeding cost per pupil per day; lack of resources for effective monitoring and lack of better conditions of service staff were some of the major challenges confronting the GSFP.

Lack of proper accountability in contract bidding to qualified caterers and financing has also been identified as some of the challenges to GSFP (Send foundation Ghana, 2007). The study revealed that the audit's results were asserted that 58% of districts involved "did not use laid-down procurement

procedures" when awarding contracts for the programme.

Again, audits reports have shown financial and corruption-related issues within the local management in terms of documentations (Send foundation Ghana, 2007). The documented corruption includes award of contracts to non-existent companies; the disappearance of funds allocated to program management and the deliberate purchase of unwholesome but cheaper foodstuffs by the stakeholders. Also inability of the local management to perform monitoring and evaluation practices to support the tracking and execution of the GSFP was a typical challenge of GSFP.

In a study, Amoah, Asante and Amoah (2009) pointed out that lack of knowledge of farmers or Farmer-Based Organisation in the local communities to produce local food stuffs for the programme; and inability of the stakeholders in the implementation process to purchase foodstuffs from the community were some of the major challenges confronting the GSFP.

## **III. METHODOLOGY**

### **Research Design**

The descriptive survey research design was the design used for the study. This research design was designed was used to gather information on effects of the GSFP on school enrolment, attendance and academic performance at the Mpohor-Wassa East District. This design was appropriate because the study sought to generate new knowledge on the GSFP and to enable stakeholders of the programme to develop appropriate intervention strategies to improve the GSFP in the Mpohor-Wassa East District and Ghana as a whole.

### **Sample and Sampling Procedure**

A total of 21 respondents were selected and used for the study. The twenty (21) respondents were selected from 5 Basic schools in the District where GSFP have been implemented for the past decade. The 21 respondents were made up of one (1) coordinator of the GSFP; five (5) head teachers; five (5) caterers and ten (10) Basic school teachers (2 teachers each from the 5 selected Basic schools. Purposive sampling procedure of the non-probability sampling technique was employed for the study.

### **Research Instruments**

The study used both quantitative and qualitative data-gathering instruments. Questionnaire and interview were the two (2) instruments used to collect data from the respondents. Questionnaire constituted the quantitative part while the interview constituted the qualitative part of the instruments.

The questionnaire was made up of three (3) sections (A, B & C) containing 17 questions. Section A consists of two (2) items that requires demographic data of the respondents. Section B consists of eight (8) questions based on the relevance of the GSFP; whereas Section C also consists of seven (7) question items on the challenges faced by the implementation of the GSFP. On the other hand, the interview was done using an Interview guide. In addition, diary notes and audiotapes were made to augment information that was obtained to ensure triangulation of the data.

### **Data Collection Procedure**

Questionnaires were administered to the respondents to answer. All the 21 questionnaires given out were retrieved which resulted in hundred percent (100%) retrieval rate. After the administration of the questionnaire, an interview session was conducted for only eleven (11) respondents (interviewees) made up

of the District coordinator of the GSFP; five (5) head teachers and five (5) Basic school teachers using the interview guide. This was done to obtain additional information which were not captured by the questionnaire. The interview session lasted 5-10 minutes for each of the interviewee.

### **Data Analysis Method**

The study employed both quantitative and qualitative methods of data analysis. Items in the questionnaire were analyzed in quantitatively using descriptive statistics such as frequencies and percentages. Data obtained from the interview guide were also analysed qualitatively. The data obtained from the interview guide were transcribed, analysed and summarised thematically.

## **IV. RESULTS AND DISCUSSION**

### **Analysis of the Results**

This aspect of the study presents the analyses and discussion of the results in relation to the 2 research questions posed by the study. The analysis was done to cover three (3) thematic areas:- socio-demographic characteristics of the respondents (work experience and sex of respondents); relevance of the GSFP and challenges faced by the implementation of the programme.

### **Socio-Demographic Characteristics of Respondents**

The respondents' socio-demographic characteristics data on sex of the respondents and working experience in Ghana Education Service were sought and the findings with respect to sex are presented in Table 1 below.



**Table 1: Sex of Respondents**

Sex	Frequency	Percentage %
Male	10	48
Female	11	52
<b>Total</b>	<b>21</b>	<b>100</b>

Source: (Respondents' questionnaire, 2017)

Results in Table 1 shows clearly that, majority of the respondents 52% were females while 48% were males. This means that majority of the views in the study were from females. Again, the working experience of the respondents was also sought and the data obtained are presented in Table 2.

**Table 2: Work Experience**

Experience in years	Frequency	Percentage %
1-5	3	14
6-10	10	48
11-15	1	5
16 -20	3	14
21 and above	4	19
<b>Total</b>	<b>21</b>	<b>100</b>

Source: (Respondents' questionnaire, 2017)

The responses in Table 2 indicates that, out of the 21 respondents, 3 (14%) had a work experience of 1-5 years, 10 (48%) had work experience of 6 -10 years, 1 (5%) had a work experience of 11-15 years, 3 (14%) had working experience of 16-20 years and 4 (19%) also had work experience of 21 years and above. It can be concluded that, majority of the respondents had worked for more than 6-10 years; and therefore, they have very rich working experience in the Ghana Education Service.

**Presentation of Results by Research Questions**

**Research Question 1: What are the relevance of the school feeding programme in the Mpohor-Wassa East District?**

In answering research question 1, respondents' responses to questions (3 - 10) in the questionnaire on the relevance of the GSFP in the Mpohor-Wassa East District were analysed using frequency and percentages and are presented in Table 3 below:

**Table 3: Relevance of School Feeding Programme in Mpohor-Wassa East District**

No	Relevance of GSFP in Mpohor-Wassa East District	Yes	No	TOTAL (%)
		Freq. (%)	Freq. (%)	
3	Has the GSFP improved enrolment of pupils in the Mpohor-Wassa East District?	21 (100)	0 (0.0)	21 (100)
4.	Has the GSFP increased the attendance rate of truant pupils in the Mpohor-Wassa East District?	20 (95.2)	1 (4.8)	21 (100)
5.	Has the GSFP decreased school drop-out rate of pupils in the Mpohor-Wassa East District?	19 (90.4)	2 (9.5)	21 (100)
6.	Has the GSFP reduced absenteeism of pupils in the Mpohor-Wassa East District?	20 (95.2)	1 (4.8)	21 (100)
7.	Has the GSFP increased pupils'	14	7	21 (100)

	retention rate in the Mpohor-Wassa East District?	(66.7)	(33.3)	
8.	Has the GSFP reduced malnutrition in pupils' in the Mpohor-Wassa East District?	1 (4.8)	20 (95.2)	21 (100)
9.	Has the GSFP reduced pupils' short-term hunger during classes' hours in the District?	18 (85.7)	3 (14.3)	21 (100)
10.	Has the GSFP increased employment of farmers and caterers in the Mpohor-Wassa East District?	16 (76.2)	5 (23.8)	21 (100)

Source: (Respondents' questionnaire, 2017)

Results from Table 3 shows that, all the 21 respondents representing 100% agreed that school feeding programme has improved enrolment of pupils in schools in the District. Again, majority (20 out of 21) respondents representing 95.2% agreed that GSFP has increased the attendance rate of truant pupils while 1 respondent representing 4.8% disagreed to the same statement.

On the issue of whether the school feeding programme has increased pupils' retention rate in the District, 14 respondents representing 66.7% agreed to the statement while 7 respondents representing 33.3 % disagreed to the same statement. Again, when asked if the GSFP has reduced malnutrition in pupils' in the District, as many as 20 respondents representing 95.2%

disagreed to the statement while only 1 respondent representing 4.8% disagreed to the same item.

On the issue of whether the school feeding programme has reduced pupils' short-term hunger during classes' hours in District 18 respondents representing 85.7% said "yes" while only 3 respondents representing 14.3% responded "No". This means that the food did satisfy the pupils hunger for a while. Moreover, when asked if the GSFP has increased employment of farmers and caterers in the District, 16 respondents representing 76.2% agreed while 5 respondents representing 23.8% disagreed to the same statement.

The above responses indicated that the GSFP is relevant to the pupils in the Mpohor-Wassa East District and the Ghana as a whole.

**Research Question 2: What are the challenges facing the implementation of the school feeding programme in the Mpohor-Wassa East District?**

In answering research question 2, respondents' responses to items (11-17) in the questionnaire on the challenges faced by the implementation of the GSFP in the District were analysed using frequency and percentages and is presented in Table 4 below.

**Table 4: Challenges Faced by School Feeding Programme in Mpohor-Wassa East District**

No.	Challenges of GSFP in the District	Yes	No	TOTAL (%)
		Freq. (%)	Freq. (%)	
11.	Has the school feeding programme contract been awarded to right	2 (9.5)	19 (90.5)	21 (100)

	catering companies?			
12.	Is the money for the school feeding programme openly accounted for by the stakeholders?	1 (4.8)	20 (95.2)	21 (100)
13.	Is the school feeding programme supervised and monitored by the stakeholders?	2 (9.5)	19 (90.5)	21 (100)
14.	Does the GSFP implementation committee delay in payments to caterers and other service providers?	21 (100)	0 (0.0)	21 (100)
15.	Is the food properly prepared for pupils in the Assin-North Municipality?	16 (76.2)	5 (23.8)	21 (100)
16.	Does the school feeding programme provide good nutritional meals for the pupils in the Municipality?	0 (0.0)	21 (100)	21 (100)
17.	Has the GSFP boost domestic food production among farmers in the Assin-North Municipality?	11 (52.4)	10 (47.6)	21 (100)

Source: (Respondents' questionnaire, 2017)

Results from Table 4 reveals that 19 respondents representing 90.5% disagreed that GSFP\_contract been awarded to right catering companies whereas only 2 respondents representing 9.5% agreed. As many as 20 respondents representing 95.2% disagreed that money for the school feeding\_programme openly accounted for by the stakeholders whereas 1 respondent representing 4.8% agreed to the same statement.

Again, when asked if the school feeding programme supervised and monitored by the stakeholders, 19 of the respondents representing 90.5% disagreed whereas only 2 respondents representing 9.5% agreed to the same statement. On the issue of whether the GSFP implementation committee delay in payments to caterers and other service providers, all the 21 respondents 100% agreed to the statement whereas none of them disagreed to the same item.

On the issue of whether the school feeding programme provide good nutritional diet for the pupils, all the 21 respondents 100% said "No" with none of them responding "yes". Again, with regards to whether the GSFP has the boost domestic food production in the Municipality, 11 respondents representing 52.4% agreed to the statement whereas 10 respondents representing 47.6% disagreed to the same item.

During the interview sessions, very interesting responses were revealed. When asked whether the GSFP cover all the Basic schools in the District, all the interviewee indicated that the programme covers only few selected schools. Again, the respondents also indicated that caterers did not have suitable and hygienic kitchen for cooking and that they often cook in an open space or under a shed. They also indicated that pupils' do not have canteens and they eat the food on open spaces such as the school field or on the verandas.

The interviewees also indicated monetary payments to the caterers and other service providers were not done promptly and that government still owes the service providers. Again, when asked if the qualified caterers have been awarded the contract to cook the food, majority of the respondents revealed that most of these caterers were engaged not on merit but based on the political party affiliations. They mentioned that faithful party members of the government in power were usually appointed as new caterers whereas the old ones were always sacked. Moreover, the interviewees also indicated that although the GSFP has the boost local food production in the Municipality, but the stakeholders did not buy most of the food stuffs from the local farmers but rather preferred to buy cheap food stuffs from the open markets.

### **Discussion of the Results**

The results of this study showed that the GSFP has a lot of relevance to the Basic school pupils and the community at large. It was observed that since the implementation of the GSFP, there have been decreased in school drop-out rate and absenteeism among school pupils. Again, majority of the respondents agreed that GSFP had increased school enrolment, increased pupils' retention rate in schools, increased attendance rate of truant pupils; increased employment for caterers and farmers and had also reduced pupils' short-term hunger during class hours in the District. This means that most pupils have been enrolled in schools due to the GSFP. These findings lend credence to results of pioneer researchers (Amoah, Asante & Amoah, 2009; Kamaludeen, 2014) revealed that the SFP increase school enrolment, attendance and retention; reduce hunger and malnutrition; and boost domestic food production.

Reflections of the responses from the respondents revealed that the GSFP has been confronted with a lot of challenges. Majority of the respondents strongly

believed that GSFP contract have not been awarded to right catering companies but to political party members. It was observed that the GSFP have been poorly supervised and monitored by the stakeholders and also the monetary payments to the service providers were not done promptly. This finding is in agreement with the results of (Send foundation Ghana, 2007) that inability of the local management to perform monitoring and evaluation practices to support the tracking and execution of the GSFP was a typical challenge.

It came to light that the caterers did not provide good nutritional meals for the pupils and this may affect the nutritional requirement of the pupils. For example, when asked whether the school feeding programme provide good nutritional diet for the pupils, all the 21 respondents 100% said "No" with none of them responding "yes". This finding is contradicts the results of pioneer researchers (e.g. Broca & Stamoulis, 2003; Adelman, Gilligan & Lehrer, 2009; Jomaa, McDonnell & Probart, 2011) that the SFP can improve the nutritional status of school age children over time.

One significant finding from this study that came out during the interview session was that fewer number of the respondents indicated "yes" for the pupils' retention rate in schools as compared to enrolment and attendance rates. This means that some of the pupils do not stay in school but leave or run away from the school after eating the meal.

Another significant finding from the interview session was that the GSFP implementation committees (DIC, SIC and other stakeholders) did not employ qualified caterers and that they often award the contracts to political party members. These findings supported the assertion by Send foundation Ghana, (2007) that lack of proper accountability in contract bidding to qualified caterers was a challenge to GSFP. Again, the interviewees indicated that although the GSFP has the boost local food production, however, the

stakeholders did not purchase the foodstuffs from the local farmers but rather buy cheap and unwholesome foodstuffs from the open markets. This finding is in agreement with the result of (Send foundation Ghana, 2007) that stakeholders deliberately purchase unwholesome but cheaper foodstuffs from the markets.

Another shocking finding was that most of these caterers do not have suitable and hygienic kitchen for cooking. Again, pupils' do not have canteens and therefore, they eat the food on open spaces and also the feeding cost per pupil per day was insufficient and also was not released on time by the stakeholders. This finding is in consonance with the result of Kamaludeen (2014) that delay in payments to caterers and non-availability of suitable kitchen and students' canteens were some of the major challenges facing the GSFP.

### Conclusions

Based on the findings of the study, it can be concluded that since the inception of the GSFP there have been significant improvements in pupils' enrolment and attendance rates, leading to reduction in truancy, absenteeism and drop-out rate. Again, since there was reduction in pupils' retention rate in schools compared to enrolment rate; it implies that some of the pupils did not stay in school but leave or run away from school after eating the meals. It was also found out that GSFP did not cover all the Basic schools in the Mpohor-Wassa East District and Ghana as a whole but covers only few selected schools. It was observed that GSFP had boost the local food production but the stakeholders (DIC, SIC and caterers) did not purchase the foodstuffs from the local farmers but rather buy cheap foodstuffs from the open markets. It was revealed that the GSFP contract have not been awarded to right catering companies but to political party members. The GSFP have been poorly supervised and monitored by the stakeholders and that caterers did not provide good nutritional meals

for the pupils. It can be concluded that the monetary payments to the caterers and other service providers of the GSFP were not done promptly. It was also observed that the feeding cost per pupil per day was insufficient and also was not released on time. Finally, can also be concluded that caterers did not have suitable kitchen for cooking and pupils' also did not have proper canteens and that they eat the food in open spaces such as the school field or on the classroom verandas.

### Recommendations

In the light of conclusions drawn from the study, the following recommendations are made:

- 1) Government of Ghana should extend the GSFP to cover all the Basic schools in Ghana so as to reduce short-term hunger of pupils during classes' hours.
- 2) The stakeholders should properly supervise and monitor of the GSFP so that the caterers would provide good nutritional meals for the pupils.
- 3) Ghana government must increase feeding cost per pupil per day, increase funds for the programme and also release funds on time to enhance effective running of the programme.
- 4) The District Implementation Committee (DIC), Schools Implementation Committee (SIC), and the caterers should be sensitized about the need to purchase local foodstuffs from the famers.
- 5) The stakeholders should provide suitable kitchen for cooking and also proper canteens for the pupils so as to avoid eating in open spaces such as the school field or on the verandas.
- 6) The feeding cost per pupil per day should be increased and must be released on time.

## V. REFERENCES

- [1]. Adelman, S., Gilligan, D. & Lehrer, K. (2009). How effective are food for education program?: A critical assessment of the evidence from developing countries, 2008, International Food Policy Research Institute, Washington, DC.
- [2]. Amoah, A. K. (2017). What does education Act 778 mean for Ghana?. Retrieved October 2, 2017 from <https://www.ghanaweb.com/GhanaHomePage/features/>
- [3]. Amoah, K. D., Asante, B. O. & Amoah, K. B. S. (2009). Ghana School Feeding Programme (GSFP) initiative and the farmers dream. a survey on the role of farmer based organizations (FBOS) in the implementation of GSFP in Greater Accra Region.
- [4]. Broca S. & Stamoulis, K. (2003). Micro- and macro evidence on the impact of undernourishment, nutrition intake and economic growth. Economic and Social Development Department.
- [5]. Food and Agriculture Organization of the United Nations (2008). The state of food insecurity in the World. Rome: FAO. Retrieved May 2, 2018 from <http://www.fao.org/docrep/011/i0291e/htm>
- [6]. Grantham-McGregor, S. M., Chang, S., & Walker, S. P. (1998). Evaluation of school feeding programmes: Some Jamaican examples. *American Journal of Clinical Nutrition*, 67 (4), 785S-789S.
- [7]. Ghana Living Standard Survey (2006). School feeding for pupils. Ghana Statistical Service. Accra: Longman Publication.
- [8]. Government of Ghana (2015). Ghana school feeding programme draft national school feeding policy. Programme Document.
- [9]. Kamaludeen, H. (2014). The impact of the Ghana school feeding programme on enrolment, attendance and retention in Ga south municipal schools. An MPHIL Thesis, Faculty of Public Administration, University of Ghana, Legon, Ghana.
- [10]. Jomaa, L. H., McDonnell, E. & Probart, C. (2011). School feeding programmes in developing countries: Impacts on children's health and educational outcomes. *Nutrition Review*, 69, 83-98.
- [11]. Ministry of Local Government & Rural Development (MLGRD), (2011). Ghana School feeding Programme. Annual Operating Plan (AOP) of the Ghana SFP.
- [12]. Oshaug, A. & Haddad, L. (2002). 'Nutrition and Agriculture.' In *Nutrition: A Foundation for Development*. Geneva. ACC/SCN.
- [13]. Send foundation Ghana (2008). Ghana: Nationally-run school feeding programme mired in corruption. Retrieved May 12, 2018 <https://reliefweb.int/report/ghana/ghana-nationally-run-sfp>.
- [14]. Tuffour, A. (2008). Understanding school feeding in Ghana -WFP Remote . A National Inventory of the Ghana School Feeding Programme, SNV Ghana.
- [15]. World Food Programme, (2008). School feeding programme: Annual operating plan. Accra: Ghana: Nationally-run school feeding programme mired in corruption

# Heavy Metal Concentration and Bioaccumulation Potential of Plants Within Dumpsite Soil In Ozoro, South-South, Nigeria

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## ABSTRACT

This study investigated the concentration and bioaccumulation of Heavy metals of plants within waste dumpsites in Ozoro, South-South Nigeria. The soil and plants parts (Root and shoot) were obtained from the dumpsite and at a farm land far away from the dumpsite (Control site). The soil and plant parts were digested using aqua regia and analysed for heavy metals using Atomic Absorption Spectrophotometer (Buck 200A model). *Musa paradisiacal* (Plantain), *Manihot esculenta* (Cassava), *Colocasia esculenta* (Cocoyam) and *Carica papaya* (Pawpaw) were studied. The heavy metals cadmium, copper, Iron, lead, manganese and zinc were analyzed. The metal concentration in mg/kg ranged thus; Cd (0.01 – 0.06); Cu (0.01 – 0.08); Fe (0.01 – 0.08); Pb (0.01 – 0.07); Mn (0.01 – 0.06) and Zn (0.01 – 0.05). The metal concentrations in the dumpsite soil and plants were relatively higher than those from the control site. *Musa paradisiacal* and *Manihot esculenta* had their heavy metals concentrations accumulated more in the roots than in the shoots while *Colocasia esculenta* and *Carica papaya* had heavy metal concentration more in the shoot than in the root. Bioaccumulation Factor of the studied plants showed that *Musa paradisiacal* is a bioaccumulator for Manganese, *Manihot esculenta* and *Colocasia esculenta* are bioaccumulators for cadmium while *Carica papaya* is a bioaccumulator for Cadmium, copper and Iron. Translocation Factor ( $TF_{\text{Root to Shoot}}$ ) of the heavy metals in *Musa paradisiacal* and *Manihot esculenta* were all less than 1 while the ( $TF_{\text{Root to Shoot}}$ ) for *Colocasia esculenta* and *Carica papaya* were all greater than 1 indicating easy translocation of the metals to the shoot by *Colocasia esculenta* and *Carica papaya*. The Translocation Factor ( $TF_{\text{Soil to Root}}$ ) for cadmium was greater than 1 for all the plants except *Carica papaya*. Copper and Iron had  $TF_{\text{Soil to root}}$  greater than 1 in *Manihot esculenta* while manganese had  $TF_{\text{Soil to root}}$  greater than 1 in *Musa paradisiacal* implying easy translocation of the metals from soil to root. The Enrichment Factor of the heavy metals were all greater than 1 which implies that the metals are all readily available for absorption by the plants. The metal concentrations were less than FAO/WHO guidelines except lead. The ease at which cadmium and lead were translocated from the root to the shoot calls for concern. Therefore planting of crops around dumpsite soils should be discontinued with in order to safeguard our health.

**Keywords :** Bioaccumulation, Concentration, Dumpsites, Heavy Metal, Plants, Order, Translocation

## I. INTRODUCTION

Heavy metals are metals and metalloids with atomic density greater than 4 g/cm<sup>3</sup> or 5 times or more greater than water (Nagajyoti et al., 2010). Most dumpsites have been largely utilized for the cultivation of a varieties of edible vegetables and plants not minding

available data on the heavy metals phytoaccumulation potentials of plants in contaminated and polluted soils (Cobb et al., 2000; Benson and Ebong, 2015; Obasi et al., 2013, Ojebah and Uwague, 2015). This they do for consumption and profit making without taking cognizance of the absorption of toxic metals by the crops grown around these dumpsites (Cortez and

Ching, 2014). The consumption of plants grown in contaminated soils result in the transfer of the contaminants including heavy metals through the food chain (Ojebah and Uwague, 2015).

Bioaccumulation factor (BF), is defined as the ratio of chemical concentration in a plant to soil. It is used to measure the effectiveness of a plant in concentrating pollutant into aerial part (Fayiga et al., 2004), and translocation factor (TF) is the quotient of contaminant concentration in shoots to roots, which is used to measure the effectiveness of a plant in transferring a chemical from roots to shoots (Sun et al., 2009). BFs and TFs are usually calculated to evaluate plants for phytoextraction purposes and the effectiveness of the harvestable aerial parts of plants in metal accumulation and translocation (Zhang et al., 2002; Sun et al., 2008).

The present study was embarked upon to determine the concentration and bioaccumulation of some heavy metals by *Musa paradisiacal* (Plantain), *Manihot esculenta* (Cassava), *Colocasia esculenta* (Cocoyam) and *Carica papaya* (Pawpaw) commonly found in dumpsites to ascertain their bioaccumulation potentials.

## II. MATERIALS AND METHODS

### Study Area

The study was conducted in Ozoro, South-South Nigeria. Ozoro is located at longitude 6°12'58"E and latitude 5°32'18"N (www.wikipedia.org). Ozoro is one of fast developing Urban towns in Delta State, Nigeria with an increasing population due the State own Polytechnic.

### Sample Collection and Treatment

The method described by Zakka et al., (2014) was adopted. The whole plants (*Musa paradisiacal*, *Manihot esculenta*, *Colocasia esculenta* and *Carica papaya*) were harvested from the dumpsite soil along Owelogbo road, Ozoro on the 20<sup>th</sup> of April, 2018. Soil

sample (150g) were collected from the root zone of each plant to a depth of 15cm with the aid of a hand trowel and mixed together thoroughly. Other plants were also collected from a control site. The collected soil samples were air-dried for 3 days at room temperature while the shoots and roots of the plants samples were washed separated and air-dried for 3 days at room temperature. The soil samples were ground into fine particles using an agate mortar and sieved. One gram (1g) of each of the soil and plants samples was digested separately with 10ml of aqua regia and the mixture was heated for 10minutes. Distilled water was added to avoid drying up the sample digest and then filtered through Whatman number 1 filter paper into 50cm<sup>3</sup> standard volumetric flask and made up to mark.

### Heavy Metals Analysis

The heavy metals Cadmium, Copper, Iron, Lead, Manganese and Zinc were analyzed in the soil and parts of the plants samples of dumpsite soil and controlled site soil using Atomic absorption spectrophotometer (Buck 200A model). The heavy metal determination was done in triplicates. All reagents used for the analysis were of analytical grade. Glass wares and plastics were soaked in 20% HNO<sub>3</sub> washed with detergent and copiously rinsed with distilled water.

### BIOACCUMULATION FACTOR (BF) AND TRANSLOCATION FACTOR (TF) AND ENRICHMENT FACTOR (EF) OF THE HEAVY METALS

The Bioaccumulation Factor (BF), Translocation Factor (TF) and Enrichment Factor (EF) were computed from the relations (Obasi et al., 2013; Setpathy et al., 2014; Zakka et al., 2014).



$$B.F = \frac{\text{concentration of metals in plants}}{\text{concentration of metal in soil}}$$

$$T.F_{\text{Root to Shoot}} = \frac{\text{concentration of metals in plant shoot}}{\text{concentration of metal in plant root}}$$

$$T.F_{\text{Soil to Root}} = \frac{\text{concentration of metals in plant root}}{\text{concentration of metal in soil}}$$

$$E.F = \frac{\text{concentration of metals in contaminated soil}}{\text{concentration of metal in uncontaminated soil}}$$

### III. RESULTS AND DISCUSSION

The result of heavy metals concentration in the dumpsite, control site as well as the root and shoot of the plants in dumpsites and control sites are presented in table 1 – 3 and figure 1 and 2. The Bioaccumulation Factor (BF), Translocation Factor (TF) and Enrichment Factor of the Heavy metals are calculated and presented in Table 4 - 7 and Figure 3 – 6.

Table 1: Metal concentration in dumpsite soil and control site (Mean±SD)

Sites	Metal concentration (mg/kg)					
	Cd	Cu	Fe	Pb	Mn	Zn
Dumpsite	0.02±0.01	0.04±0.01	0.06±0.01	0.05±0.01	0.03±0.005	0.04±0.01
Control site	0.01±0.005	0.02±0.01	0.01±0.01	0.03±0.005	0.01±0.00	0.01±0.005

Table 2: Metal concentration in root and shoot of plants in dumpsite (Mean±SD)

Samples	Metal concentration (mg/kg)					
	Cd	Cu	Fe	Pb	Mn	Zn
<i>Musa paradisiacal</i> root	0.02±0.01	0.03±0.005	0.04±0.00	0.02±0.005	0.06±0.01	0.04±0.01
<i>Musa paradisiacal</i> shoot	0.01±0.005	0.02±0.01	0.02±0.005	0.01±0.00	0.01±0.005	0.01±0.00
<i>Manihot esculenta</i> root	0.04±0.01	0.06±0.01	0.07±0.01	0.04±0.01	0.03±0.010	0.04±0.01
<i>Manihot esculenta</i> shoot	0.01±0.005	0.02±0.01	0.03±0.01	0.02±0.00	0.01±0.00	0.02±0.005
<i>Colocasia esculenta</i> root	0.02±0.005	0.01±0.005	0.01±0.005	0.01±0.00	0.02±0.005	0.01±0.005
<i>Colocasia esculenta</i> shoot	0.05±0.01	0.07±0.01	0.08±0.01	0.07±0.01	0.04±0.01	0.05±0.01
<i>Carica papaya</i> root	0.01±0.00	0.02±0.005	0.03±0.01	0.01±0.005	0.01±0.005	0.02±0.01
<i>Carica papaya</i> shoot	0.06±0.005	0.08±0.01	0.1±0.00	0.07±0.01	0.04±0.01	0.04±0.01

ND - Not Detected

Table 3: Metal concentration in root and shoot of plants in control site (Mean±SD)

Samples	Cd	Cu	Fe	Pb	Mn	Zn
<i>Musa paradisiacal</i> root	ND	0.02± 0.01	0.02±0.005	0.01± .005	ND	0.01± 0.00
<i>Musa paradisiacal</i> shoot	ND	ND	ND	ND	ND	ND
<i>Manihot esculenta</i> root	0.02±0.005	0.04±0.005	0.04±0.01	0.03±0.01	0.02±0.005	0.03±0.01
<i>Manihot esculenta</i> shoot	ND	0.01±0.010	ND	0.01±0.010	ND	ND
<i>Colocasia esculenta</i> root	ND	ND	ND	ND	ND	ND
<i>Colocasia esculenta</i> shoot	ND	0.02±0.005	0.02±0.010	ND	ND	0.01±0.005
<i>Carica papaya</i> root	ND	0.01±0.00	0.01±0.005	ND	ND	0.01±0.010
<i>Carica papaya</i> shoot	0.01±0.005	ND	ND	ND	ND	0.01±0.005

ND - Not Detected

Table 4: Bioaccumulation factor (BF) of metals in the plant (Mean±SD)

	Cd	Cu	Fe	Pb	Mn	Zn
<i>Musa paradisiacal</i>	0.75	0.63	0.50	0.30	1.17	0.63
<i>Manihot esculenta</i>	1.25	1.00	0.83	0.60	0.67	0.75
<i>Colocasia esculenta</i>	1.75	1.00	0.75	0.80	1.00	0.75
<i>Carica papaya</i>	1.75	1.25	1.08	0.80	0.83	0.75

Table 5: Translocation factor ( $TF_{\text{Root to Shoot}}$ ) of heavy metals in the plant

	Cd	Cu	Fe	Pb	Mn	Zn
<i>Musa paradisiacal</i>	0.50	0.67	0.50	0.50	0.17	0.25
<i>Manihot esculenta</i>	0.25	0.33	0.43	0.50	0.33	0.50
<i>Colocasia esculenta</i>	2.50	7.00	8.00	7.00	2.00	5.00
<i>Carica papaya</i>	6.0	4.00	3.33	7.00	4.00	2.00

Table 6: Translocation factor ( $TF_{\text{Soil to Root}}$ ) of heavy metals in the plant

	Cd	Cu	Fe	Pb	Mn	Zn
<i>Musa paradisiacal</i>	2.00	0.75	0.67	0.40	2.00	1.00
<i>Manihot esculenta</i>	4.00	1.50	1.17	0.80	1.00	1.00
<i>Colocasia esculenta</i>	2.00	0.25	0.17	0.20	0.67	0.25
<i>Carica papaya</i>	1.00	0.50	0.50	0.50	0.33	0.50

Table 7. Enrichment factor of heavy metals

Metal	Enrichment Factor
Cadmium	2.00
Copper	2.00
Iron	6.00
Lead	1.67
Manganese	3.00
Zinc	4.00

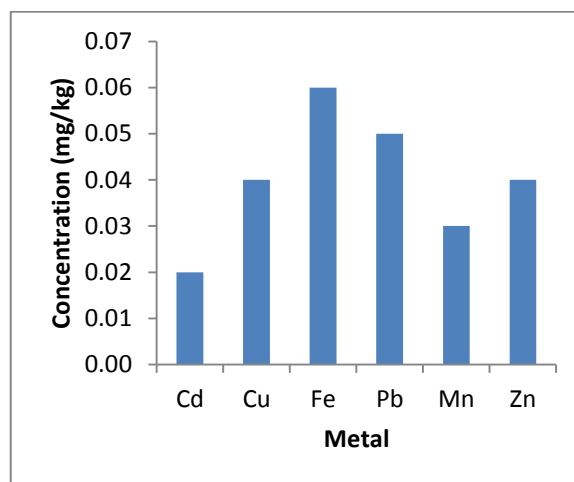


Figure 1: Distribution of heavy metals in the Dumpsites soil

Table 8: FAO/WHO Recommended limits for heavy metals

Metal	(mg/kg)
Cadmium	0.1
Copper	10
Lead	0.05
Zinc	5 – 15
Manganese	0.3
Iron	0.3

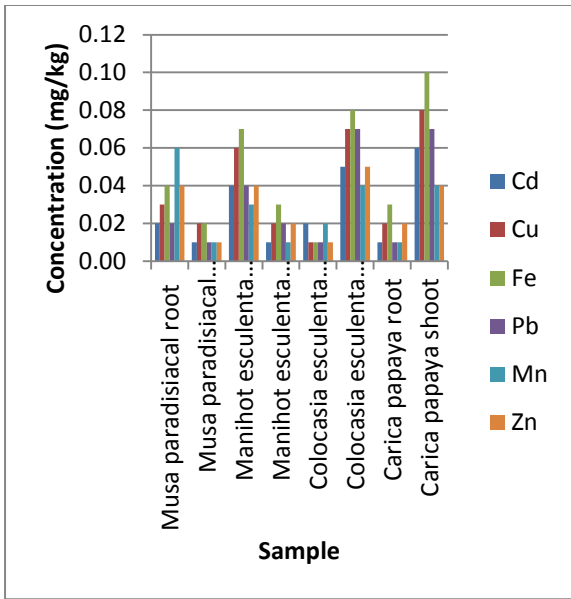


Figure 2: Concentration of metals in the roots and shoots of plants grown in dumpsites

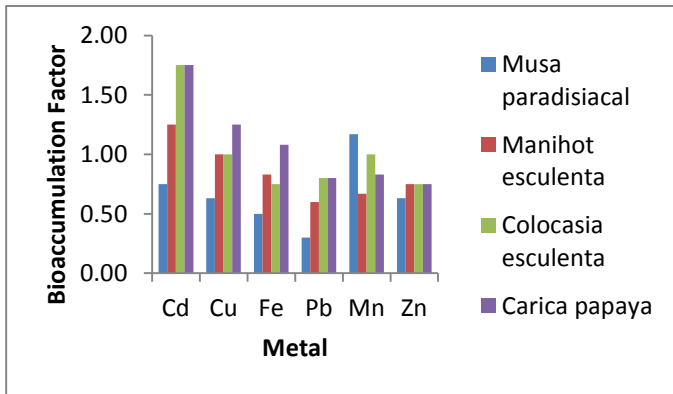


Figure 3: Bioaccumulation factor (BF) of plants grown in dumpsites

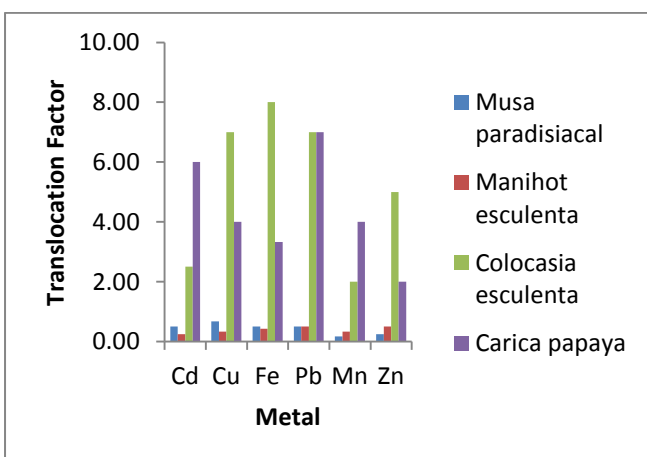


Figure 4: Translocation Factor ( $TF_{\text{Root to shoot}}$ ) of heavy metals by plants grown in dumpsites

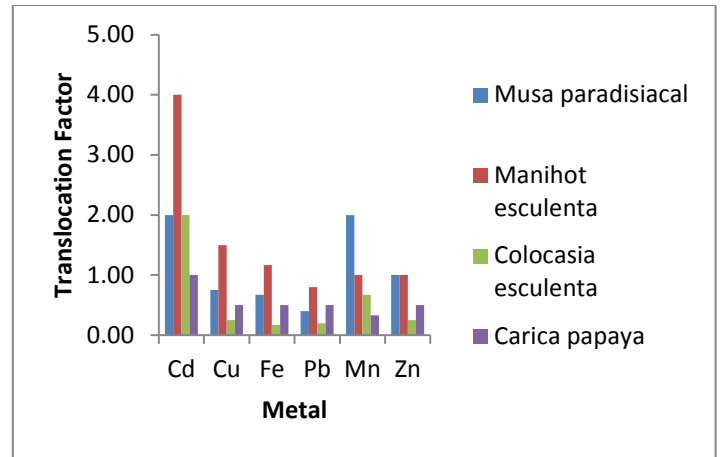


Figure 5: Translocation Factor ( $TF_{\text{Soil to Root}}$ ) of heavy metals by plants grown in dumpsites

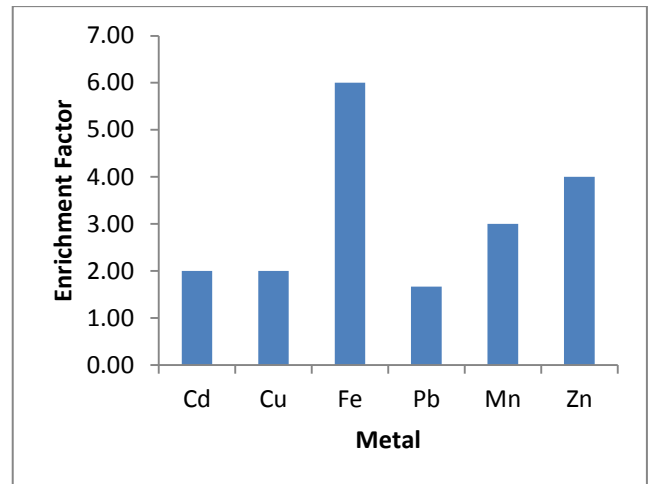


Figure 6: Enrichment Factor (EF) of heavy metals in the dumpsite soil

### Discussion

Iron was the most dominant metal in the dumpsite soil with a mean value of  $0.06 \pm 0.005 \text{ mg/kg}$ . The next predominant metal was lead with a mean value of  $0.05 \pm 0.010 \text{ mg/kg}$ . Copper and zinc result was  $0.04 \pm 0.010 \text{ mg/kg}$  whereas manganese and cadmium had a mean metal concentration of  $0.03 \pm 0.005 \text{ mg/kg}$  and  $0.02 \pm 0.010 \text{ mg/kg}$  respectively (Table 1 and Figure 1). Cadmium and lead are toxic while Zinc, Manganese Iron and Copper are essential micronutrients (Brady and Weil, 2002). The heavy metals in the dumpsite soil follow the order:  $\text{Fe} > \text{Pb} > \text{Cu} = \text{Zn} > \text{Mn} > \text{Cd}$ . The heavy metals Concentrations of the dumpsite soil were higher

compared to the control soils. The heavy metal concentration of control site follows in the order: Pb>Cu>Fe=Cd=Mn=Zn. The metal concentrations results were below recommended guidelines by FAO/WHO (1995) except lead (Table 8).

*Musa paradisiacal* and *Manihot esculenta*, had their heavy metals concentrations accumulated more in the roots than in the shoots while *Colocasia esculenta* and *Carica papaya* had the heavy metals concentrations more accumulated in the shoot than in the root (Table 2 and Figure 2). Higher concentration of the heavy metals in the root more than in the shoot had been reported by Satpathy et al., (2014) whereas Zakka et al., (2014) reported higher concentration of the metals in the shoot than in the root. The metal concentration in the root of *Musa paradisiacal* ranged from 0.02-0.06mg/kg while the shoot ranged from 0.01 – 0.02mg/kg (Table 2). The metal concentration follows in the order: Mn>Fe=Zn>Cu>Cd=Pb in the root and Cu=Fe>Cd=Pb=Mn=Zn in the shoot (Table 2 and Figure 2). The metal concentration in the root of *Manihot esculenta* ranged from 0.03 – 0.07mg/kg and 0.01 – 0.03mg/kg in the shoot. The metal concentration in the root and shoot of *Manihot esculenta* follows the ranking: Fe>Cu>Cd=Pb=Zn>Mn and Fe>Cu=Pb=Zn>Cd=Mn. The metal concentration in the root and shoot of *Colocasia esculenta* ranged from 0.01 – 0.02 mg/kg and 0.04 – 0.08 mg/kg respectively (Table 2 and Figure 2). The metal concentration follows the trend: Cd=Mn>Cu=Fe=Pb=Zn in the root of *Colocasia esculenta* and Fe>Cu=Pb>Cd=Zn>Mn in the shoot of *Colocasia esculenta*. The metal concentration in the root and shoot of *Carica papaya* ranged from 0.01 – 0.03mg/kg and 0.04 – 0.08mg/kg respectively. The metal concentrations are ranked in the order: Fe>Cu=Zn>Cd=Pb=Mn in the root of *Manihot esculenta* and Cu>Pb>Cd>Mn=Zn>Fe in the shoot of *Carica papaya* (Table 2 and Figure 2).

The Bioaccumulation factor (BF) is shown in table 4 and Figure 3. The BF factor ranged from 0.30 - 1.17 for *Musa paradisiacal*; 0.60 - 1.25 for *Manihot esculenta*; 0.75 – 1.75 for *Colocasia esculenta* and 0.75 – 1.75 for *Carica papaya*. The Bioaccumulation factor for the studied plants *Musa paradisiacal*, *Manihot esculenta*, *Colocasia esculenta* and *Carica papaya* follows in the order: Mn>Cd>Cu=Zn>Fe>Pb; Cd>Cu>Fe>Zn>Mn>Pb; Cd>Cu=Mn>Pb>Fe=Zn and Cd>Cu>Fe>Mn>Pb>Zn respectively (Table 4 and Figure 3). BF values less than or equal to 1 implies that the plant only absorbs the heavy metals but no accumulation of the metal while BF values greater than 1 indicates that the heavy metals are accumulated (Satpathy et al., 2014). The BF values for the heavy metals in *Musa paradisiacal* were all less than 1 except Manganese (1.17). This indicates that *Musa paradisiacal* is a good bioaccumulator for Manganese. BF values for the heavy metals in *Manihot esculenta* and *Colocasia esculenta* were all less than or equal to 1 except Cadmium (1.25 and 1.75 for *Manihot esculenta* and *Colocasia esculenta* respectively) showing that cadmium can readily bioaccumulate in *Manihot esculenta* and *Colocasia esculenta*. The BF values of the heavy metals in *Carica papaya* had values greater than 1 for Cadmium (1.75), copper (1.25) and Iron (1.08) while the rest were less than 1 which shows that *Carica papaya* is a good bioaccumulator for Cadmium, copper, and Iron.

The Translocation Factor (TF<sub>Root to Shoot</sub> and TF<sub>Soil to Root</sub>) are shown in Table 5 and 6 and Figure 4 and 5. Transfer factor is a major component of human exposure to toxic heavy metals via the food chain (Satpathy et al., 2014). The Translocation Factor (TF<sub>Root to Shoot</sub>) for *Musa paradisiacal*, *Manihot esculenta*, *Colocasia esculenta* and *Carica papaya* are ranged from 0.25 – 0.67; 0.25 – 0.50; 2.00 – 8.00 and 2.00 – 7.00 respectively. The Translocation factor (TF<sub>Root to Shoot</sub>) for the metals in the plants as shown in Table 5 and Figure 4 follows in the order: Cu>Cd=Fe=Pb>Zn>Mn for *Musa paradisiacal*; Pb=Zn>Fe>Cu=Mn>Cd for

*Manihot esculenta*; Fe>Cu=Pb>Zn>Cd>Mn for *Colocasia esculenta* and Pb>Cd>Cu=Mn>Fe>Zn for *Carica papaya*. Translocation Factor ( $TF_{\text{Root to Shoot}}$ ) was highest in lead, followed by copper and Iron and least in Manganese. Translocation Factor ( $TF_{\text{Root to Shoot}}$ ) of the heavy metals for *Musa paradisiacal* and *Manihot esculenta* were all less than 1 showing that the translocation of the metals to the shoot by these plants is not easy. The ( $TF_{\text{Root to Shoot}}$ ) for *Colocasia esculenta* and *Carica papaya* were all greater than 1. This indicates the easy translocation of the metals to the shoot by these plants (Obasi et al., 2013). Translocation Factor ( $TF_{\text{Root to Shoot}}$ ) was highest in lead, followed by copper and Iron and least in Manganese (Table 5 and Figure 4)

The Translocation Factor ( $TF_{\text{Soil to Root}}$ ) for *Musa paradisiacal*, *Manihot esculenta*, *Colocasia esculenta* and *Carica papaya* ranged from 0.40 – 2.00; 0.80 – 4.00; 0.17 – 2.00 and 0.33 – 1.00 respectively (Table 6 and Figure 5). The Translocation Factor ( $TF_{\text{Soil to Root}}$ ) follows in the order Cd=Mn>Zn>Cu>Fe>Pb for *Musa paradisiacal*; Cd>Cu>Fe>Mn=Zn>Pb for *Manihot esculenta*; Cd>Mn>Cu=Zn>Pb>Fe for *Colocasia esculenta* and Cd>Cu=Fe=Pb=Zn>Mn for *Carica papaya*. The Translocation Factor ( $TF_{\text{Soil to Root}}$ ) for cadmium was greater than 1 for all the plants except in *Carica papaya* (1.00). Copper and Iron had  $TF_{\text{Soil to root}}$  greater than 1 in *Manihot esculenta* while manganese had  $TF_{\text{Soil to root}}$  greater than 1 in *Musa paradisiacal*. This implies easy translocation of these metals from soil to root. The Translocation Factor ( $TF_{\text{Soil to Root}}$ ) was highest for cadmium, followed by Manganese and least in lead (Table 6 and Figure 5). Translocation Factor (TF) is an important indicator that allows for the Assessment of the mobility of heavy metals in plants (Zakka et al., 2014; Zhao et al., 2001). The higher the values recorded for TF the more mobile or available the metals are (Satpathy, 2014). Metal transfer process is very necessary in ascertaining the distribution of the metals in different plant tissues (Xiong, 1998).

The Enrichment Factor (EF) of the dumpsite soils for the heavy metals ranged from 1.67 – 6.00 (Table 7 and Figure 6). The enrichment factor follows in the order: Fe>Zn>Mn>Cd=Cu>Pb. EF values greater than 1 implies higher availability and distribution of metals in the contaminated soil (Satpathy et al., 2014) thus increasing the metal accumulation in the plant species grown on the dumpsite. The EF of the heavy metals were all greater than 1 which implies that they are all readily available and distributed in the dumpsite soils. Iron had the highest EF and lead had the least (Table 7 and Figure 6).

#### IV. CONCLUSION/RECOMMENDATION

The present study showed the metal concentration in the dumpsite soil and plant parts to be higher than those in the control site. The bioaccumulation and translocation Factors as well as the Enrichment Factors of the heavy metals were determined. The concentration of the heavy metals in the soil as well as the plant parts were all within the FAO/WHO (1995) except lead. The concentration of the heavy metals in the dumpsite soil follows in the order: Fe>Pb>Cu=Zn>Mn>Cd. The accumulation of the heavy metals was higher in the root than in the shoot for *Musa paradisiacal* and *Manihot esculenta* while the metals were more accumulated in the shoot than in the root for *Colocasia esculenta* and *Carica papaya*. *Musa paradisiacal* is a good bioaccumulator for Manganese, *Manihot esculenta* and *Colocasia esculenta* are bioaccumulators for cadmium while *Carica papaya* is a bioaccumulator for Cadmium, copper and Iron. Translocation Factor ( $TF_{\text{Root to Shoot}}$ ) was highest in lead, followed by copper and Iron and least in Manganese. Translocation Factor ( $TF_{\text{Root to Shoot}}$ ) *Musa paradisiacal* and *Manihot esculenta* were all less than 1 while the ( $TF_{\text{Root to Shoot}}$ ) for *Colocasia esculenta* and *Carica papaya* were all greater than 1 indicating easy translocation of the metals to the shoot by *Colocasia esculenta* and *Carica papaya* plants. The Translocation Factor ( $TF_{\text{Soil to Root}}$ ) for cadmium was

greater than 1 for all the plants except *Carica papaya*. Copper and Iron had  $TF_{\text{Soil to root}}$  greater than 1 in *Manihot esculenta* while manganese had  $TF_{\text{Soil to root}}$  greater than 1 in *Musa paradisiacal*. This implies easy translocation of the metals from soil to root. The Enrichment Factor of the heavy metals were all greater than 1 which implies that they are all readily available and distributed in the dumpsite soils for absorption by the plants.

Although the metal concentrations were quite low in comparison with FAO/WHO (1995) recommended guidelines, the ease at which the non essential and toxic element cadmium and lead are translocated from root to shoot calls for serious concern. Therefore planting of crops around dumpsite soils should be discontinued with in order to safeguard our health.

## V. REFERENCES

- [1]. Benson N. U. and Ebong G. A. (2005). Heavy metal in vegetables commonly grown in a tropical garden ultisol. *J. Sustain. Trop. Agric. Resour.* 16:77- 80
- [2]. Brady N. C. and Weil R. R. (2002). *The Nature and Properties of Soil*, Prentice-Hall, Upper Saddle River, NJ, USA, 13th edition.
- [3]. Cobb G. P., Sands K., Waters M., Wixson B. G. and Dorward-King E (2000). Accumulation of heavy metals by vegetables grown in mine wastes. *Environmental Toxicological Chemistry* 19:600-607
- [4]. Cortez L. A. S. and Ching J. A. (2014). Heavy Metal Concentration of Dumpsite Soil and Accumulation in *Zea mays* (corn) Growing in Closed Dumpsite in Manila, Philippines. *International Journal of Environmental Science and Development*, Vol 5(1): 77-80
- [5]. FAO/WHO (1995). *Evaluation of Certain Food Additives and Contaminants* vol. 859, Technical Report Series
- [6]. Fayiga A. O., Ma L. Q., Cao X. and Rathinasabapathi B. (2004). Effects of heavy metals on growth and arsenic accumulation in the arsenic hyperaccumulator *Pteris vittata* L. *Environ. Pollut.*, 132: 289-296.
- [7]. Nagajyoti, P. C. Lee, K.D. and Sreekanth, T. V. M.(2010). Heavy Metals, Occurrence and Toxicity for Plants: A Review. *Environmental Chemistry Letters*, vol. 8(3), pp.199-216.
- [8]. Obasi, N. A., Akubugwo, E. I., Kalu, K. M., and Ugbogu, O. C. (2013) – Speciation of Heavy metals and Phyto-accumulation potentials of selected plants on major dumpsites in Umuahia, Abia State, Nigeria. *International Journal of Current Biochemistry Research* 1(4): 16 - 28.
- [9]. Ojebah, C. K and Uwague, A. (2015), Heavy Metal Concentration of Plants (*Zea mays*, Potato, Green leaf, Water leaf) Grown Around Waste Dumpsites in Ozoro, Delta State, Nigeria. *J. of Biological Science and Bioconservation*, Vol. 7, No. 2, Pp. 20 - 29.
- [10]. Satpathy D., Reddy V. M. and Dhal S. P. (2014). Risk Assessment of Heavy Metals Contamination in Paddy Soil, Plants, and Grains (*Oryza sativa* L.) at the East Coast of India. *BioMed Research International* Volume, Pp 1 – 11. Available at <http://dx.doi.org/10.1155/2014/545473>
- [11]. Sun Y B., Zhou Q. X., and Diao CY (2008). Effects of cadmium and arsenic on growth and metal accumulation of Cd-hyperaccumulator *Solanum nigrum* L. *Bioresource Technol.* 99: 1103-1110.
- [12]. Sun Y B., Zhou Q. X., Wang L. and Liu W. T. (2009). Cadmium tolerance and accumulation characteristics of *Bidens pilosa* L. as a potential Cd hyperaccumulator. *J. Hazard. Mater.*, 161: 808-814
- [13]. [www.wikipedia.org](http://www.wikipedia.org)
- [14]. Xiong Z. T. (1998), Lead uptake and effects on seed germination and plant growth in a Pb hyperaccumulator *Brassica pekinensis* Rupr,

Bulletin of Environmental Contamination and Toxicology, 60(2): 285-291.

- [15]. Zhang W. H., Cai Y., Tu C. and Ma Q. L. (2002). Arsenic speciation and distribution in an arsenic hyperaccumulating plant. *Sci. Total Environ.*, 300: 167-177.

# A Review on Weather Forecasting using R

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## ABSTRACT

In this project, we are forecasting whether rain may occur or not in the coming day. We are using public data to implement this. We are using 3 algorithms in this project viz. Logistic Regression, Decision Tree and Random Forest which is implemented using R programming. 3 algorithms are being used just to improve the efficiency of our project. In our dataset we will have different parameters or fields (independent variables) like Wind Speed, Wind Direction etc. that will affect dependent variable i.e. RainTomorrow. After applying algorithms on different fields of dataset i.e. independent variable and dependent variable, we will predict whether rain fall will occur or not.

Keywords : R programming, Logistic Regression, Decision Tree, Random Forest, independent variable, dependent variable.

## I. INTRODUCTION

R is programming language for statistical computing. R programming is mainly used by statisticians and data miners for developing data analysis. Basically, we are mining the data for our result using R. Data mining is the procedure of finding patterns in large dataset including methods of machine learning, database systems and statistics and it is a method that are applied to extract data patterns. Data mining involves six tasks viz. Anomaly detection, Association rule learning, Clustering, Classification, Regression and Summarization. In this project we are predicting whether rainfall may occur or not in the coming day using data mining techniques. We have used public data to predict the whether rainfall will occur or not. Data field present in our data are date, location, mintemp, maxtemp, Rainfall, Evaporation, Sunshine, WindGustDir, WindGustSpeed, WindDir9am, WindDir3pm, WindSpeed9am, WindSpeed3pm, Humidity9am, Humidity3pm, Pressure9am, Pressure3pm, Cloud9am, Cloud3pm, Temp9am,

Temp3pm, RainTomorrow. All other variable other than RainTomorrow is independent variable. All this variable are given input to model which is implemented using different algorithms.

## II. Literature Review

Incremental K-Means algorithm is used by Sanjay Chakraborty, N.K.Nagwani, Lopamudra Dey [1] in their research paper that defines the methodology which first find some useful patterns in the form of curves. The generated curves is then used in the later stage for forecasting through linear regression by matching to the closest pattern to each time series that has to be predicted. This approach is applied on Kddcup 2003 dataset. Some work is done on real time storm detection through data mining. In this approach, a model and algorithms for bridging the gap between the physical environment and the cyber infrastructure framework by means of an events processing approach to responding to anomalous behavior and sophisticated data mining algorithms



that apply classification techniques to the detection of severe storm patterns. The above ideas have been implemented in the LEAD-CI prototype and accuracy of this technique is calculated.

M.Kannan, S.Prabhakaran, P.Ramachandran [2] in their paper has used the technique of simple linear regression, multiple linear regression and classification technique to classify the reason for rainfall in the ground level. Using multiple linear regression model they have predict that whether rainfall will occur or not.

### III. Existing Work

In the existing work, as we referred to M. Kannan, S.Prabhakaran, P.Ramachandran [2] paper, regression and classification technique is used to predict the rainfall in the coming years. They have used clustering technique to group the element i.e. particular area occupied by the rainfall region. Prediction technique is used to predict the rainfall occur in some particular region. Prediction methods in data mining is used to analyze the rainfall occupied in the region using regression approach. In regression method, they have used Karl Pearson correlation coefficient for finding how many centimeters rainfall occur in particular region. They have collected previous five years of data of Tamil Nadu, Chennai for the month of September, October and November.

Regression uses two methods i.e. Simple linear regression and multiple linear regression model. Regression model containing two or more than two predict variable is called MLR (Multiple linear regression). Multiple linear regression is used to predict the average summer monsoon rainfall for a particular year using the dataset which contains monthly rainfall data of the summer-monsoon of the previous year. MLR equation is set as  $y = aX_1 + bX_2 + cX_3$  where  $X_1$  is the September rainfall for the year  $Y$ ,  $X_2$  is the October rainfall for the year  $Y$ ,  $X_3$  is the November rainfall for the year  $Y$ ,  $y$  is average rainfall

of the year  $Y+1$ . They have used regression coefficient as a mean value for the month of September and October. This same process is done till end. They have used some coefficient in multiple linear equation to take the mean value of the corresponding instances.

### IV. Proposed Work

We have also used three algorithms to predict whether rainfall will occur not viz. Logistic Regression, Decision tree and Random Forest. In public data our dependent variable is "RainTomorrow" which tells whether rain will come in coming day or not. We cleaned our dataset i.e. removing NULL values, removing unwanted field. We will also split the data into 70% train data and 30% test data using split(). Firstly, we will take our public data in one variable, it can be written as "weather\_data <- read.csv("weather.csv", header = TRUE, sep = ",", stringsAsFactors = TRUE)". While implementing the project, we can observe that fields such as 'Date', 'Location', 'RISK\_MM', 'Rainfall', 'RainToday' is not required. We can remove this field using following syntax "weather\_data2<-subset(weather\_data,select = -c(Date, Location, RISK\_MM, Rainfall, RainToday))", where '-c' will delete the fields from public dataset and will save the new dataset to new variable i.e. 'weather\_data2'. After deleting the unused fields we can search or "NA" (Not available) values in our dataset by using syntax "cols\_Na<-apply(weather\_data2,2,function(x){sum(is.na(x))})". When we will see output of this we will come to know the number of NA's values in each fields present in the dataset After dataset is cleaned then that dataset is given as input to model created using algorithms like Logistic Regression, Decision Tree and Random Forest.

Logistic regression is a type of regression model in which response variable i.e. dependent variable has a categorical value such as True/False or 0/1. This algorithm calculates the probability of binary

responses as response variable using on the mathematical equation relating with the predictor variables. Mathematical equation for logistic regression is “ $y=1/(1+e^{-(a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+\dots)})$ ”, where, y is response variable, x is the predictor variable, a and b are the coefficient which are numeric constant. The function which is used to create the regression model is glm() function. Syntax for glm() is glm(formula,data,family).

The decision tree is a graph to depict choices and their respective result which is in the form of tree. Classification as well as regression can be done with the decision tree. Rpart() is used to implement the decision tree in which one model is created by giving the cleaned public dataset as a input.

In random forest, large number of decision trees are generated and every observation is fed into each decision tree. In each iteration, a new observation is fed into all the trees and then taking a majority vote for every classification model. The function used to implement Random Forest is randomForest(). Syntax for randomForest() is : randomForest(formula,data) where **formula** is a formula describing the predictor and responsive variables and **data** is the name of the data set which is being used.

## V. Conclusion

Thus, we have compared the existing work with our proposed work. We can observe that only multiple linear regression is used to predict the rainfall in the coming days but we have used 3 algorithms to predict the rainfall will occur or not, which is more efficient than multiple linear regression model. We have used three algorithms to improve the efficiency of our result which will give more accurate results at the end. Three algorithms i.e. Logistic regression, decision tree and random forest are applied on the same data set and we will check the accuracy of the respective algorithm and will predict at the end using the algorithm having more accuracy.

## VI. References

- [1]. Sanjay Chakraborty, N.K.Nagwani, Lopamudra Dey “Weather Forecasting using Incremental K-Means clustering”, in *CiiT International Journal of Data Mining & Knowledge Engineering*, May 2012
- [2]. M.Kannan, S.Prabhakaran, P.Ramachandran, “Rainfall Forecasting Using Data Mining Technique”, *International Journal of Engineering and Technology* Vol.2 (6), 397-401, 2010.

# Heat Transfer Characteristic of Spiral Heat Exchanger: Effect of Reynolds Number on Heat Transfer Coefficient for Acetic Acid - Water System

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## ABSTRACT

In this paper an experimental study has been conducted to investigate heat transfer coefficients and effectiveness for acetic acid- water miscible system in the spiral heat exchanger (SHE). Cold fluid is Acetic acid – water solution while hot fluid is water. Experiments have been conducted by varying the mass flow rate of cold fluid (5 % to 30% Acetic acid in water) from 0.0833 Kg/sec to 0.133 Kg/sec and keeping the hot fluid flow rate constant then the values of Reynolds number and heat transfer coefficient are calculated.

**Keywords :** Spiral Heat Exchanger; Reynolds number; Heat transfer coefficient.

## I. INTRODUCTION

Energy saving is very important in our global world, heat exchanger is useful for energy saving. Spiral heat exchangers play a main role in cooling high density and viscous fluids. Spiral heat exchanger has excellent heat exchange because of far compact and high heat transfer efficiency. Spiral heat exchangers consist of two long plates rolled together forming a spiral. The space between the plates is kept by welding to form the channels for the flow of the fluids. Spiral heat exchanger is self cleaning equipment with low fouling, easily accessible for inspection or mechanical cleaning and with less space requirements.

## II. LITERATURE SURVEY

The research was done by Dr. M. A. Hossian, M. I. Islam et. al on compressive study on heat transfer coefficient and effectiveness for water using spiral heat exchanger [1]. They conducted experiments to investigate the overall heat transfer coefficient and

effectiveness for water using spiral heat exchanger. They designed a physical model of spiral heat exchanger. They varied mass flow rate of hot fluid from 0.049 kg/sec to 0.298 kg/sec and mass flow rate of cold fluid was varied from .029 kg/sec to 0.225 kg/sec. They observed that heat transfer rate depends directly on mass flow rate of hot and cold water in which maximum heat transfer rate is obtained at lower hot water flow rate. They also concluded that heat transfer coefficient increases with increase in Reynolds number and hot water flow rates and effectiveness decreases with increase in hot water flow rates. The research was carried out by Bhavsar et al. on design and experimental analysis of spiral tube heat exchanger [2]. Their aim was to develop new design methodology for flow of hot and cold fluids, where hot fluid flows in axial path while the cold fluid flows in a spiral path. They designed and fabricated the spiral tube heat exchanger to measure the experimental tests. They worked to streamline design methodology of spiral tube heat exchanger. They have designed methodology for spiral tube heat

exchanger and experiments performed on it to analyses pressure drop and temperature change in hot and cold fluid on shell side and tube side. The research was carried out by Yoo Geun-jong et. al on fluid flow and heat transfer characteristics of spiral coiled tube and effects of Reynolds number and curvature ratio [3]. They performed a numerical analysis and studied flow and heat transfer characteristics in spiral coiled tube heat exchanger. They increased gradually increased radius of curvature of spiral coiled tube till total rotating angle of  $12\pi$  is reached. They concluded that cross sectional velocity distribution of the main flow and secondary flow shows similarity for both spiral and helical coiled tubes. They also concluded that friction factor and Nu increases in sane proportion with Re and square root of dean number in both coiled tubes. They finally concluded that Re had stronger effect as compared to curvature ratio. The research was carried out by Naphon and Wongwises on study of the heat transfer characteristics of a compact spiral coil heat exchanger under wet-surface conditions [4]. The main focus of their work was to find the heat transfer characteristics and the performance of a spiral coil heat exchanger under cooling and humidifying conditions. They used air and water as working fluids. They developed a mathematical model based on mass and energy conservation and solved by using the Newton-Raphson iterative method to determine the heat transfer characteristics. They found out that enthalpy, effectiveness and the humidity effectiveness decreased with increasing air mass flow rate for a given inlet-water temperature, inlet-air humidity ratio and water mass flow rate. The increase in the outlet enthalpy and outlet humidity ratio of air was larger than those of the enthalpy of saturated air and humidity ratio of saturated air. Therefore, the enthalpy effectiveness and humidity effectiveness tend to decrease with increasing air mass flow rate. They also observed that the effect of inlet-air temperature on the tube surface temperature. At a specific inlet-air temperature, the tube surface temperature generally increases with

increasing air mass flow rate; however, the increase of the tube surface temperature at higher inlet-air temperatures was higher than at lower ones for the same range of air mass flow rates. They found that at a specific air mass flow rate, the tube surface temperature decreases as water mass flow increases. Finally the results obtained from the developed model are validated by comparing with the measured data. The research was carried out by Shuobing Yang et. al on modelling on the fluid temperature distribution of a spiral heat exchanger [5]. They derived a non linear model by investigating a small volume of spiral heat exchanger. They compared proposed model with the previous model. They established a nonlinear mathematical model. They finally concluded that model of spiral heat exchanger based on Bessel function and verified that simulation results obey the heat exchange principle. The research was carried out by M. Ghobadi et. al on heat transfer and pressure drop in a spiral square channel [6]. They fabricated spiral channel on a copper plate. They performed experiments once with fluids entering from the side of the spiral channel and existing from the middle of the spiral channel and vice-versa. They noticed heat transfer behaviour for different flow rates from laminar to turbulent flow. They observed heat transfer increased due to the spiral geometry. They finally concluded heat transfer and pressure drop performance of spiral heat exchanger channel for four different silicone oils. They found that 0.65 cSt silicone oil gives better heat transfer than other fluids. They came to know that spiral channel does not increase the augmentation for low flow rates and pressure drop increases with increase in flow rates. The research was carried out by Hui Zhu et. al on experimental study on the heat transfer enhancement by dean vortices in spiral tubes [7]. They experimentally studied heat transfer enhancement in spiral tubes by controlling dean vortices like Reynolds number, fluid viscosity and curvature ratio. They also considered torsion of the spiral tube. They performed experiments under constant wall temperature with

one straight coil and 7 kinds of spiral copper tubes. They concluded that Nusselt number increases with increase in Reynolds number, viscosity and curvature ratio. They also found out that pressure drop increases with increase in Reynolds number. They noticed that heat transfer performance of spiral tube is better than a straight tube. They developed a correlation equation of heat transfer enhancement by dean vortices obtained through multiple regressions. The research was carried out by Rajavel and Saravanan on an experimental study of spiral plate heat exchanger for electrolytes[8]. They investigated convective heat transfer coefficient for electrolytes using spiral heat exchanger. They varied the mass flowrate, temperature and pressure of the cold fluid, keeping the mass flowrate of hot fluid constant. They concluded that heat transfer coefficient increases with increase in Reynolds number of electrolytes which increases the Nusselt number. The data obtained from the experimental study compared with the theoretical data. They have also developed a new correlation based on experimental data for practical application. The research was carried out by Xinjun Li on the numerical analysis of spiral heat exchanger[9]. He used lumped parameter method and established a mathematical model for spiral heat exchanger. He used finite difference method for obtaining a differential equation and calculated steady temperature field of spiral heat exchanger. He concluded that response time is not affected by the temperature or the flow rate of the heat source. He also came to know that the maximum error between two methods was 5% only which proves that lumped parameter method is right. He finally concluded that lumped parameter plays an important role in guiding design and analysis of the spiral heat exchanger.

### III. METODOLOGY

The experimental setup for the Spiral Plate Heat Exchanger includes two large storage tanks, one for storing the hot fluid and the other for storing the cold

fluid. There are two pumps (0.5 hp) connected to the tanks, one at the side of either tank. They provide the driving force required to push the fluids into the respective inlet nozzles of the heat exchanger and to maintain the flow within the unit. The fluid is pumped through the pipes, i.e., the tank outlets which have valves fitted on them to adjust the flow rate. One of the pipe is connected between the outlet of the cold fluid storage tank and the inlet nozzle of the shell (top) while the other pipe is attached to the shell outlet nozzle (front) and is let out into the tank at the other end. On the other hand, one of the pipe is connected between the outlet of the hot fluid storage tank and inlet nozzle of the coil (back) while the other pipe is attached to the coil outlet nozzle (top) and is let out into the tank at the other end. Pipe is attached to the outlet nozzle located towards the bottom of the shell at the back. This acts as the drain. The pipes are provided with adequate sized horse clips fixed at the point of attachment to the nozzles of the Spiral Plate Heat Exchanger, to hold the pipes firmly in place. The drain at the back is provided with a valve that can be opened and shut as and when required.

### IV. PROCEDURE

The two tanks are initially filled with the respective fluids up to approximately 75% of their capacity. The heating system is switched on, activating the pumps. Heating commences and is continued till the required (predefined) temperatures are attained. The fluids are pumped through the pipes at a specific flow rate, which can be adjusted using the valves fitted to the pipes. Prior to that, the flow rates are measured. The valve of the drain at the bottom is initially kept shut so that the fluid entering the channel is not allowed to escape. Both the channels are allowed to fill up completely. Since the fluid in the coil, i.e. the hot fluid is not linked to the drain directly; there will be some amount of residual fluid in the coil from the earlier runs. Hence, care should be taken to ensure

that the temperature readings from the fluid in the coil are taken only after the residual fluid has been emptied. Heat exchange takes place and the temperature readings of the inlet and outlet of the hot fluid and those of the cold fluid are noted. Log Mean Temperature Difference (LMTD) is calculated using these readings. Reynolds number and Prandtl number are also calculated accordingly, using the values of the flow rate. The flow rates are varied and the procedure is repeated. The values of Reynolds number, Prandtl number and the heat transfer co-efficient, heat transfer rate, heat transfer area, effectiveness and number of transfer units are obtained.

### V. CALCULATION METHODOLOGY

The heat released or absorbed is calculated using the expression,

$$Q = \dot{m} C_p \Delta T \tag{1}$$

Where,  $\dot{m}$  is hot or cold fluid flow rate,  
 $C_p$  is specific heat capacity of hot or cold fluid,  
 $\Delta T$  is Temperature difference of hot and cold fluid.

To calculate theoretically the Nusselt number for cold fluid shell side a new correlation was established which fit the experimental data,

$$Nu = 1.7 (Re)^{0.4} (Pr)^{0.4} \tag{2}$$

Similarly to calculate theoretically the Nusselt number for hot fluid tube side,

$$Nu = 1.7 (De)^{0.4} (Pr)^{0.4} \tag{3}$$

Where,  
 Nu= Nusselt Number,  
 De= Dean Number of hot fluid,  
 Pr =Prandtl Number of cold fluid

To calculate heat transfer coefficient (h) of cold and hot side fluid,

$$Nu = \frac{h d_e}{k} \tag{4}$$

$$h = \frac{Nu k}{d_e} \tag{5}$$

$k$  = Thermal conductivity of hot or cold fluid,  
 $d_e$ = Equivalent diameter shell side or tube side  
 To calculate theoretically Overall heat transfer coefficient (U),

$$\frac{1}{U} = \frac{1}{h_i} + \frac{1}{h_o} + \frac{t_s}{k_s} \tag{6}$$

Experimentally Overall heat transfer coefficient is calculated as

Logarithmic mean temperature difference (LMTD) can be found from the following equation

$$\Delta T_{lm} = \frac{(T_1 - T_3) - (T_2 - T_4)}{\ln \left[ \frac{T_1 - T_3}{T_2 - T_4} \right]} \tag{7}$$

Where,  
 $T_1$ =Hot water inlet temperature;  
 $T_2$ = Hot water outlet temperature;  
 $T_3$ =Cold water inlet temperature;  
 $T_4$ =Cold water outlet temperature

Experimental Overall Heat transfer coefficient (U) is estimated from the following equation,

$$U = \frac{Q}{A \Delta T_{lm}} \tag{8}$$

Capacity Ratio (R)

$$R = \frac{(\dot{m} c_p)_{min}}{(\dot{m} c_p)_{max}} \tag{9}$$

Fin Analogy number is calculated by following equation

$$F_a = \frac{NTU(1-R)}{2} \tag{10}$$

Efficiency is calculated by following equation

$$\eta = \frac{\tanh(Fa)}{Fa} \quad (11)$$

Effectiveness ( $\epsilon$ ) of the heat exchanger,

$$\epsilon = \frac{(T_4 - T_3)}{(T_1 - T_3)} \quad (12)$$

## VI. RESULT AND DISCUSSION

The performance characteristics of spiral heat exchanger for different concentration acetic acid – water system is studied. The cold fluid concentration is varied from 5% to 30% respectively. The effects of heat transfer coefficient with respect to Reynolds number is studied for both co-current and counter flow arrangements as shown in figure 1.

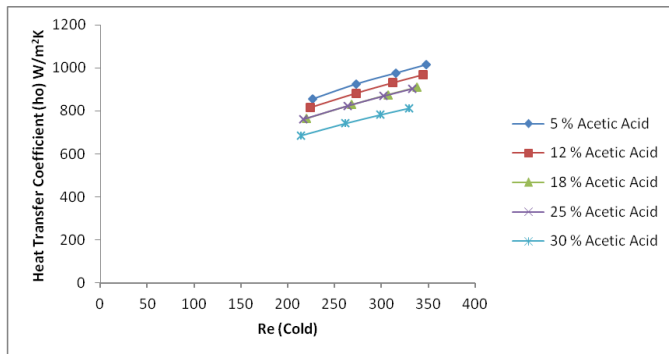


Fig. 1: Heat Transfer Coefficient (Cold) Vs Reynolds Number (Cold) for Acetic Acid-Water System

It is observed that heat transfer coefficient increases with increase in Reynolds number for all four cold water flow rate from 0.0833 Kg/sec to 0.133 Kg/sec for both co-current and counter current flow.

## VII. CONCLUSION

Experiments were performed on spiral heat exchanger with different cold water flow rates and different concentration of cold fluids in parallel and counter current flow arrangements. The result shows that heat transfer coefficient increases linearly with Reynolds number for four different cold water flow rate which is satisfactory for spiral heat exchanger.

## VIII. REFERENCES

- [1]. Dr M A. Hossain, M I. Islam, S A. Ratul, MT U R. Erin, " Comprehensive Study on Heat Transfer Co-efficient and Effectiveness for Water Using Spiral Coil Heat Exchanger" Proceedings of the Global Engineering, Science and Technology Conference 2012 28-29 December 2012, Dhaka, Bangladesh.
- [2]. Jay J. Bhavsar, V. K. Matawala, S. Dixit, "Design and Experimental Analysis Of Spiral Tube Heat Exchanger", International Journal of Mechanical and Production Engineering, ISSN: 2320-2092, Volume-1, Issue-1, July-2013.
- [3]. Geun-jong Yoo, Hoon-ki Choi, Wa-ryong Dong, "Fluid flow and heat transfer characteristics of spiral coiled tube: Effects of Reynolds number and curvature ratio", Journal of Central South University, , Volume 19, Issue 2 , pp 471-476, February 2012.
- [4]. Paisarn Naphon, Somchai Wongwises, "A study of the heat transfer characteristics of a compact spiral coil heat exchanger under wet-surface conditions" Experimental Thermal and Fluid Science" 29 , 511-521, 2005.
- [5]. Shuobing Yang, Kohsuke Fukawa and Mingcong Deng, "Modeling on the Fluid Temperature Distribution of a Spiral Heat Exchanger", 2014 IEEE International Conference on Automation Science and Engineering (CASE) Taipei, Taiwan, August 18-22, 2014
- [6]. M Ghobadi , Y. S. Muzychka, " Heat transfer and pressure drop in a spiral square channel", Experimental Heat Transfer: A Journal of Thermal Energy Generation, Transport, Storage, and Conversion, 28:6, 546-563, 2015.
- [7]. Hui Zhu1 , Hanqing Wang2 , Guangxiao Kou2, "Experimental study on the heat transfer enhancement by Dean Vortices in spiral tubes", International Journal Of Energy And Environment, Volume 5, Issue 3, pp.317-326, 2014.
- [8]. Dr. Rajavel Rangasamy, "Experimental and Numerical Studies of a Spiral Plate Heat Exchanger" Thermal Science 00 (2013): 131-131.
- [9]. Xinjun Li, "The Numerical Analysis of Spiral Heat Exchanger", Advanced Materials Research, Vols. 860-863, pp 1474-1477, 2014.

# Ethnomedicinal plants used to cure skin diseases by the Nepali community of Nagaon and Sonitpur Districts of Assam, India

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## ABSTRACT

The Present Study Was Conducted In Nagaon And Sonitpur Districts Of Assam, India To Document The Medicinal Plants Which Are Being Used By The Nepali Community To Cure Various Skin Diseases. Study Documented 25 Plant Species Belonging To 21 Families Of Which Are 7 Trees, 8 Shrubs, 7 Herbs And 3 Climbers. The Various Skin Diseases Treated By Them Include Boils, Scabies, Ringworm, Pimples, Burns, Itches And Dandruff.

**Keywords :** Medicinal Plants, Skin Diseases, Nepali community, Nagaon and Sonitpur districts, Assam.

## I. INTRODUCTION

Indian traditional medicine is based on the different systems such as Ayurveda, Siddha and Unani used by the various communities (Gadgil 1996). World Health Organization estimated that over 80% of the people in developing countries depend on the traditional medicines for their primary health needs (Shankar *et al.* 1993). There are estimated to be around 25,000 effective plant-based formulations, used in folk medicine and known to the rural communities in India (Ramakrishnappa 2000). Village communities from various ecosystems used largest proportion of biodiversity for human and veterinary healthcare. Of all the organisms, medicinal plants have been greatly considered by the rural communities as they improve the economy of the rural people. Thus there is now urgency for ethnobotanical research amongst the aboriginal people (Ojha 2000; Maheswari 1983). Today there is an increasing desire to document the role of ethno-botanical studies in trapping the centuries old traditional folk knowledge as well as searching for new plant resources for food, drugs, etc.

People living in the developing countries rely quite effectively on the traditional medicine for primary health care (Jain1987; Sullivan *et al.*1997; Singh 2002).

Since medicinal plants are nontoxic and easily affordable they play a vital role not only for pharmacological research and drug development, but also when plant constituents are used directly as therapeutic agents and as starting materials for the synthesis of drugs (Verma 2016).

The knowledge of medicinal plants has been accumulated in the course of many centuries based on the different Indian systems of medicines such as Ayurveda, Unani and Siddha. Medicinal plants play a major role in the rural areas of the third world countries. The role of medicinal plants in resolving health problem is invaluable on a global scale. In India, it is reported that traditional users use 2500 species of plants and 100 species of plants serve as regular source of medicine (Lev 2006). During the last few decades there has been increased interest in the study of medicinal plants and their traditional use in



different parts of the world (Rossato 1999). Documenting the indigenous knowledge through ethnobotanical studies is important for the conservation and utilization of biological resources. In recent years, there has been a tremendous range of interest in the medicinal plants especially those used in Ayurvedas and other traditional systems of medicines. Allopathic drugs have brought a revolution throughout the world but the plant based medicines have its own unique status. There is an urgent need to document the ethno-biological information presently existing among the diverse communities before the traditional knowledge is completely lost (Rao, 1996). Skin disease is a common ailment. Skin complaints affects all ages of people from the neonate to the elderly and cause harm in number of ways. The physical inspection of the skin and the mucous membranes makes foundation of an exact analysis of the skin membrane conditions ( Korpenwar 2012). These conditions are mostly present with skin exterior changes (wound) which have additional or fewer discrete features (Madhu et al. 2011). Due to change in livelihood and environmental degradation, the traditional knowledge faces the risk of disappearing before documentation. Therefore, in the present paper, an attempt has been made to document the list of ethno-medicinal plants used to cure skin diseases by the Nepali community of Nagaon and Sonitpur District, Assam.

Nepali community, amongst different communities existing in Assam, is one such community which has rich cultural heritage. Nepalis are scattered all over Assam and other North Eastern states as well. However, in Assam Nepalis are mostly concentrated in the district of Sonitpur.

## II. METHODS AND MATERIALS

**2.1 Study area:** The study has been conducted among the Nepali community during March 2011-October 2014 in Missa, Jakhlabandha and Sulung

villages of Nagaon district and Tezpur, Biswanath Chariali, Gohpur and Dhekiajuli villages of Sonitpur district of Assam.

The primary information regarding the use and values of plants were collected during the field work using standard survey techniques ( Deshmukh et al. 2011) that includes individual and in-depth interviews, and group discussion among the local plant users, community members and healers (*ojah/dhami*), persons having indigenous knowledge etc. Ethno-medicinal information was collected through questionnaire. The set questions contained the local name of the plants used to cure skin diseases; the plant part used for this purpose and the mode of administration of the plant materials. The interviews were performed in Nepali language for which interpreters were used. Some of them were well versed with Assamese language. After the interview, the informants were asked to supply the plant specimens and often they accompanied to the field to collect plant materials. Particularly visits to Bura Chapori Wildlife Sanctuary and Dhekiajuli in Sonitpur district Assam were fruitful. A few elderly ladies were particularly helpful in some cases. Details of use including the approximate amounts and number of doses were recorded for specific diseases for authentication and validation of method (Jain S.K, 1987).

The collected plant specimens were processed into mounted herbarium sheets (Jain and Rao, 1977) and were identified with the help of various literature including Hooker (1872- 1897), Kanjilal et.al. (1934-1940), Bor (1940); Deb (1961 a,b) and Sinha (1987), Kritikar and Basu, (1993) and by consulting experts. Identification of specimens was confirmed by matching at the herbarium of Assam University, Silchar and at the Botanical Survey of India (Eastern Circle), Shillong. Secondary informations were collected by

reviewing numerous published works related to the present study and are referred appropriately.

For this work necessary permission was taken from the Community leaders for publishing the knowledge imparted by them.

Almost all the possible information regarding the medicinal uses of the collected plants by the Nepali community have been included in the text/result.

### III. RESULTS AND DISCUSSION

Data collected through the survey in Sonitpur and Nagaon districts Assam led to the record of 25 species of plants representing 22 genera from 21 families which are used to treat the different types of skin diseases.. These include plants of different habit groups including herbs (7 spp. or 28%), shrubs (8 spp. or 32%), trees (7 spp. or 28%) and climbers (3 spp. or 12%). For each species, scientific and local names, family, parts used and uses are presented in Table 1 and Figure 1. The most commonly represented families were Amaranthaceae (3 spp.), Solanaceae and Cucurbitaceae (2 spp.) each. Different plant parts were used for the treatment of various skin diseases. In general, leaf (10 spp.) was highly used followed by fruit (5 spp.), bark (4 spp.), root (4 spp.), rhizome, seed and latex (2 spp. each), whole plant and bulb (1 spp. each) (Figure 2). These plants were used for the treatment of various skin diseases such as boils, scabies, ringworms, allergy, pimples and acnes, burns, itches and dandruff. In majority of cases, the herbal medicines were prepared in the form of juice and paste. Maximum numbers of plants were used for boils (8 spp.) followed by scabies and ringworms (4 spp.), allergy and pimples (3spp.), burns, itches and dandruff (1 spp.) each (Figure 3).

The present investigation revealed that out of the total of 25 species, 8 species (*Achyranthes aspera*, *Alstonia scholaris*, *Amaranthus gangeticus*, *Bombax cieba*, *Ficus racemosus*, *Melia azedarach*, *Trichosanthes anguina* and *Trichosanthes dioica*) have found new uses as ethnomedicine used for curing skin diseases by the Nepali community of Nagaon and Sonitpur districts of Assam. (Table 1)

The rural people preferred preparing medicines by combining several plants since the combination rapidly cures the disease and also enhance the immunity power of the patients. This is constant with the other general observation which has been reported earlier in relation to medicinal plant studied by Indian traditional system (Balaraju *et al.* 2015).

Global trend of interest in the conventional system of medication can be noticed in recent previous years. In the development of health care ethno-botanical studies have develop into increasingly helpful. Medicinal plants are rich sources of antimicrobial agents. Majority of the people of the world presently depends on conventional traditional medicinal plants which were used as remedies to cure various skin infectious diseases (Sheher Bano *et al.* 2013).

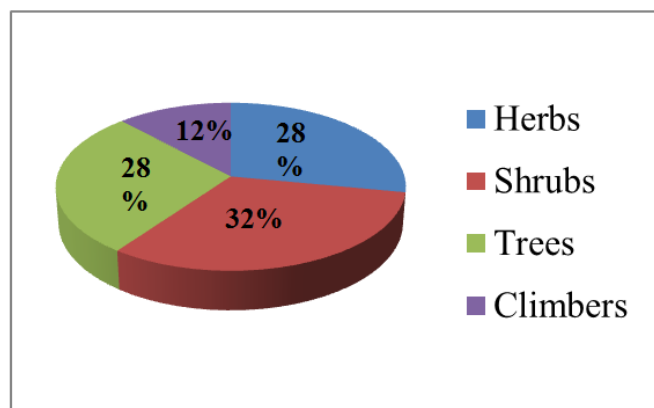


Fig.1. Different habit –group of plants used by the Nepali community of Nagaon and Sonitpur Districts of Assam to cure skin diseases.

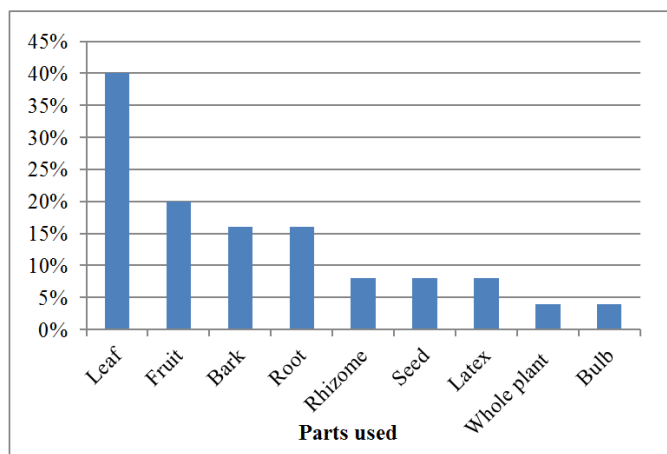


Fig. 2. Percentage of plant parts used as Ethno-medicine by the Nepali community of Nagaon and Sonitpur Districts of Assam to cure skin diseases

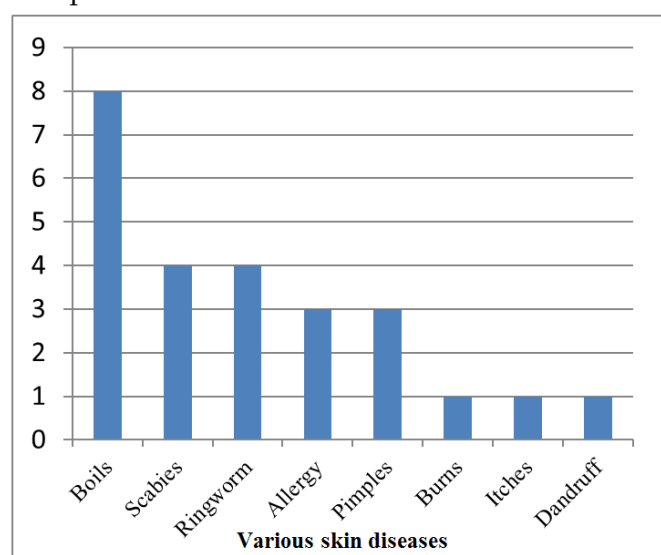


Fig.3. Number of plant species used for curing various skin diseases by the Nepali community of Nagaon and Sonitpur Districts of Assam

#### IV. CONCLUSION

The Nepali community is heavily dependent on the plant products and believes in their various remedial properties since long. The traditional healers of this area grow many of their required plants in their home gardens and the remaining plants are collected from the nearby wild vegetation. All their knowledge on ethno-medicine has been transmitted orally through the generations and most of these are closely guarded treasures. Therefore, there is no written document.

It has also been noticed that the younger generation have least interest to learn the uses of these plants. Therefore, it is important to survey and document their indigenous knowledge at the earliest. At the same time the wisdom of the community on the process of preparation by the medicine-men and their utilization should be given due importance.

These ethno-medicinal plants are also a source of income for the local Nepali community. In these regions, the traditional communities collect medicinal plants from the wild and sell those in the local market. Over – exploitation and unscientific tapping by the ignorant local people have resulted in the loss of many important plants. Many of these plants are on the brink of extinction at least in local vegetation and there is an urgent need to conserve such plants with high medicinal value to ensure their existence and sustainable utilization. These plants must be protected from the massive, indiscriminate deforestation and uncontrolled exploitation.

#### V. ACKNOWLEDEMENT

Authors are grateful to the local resource persons who have shared their indigenous knowledge and continuously helped during the field work as well for their kind co-operation.

Cite this article as :

#### VI. REFERENCES

- [1]. Balaraju, S. Ramamurthy, N. Konkala, A. Suresh, S." Ethnomedicinal plants used to cure skin diseases by tribals of Mahabubnagar district, Telangana state". *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, 2015, vol.10:25-27
- [2]. Bor, N.L. "Flora of Assam". Vol. V Govt. of Assam, Shillong 1940.

- [3]. Deb, D.B. "Monocotyledonous plants of Manipur Territory." *Bull. Bot. Surv. India.* 1961a. 3(2): 115-138.
- [4]. Deb, D.B. "Dicotyledonous plants of Manipur Territory." *Bull. Bot. Surv. India* 1961b. 3(3): 253-350.
- [5]. Deshmukh, V.R., Ratod, V.N. & Pardeshi, V.N. "Ethnoveterinary medicine from Jalna district of Maharashtra state." *Indian Journal of Traditional Knowledge* 2011. 10(2): 344-348.
- [6]. Jain, S.K. , Rao, R.R.."Hand book of field and herbarium methods".New Delhi 1977.
- [7]. Kanjilal, U.N., Kanjilal, P.C., Das A. & Purkayastha "Flora of Assam". (Vol. I & II). Govt. of Assam, Shillong 1934-1936.
- [8]. Kanjilal, U.N., Kanjilal, P.C., Das, A. & De R.N. "Flora of Assam". (Vol. III- IV). Govt. of Assam, Shillong. 1938-1940.
- [9]. Kirtikar, K.R., Basu, B.D. "Indian Medicinal plants".1933. Vol. 1-4 Allahabad, India.
- [10]. Kirtikar, K.R., Basu, B. D. "Indian Medicinal plants". Vol. I-IV. Periodicals Experts Book Agency. Delhi, India. 1982. 1-86.
- [11]. Korpenwar A.N. "Ethnomedicinal Plants Used To Cure Skin Diseases In Ambabarwa Wild Life Sanctuary Area Of Buldhana District (M.S.), India." *International Journal of Recent Trends in Science and Technology*, 2 (3): 2012, 36-39
- [12]. Lev E, "Ethno-diversity within current Ethnopharmacology as part of Israeli traditional medicine- A review." *Journal of Ethnobiology and Ethnomedicine*, 2006, 2-4.
- [13]. Ojha H.R., "Current policy issues in NTFP development in Nepal, (Asia Network for Small Scale Bio-resources, Kathmandu, Nepal)," 2000.
- [14]. Maheswari J.K. "Development in ethnobotany." editorials, *J Econ Tax Bot*, 4(1), 1983, 1-4.
- [15]. Singh J.S. "The biodiversity crisis: A multiplication review." *Current Science*, 82(6), 2002. 638.
- [16]. Singh J.S., "The biodiversity crisis: A multiplication review." *Current Science*, 82(6), 2002. 638.
- [17]. Sullivan K., Shealy C.L.," Complete natural home remedies". Element books limited, Shaftsbury, UK, 1997.
- [18]. Gadgil M., "Documenting diversity: An experiment". *Current Science*, 70(1), 1996, 36.
- [19]. Madhu, V., Arra R.Y." Investigations on Ethnomedicinal plants used to cure skin diseases in Adilabad District, Andhra Pradesh." *India. Int. J. of Pharm. and Life Sci.*, 2(5): 2011. 742-745.
- [20]. Ramakrishnappa K. "Impact of cultivation and gathering of medicinal plants on Biodiversity: Case studies from India .In: Biodiversity and the Ecosystem Approach in Agriculture, Forestry and Fisheries FAO "2000.
- [21]. Rao, R. R. "Traditional knowledge and sustainable development: Key role of Ethnobiologist, Ethnobotany ".1996. 8:14-24
- [22]. Rossato, S.C. Leitao-filho, H. Gegossi, A. "Ethnomedicinal knowledge of the Alantic forest coast (Brazil), *Economic Botany*." 53, 1999, 387-395.
- [23]. Shankar,D. , Majumdar, B. "Beyond the biodiversity convention: The challenges facing the biocultural heritage of India's medicinal plants. In: Medicinal plants for forest conservation and health care, (Non-wood forest products Services)." 1993. 11,163.
- [24]. Sinha, S.C." Ethnobotany of Manipur- Medicinal Plants. "*Front. Bot.* 1987. 1: 123-152.
- [25]. Sunita V." Medicinal plants used in cure of skin diseases." *Advances in Applied Science Research*, 2016, Vol. 7(3):65-67

**Table 1** : Medicinal plants used for curing different types of skin diseases

Sl. No.	Plant species	Local name	Parts used	Uses
1	<i>Achyranthes aspera</i> L. Amaranthaceae	Apamarga	Root	Root pieces are soaked in the water for overnight and given next morning in empty stomach for 7 days to cure allergy.
2	<i>Allium sativum</i> L. Amaryllidaceae	Lasun	Bulb	Bulb paste mixed with leaf paste of <i>Ocimum canum</i> and coconut oil applied on face as face pack for pimples and acne.
3	<i>Alstonia scholaris</i> (L.) R.Br. Apocynaceae	Chatyan	Bark	Bark paste is applied in skin diseases.
4	<i>Amaranthus gangeticus</i> L. Amaranthaceae	Morisa	Leaf	Leaf paste is applied on the boils.
5	<i>Amaranthus spinosus</i> L. Amaranthaceae	Khutura	Root	Root poultice is applied on boils to hasten suppuration.
6	<i>Basella alba</i> L. Basellaceae	Puii saak	Leaf	Leaf paste is applied as lotion in burns.
7	<i>Bombax cieba</i> L. Bombacaceae	Simal	Bark	Paste of bark is applied to cure scabies.
8	<i>Chromolaena odorata</i> (L.) R.M. King & H.E.Robinson Asteraceae	Jarmoni bon	Leaf	Leaf paste with the leaf paste of <i>Achyranthes aspera</i> and <i>Scarpia dalcio</i> is applied externally on the boils.
9	<i>Cissampelos pareira</i> L. Menispermaceae	Tikunthyak	Rhizome	Juice of rhizome is given to cure any kind of skin diseases.
10	<i>Citrus limon</i> (L) Osbeck Rutaceae	Thulla nimbu	Fruit, seed	Paste is good for any kind of skin disease and pimples.
11	<i>Clematis gouriana</i> Roxb. Ranunculaceae	Baghjunge	Leaf	Leaf juice is applied externally to cure skin diseases.
12	<i>Curcuma longa</i> L. Zingiberaceae	Holdi	Rhizome	Paste is applied on pimples, ringworm and other skin diseases.
13	<i>Dandrocniide sinuate</i> (BL.) Urticaceae	Suraat gacha	Leaf	Juice of leaves are used for curing various skin diseases such as ringworm, scabies, itches etc.
14	<i>Dioscorea pentaphylla</i> L. Dioscoreaceae	Jagatebhyakur	Leaf	Juice of leaf is applied to treat boils.
15	<i>Ficus racemosus</i> L. Moraceae	Dumri	Latex	Latex is applied over the boils.
16	<i>Jasminum gracile</i> Andrews Oleaceae	Chameliphool	Root	Juice of root is used for the treatment of ringworm.
17	<i>Leucas plukenetii</i> (Roxb.) Spreng. Lamiaceae	Drunapuspa	Leaf	Leaf juice is mixed with leaf juice of <i>Ageratum conyzoids</i> given for allergies.
18	<i>Madhuca indica</i> Koeing. Sapotaceae	Mahua	Latex, seed	Latex from tree trunk is used to cure boils and seed paste is used to cure other skin diseases.

19	<i>Mallotus philippensis</i> Lam. Euphorbiaceae	Rohini	Fruit	Fruit juice is used to cure scabies, ringworm and dandruff.
20	<i>Melia azedarach</i> L. Meliaceae	Bakaino	Bark	Bark juice is used to cure various kinds of skin diseases.
21	<i>Moringa oleifera</i> Lam. Moringaceae	Sajina	Leaf	Leaf juice is applied on allergies.
22	<i>Solanum indicum</i> L. Solanaceae	Bhekuri	Fruit	Fruits are considered as medicinal for various skin diseases.
23	<i>Solanum torvum</i> Sw. Solanaceae	Thulla bhekuri	Leaf	Leaf paste is applied for various skin diseases.
24	<i>Trichosanthes anguina</i> L. Cucurbitaceae	Dhundali	Fruit	Paste is applied on boils.
25	<i>Trichosanthes dioica</i> (L.) Roxb. Cucurbitaceae	Potol	Fruit	Paste is applied on boils.

# Determination of Nitrate and Nitrite Contents in Tube-Well Water in Evwreni Town, Delta State

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## ABSTRACT

Ten samples of tube-well water were collected at random from Evwreni town, Delta State and sent to the laboratory. The concentration of Nitrate ( $\text{NO}_3^-$ ) and nitrite ( $\text{NO}_2^-$ ) in mg/L of tube-well water samples were analyzed, using spectrophotometer method. The result obtained show that nitrate values ranged from  $11.8 \pm 0.1$  to  $12.8 \pm 0.2$ mg/L while that of nitrite ranged from  $0.2 \pm 0.2$  to  $0.4 \pm 0.3$ mg/L and all values were within the WHO maximum acceptable concentration. The tube-well water analyzed and the results obtained are compliance with drinking water standard based on national/international guideline hat provide assurance that such tube-well water is safe for consumption.

**Keywords:** Nitrate, nitrite, tube-well, Evwreni Town.

## I. INTRODUCTION

Nitrate and nitrite are found in nature as they are the en product of the aerobic decomposition of organic nitrogenous matter as well as the decomposition of organic micro-organisms(Jagessar et al, 2011). They are naturally occurring inorganic ions present in our environments.

Nitrate ( $\text{NO}_3^-$ ) is a polyatomic ion with the molecular formula  $\text{NO}_3^-$  and produced in the absence of mineral nitrate sources, by means of various fermentation processes using urine and drug nitrates (wikipedia.org/wiki/nitrate).

Nitrate is a salt or ester of nitrous acid, containing the anion  $\text{NO}_2^-$  or the group  $\text{NO}_2$ .

Nitrates and nitrites are chemicals used in fertilizers, rodenticides and as food preservatives (USEPA, 1991).

Nitrate and nitrites occur naturally in plants food as part of the nitrogen cycle between air, land and water

environment

([www.foodstandards.gov.au/scienceeducation](http://www.foodstandards.gov.au/scienceeducation)).

In nature (soil), nitrate and nitrite can be found igneous and volcanic rocks.

Nitrate and nitrite salts completely dissolve in water. The common sources of sources of nitrates and nitrite ions are through municipal and industrial waste water, refuse dumps, animal feeds and septic systems (Nugent et al, 2011).

Nitrates and nitrites enter the ground water and made their into “tube-well” water through many sources such as agricultural activities (including over application of chemicals fertilizers and chemical manure) wastewater treatment through septic system or leaking sewages line, industrial processes, improperly functioning septic systems, motor vehicles and poor sanitary activities (Jacinthe et al, 2000).

In Niger Delta, tube well water now serves as one the easily accessed and sources of drinking water for a great number of its, towns and villages.

Exposure to high concentration of nitrate and nitrite has been linked to increased incidence of cancer in adults, possible increased incidence of brain tumors, leukemia and nose and throat tumor in children (USEPA, 1991).

Excessive levels of these nitrogen compounds in drinking water have caused services illness and sometimes death in infants less than six months of age (EFS, 2010). The primary health hazard from drinking water with nitrate – nitrogen occurs when nitrates are transformed to nitrites in the digestive system.

High concentration of nitrate are known to cause what is called “blue baby syndrome” in which the blood cannot bring enough oxygen to the body cell and tissue of babies less than six months of age ([www.riwelltesting.org](http://www.riwelltesting.org)). The nitrate ion are absorbed into the blood stream where they oxidized  $Fe^{2+}$  in the hemoglobin to  $Fe^{3+}$ . Hemoglobin containing oxidized ion known as met-hemoglobin reduces the oxygen carrying capacity in the blood (George et al, 2001).

Other symptom or health effect include shortness of breath of the skin (<http://desinh.gov/organization/water/dwgb/-index.htm>), intrauterine growth retardation (Cedergren) and nervous system defect (Brender et al, 2004).

Nitrates are fairly stable nitrogenous compounds degradable into unstable nitrates that can combine readily with other compounds in the digestive track to form carcinogenic nitrosamines (Hill, 2002).

There was a strong relation between nitrate concentrations and reoccurring diarrhea acid, 80%

cases were explained by nitrate concentration above (Gupta et al, 2010).

The total daily intake of nitrates by adults is estimated to be 51mg, which is 44.3mg from food and 6.8mg from drinking water containing nitrate at a concentration of 4.4mg/L (Kumar et al, 1993).

The World Health Organization (WHO) fixed limit of the contents of nitrates and nitrites in drinking water is 50mg/L and 3.0mg/L respectively (WHO, 2004).

The present study focuses on the assessment of nitrate and nitrite concentration in tube-well water.

## II. MATERIAL AND METHODS

**Location of the research:** Evwreni Town is an Oil Producing Community in Ughelli North Local Government Area of Delta State. It has 14 oil wells, glow and compressor status operated by the SPDC, which produces 15,000 barrels of crude daily from the area since 1996 (31 Jan. 2000).

Evwreni is made up of six (6) major quarters: Urhevwe, Uruekpo, Uvwotie, Okpawha, Ogbudu and Uneni. There is no definite population census figure but it is one of the largest Community in Ughelli North Local Government Area.

It is 154.6 kilometers by road to Port Harcourt and 45.3 kilometers to Warri.

### Sample collection and analytical process

Ten samples of tube-well water were collected from ten different sites in Evwreni Town. The samples were collect into a clean 1.5litres plastic bottles. The bottle were washed and rinsed with tube-well water before collection. The plastic battles were particularly filled with the samples of tube-well and tightly covered.



The temperature of samples were measured, recorded and labeled from 0 to 10 in triplicates, taken to the laboratory and analyzed for nitrate and nitrite contents.

#### Nitrate Determination

10ml of nitrate stock solution was pipette into a beaker, 5ml of HCl and 2ml of Zn/NaCl granular mixture were added and allowed to stand for 30 minutes, with occasional stirring to form nitrite. Then the solutions were filtered into 100ml standard flask using Whatman No 1 filter paper and diluted up to mark.

Aliquot of stock solution containing 0.26-10.7 $\mu$ g/ml of reduced nitrate were transferred into series of 10ml standard flask, 1ml of 0.5% Sulfanilic acid 1ml of 2mol/HCl solution were added and shaken thoroughly for 5 minutes. (Diazotization). Then 1ml of 2 mol/l NaOH solution was added to for an azo dye. The contents were diluted to 10ml with water and the absorbance of the red colour dye was measured at 540nm against the corresponding reagent blank, using Jenway 754 UV-visible spectrophotometer.

#### Nitrite Determination

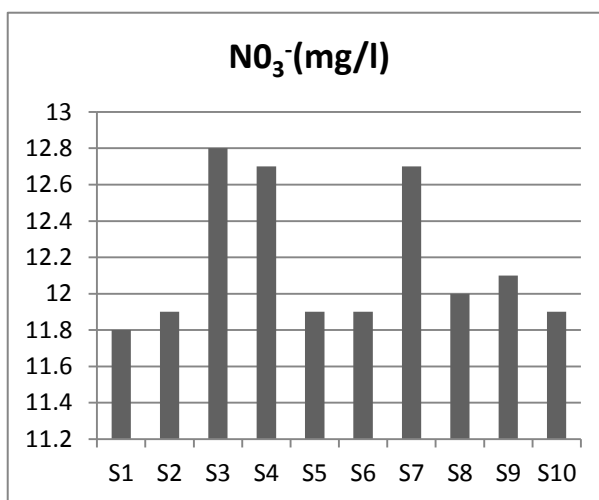
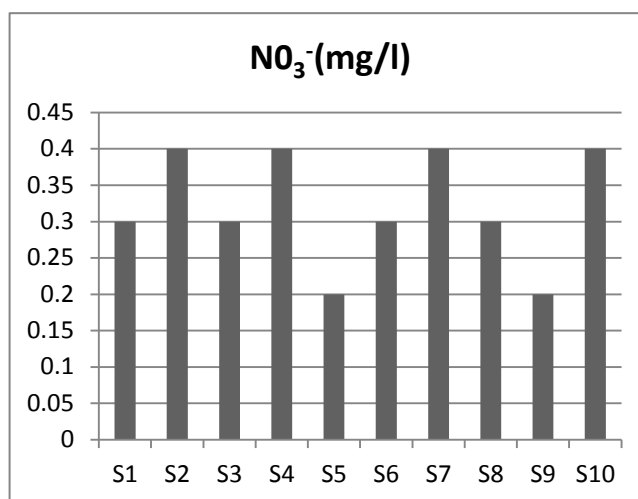
Aliquot of stock solution containing 0.2-8.0 $\mu$ g/l of nitrite were transferred into series of 10ml calibrated flask. To each flask 1ml of 0.5% sulfanic acid and 1ml of 2mol/l HCl solution were added and the solution was shaken thoroughly for 5 minutes. (Diazotization reaction). Then 1ml of 0.5% methyl anthranilate and 2ml of 2mol/l NaOH solution were added to from azo dye and the contents were diluted with 10ml using water. Then absorbance of the red coloured dye was measured at 540nm against the corresponding reagent black, using Jenway – UV-visible spectrophotometer.

### III. RESULT AND DISCUSSION

Table 1: Nitrate and nitrite content of tube-well water sample.

S/N	Samples	NO <sub>3</sub> <sup>-</sup> (mg/l)	NO <sub>2</sub> <sup>-</sup> (mg/l)
1	S1	0.3 ± 0.2	11.8 ± 0.1
2	S2	0.4 ± 0.3	11.9 ± 0.2
3	S3	0.3 ± 0.4	12.8 ± 0.2
4	S4	0.4 ± 0.1	12.7 ± 0.2
5	S5	0.2 ± 0.2	11.9 ± 0.2
6	S6	0.3 ± 0.2	11.9 ± 0.2
7	S7	0.4 ± 0.1	12.7 ± 0.2
8	S8	0.3 ± 0.3	12.0 ± 0.1
9	S9	0.2 ± 0.5	12.1 ± 0.1
10	S10	0.4 ± 0.3	11.9 ± 0.2
		PL:WHO SID	3      50

Results are expressed in mean +STD test were carried out in triplicates



The nitrate values obtained ranged from 11.8 + 0.1 to 12.8 + 0.2. The highest contents of nitrate was 12.8 + 0.2mg/L for samples S3 while the lowest was 11.8 + 0.1 for sample S5 and all were below the maximum acceptable concentration (50mg/L). The nitrite levels ranged from 0.2 + 0.2 to 0.4 + 0.3mg/L for sample S5 and sample S2 / S10 respectively. The highest contents of nitrite was 0.4 + 0.3mg/L while the lowest was 0.2 + 0.2mg/L and all were within the WHO maximum acceptable concentration (3.0mg/L).

#### IV. CONCLUSION AND RECOMMENDATIONS

The nitrate and nitrite concentration from this research work provided data about the quality of the tube-well water quality in Ewewni town. The concentration of nitrate and nitrite were below the maximum acceptable concentration set by WHO.

The fact that the level of both nitrate and nitrite in the tube-well water was below most international standards, authority should not stop water quality assessment and monitoring in regular basis. There is need for home treatment system to be installed in order to remove nitrate and nitrite from tube-well water.

#### V. REFERENCES

- [1]. Brender, J.D., Olive, J.M., Falkner, M., Suarez, L., Marckwardt, W., Hendricks, K.A. (2004). Dietary nitrites and nitrates, nitrosable drugs, and neutral tube defects. *Epidemiology*. 20:330-336.
- [2]. Environment fact sheet (EFS) (2010). Nitrate and Nitrite in Drinking Water, [www.des.nh.gov](http://www.des.nh.gov).
- [3]. George, M, Wiklund, L., Aastrup, M., Pousette, J., Thinholm, B., Saldeen I., Wernroth, L., Zuren, B., Holmberg, L., (2001). Incidence and geographical distinction of sudden infant death syndrome in relation to content of nitrate in drinking water and groundwater level: *Eur J. Clin. Invest.*, 31(12): 1083-1094.
- [4]. Gupta, S.K., Gupta, R.C., Gupta, A.B; A.K. Bassin J.K., GuptaA., Sharma, ML (2010). Recurrent diarrhea in children, living in areas with high levels of nitrite in drinking water, *Arch-Environ-Health*. 56(4):369-73
- [5]. Hill, M. (2002), Nitrate and Nitrite in food and water, London, Ellis Horwood Publishers, pp 195.
- [6]. <http://desinh.gov/organization/water/dugb/index.htm>.
- [7]. Jacinthe, P.A., W.A. Dick and LC Brown (2000). Bioremediation of nitrate contaminated shallow soil and water via water table magt. techniques: Evaluation and release of nitrous oxide, "Soil biology and biochemistry, vol. 32 (3): pp 371 – 382.
- [8]. Jagessar, R.C., Sooknundun, J. (2011), "Determination of nitrate anion in waste from nine selected area of coastal Guyana via spectrophotometric method". *IJRRAS* 7(2): 203-212.
- [9]. Kumar, B.S.M., Srikanth T.R., Belasubramanian, N., (1993) "Spectrophotometric determination of nitrogen dioxide in air". *Fresenius J. Anal. Chem.* 345: 592-594.
- [10]. Nurgent M, Liposey and Wisdom (2011). Ground water Hydrology. *Enu.Sci.Tech.*362138.
- [11]. U. S. Environment Protection Agency (1991) "Registration Eligibility Decision: Inorganic Nitrate/Nitrite ("Sodium and Potassium Nitrates"). [www.epa.gov/oppsrrdi/REDS/old](http://www.epa.gov/oppsrrdi/REDS/old).
- [12]. WHO (World Health Organization) (2006). WHO Guidelines for Drinking Water Quality: First addendum to third Edition Volume 1.
- [13]. [Wikipedia.org/wiki/nitrate](http://Wikipedia.org/wiki/nitrate).
- [14]. [www.foodstandards.gov.au/scienceeducation](http://www.foodstandards.gov.au/scienceeducation).
- [15]. [www.riwelltesting.org](http://www.riwelltesting.org).

# Determination of Some Heavy Metals and Physicochemical Properties in Samples of Tube-Well Water in Evwreni Town, Delta State

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## ABSTRACT

Ten samples of tube-well water were collected at random from Evwreni town, Delta State and were analyzed for heavy metals and physicochemical properties using atomic absorption spectrometer and standard methods respectively. The pH values were between 6.0 and 6.6, within the WHO maximum acceptable concentration. The conductivity values were between 66 to 99 $\mu$ s/cm, TDS value ranged from 60 to 85.5. The lead (Pb) ranged from 0.001 to 0.006mg/l, Copper (Cu) 0.2 to 0.9mg/l, iron (Fe) 0.3 to 0.7mg/l, Zinc (Zn) 0.1 to 0.3mg/l, Chromium (Cr) 0.1 to 0.5mg/l. All the values were below WHO maximum acceptable concentration.

**Keywords :** Physicochemical, Chromium, Copper, TDS, EDTA

## I. INTRODUCTION

Drinking water is one of the most significance elementary needs for the survival of life span [1]. Throughout the entire world more than one billion people are faced with deficit of sufficient nontoxic water and among those more than 800 million in village areas are at threat for drinking water [2].

Water is the elixir of life and it is necessary for survival of all living things. Water makes up of more than one thirds of the weight of human body [3].

Man needs water for industrial development, navigation, irrigation to grow food, generation of hydro-electricity power, recreation and enhancement of fish, wildlife and host of other purposes [4].

Water resources have been the most exploited natural system since the world began and it is used for domestic, industrial and agricultural activities [5].

In Nigeria, especially in Niger Delta State area, tube-well serves as the most easily accessed and cheap

source of drinking water for a greater number of 140 million people.

Water is the most important natural resources without which life would be nonexistent. Portable good water is already a limited source in many parts of our country and the whole world. Safe drinking water is a basic need for good health and it is also a basic right of humans.

Water posses the power of life and it is a constant auxiliary to our daily life, social organization, economic, ambition and function [6].

Heavy metals are those with a density range from above 3.0g/cm<sup>3</sup> to 7g/cm<sup>3</sup>, atomic weight greater than sodium (23), atomic number greater than 20, found in period four (4) and above [7].

Nearly, all types of water contain heavy metals, many of which results from the natural wecdthermy of the surface of the earth [8].

In thousands of villages across the globe unsafe water from heavy metal contaminated is causing death and fatal diseases [9].

Water bodies are getting adulterated uninterruptedly with metals because of removal of solid waste and influenced by industries as well as domestic dirt [10].

The infants and younger populations are more prone to the toxic effects of heavy metals, as the rapidly developing body systems in the fetus. Infants and young children are far more sensitive [11]

## II. MATERIAL AND METHODS

### Location of the Research:

Evwreni Town is an Oil Producing Community in Ughelli North Local Government Area of Delta State. It has oil wells, glow and compressor status operated by the SPDC, which produces 15,000 barrels of crude daily from the area since 1996.

Evwreni is made up of six (6) major quarters: Urhevwe, Uruekpo, Uvwotie, Okpawha, Ogbudu and Uneni. There is no definite population census figure but it is

one of the largest Community in Ughelli North Local Government Area. It is 154.6 kilometers by road to Port Harcourt and 45.3 kilometers to Warri.

### Sample collection and analysis

Ten samples of 75ml of tube-well water were collected in clean plastic bottles from different quarters in Evwreni town. The samples were labeled from 1 to 10. Duplicate samples were collected and analyzed for physicochemical properties.

### Physico-chemical analysis

The appearance of water sample was analyzed and observed by virtual for colour and inhaled for odour. There was also physical determination for taste. The pH was determined using Jenway Model PH Water. The conductivity was determined with a conductivity meter (Aquapro Model AP - Z).

The total dissolved solid (TDS) by Gravimetric method, using conductivity/TDS meter. Total hardness, calcium and magnesium were determined by EDTA titrimetric method.

Table I : Physical properties of tube-well water samples

Sample	Appearance	Taste	Odour	pH	Conductivity	Total Dissolved Solid (TDS)	Total Hardness (TH)
1.	Colourless	Tasteless	Odourless	6.5	126	85.5±0.2	86.0±0.3
2.	Colourless	Tasteless	Odourless	6.5	94	72.1±0.3	91.3±0.9
3.	Colourless	Tasteless	Odourless	6.5	108	83.4±0.2	91.7±0.6
4.	Colourless	Tasteless	Odourless	6.5	126	75.7±0.1	66.0±0.2
5.	Colourless	Tasteless	Odourless	6.0	164	63.1±0.4	73.3±0.6
6.	Colourless	Tasteless	Odourless	6.0	124	73.2±0.4	101.3±0.6
7.	Colourless	Tasteless	Odourless	6.5	123	60.1±0.2	98.4±0.7
8.	Colourless	Tasteless	Odourless	6.0	132	79.5±0.4	99.3±0.9
9.	Colourless	Tasteless	Odourless	6.5	100	62.4±0.3	88.1±0.7
10.	Colourless	Tasteless	Odourless	6.0	99	82.1±0.2	91.3±0.9
(WHO)	Colourless	Tasteless	Odourless	6.5-9.6	900-µs/cm	100	500

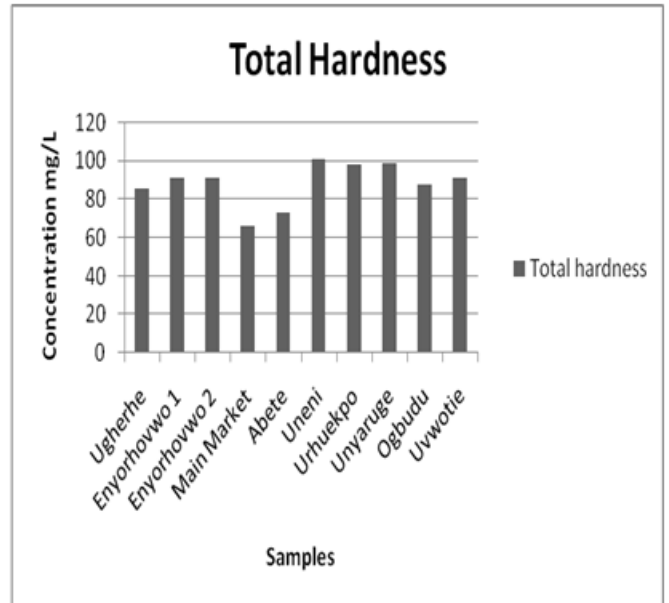
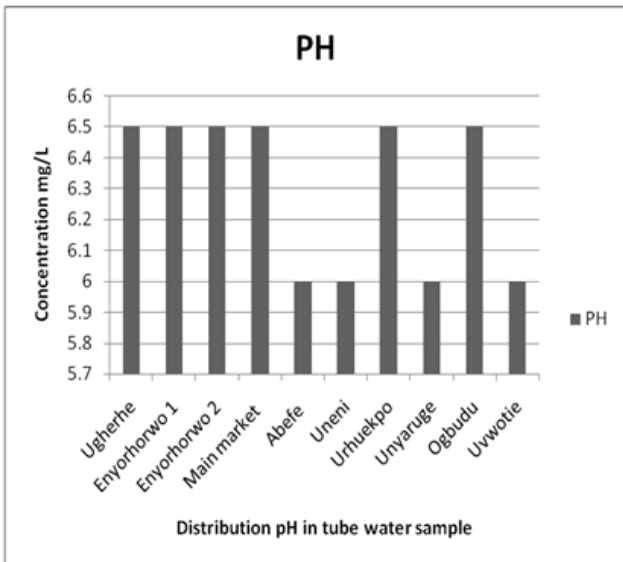


Fig 3. Frequency distribution pattern of total dissolved solid in tube-well water sample

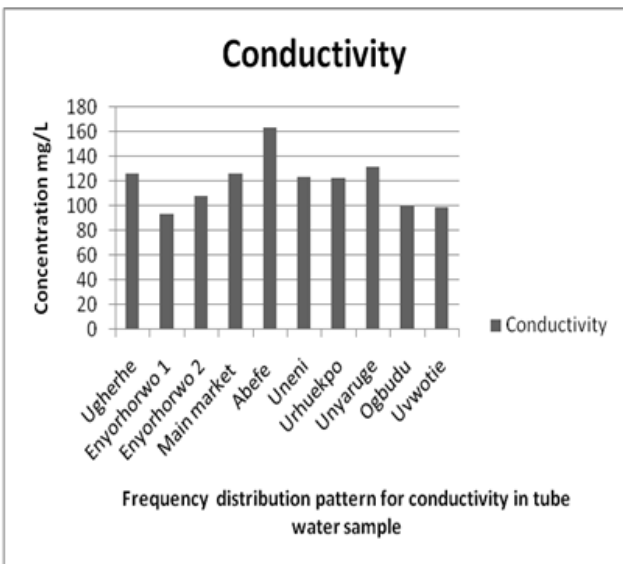
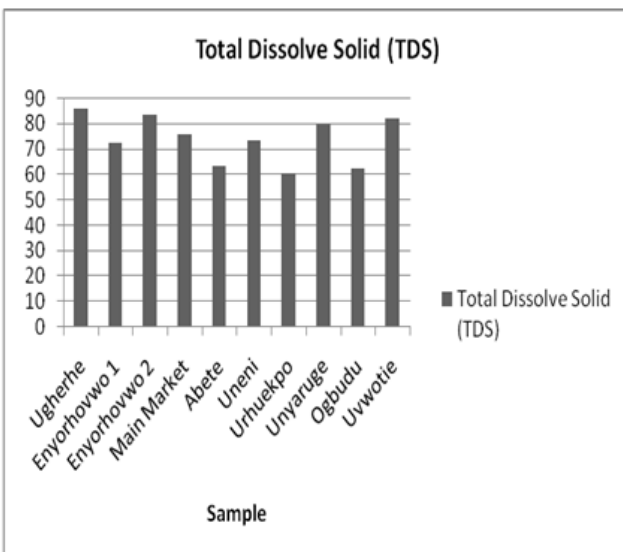


Fig 4. Frequency distribution pattern of total hardness in tube-well water sample



### III. RESULTS AND DISCUSSION

The samples (fig.2) of the tube-well water organoleptic assessment were carried out. All the samples were colourless, tasteless and odourless. The pH of the tube-well water ranged between 6.0 and 6.5 with WHO permissible limit (6.5-9.5), with the exception of samples 5, 6, 8 and 10 slight below with

6.0. The conductivity ranged from 94 to 164  $\mu\text{s}/\text{cm}$ , with the permissible limit of WHO (900  $\mu\text{s}/\text{cm}$ ).

**Heavy Metals in Water:**

The samples were labeled from 1 to 10 and taken to the laboratory for the analysis of heavy metal.

The tube-well water samples were digested with nitric acid before further analysis for Pb, Cu, Zn and Cr.

The atomic absorption spectroscopy (model spectrum Lab ST-AAS-02, series AASW with Gravities finances, UK) instrument was used to detect the heavy metals.

Heavy metal concentrations of the tube-well were illustrated in Table (II) the metal concentrations in tube-well water were found in the following order: Pb>Cu>Fe>Zn in the ten tube-well water from Evwreni.

The sequence of metal concentration in the tube-well water sample was as follow: Pb>Cu>Fe>Zn (Table II)

**PL: Permissible limit according to WHO [12].** The data shown are satisfactorily different at  $P<0.05$  level. The difference in the concentration of the five heavy metals content of the tube-well water samples shows significance. The mean  $\pm$  STD metals (Pb, Cu, Fe, Zn and Cr) were recorded for the tube-well water in Table II.

**STATISTICAL ANALYSIS**

SPSS (version 20) One-way ANOVA and Ducan multiple range test were used to evaluate the significance ( $P<0.05$ ) in the concentration of different studied metals with respect to different sites.

A probability at the level of 0.05 less was considered significant. Mean  $\pm$  STD was estimated.

Mean  $\pm$  STD of heavy metals concentration (mg/l) in tube-well water.

**Table II: Mean  $\pm$  STD of Heavy Metals concentration (mg/l) in tube-well water.**

Well	Heavy metals				
	Pb	Cu	Fe	Zn	Cr
1	0.006 $\pm$ 0.2	0.5 $\pm$ 0.0	0.5 $\pm$ 0.0	0.3 $\pm$ 0.2	0.01 $\pm$ 0.0
2	0.002 $\pm$ 0.1	0.5 $\pm$ 0.1	0.7 $\pm$ 0.1	0.2 $\pm$ 0.1	0.05 $\pm$ 0.1
3	0.001 $\pm$ 0.0	0.5 $\pm$ 0.0	0.5 $\pm$ 0.2	0.2 $\pm$ 0.1	0.02 $\pm$ 0.1
4	0.003 $\pm$ 0.1	0.5 $\pm$ 0.0	0.5 $\pm$ 6.0	0.7 $\pm$ 0.2	0.02 $\pm$ 0.2
5	0.005 $\pm$ 0.1	0.4 $\pm$ 0.0	0.3 $\pm$ 0.1	0.3 $\pm$ 0.1	0.02 $\pm$ 0.0
6	0.001 $\pm$ 0.0	0.5 $\pm$ 0.1	0.7 $\pm$ 0.1	0.3 $\pm$ 0.1	0.01 $\pm$ 0.0
7	0.002 $\pm$ 0.1	0.5 $\pm$ 0.1	0.7 $\pm$ 0.1	0.2 $\pm$ 0.1	0.02 $\pm$ 0.2
8	0.003 $\pm$ 0.2	0.9 $\pm$ 0.0	0.6 $\pm$ 0.1	0.6 $\pm$ 0.1	0.02 $\pm$ 0.0
9	0.001 $\pm$ 0.2	0.5 $\pm$ 0.0	0.5 $\pm$ 0.0	0.3 $\pm$ 0.2	0.03 $\pm$ 0.2
10	0.003 $\pm$ 0.2	0.2 $\pm$ 0.1	0.6 $\pm$ 0.1	0.3 $\pm$ 0.1	0.05 $\pm$ 0.1
PL(WHO)	0.01	2.00	3.00	3.00	0.05

On the physical properties, the appearance, taste, odour, pH and conductivity, (Table I) the samples of the tube-well water were colourless, tasteless and odourless, showing good value for consumption. The pH values obtained for six samples were 6.5 within, while four other samples were 6.0, slightly below WHO permissible limit (6.5 - 9.5). Low pH in water is a major course in some sensitive persons, of gastro-intestinal irritation.

The conductivity was between 94 $\mu\text{s}/\text{cm}$  and 132 $\mu\text{s}/\text{cm}$ , within the maximum permissible limits set by WHO (900 $\mu\text{s}/\text{cm}$ ). The TDS levels found below the permissible limit set by WHO (100). The sample (1) has the highest (85.5  $\pm$  0.2) while sample (7) has the least TDS level of (60.1  $\pm$  0.2). But all the sample fall within the permissible limit recommended by WHO [12].

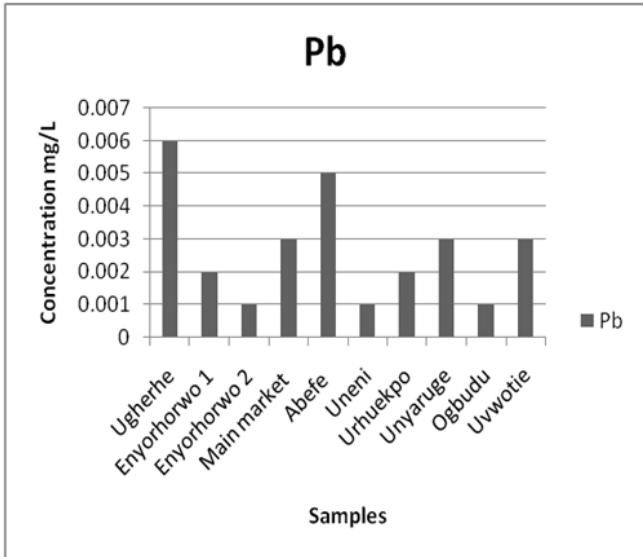


Fig 5. Frequency distribution pattern of lead in tube-well water sample

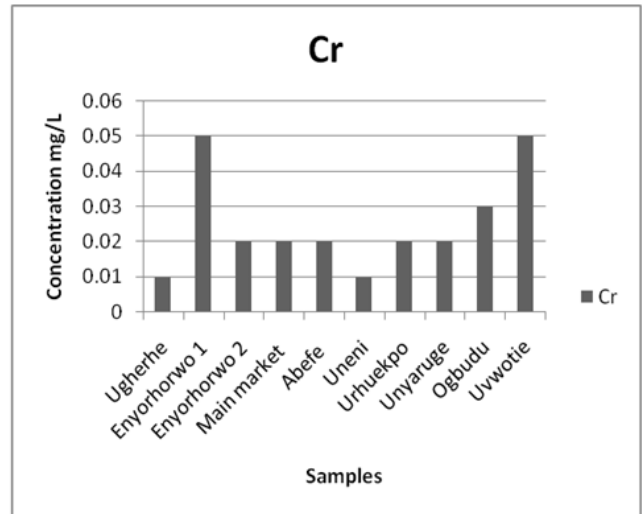


Fig 7. Frequency distribution pattern of chromium in tube-well water sample

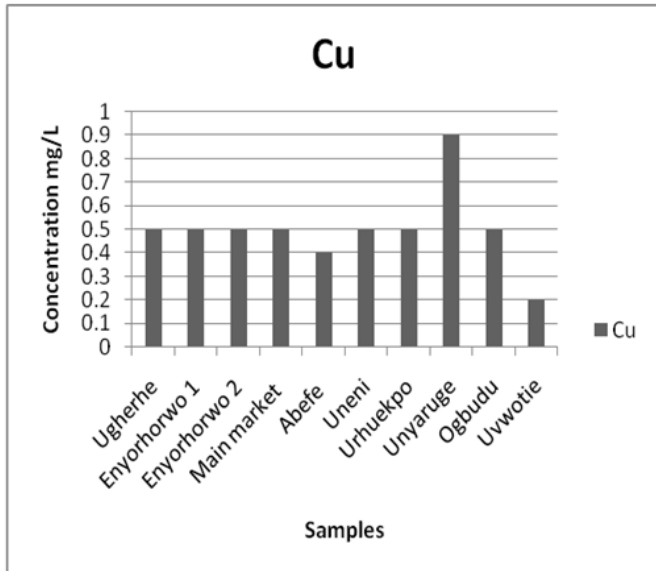


Fig 6. Frequency distribution pattern of iron in tube-well water sample

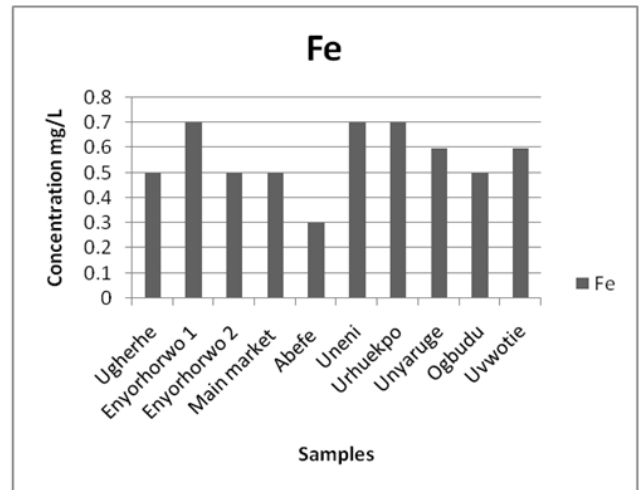


Fig 8. Frequency distribution pattern of iron in tube-well water sample

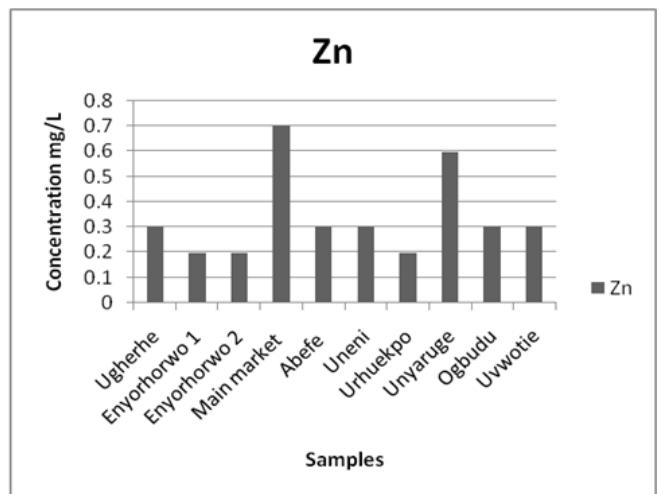


Fig 9. Frequency distribution pattern of zinc in tube-well water sample

Table II : Mean Concentration of heavy metal (mg/L) in tube-well water

Water samples	Pb	Cu	Fe	Zn	Cr
1 Ugherhe	0.006 $\pm$ 0.2	0.5 $\pm$ 0.0	0.5 $\pm$ 0.0	0.3 $\pm$ 0.2	0.01 $\pm$ 0.0
2 Enyorhovwo 1	0.005 $\pm$ 0.1	0.3 $\pm$ 0.1	0.6 $\pm$ 0.1	0.3 $\pm$ 0.1	0.05 $\pm$ 0.1
3 Enyorhovwo 2	0.001 $\pm$ 0.0	0.5 $\pm$ 0.0	0.5 $\pm$ 0.2	0.2 $\pm$ 0.1	0.02 $\pm$ 0.1
4 Main Market	0.001 $\pm$ 0.0	0.5 $\pm$ 0.1	0.7 $\pm$ 0.1	0.3 $\pm$ 0.1	0.02 $\pm$ 0.2
5 Abete	0.005 $\pm$ 0.1	0.4 $\pm$ 0.0	0.3 $\pm$ 0.1	0.3 $\pm$ 0.1	0.02 $\pm$ 0.0
6 Uneni	0.004 $\pm$ 0.2	0.4 $\pm$ 0.0	0.3 $\pm$ 0.1	0.3 $\pm$ 0.1	0.01 $\pm$ 0.0
7 Urhuekpo	0.002 $\pm$ 0.1	0.5 $\pm$ 0.1	0.7 $\pm$ 0.1	0.2 $\pm$ 0.1	0.02 $\pm$ 0.2
8 Unyaruge	0.03 $\pm$ 0.1	0.9 $\pm$ 0.0	0.6 $\pm$ 0.0	0.6 $\pm$ 0.1	0.04 $\pm$ 0.0
9 Ogbudu	0.001 $\pm$ 0.2	0.5 $\pm$ 0.0	0.4 $\pm$ 0.1	0.1 $\pm$ 0.3	0.03 $\pm$ 0.2
10 Uvwotie	0.003 $\pm$ 0.2	0.3 $\pm$ 0.1	0.6 $\pm$ 0.1	0.3 $\pm$ 0.1	0.05 $\pm$ 0.1
PL(WHO)	0.01	2.0	3.0	3.0	0.05

Ten samples of tube-well water were analyzed for Pb, Cu, Fe Zn and Cr with AAS. The Pb, Cu, Fe, Zn and Cr have maximum acceptable concentration of 0.01mg/l, 2.00mg/l, 3.00mg/l, 3.00mg/l and 0.05mg/l respectively for tube-well maximum acceptable concentration (M.A.C.). For the protection of human health guidelines for the presence of heavy metals in drinking water have been set by different international organizations such as WHO, EPA, USEPA and EUC [13].

The result, from (Table ii) shows that all the samples analyzed for the various heavy metals were within the safe limit recommended by WHO [12]. The mean + STD values of the measured metals (Pb, Cu, Fe, Zn and Cr) are as recorded.

The result obtained from the analysis of lead in (fig 3) is in the range of 0.001 to 0.006mg/l. The samples collection at both Enyorhovwo and main market have the concentration values of 0.001 mg/l while that of Ugherhe was with the highest concentration of 0.006mg/l; though lower than the WHO maximum acceptable concentration (0.01mg/l).

Lead is a potent neurotoxin that accumulates in soft tissues and bones and a possible human carcinogen [14]. It can cause damage to nervous connection (especially in young children) and brain disorder.

From the result of analysis of copper (fig. 4) it ranged from 0.20 to 0.90mg/L and all the concentration values for tube-well were below the WHO maximum concentration (2.00mg/L). Copper occurs in drinking water from copper pipe, as well as from additive designed to control algal growth [15]. Drinking water contaminated with high level of copper may lead to chronic anemia, vomiting, diarrhea, nausea and abdominal pain. Iron in (fig. 4) concentration in tube-well water sample ranged from 0.30 to 0.70mg/l and all the values were within the WHO maximum acceptable concentration (3.00mg/l). Iron mostly occurs in anaerobic underground water in the form of (ferrous) which is soluble and it becomes as an insoluble (ferric) when it comes in contact with air. The presence of Iron may be due to clay deposit in the area and is responsible for brownish-red colour of water when allowed to stay for some minutes. The presence of iron in water changes the characteristics of fresh water by altering the colour and as well as taste of water. From the result obtained for the analysis of zinc (fig 5), the values ranged from 0.1 to 0.3mg/L and all sample have concentration below the WHO maximum acceptable concentration from drinking water (3.00mg/L). the chromium (fig 6) contents on the tube-well water analyzed ranged from 0.1 to 0.5mg/L.



The highest concentration of chromium recorded was 0.05mg/L, both at Enyorhovwo and Uvwotie and were exactly at the WHO maximum acceptable concentration (0.05mg/L). The borderline chromium contents in these areas might be due to the presence of farm lands where different fertilizers are abundantly used in farming. Long term exposure to chromium can cause damage to the kidney, liver, circulatory and nervous tissues [15].

#### IV. CONCLUSION/RECOMMENDATIONS

The source of water (tube-well) studies is of the commonest sources of drinking water in Evwreni town. The physico-chemical properties investigated in this study were within the WHO permissible limits. The physical properties were all within the specified conditions. All the heavy metals analyzed were within the WHO maximum acceptable concentration (MAC). This shows that the tube-well water is fit for human consumption.

Nevertheless, the tube wells should not be sited at the outskirts of the town but far from farmland areas, in order to avoid high trace of chromium. The local government can also assist by assisting the community by carrying out a routine test for both organoleptic attributes and heavy metal concentration in the tube-well water.

#### V. REFERENCES

- [1]. Hasan M, Laboni B; Shahadat, H; Pinku, P; Alauddin, C & Farhad, A (2017) *Journal of Environmental and Analytical Toxicology*; 2 (7) PP 433 - 435
- [2]. Kumar M & Puri, A (2012). A review of permissible limit of drinking water. *Indian J. Occu Environ Med.* 16:40-44.
- [3]. Afrasial, K.T; I.N Sultan; P. Parakulsuksatid; M. Shafi A. Khan; M W. Khan & S. Hussain (2013). Detection of heavy metal (Pb, Sb, Al, As) through atomic absorption spectroscopy from drinking water of District Pishin, Balochistan, Pakistan. *Int. J. Curr Microbiol. Appl.Sci* vol 3(1) pp 299 - 308
- [4]. Onoja, P.K., Odi, E.M & Ochala, A.U, (2013). Physical chemical studies and bacteriological assay of sachet water samples marketed in Kogi State University Compound, Anyiagba. *International Journal of Analytical and Bioanalytical Chemistry.* 3(4):PP 146 -150
- [5]. Agwu, A., Avoaja A.G & Kalu A.U (2013). The Assessment of Drinking water sources in Aba metropolis, Abia State, Nigeria. *Resources and Environment* 3(4). 72-78
- [6]. Baron, L & Beratin (2004) Evaluating the Environment impact of various diary patterns combined with different food palliation systems, in *European Journal of clinical Nutrition*, Vol. 12 (5) pp 1- 28.
- [7]. DR Baldwin & W.J. Marshall Heavy metal poisoning and its laboratory investigation. *J. of clinical biochemistry* 36(3), 267 - 300, 1999.
- [8]. V D Newcomb & JD Rimstidt 2002 *App. Geochem* 7;449
- [9]. Khan, B.A, N. Abdullah & M.A. Tahir (2002). Drinking water quality and standardization in Pakistan. *Proceedings of the national workshop on quality of drinking water, organized by PCRWR and chemical society of Pakistan, Islamabad.*
- [10]. Haque M.R. Mannar, M.A & Islam M.M (2006) Seasonal variation of heavy metals concentrations in Gudusia Chapra inhabiting the Sundarban Mangrove forest. *J. Naomi* 23:1-21.
- [11]. Johnson D. B & K.B Hallberg (2005). Acid Mine drainage remediation options: a review *Sci Total Environ*, Vol 338 pp 3 - 14.
- [12]. World Health Organization (1999). *Guidance for drinking water Quality. Health Criteria and other supporting information*, 2nd ed., vol 2 AITBS publishers New Delhi, pp 119 - 382.
- [13]. J.E Macrovecchio, S.E Bothe & R.H Freige. Heavy metals, major metals, trace elements, handbook of water analysis 2nd ed. Edited by LM Nollet, CRC press, London, pp 275-311.
- [14]. C.O. Eli-Eromosele. M.Sc Thesis. University of Lagos, Nigeria, 2010.
- [15]. Njar, G.N; A.L Iwara; A. Offong & T.D Deckorr (2013) Assessment of heavy metal status of borehole in Calabar South Local Government Area of Cross River State, Nigeria. *Ethiopian Journal of Environmental Studies and Mgt* 5(1) pp 33 - 35.

# Virtual Instrumentation Based Brain Tumor Detection, Analysis and Identification

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## ABSTRACT

End to end mechanism of automating the tumor detection and classifying the tumor cells is carried out in this paper. Denoising followed by image enhancement and segmentation is used for tumor detection. Comparative evaluation of segmentation techniques is carried out which include Thresholding, Watershed algorithm, K-means, Fuzzy C. Performance of segmentation algorithm is evaluated by accuracy analysis. Fuzzy C is proved to be the best segmentation technique for brain tumor detection. Different parameters are extracted from the detected tumor which is used to train the Support Vector Machine. Designed Support Vector Machine is then used to determine tumor type whether benign or malignant.

**Keywords :** Brain Tumor, Image processing, MRI, Filtering, Segmentation, SVM

## I. INTRODUCTION

The uncontrolled growth of cell results in a tumor. Tumor detected at an early stage helps in saving persons life. For brain tumor detection, a person undergoes MRI scanning. MRI image obtained is further analyzed by doctors visually to detect the presence of a tumor. However, a considerable variation is observed among doctors which results in variable conclusion. Detection of tumor type whether benign or malignant requires a biopsy to be carried. This is extremely time consuming. Medical imaging hence plays a very important role where the results are obtained in less time and are more accurate and reliable compared to manual testing.

In the last few years, researchers have developed several techniques which automate the process of tumor detection and analysis.

Benson C.C. et al.[25] proposed a watershed algorithm based on different feature combination such as color,

edge, orientation, and texture. The over segmentation problem is overcome by using a marker-based watershed algorithm where markers were found manually. The accuracy is calculated by Dice and Tanimoto coefficient.

Guang Yang et al.[3] proposed a method where discrete wavelet transform is used to distinguish between tumor grades. The comparison is done on different window size and found that Coif wavelet produces the best clustering result. Besides, it is also found that the sub spectral analysis is sufficient to distinguish grades of the tumor.

Sergio Pereira et al.[2] proposed a Convolutional Neural Network based method for segmentation of brain tumor. Heterogeneity in MRI images is addressed using intensity normalization. The variation in the structural components in

a brain tumor was handled by data augmentation. It is found that small kernel proves to be more efficient and are less prone to overfitting.

## II. PROPOSED METHOD

Fig 3.1 shows design flow required for tumor detection.

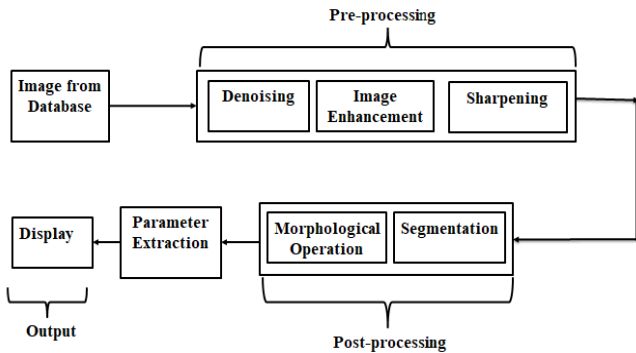


Fig 3.1

### A. Image and Database

Brain tumor images can be MRI images or CT scan images. MRI images are usually preferred over CT scan. This is because ionizing radiations are not used while carrying out MRI imaging besides MRI image depicts anatomy and evaluate structure in much greater details as compared to CT scan[1]. MRI images are therefore used for carrying out an evaluation of segmentation techniques.

Images of MRI are taken from figshare.com where images from 3064 patients are available. Each .mat file in above dataset consists of brain image, extracted tumor image, and its type. This image data set is used to train the Support Vector Machine.

### B. Pre-processing

MRI images are highly affected by Rician noise. MRI images are also subjected to uneven contrast. Proper intensity standardization along with noise removal is required before any analysis is carried out on the

image. Pre-processing stage hence consists of denoising followed by image enhancement and sharpening.

The advantage of the designed pre-processing stage is that it doesn't over smoothen or blur the image instead helps in maintain the image features unlike other pre-processing technique

### Denoising

MRI images are highly affected by Rician noise. Hard wavelet denoising technique with two level of decomposition is used. This is because the Peak Signal to Noise Ratio is maximum and Mean Square Error is minimum with Hard wavelet transform denoising technique when compared with Median filter, Weiner filter, and Soft wavelet transform.[1]

In Hard wavelet denoising technique, the signal is split into lower and upper sidebands. The detailed coefficient is then subjected to thresholding. The universal thresholding technique is used for calculating the threshold.

$$\lambda_j = \frac{\delta \sqrt{2 \log(N)}}{\sqrt{\log_2^{j+1}}} \quad (1)$$

The coefficient less than threshold value are reduced to zero while coefficient greater than threshold is left unchanged.

$$\begin{aligned} y &= x & \text{if } |x| > \lambda \\ y &= 0 & \text{if } |x| < \lambda \end{aligned} \quad (2)$$

Where y is the output signal, x is the input and λ is the threshold value

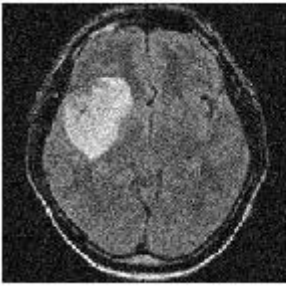


Fig 2.1: Image with Rician noise

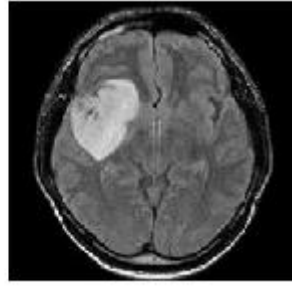


Fig 2.2: Filtered Image

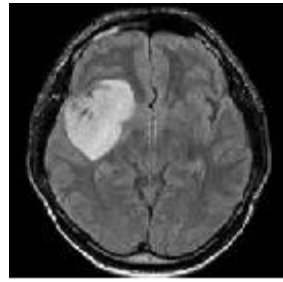


Fig 2.3 : Filtered Image Enhanced Image

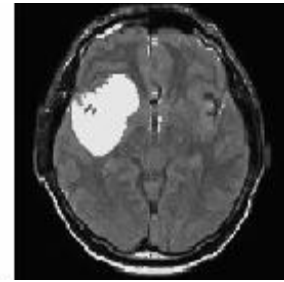


Fig 2.4 :

### Image Enhancement

MRI images suffer from poor contrast. Besides luminance non-linearity is also introduced by imaging devices. Enhancing the image contrast is necessary before any further processing.

Enhancing the image is carried out by combining the histogram process with gamma correction[4].

Cumulative histogram is initially calculated using-

$$C(h_i) = \sum_{i=1}^k hist(r_i) \quad (3)$$

Where  $i$  is the gray level of image and  $hist(r_i)$  is a discrete function which defines the intensity levels of a digital image.

Median, minimum and maximum values are then calculated to determine the value of gamma-

$$g = \log \left( \frac{\text{median} - \text{minimum}}{\text{maximum} - \text{median}} \right) \quad (4)$$

The gamma values are then used to enhance the contrast of the image. The enhanced image is -

$$G(x, y) = f(x, y)^{\frac{1}{g}} \quad (5)$$

Where  $G(x, y)$  is enhanced an image,  $f(x, y)$  is the original image and  $g$  is the value of gamma.

### Sharpening

Edges, play an important role in tumor detection to separate the normal cells from tumor cells. This high-frequency information about the edges is enhanced using sharpening.

First and second order derivatives are highly sensitive to noise and less sensitive to delicate edges.[5] Hence, Canny edge detection technique is used for sharpening. Firstly Sobel operators are used.

$$\begin{aligned} \text{Kernel1} &= \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \\ \text{Kernel2} &= \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} \end{aligned} \quad (6)$$

The gradient obtained are used to determine the magnitude and angle.

$$\begin{aligned} |G| &= \sqrt{G_x^2 + G_y^2} \quad , \\ \theta &= \arctan \left( \frac{|G_y|}{|G_x|} \right) \end{aligned} \quad (7)$$

Where  $G_y$  and  $G_x$  are gradients in x and y-direction respectively.

The non-maximum suppression is carried out followed by hysteresis thresholding where values below the threshold are suppressed. The image obtained by sharpening is added with the enhanced image to get the complete pre-processed image.

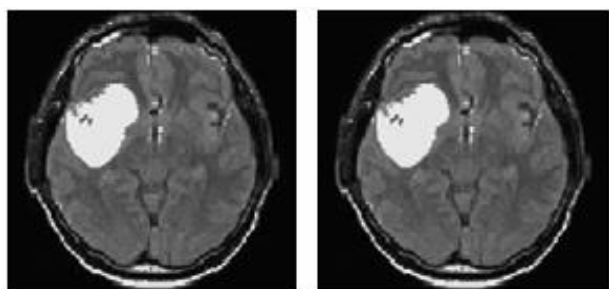


Fig 2.5 : Enhanced Image      Fig 2.6 : Enhanced and Sharpened Image

A. Post-processing.

Post-processing concentrates on the segregating the tumor cells from the normal cells. This is done by skull tripping followed by segmentation and morphology.

### Skull Tripping

Skull tripping is used to separate brain tissue from the non brain tissue. Skull tripping is done firstly by binarizing the image using the threshold value. Filling and erosion are carried out on the binarized image to obtain the mask. The mask generated is then used to trip of the skull, separating the brain tissue.[20]

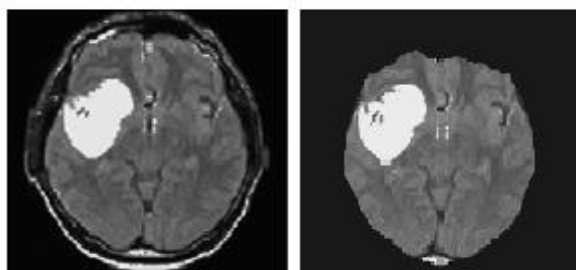


Fig 2.6: Enhanced and Sharpened Image      Fig 2.7: Skull tripped Image

### Segmentation

Comparative analysis of five different techniques is carried out this involves Thresholding, Watershed, K-means, and Fuzzy C.

### Thresholding

Thresholding divides the pixels based on its intensity levels. In MRI images, the tumor part as high intensity and solidity compared to the other brain tissues. The histogram is used to determine the value of threshold which separates the high-intensity tumor part from the nontumor ones.

$$y(x,y) = 1 \quad \text{if } f(x,y) > \lambda \quad (8)$$

$$y(x,y) = 0 \quad \text{if } f(x,y) < \lambda$$

Where  $y((x,y))$  is threshold image,  $f(x,y)$  is the original image and  $\lambda$  is the value of the threshold.

This technique is easy to implement but is inefficient while detecting cancerous tumor and tumor in an early stage.

### Watershed

Watershed algorithm is based on topological interpretation.

A pixel with similar intensity appears to be like basins. Filling of basin starts from the local minima of individual basins and stops when it reaches a peak point of the basin. The entire image gets divided into lines called watershed lines. The internal and external markers are determined where internal marker defines the area of interest and external marker defines the background.[25].Morphological operates than separate the tumor cells from the normal ones.

### K-means

It is unsupervised learning method which groups pixels depending on its characteristics. K-means is an iterative process which consists of four major steps. It starts with finding the number of cluster 'k' whose centroids are randomly chosen.

Euclidean distance is calculated between the pixel and the cluster. Grouping of pixels into a cluster is done based on the shortest distance. The centroid is the re-calculated and process continues until the centroid remains unchanged.[19]

The formula is used to compute cluster means m-

$$M = \frac{\sum_{i:c(i)=k} x_i}{N_k}, k = 1, \dots, k \quad (9)$$

While the distance between the pixel and cluster is determined by-

$$D(i) = \arg \min \|x_i - M_k\|^2, i = 1, \dots, N \quad (10)$$

It is observed that the algorithm is fast and offers best results with discrete data set.

### Fuzzy C

Fuzzy C is an iterative algorithm where identical data points are grouped into clusters. An iterative action is carried out on following objective function-

$$F = \sum_{p=1}^N \sum_{q=1}^C \mu_{pq}^m |x_p - c_q|^2 \quad (11)$$

Here N represents total pixels, C represents the cluster number m is the factor of fuzziness. p is the pixel in N and q is the cluster in C denoted by xp and cq respectively.

After every iteration, the value of F reduces which indicates that the algorithm produces fair separation of pixels into required clusters.[24] The algorithm is quite efficient than K-means but the time required for clustering is very large.

### C. Support Vector Machine.

Support Vector Machine(SVM) is based on the concept of decision planes which helps to separate set of items having dissimilar properties. Classifying

tumor as benign or malignant is done by SVM. It involves two steps training and testing.

### Training

To train the Support Vector Machine, features are extracted from the database images. Statistical features include mean, entropy, standard deviation, skewness, kurtosis, contrast, energy, and correlation will regional feature includes area, perimeter, major and minor axis and eccentricity[26]. These are then used to train the Support vector machine.

### Statistical features-

#### Mean

Mean gives a contribution of individual pixel intensity. It is given by formula-

$$M = \frac{1}{m * n} \sum_{x=0}^{m-1} \sum_{y=0}^{n-1} f(x, y) \quad (12)$$

Where m and n represents number of rows and columns.

#### Entropy

Entropy is used to determine the randomness of the image texture. It is given by following formula-

$$E = - \sum_{x=0}^{m-1} \sum_{y=0}^{n-1} f(x, y) \log_2 f(x, y) \quad (13)$$

where m and n represent the number of rows and columns.

#### Std deviation

It can serve as a measure of inhomogeneity.

$$SD = \sqrt{\frac{1}{m * n} \sum_{x=0}^{m-1} \sum_{y=0}^{n-1} (f(x, y) - M)^2} \quad (14)$$

where m and n represents the number of rows and columns and M is the mean

**Skewness**

A measure of symmetry is determined by skewness. It is given by formula-

$$S(X) = \frac{1}{m * n} \frac{\sum(f(x, y) - M)^3}{SD^3} \quad (15)$$

Where SD is the std deviation and M is the mean and m and n represents a number of rows and columns

**Kurtosis**

Kurtosis determines the shape of a random variable's probability distribution.

$$K(X) = \frac{1}{m * n} \frac{\sum(f(x, y) - M)^4}{SD^4} \quad (16)$$

Where SD is the std deviation and M is the mean and m and n represents the number of rows and columns

**Contrast**

Contrast measures intensity of a pixel and its neighbor over the image. It is given as-

$$Contrast = \sum_{x=0}^{m-1} \sum_{y=0}^{n-1} (x - y)^2 f(x, y) \quad (17)$$

where m and n represents the number of rows and columns

**Energy**

This parameter measures the similarity between of an image

$$Energy = \sum_{x=0}^{m-1} \sum_{y=0}^{n-1} f^2(x, y) \quad (18)$$

**Correlation**

Spatial dependencies between the pixels are described by Correlation

$$Correlation = \frac{\sum_{x=0}^{m-1} \sum_{y=0}^{n-1} (x, y) f(x, y) - M_x M_y}{\sigma_x \sigma_y} \quad (19)$$

where  $M_x$  and  $\sigma_x$  are the mean and standard deviation in the horizontal spatial domain and  $M_y$  and  $\sigma_y$  are the mean and standard deviation in the vertical spatial domain.

**Homogeneity**

It is used to determine the textured and non-textured feature of the image

$$Homogeneity = \sum_{x=0}^{m-1} \sum_{y=0}^{n-1} \frac{1}{1 + (x + y)^2} f(x, y) \quad (20)$$

**Regional parameter-**

**Area**

Image after segmentation represents total number of black and white pixels[19].The binary image representation is given by-

$$I = \sum_{x=0}^{m-1} \sum_{y=0}^{n-1} (f(0) + f(1)) \quad (21)$$

The image is 256\*256 hence the value of m and n is 256. To calculate area number of white pixels needs to be considered

$$Area = 0.256 * \sum \sum f(0) \text{ mm}^2 \quad (22)$$

**Major and minor axis**

The major axis is the length (in pixel) of the largest axis of the tumor ellipse and the minor axis is the length (in pixel) of the smallest axis of the tumor ellipse.

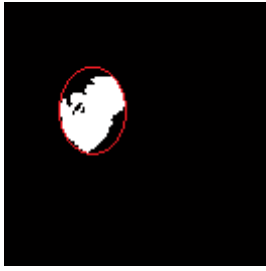


Figure 2.8

**Perimeter**

It is the no of pixels that form the edge of the tumor image.

**Eccentricity**

It is defined as the ratio of the axis length which includes major and minor axis.

**Testing**

In testing, the tumor detected test image undergoes the similar feature extraction which is then used by SVM to classify the tumor whether malignant or benign.

**III. EVALUATION AND RESULT**

Evaluation and result of segmentation Algorithm:

The following image shows the few sample outcomes of the segmentation algorithm.

In Fig 3.1, A represents the skull tripped MRI image, B shows tumor detection obtained by thresholding, C shows tumor detection obtained by watershed, D shows tumor detection obtained by K means and E shows tumor detection using Fuzzy C.

The evaluation metrics used to evaluate the techniques are sensitivity, specificity, and accuracy[23].

Accuracy is the degree of correctness of diagnostic the test on a condition. Accuracy is given by following formula-

$$Accuracy = \frac{TN + TP}{TN + TP + FN + FP} \quad (23)$$

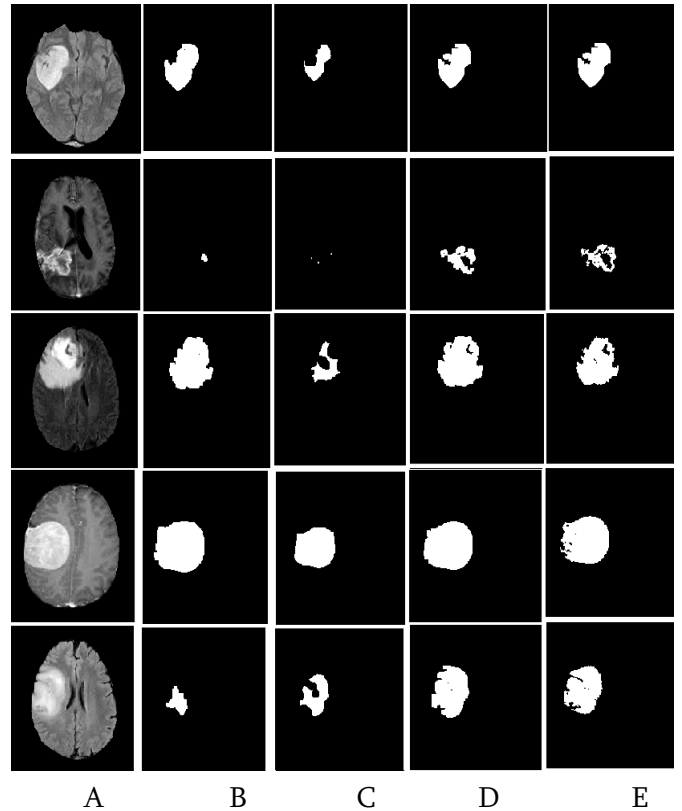


Figure 3.1 Output of segmentation algorithm

Specificity determines how good the test is at identifying the normal condition. Specificity is given by following formula-

$$Specificity = \frac{TN}{TN + FP} \quad (24)$$

Sensitivity is used to determine the goodness of the test in detecting the diseases. Sensitivity is given by following formula-

$$Sensitivity = \frac{TP}{TP + FN} \quad (24)$$

The below table shows the comparative analysis of the segmentation algorithm –

Methods	Accuracy	Specificity	Sensitivity
Thresholding	80.78%	83.33%	86.61%



Watershed	78.82%	84.76%	75.91%
Kmeans	88.17%	88.90%	65.78%
Fuzzy C	91.09%	91.56%	71.78%

Table 3.1 Comparison of segmentation techniques

The comparison of the segmentation algorithm is also done using timing parameter and area analysis.

The following graph shows timing analysis of the four segmentation algorithm on 35 images. The y-axis shows time in seconds for every image on x-axis -

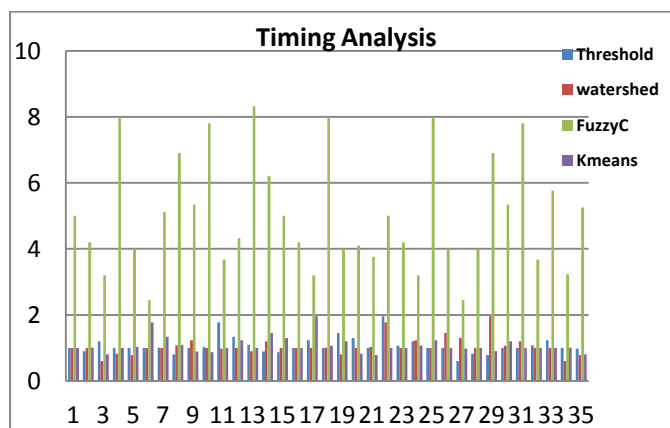


Figure 3.2 Timing analysis of segmentation algorithm

It is observed that the Fuzzy C algorithm requires the maximum time compared to rest of the algorithm.

The following graph shows area analysis of the four segmentation algorithm on 35 images which is compared to the true area. The y-axis shows the area (in pixel) for every image on x-axis -

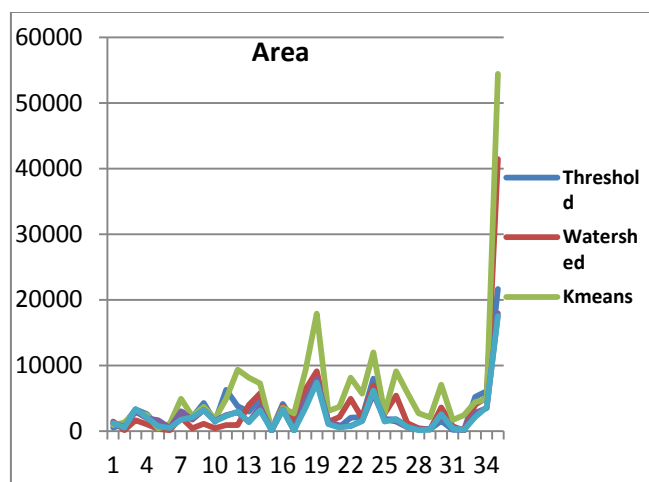


Figure 3.2 Area analysis of detected tumor

It is found that the area of the detected tumor in Fuzzy C highly resembles the actual tumor area. In kmeans, the area of detected tumor slightly resembles the actual tumor area. On the other hand, the area detected by threshold and watershed highly various in comparison with the actual tumor area. Thus the accuracy of fuzzy C is high as proved in Table 1.

Evaluation and result of SVM:

SVM is trained with 3064 images taking into consideration the statistical and regional parameters. 35 test images are used to check the designed SVM. The classification of the tumor into benign and malignant is proved accurate in 32 cases out of 35 cases which results in an accuracy of 91.42%.

#### IV. CONCLUSION

In this paper, the main focus was to design a model to detect tumor with accuracy and classify them into benign and malignant. For detecting a tumor, pre-processing(denoising and image enhancement) and post-processing (segmentation and morphology) is carried out wherein four different segmentation algorithm are compared based on accuracy, sensitivity, specificity and timing analysis.

It is observed that the thresholding and watershed methods of tumor detection are inefficient in detecting an early-stage tumor, besides the cancerous tumor are also not accurately detected by these methods. K means on the other side, provide better accuracy compared to the threshold and watershed but is less accurate compared to Fuzzy C. Fuzzy C is highly accurate and proves to be the best tumor detection algorithm. Support Vector Machine is trained to test and classify a tumor as malignant and benign. It proved to be 91.42% accurate. This research can be extended further to identify the cancerous cell inside the tumor.

## V. REFERENCES

1. Saylee Lad and Dr. Prof M. S. Panse, "Comparative Evaluation of Rician Noise Denoising Techniques for MRI Images", *International Journal of Research and Scientific Innovation (IJRSI) | Volume V, Issue II, February 2018 | ISSN 2321-2705*
2. Srgio Pereira, and Adriano Pinto, "Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Images", *IEEE Transactions on Medical Imaging, Volume: 35, Issue: 5, pp 1240 - 1251 May 2016*
3. Guang Yang, Tahir Nawaz, "Discrete Wavelet Transform-Based Whole-Spectral and Subspectral Analysis for Improved Brain Tumor Clustering Using Single Voxel MR Spectroscopy" *IEEE Transactions on Biomedical Engineering Volume: 62, Issue: 12, pp 2860 - 2866, Dec. 2015*
4. Shih-Chia Huang and Fan-Chieh Cheng, "Efficient Contrast Enhancement Using Adaptive Gamma Correction With Weighting Distribution", *Volume: 22, Issue: 3, pp 1032 - 1041, March 2013*
5. P Bao, "Canny edge detection enhancement by scale multiplication", *IEEE Transactions on Pattern Analysis and Machine Intelligence Volume: 27, Issue: 9, pp 1485 - 1490 Sept. 2005*
6. PJanani, J.Premaladha and K.S.Ravichandran, "Image Enhancement Techniques: A Study", *Indian Journal of Science and Technology, Vol 8, Issue 22, pp 1-12, September 2015.*
7. Qingkun Song, Li Ma, JianKun Cao, Xiao Han, "Image Denoising Based on Mean Filter and Wavelet Transform" *4th International Conference on Advanced Information Technology, IEEE, pp39-42, February 2016*
8. Isshaa Aarya, Danchi Jiang, Timothy Gale, "Adaptive Filtering Technique for Rician Noise Denoising in MRI", *Biomedical Engineering International Conference, IEEE, December 2013*
9. Sheikh Tania and Raghad Rowaida, "A Comparative Study of Various Filtering Techniques for Removing Various Noisy Pixels in Aerial Image" *International Journal of Signal Processing, Image Processing and Pattern Recognition, Vol 9, Issue 3, pp113-124, 2016*
10. Pankaj Hedao, Swati S Godbole, "Wavelet Thresholding Approach for Image Denoising", *International Journal of Network Security and its Application, Volume 3, Issue 4, July 2011*
11. Chanchal Srivastava, Saurabh Kumar Mishra, Pallavi Asthana, "Performance Comparison of Various Filters and Wavelet Transform for Image De-noising", *IOSR Journal of Computer Engineering, Volume 10, Issue 1, pp55-63, March 2013*
12. Inderpreet Singh, Inderpreet Singh, "Performance Comparison of Various Image Denoising Filters Under Spatial Domain", *International Journal of Computer Applications, Volume 96, Issue No.19, pp 22-30, June 2014*
13. Mohd Tahir, Anas Iqbal, Abdul Samee Khan, "A Review Paper of Various Filters for Noise Removal in MRI Brain Image," *International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 12, December 2016*

14. S Grace Chang, Bin Yu, Senior Member, Martin Vetterli, Fellow, " Adaptive Wavelet Thresholding for Image Denoising and Compression" IEEE transactions on image processing, vol. 9, no. 9, pp 1532-1546, September 2000
15. KDevi Priyaa, G.Sasibhushana Raob, P.S.V.Subba Raa," Comparative Analysis of Wavelet Thresholding Techniques with Wavelet-Wiener Filter on ECG Signal", 4th International Conference on Recent Trends in Computer Science & Engineering, Volume 87, pp178-183, 2016
16. R Bouchouareb and D. Benatia," Comparative Study between Wavelet Thresholding Techniques (Hard, Soft, and Invariant-translation) in Ultrasound Images" International Journal of Bio-Science and Bio-Technology Vol.6, No. 6 pp.29-38, 2014
17. Afrah Ramadhan<sup>1</sup>, Firas Mahmood<sup>2</sup> and Atilla Elci<sup>3</sup>, " IMAGE DENOISING BY MEDIAN FILTER IN WAVELET DOMAIN" The International Journal of Multimedia & Its Applications (IJMA) Vol.9, No.1, pp31-40, February 2017
18. <https://radiology.ucsf.edu/blog/neuroradiology/exploring-the-brain-is-ct-or-mri-better-for-brain-imaging>
19. Jselvakumar A.Lakshmi T, "Brain Tumor Segmentation and Its Area Calculation in Brain MR Images using K-Mean Clustering and Fuzzy C-Mean Algorithm" IEEE-International Conference On Advances In Engineering, Science And Management ,pp 186-190, March 2012
20. Swapnil R. Telrandhe and Amit Pimpalkar," Detection of Brain Tumor from MRI images by using Segmentation &SVM"IEEE Conference on Futuristic Trends in Research and Innovation for Social Welfare, pp1-6, October 2016
21. SR.Telrandhe, A.Pimpalkar and A.Kendhe, "Brain Tumor Detection using Object Labeling Algorithm & SVM", in International Engineering Journal For Research & Development Vol. 2, pp. 2-8, Nov 2015.
22. MShasidhar, Y.S.Raja and B.Y.Kumar, "MRI brain image segmentation using modified fuzzy c-means clustering algorithm," in Proceedings in IEEE International Conference on Communication Systems and Network Technologies, pp. 473-478, 2011
23. V Sheejakumari, Sivasamy Gomathi," Brain tumor detection from MRI images using histogram based segmentation and modified neural network", in Computational Life Sciences and Smarter Technological Advancement, Biomedical special issue ,pp 1-9
24. Priyansh Sharma," A Review on Image Segmentation with its Clustering Techniques", International Journal of Signal Processing, Image Processing and Pattern Recognition Vol.9, No.5 (2016), pp.209-218
25. Benson C. C., " Brain tumor extraction from MRI brain images using marker based watershed algorithm", International Conference on Advances in Computing, Communications and Informatics, pp318-323, Aug 2015
26. Nilesh Bhaskarrao Bahadure," Image Analysis for MRI Based Brain Tumor Detection and Feature Extraction Using Biologically Inspired BWT and SVM" International Journal of Biomedical Imaging, Volume 2017, pp1-12, February 2017.

# A Technical Survey on Internal Intrusion Detection and Protection System Using Data Mining and Forensics Techniques

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## ABSTRACT

There are distinctive approaches to ensure the data and also the systems from attackers. Firewalls are utilized to secure passwords according to require. Commonly these are insufficient. Because of that systems and systems are constantly under the perception of string. Intrusion detection system (IDS) distinguishes undesirable exercises of PC system, which are gets through the web. The control may take type of assaults by programmers. Yet, it is watched that most firewalls and IDS ordinarily attempt to secure PC system against outcast assaults. This paper centers overview around various data mining and legal techniques to distinguish and shield internal PC system from intrusion utilizing Internal Intrusion Detection and protection system Using Data Mining and Forensic Techniques(IIDPS) to discover insider assaults at SC level with the assistance of Data mining and Forensic Technique.

**Keywords:** Data Mining, Insider Attack, Intrusion Detection and Protection, System Call (SC), Users' Behaviors, Functionality, Identify User, Attacker Profile.

## I. INTRODUCTION

Today everybody get to the system based data .So by means of systems numerous attackers go into system. These assaults are outcast as well as insider. In outcast assaults the unapproved users gain admittance to the systems by utilizing distinctive sorts of assaults if there should be an occurrence of insider assaults the approved users attempt to trade off the respectability, privacy or accessibility of assets. Intrusion implies any arrangement of exercises that endeavour to hurt the security objectives of the data. Different methodologies like as encryption, firewalls, virtual private system, and so on. But they were insufficient to anchor the system completely.

Thus, Internal Intrusion Detection and Protection System (IIDPS), is utilized as security instruments in this system to makes users' close to home profiles to monitor users' consistent propensities as their legal highlights and decides if an approved login of user or not and if not then contrasting users current PC use practices and the examples gathered in the user's close to

home profile. Internal Intrusion Detection and Protection System (IIDPS), which recognizes practices at SC level. The IIDPS utilizes data mining and legal profiling techniques to mine system call designs that has over and over seemed a few times in a user's close to home profile. As indicated by user's legal highlights, characterized as a SC-design as often as possible showing up in a user's submitted propensities , yet once in a while being utilized by different users, are discover from the user's PC use history.

## II. EXISTING SYSTEM

A few data security techniques are accessible today to ensure data systems against unapproved utilize, duplication, modification, obliteration and infection assaults.

### A. Firewall

The fundamental reason for a firewall is to forestall unapproved access between systems. That implies shielding a locales inward system from web. In any case, drawback of firewall is that a firewall searches

externally for intrusion keeping in mind the end goal to prevent them from happening. Firewall limits access between systems to anticipate intrusion and don't flag an assault from inside system.

**B. Network based IDS**

A Network intrusion detection system (NIDS) is an intrusion detection system that endeavours to recognize malevolent action, for example, forswearing of administrations attacks, port examines or even endeavours to splits into PCs by checking system traffic. Some organize based IDSs have issue managing system based assaults that include dividing packets, These twisted bundles makes the IDSs wind up insecure and crash.

**C. Host based IDS**

Host based IDSs screen all or parts of the dynamic conduct and breaks down the internals of processing system as opposed to on its outer interfaces. The guideline of task of HIDS relies upon the way that effective gate crashers or wafers will for the most part leave a hint of their exercises, for example, keystroke logging, and identify burglary spamming, botnet activity, and spyware-utilization and so on.

Host based IDS are harder to oversee , as data must be designed and overseen for each host said and not suited for distinguishing system outputs or other such reconnaissance that objective a whole system ,in light of the fact that the IDSs just observes those system parcels got by its host.

**D. Intrusion Detection and Protection System (IDPS)**

Intrusion detection and Protection system identifies systems affected exercises and furthermore ordinary exercises to anchor data. Yet, it is extremely hard to discover huge volume OS system calls and diverse conduct and identify attackers of an intrusion.

**III. COMPARISON BETWEEN EXISTING SYSTEM AND IIDPS**

By concentrate this paper three sorts of attacks observed, Type-I assault in which users assemble individuals are not permitted to submit system calls. While in Type-II assault produces touchy system call which alter settings or data, and last third Type-III, it effectively go into security system.

Table I shows correlation of existing system with IIDPS as for assault compose and identify legitimate user work, Where 'N' image demonstrates system does not give specified capacity and 'Y' shows give assigned capacity.

TABLE I  
COMPARATIVE EXAMINATION OF THE EXISTING SYSTEMS AND IIDPS

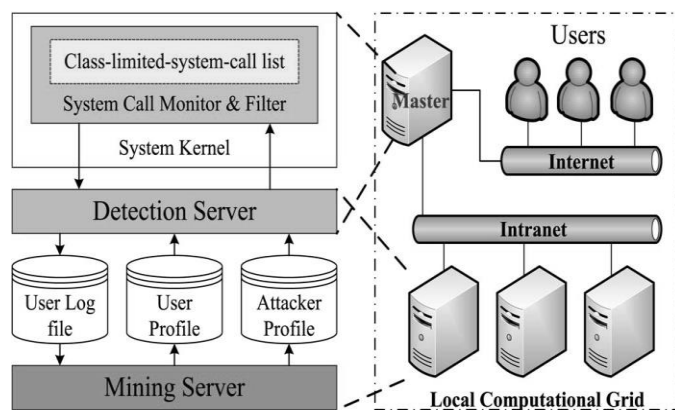
Existing systems	Attack type			
	Identify user	Type - I	Type -II	Type -III
OSSEC	N	Y	Y	N
AIDE	N	Y	Y	N
SAMHAIN	N	Y	Y	N
SYMANTE CSP	N	Y	Y	N
IIDPS	N	Y	Y	Not completely
OSSEC	Y	Y	Y	Y

Table II shows difference between response times of IIDPS system with other system detecting attacks n Identify user

Existing systems	Response time(Seconds)			
	Identify user	Type - I	Type - II	Type III
OSSEC	N	60	60	N
AIDE	N	60	60	N
SAMHAIN	N	60	60	N
SYMANTE CSP	N	60	60	N
IIDPS	N	2	2	3
OSSEC	0.45	0.001	0.001	0.45

**IV. IIDPS FRAMEWORK**

The IIDPS, as appeared in Fig. 1, comprises of a SC screen and channel, a mining server, a detection server, a neighborhood computational network, and three storehouses, including user log records, user profiles, and an attacker profile. The SC screen and channel, as a loadable module inserted in the bit of the system being considered, gathers those SCs submitted to the piece and stores these SCs in the arrangement of “uid, pid, SC” in the ensured system where uid, pid, and SC individually speak to the user ID, the procedure ID, and the SC c presented by the hidden user, i.e.,  $c \in SCs$ . It likewise stores the user contributions to the user's log record, which is a document keeping the SCs presented by the user following their submitted succession. The mining server examines the log data with data mining techniques to identify the user's PC utilization propensities as his/her personal conduct standards, which are then recorded in the's user profile. The detection server contrasts users' personal conduct standards and those SC-designs gathered in the attacker profile, called assault designs, and those in user profiles to individually recognize vindictive practices and identify who the attacker is progressively. At the point when an intrusion is found, the detection server informs the SC screen and channel to disconnect the user from the secured system. The reason for existing is to anticipate him/her from constantly assaulting the system.



**Figure 1.** IIDPS System Framework

Both the detection server and the mining server are kept running on the nearby computational framework to quicken the IIDPS's online detection and mining velocities and upgrade its detection and mining ability. On the off chance that a user sign in to the system by utilizing someone else's login design, the IIDPS distinguishes who the hidden user is by processing the comparability scores between the user's present data

sources, i.e., SCs, and the standards of conduct put away in various users' user profiles. In the IIDPS, the SCs gathered in the class-constrained SC list, as a key segment of the SC screen and channel, are the SCs restricted to be utilized by various gatherings/classes of users in the hidden system, e.g., a secretary can't present some particular special SCs. Along these lines, charges that create these SCs will be denied to be utilized by all secretaries.

## V. CONCLUSION

This paper centers on study of techniques for data mining and measurable to internal intrusion detection and protection. IIDPS system empowers data mining and legal method to identify system call, making user profile and separated from attacker profile to shield user from internal assault.

## VI. REFERENCES

- [1] Fang-YieLeu, Kun-Lin Tsai, Yi-Ting Hsiao, and Chao-Tung Yang, "An Internal Intrusion Detection and Protection System by Using Data Mining and Forensic Techniques", IEEE Int. Conf. Avail., Rel. Security, Taiwan, pp 1932-8184, 2015
- [2] S. Gajek, A. Sadeghi, C. Stuble, and M. Winandy, "Compartmented security for browsers—Or how to thwart a phisher with trusted computing," in Proc. IEEE Int. Conf. Avail., Rel. Security, Vienna, Austria, Apr. 2007, pp. 120–127.
- [3] B. Sayed, I. Traore, I. Woungang, and M. S. Obaidat, "Biometric authentication using mouse gesture dynamics," IEEE Syst. J., vol. 7, no. 2, pp. 262–274, Jun. 2013.
- [4] S. C. Arseni, E. C. Popovici, L. A. Stancu, O. G. Guta, and S. V. Halunga, "Securing an alerting subsystem for a keystroke-based user identification system," in Proc. Int. Conf. Commun., Bucharest, Romania, 2014, pp. 1–4.
- [5] M. A. Faisal, Z. Aung, J. R. Williams, and A. Sanchez, "Data-stream based intrusion detection system for advanced metering infrastructure in smart grid: A feasibility study," IEEE Syst. J., vol. 9, no. 1, pp. 1–14, Jan. 2014.
- [6] K. A. Garcia, R. Monroy, L. A. Trejo, and C. Mex-Perera, "Analyzing log files for postmortem intrusion detection," IEEE Trans. Syst., Man, Cybern., Part C: Appl. Rev., vol. 42, no. 6, pp. 1690–1704, Nov. 2012.
- [7] M. A. Qadeer, M. Zahid, A. Iqbal, and M. R. Siddiqui, "Network traffic analysis and intrusion detection using packet sniffer," in Proc. Int. Conf. Commun. Softw. Netw., Singapore, 2010, pp. 313–317.
- [8] S. Yu, K. Sood, and Y. Xiang, "An effective and feasible traceback scheme in mobile internet environment," IEEE Commun. Lett., vol. 18, no. 11, pp. 1911–1914, Nov. 2014.
- [9] AIDE. [Online]. Available: <http://aide.sourceforge.net/>
- [10] SAMHAIN. [Online]. Available: <http://www.la-samhna.de/samhain/>
- [11] Symantec CSP. [Online]. Available: <http://www.symantec.com/criticalsystem-protection>.



# Fuzzy Logic Controller based SRM Drive for EVs with Flexible Energy Control Functions

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## ABSTRACT

In this paper Hybrid Electric vehicle (HEV) technology provides an effective solution for achieving higher fuel economy and better performances with reduced greenhouse gas emissions. For Electric vehicle applications, To increase the driving miles of the electric vehicles, a photovoltaic (PV) panel is mounted along with on-board battery bank. A tri-port converter with fuzzy logic controller is proposed in this paper to control the energy flow between the PV panel, battery and SRM drive. Six operational modes are presented, four of which are developed for driving modes and rest two for stand still on-board charging. In driving modes, the Perturb and observe technique is employed in order to receive maximum power from the PV panel. In stand still charging modes, a grid connected charging topology is developed. A multi section charging control strategy is used for effective utilization of energy in case of battery charging from PV panel directly. The proposed tri-port technology with fuzzy logic controller is developed in MATLAB/SIMULINK environment and the results are proven to be successful in producing reduced harmonic distortion .

**Keywords:** Electric Vehicles, Photovoltaic (PV), Switched Reluctance Motors (SRMs), Tri-Port Converter, Perturb and Observe Technique, Fuzzy Logic Controller.

## I. INTRODUCTION

Electric vehicles have taken a significant leap forward, by advances in motor drives, power converters, batteries and energy management systems [1]-[4]. Be that as it may, due to the limitation of current battery technologies, the driving miles is moderately short that limits the wide utilization of EVs [5]-[7]. In terms of motor drives, high-performance permanent-magnet (PM) machines are generally utilized while rare-earth materials are required in large quantities, restricting the wide utilization of EVs. Keeping in mind the end goal to defeat these issues, a photovoltaic panel and a switched reluctance motor (SRM) are introduced with give power supply and motor drive, respectively. Firstly, by including the PV panel on top of the EV, a

sustainable energy source is achieved. Nowadays, a typical passenger car has a surface enough to install a 250-W PV panel. Second, a SRM needs no rare-earth PMs and is additionally robust so it gets increasing attention in EV applications. While PV panels have low power density for traction drives, they can be used to charge batteries the greater part of time. For the most part, the PV-fed EV has a comparable structure to the hybrid electrical vehicle, whose internal combustion engine(ICE) is supplanted by the PV panel. The PV-fed EV system is outlined in Figure 1. Its key components include an off-board charging station, a PV, batteries and power converters. In order to decrease the energy conversion processes, one approach is to upgrade the motor to include some on-board charging functions. For example, paper designs



a 20-kW split-phase PM motor for EV charging, yet it endures from high harmonic contents in the back electromotive drive (EMF). Another solution depends on a traditional SRM. Paper achieves on-board charging and power factor correction in a 2.3-kW SRM by utilizing machine windings as the input filter inductor. The concept of modular structure of driving topology is proposed in paper. Based on intelligent power modules (IPM), a four-phase half bridge converter is utilized to achieve driving and grid-charging. In spite of the fact that modularization supports mass production, the utilization of half/full bridge topology reduces the system reliability (e.g. shoot-through issues). Paper builds up a basic topology for plug-in hybrid electrical vehicle (HEV) that supports flexible energy flow. In any case, for grid charging, the grid should be associated with the generator rectifier that builds the energy conversion process and decreases the charging efficiency. In any case, a powerful topology and control strategy for PV-fed EVs is not yet developed. Since the PV has different characteristics to ICEs, the maximum power point tracking (MPPT) and solar energy utilization are the unique factors for the PV-fed EVs.

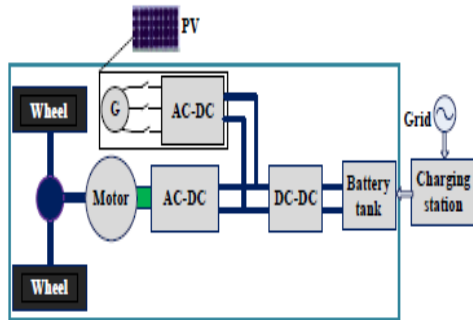


Figure 1. PV-fed hybrid electrical vehicle.

In order to achieve low cost and flexible energy flow modes, a low cost tri-port converter is proposed in this paper to arrange the PV panel, SRM and battery. Six operational modes are developed to support flexible control of energy flow.

II. TOPOLOGY AND OPERATIONAL MODES

A. Proposed topology and working modes

The proposed Tri-port topology has three energy terminals, PV, battery and SRM. They are linked by a power converter which comprises of four switching devices ( $S_0 \sim S_3$ ), four diodes ( $D_0 \sim D_3$ ) and two relays, as appeared in Figure 2 [26]. By controlling relays J1 and J2, the six operation modes are upheld, as appeared in Figure 3; the corresponding relay activities are delineated in Table I. In mode 1, PV is the energy source to drive the SRM and to charge the battery. In mode 2, the PV and battery are both the energy sources to drive the SRM. In mode 3, the PV is the source and the battery is idle. In mode 4, the battery is the driving source and the PV is idle. In mode 5, the battery is charged by a single-phase grid while both the PV and SRM are idle. In mode 6, the battery is charged by the PV and the SRM is idle.

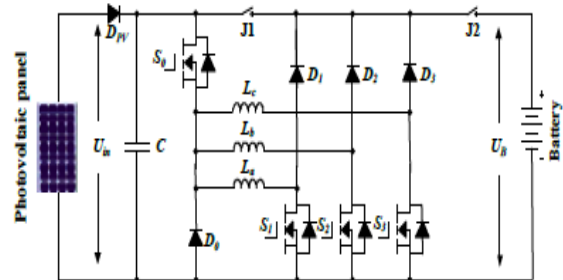


Figure 2. The proposed Tri-port topology for PV-powered SRM drive.

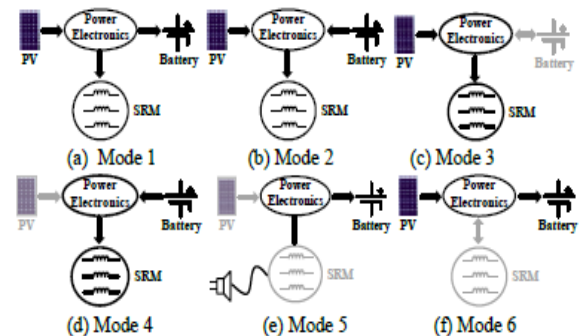


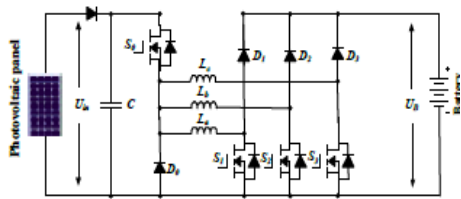
Figure 3. Six operation modes of the proposed Tri-port topology.

B. Driving modes

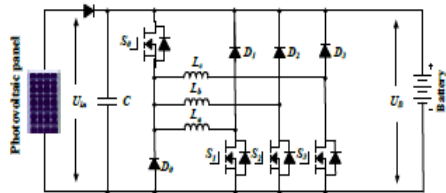
Working modes 1~4 are the driving modes to give traction drive to the vehicle.

**(1) Mode 1**

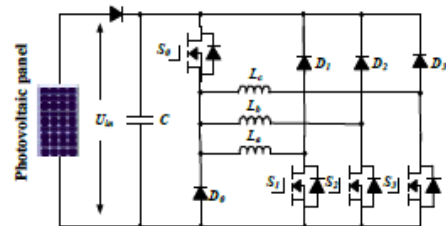
At light loads of operation, the energy produced from the PV is more than the SRM required; the system works in mode 1. The corresponding operation circuit is appeared in Fig.4 (an), The PV panel energy feed the energy to SRM and charge the battery; so in this mode, the battery is charged in EV operation condition.



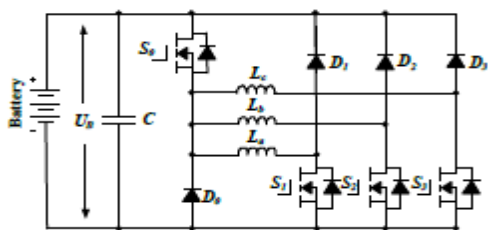
(a) Operation circuit under mode 1



(b) Operation circuit under mode 2



(c) Operation circuit under mode 3



(d) Operation circuit under mode 4

**Figure 4.** the equivalent circuits under driving modes.

**(2) Mode 2**

At the point when the SRM operates in heavy load, for example, uphill driving or acceleration, both the PV panel and battery supply power to the SRM. The relating operation circuit is appeared in Figure 4(b).

**(3) Mode 3**

At the point when the battery is out of power, the PV panel is the only energy source to drive the vehicle. The corresponding circuit is appeared in Figure 4(c).

**(4) Mode 4**

At the point when the PV can't generate electricity due to low solar irradiation, the battery supplies power to the SRM. The corresponding topology is delineated in Figure 4(d). In this mode.

**C. Battery charging modes**

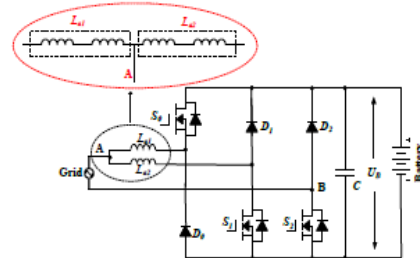
Operating modes 5 and 6 are the battery charging modes.

**(5) Mode 5**

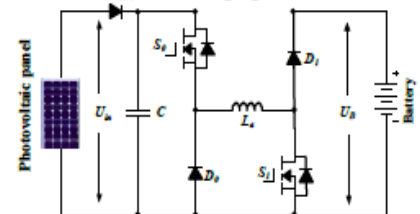
At the point when PV can't generate electricity, an external power source is expected to charge the battery, for example, AC grid. The relating circuit is appeared in Figure 5(a). One of the three phase windings is split and its midpoint is pulled out, as appeared in Figure 5(a). Phase windings La1 and La2 are employed as input filter inductors. These inductors are a part of the drive circuit to form an AC-DC rectifier for grid charging.

**(6) Mode 6**

At the point when the EV is stopped under the sun, the PV can charge the battery. The relating charging circuit is appeared in Figure 5(b).



(a) Grid charging mode



(b) PV source charging mode

**Figure 5** Equivalent circuits of charging condition modes.

### III. CONTROL STRATEGY UNDER DIFFERENT MODES

In order to make the best utilization of sun oriented energy for driving the EV, a control strategy under various modes is planned.

#### A. Single source driving mode

As indicated by the distinction in the power sources, there are PV-driving; battery-driving and PV and battery parallel fed source. In a heavy load condition, the PV power can't support the EV, mode 2 can be adopted to support enough energy and make full utilization of solar energy. Figure 6(a) demonstrates the equivalent power source; the corresponding PV panel working points is represented in Figure 6(b). Since the PV is paralleled with the battery, the PV panel voltage is clamped to the battery voltage  $U_b$ . In mode 2, there are three working states: winding excitation, energy recycling and freewheeling states, as appeared in Figure 7. Modes 3 and 4 have comparable working states to mode 2. The difference is that the PV is the only source in mode 3 while the battery is the only source in mode 4.

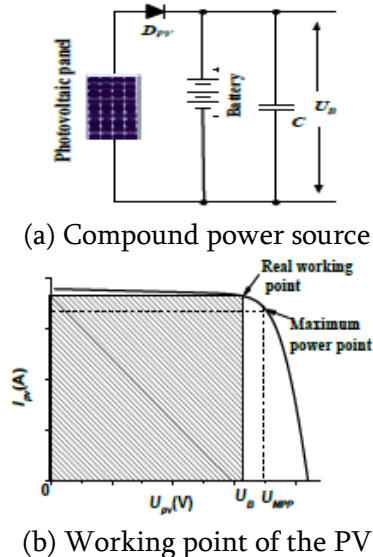
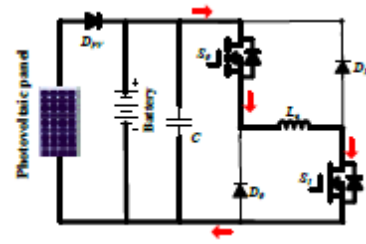
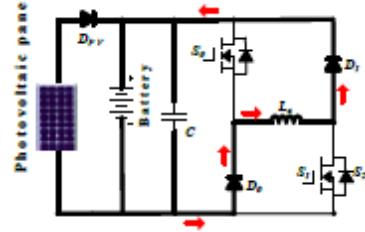


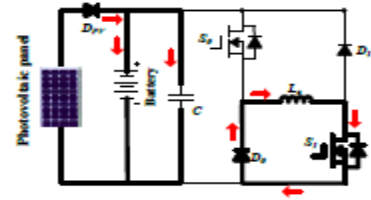
Figure 6 Power supply at mode 2.



(a) Winding excitation state



(b) Energy recycling state



(c) Freewheeling state

Figure 7. Working states at mode 2.

Neglecting the voltage drop over the power switches and diodes, the phase voltage is given by

$$U_m = R_k i_k + \frac{d\psi(i_k, \theta_r)}{dt} = R_k i_k + L_k \frac{di_k}{dt} + i_k \omega_r \frac{dL_k}{d\theta_r}, \quad k = a, b, c \quad (1)$$

where  $U_m$  is the DC-link voltage,  $k$  is phase a, b, or c,  $R_k$  is the phase resistance,  $i_k$  is the phase current,  $L_k$  is the phase inductance,  $\theta_r$  is the rotor position,  $\psi(i_k, \theta_r)$  is the phase flux linkage depending upon the phase current and rotor position, and  $\omega_r$  is the angular speed. The third term in Eq. 1 is the back electromotive force (EMF) voltage by

$$e_k = i_k \omega_r \frac{dL_k}{d\theta_r} \quad (2)$$

Consequently, the phase voltage is found by

$$U_k = R_k i_k + L_k \frac{di_k}{dt} + e_k \quad (3)$$

In the excitation area, turning on S0 and S1 will induce a current in phase a winding, as show in Figure 7(a). Phase a winding is subjected to the positive DC bus voltage.

$$+U_{in} = R_k i_k + L_k \frac{di_k}{dt} + e_k \quad (4)$$

At the point when S0 is off and S1 is on, the phase current is in a freewheeling state in a zero voltage loop, as appeared in Figure 7(c), the phase voltage is zero.

$$0 = R_k i_k + L_k \frac{di_k}{dt} + e_k \quad (5)$$

In the demagnetization region, S0 and S1 are both turned off; what's more, the phase current will flow back to the power supply, as appear in Figure 7(b). In this state, the phase winding is subjected to the negative DC bus voltage, and the phase voltage is

$$-U_{in} = R_k i_k + L_k \frac{di_k}{dt} + e_k \quad (6)$$

In single source driving mode, the voltage-PWM control is utilized as the fundamental plan, as showed in Figure 8. As per the given speed  $\omega^*$ , the voltage-PWM control is activated at speed control.

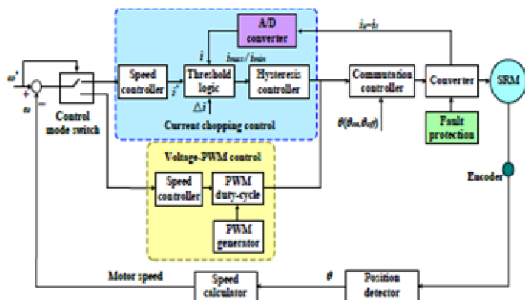
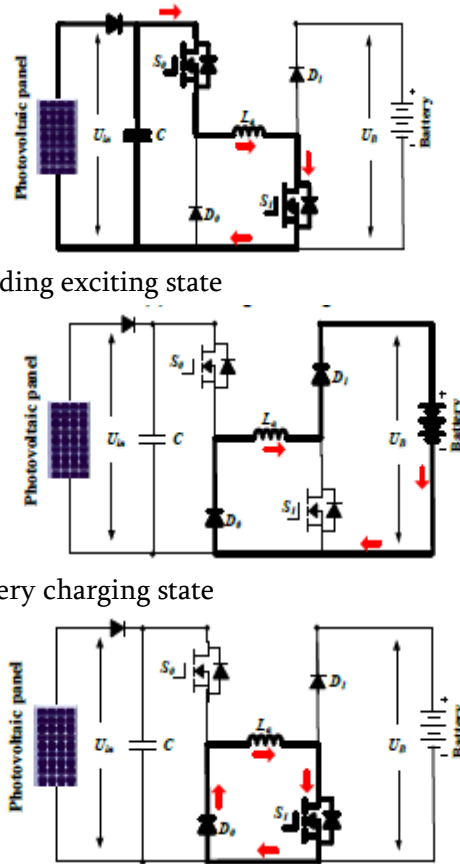


Figure 8. SRM control strategy under single source driving mode.

**B. Driving-charging hybrid control strategy**

In the driving-charging hybrid control, the PV is the driving source and the battery is charged by the freewheeling current, as represented in drive mode 1. There are two control targets: maximum power point tracking (MPPT) of the PV panel and speed control of the SRM. The dual-source condition is switched from a PV-driving mode. Firstly, the motor speed is

controlled at a given speed in mode 3. At that point, J2 is turned on and J1 is off to switch to mode 1. By controlling the turn-off point, the maximum power of PV panel can be tracked. There are three steady working states for the double source (mode 1), as appeared in Figure 9. In Figure 9(a), S0 and S1 conduct, the PV panel charges the SRM winding to drive the motor; In Figure 9(b), S0 and S1 turn off; and the battery is charged with freewheeling current of the phase winding. Figure 9(c) appears a freewheeling state.



(a) Winding exciting state

(b) Battery charging state

(c).Freewheeling state

Figure 9. Mode 1 working states.

Figure 10 is the control strategy under driving-charging mode. In Figure 10,  $\theta_{on}$  is the turn on angle of SRM;  $\theta_{off}$  is the turn-off angle of SRM. By changing turn-on angle, the speed of SRM can be controlled; the maximum power point tracking of PV panel can be achieved by adjusting turn-off angle, which can control the charging current to the battery.

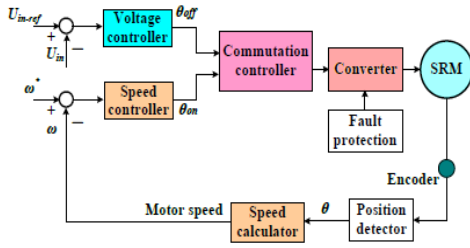


Figure 10. Control strategy under driving-charging mode (mode 1)

C. Grid-charging control system

The proposed topology also supports the single-phase grid charging. There are four fundamental charging states and S0 is dependably turned off. At the point when the grid instantaneous voltage is more than zero, the two working states are exhibited in Figure 11(a) and (b). In Figure 11(a), S1 and S2 conduct, the grid voltage charges the phase winding La2, the relating condition can be communicated as Eq.7; In Figure 11(b), S1 turns off and S2 conducts, the grid is associated in series with phase winding to charges the battery, the relating condition can be communicated

$$U_{grid} = L_{a2} \cdot \frac{di_{grid}}{dt} \tag{7}$$

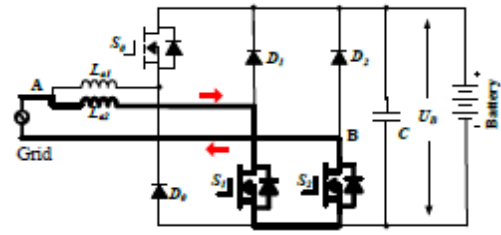
as Eq. 8.

$$U_B - U_{grid} = L_{a2} \cdot \frac{di_{grid}}{dt} \tag{8}$$

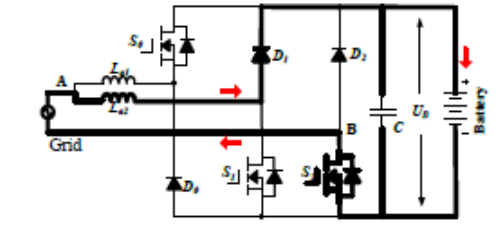
At the point when the grid instantaneous voltage is below zero, the two working states are introduced in Figure 11(c) and (d). In Figure 11(c), S1 and S2 conduct, the grid voltage charges the phase winding La1 and La2, the comparing condition can be communicated as Eq. (9); In Figure 11(d), S1 continues conducting and S2 turns off, the grid is associated in series with phase winding La1 and La2 to charges the battery, the relating condition can be communicated as Eq. 10.

$$U_{grid} = \frac{L_{a1} + L_{a2}}{L_{a1} \cdot L_{a2}} \cdot \frac{di_{grid}}{dt} \tag{9}$$

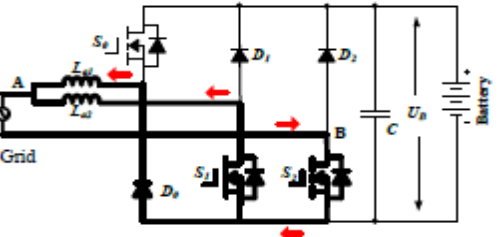
$$-U_B - U_{grid} = \frac{L_{a1} + L_{a2}}{L_{a1} \cdot L_{a2}} \cdot \frac{di_{grid}}{dt} \tag{10}$$



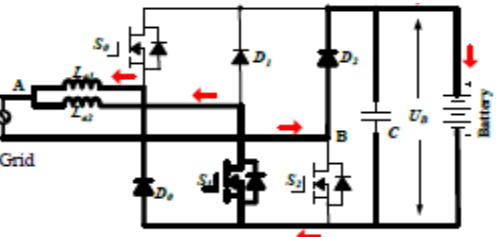
(a) Grid charging state 1 ( $U_{grid} > 0$ )



(b) Grid charging state 2 ( $U_{grid} > 0$ )



(c) Grid charging state 3 ( $U_{grid} < 0$ )



(e) Grid charging state 4 ( $U_{grid} < 0$ )

Figure 11. Mode 5 charging states .

In Figure 12,  $U_{grid}$  is the grid voltage; by the phase lock loop (PLL), the phase data can be got;  $I_{ref\_grid}$  is the given amplitude of the grid current. Combining  $\sin\theta$  and  $I_{ref\_grid}$ , the instantaneous grid current reference  $i_{ref\_grid}$  can be figured. In this mode, when  $U_{grid} > 0$ , the inductance is  $L_{a2}$ ; when  $U_{grid} < 0$ , the inductance is paralleled  $L_{a1}$  and  $L_{a2}$ ; so in order to adopt the change in the inductance, hysteresis control is employed to acknowledge grid current regulation. Besides, hysteresis control has great loop performance, global stability and small phase lag that makes grid connected control stable

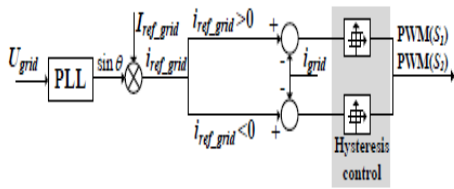
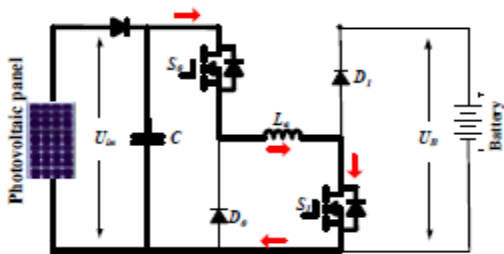


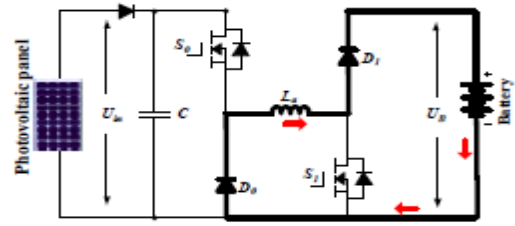
Figure 12. Grid-connected charging control (Mode 5).

**D. PV-fed charging control system**

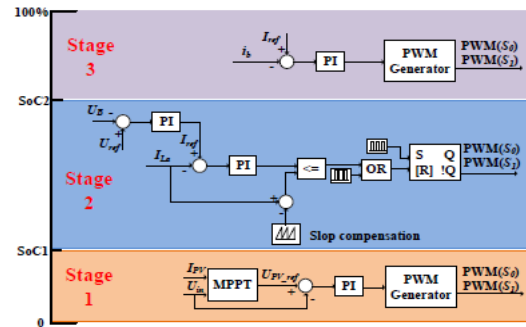
In this mode, the PV panel charges the battery specifically by the driving topology. The phase windings are employed as inductor; what's more, the driving topology can be worked as interleaved Buck boost charging topology. For one phase, there are two states, as appeared in Figure 13(a) and (b). Whenever S0 and S1 turn on, the PV panel charges phase inductance; when S0 and S1 turns off, the phase inductance discharges energy to battery. According to the state-of-charging (SoC), there are three stages to make full utilize of solar energy and keep up battery healthy condition, as represented in Fig.13 (c). During stage 1, the relating battery SoC is in 0~SoC1, the battery is in greatly need energy condition, the MPPT control strategy is utilized to make full utilization of solar energy. During stage 2, the corresponding battery SoC is in SoC1~ SoC2, the constant voltage control is adapted to charging the battery. During stage 3, the corresponding battery SoC is in SoC2~1, the micro current charging is adapted. In order to simplify the control strategy, constant voltage is employed in PV panel MPPT control.



(a) Phase inductance charging



(b) Battery charging



(c) Charging control strategy.

Figure 13. Mode 6 charging states and control strategy.

**Extension:**

**Fuzzy Logic System:**

Today control systems are usually described by mathematical models that follow the laws of physics, stochastic models or models which have emerged from mathematical logic. A general difficulty of such constructed model is how to move from a given problem to a proper mathematical model. Undoubtedly, today's advanced computer technology makes it possible; however managing such systems is still too complex.

These complex systems can be simplified by employing a tolerance margin for a reasonable amount of imprecision, vagueness and uncertainty during the modeling phase. As an outcome, not completely perfect system comes to existence; nevertheless in most of the cases it is capable of solving the problem in appropriate way. Even missing input information has already turned out to be satisfactory in knowledge-based systems.

Fuzzy logic allows to lower complexity by allowing the use of imperfect information in sensible way. It

can be implemented in hardware, software, or a combination of both. In other words, fuzzy logic approach to problems' control mimics how a person would make decisions, only much faster. Usually fuzzy logic control system is created from four major elements presented on Figure 1: fuzzification interface, fuzzy inference engine, fuzzy rule matrix and defuzzification interface. Each part along with basic fuzzy logic operations will be described in more detail below.

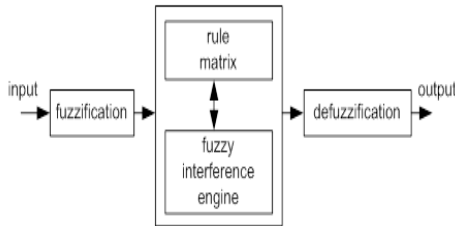


Figure 14. Fuzzy logic controller

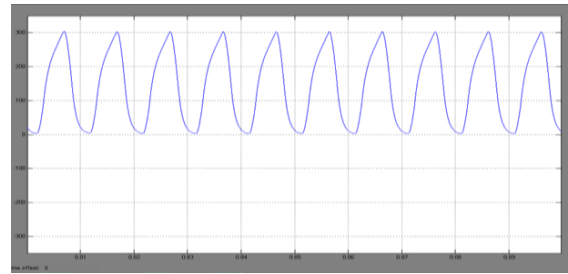
#### IV. SIMULATION

A 12/8 SRM is initially modeled in Matlab/Simulink utilizing parameters in Table II. Figure 14(a) presents the simulation results at mode 1. The load torque is set as 35 Nm, the PV panel voltage is controlled at the MPP. The freewheeling current is used to charge the battery. Figure 14(b) demonstrates the simulation results of the single-source driving (modes 2-4).

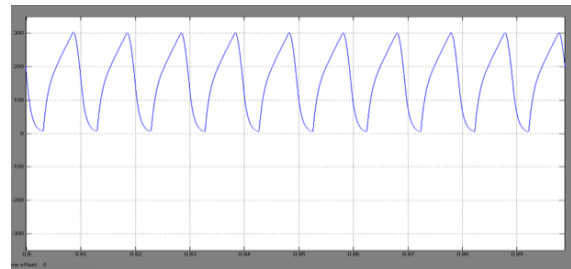
Figure 15 demonstrates the simulation results of charging where Figure 15(a) is for grid-charging. The positive half current quality is superior to anything the negative half that is caused by the change in the grid-connected inductance. Fig.15(b) and (c) are for PV-charging. Figure 15(b) presents the step change from stage 1 to 2. In stage 1, the battery is low in SoC. In order to achieve MPPT of the PV, the constant voltage control is utilized and the PV output voltage is controlled at MPP (310 V), as appeared in Figure 15(b). In stage 2, a constant voltage is embraced; the reference voltage is set to 355 V. As appeared in Figure 15(b), the charging converter output voltage is controlled at reference voltage in the step change

from stage 1 to stage 2. In stage 3, 1 A trickle charging is moreover accomplished, as appeared in Figure 15(c).

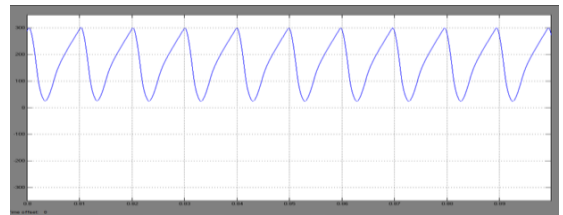
#### Mode 1



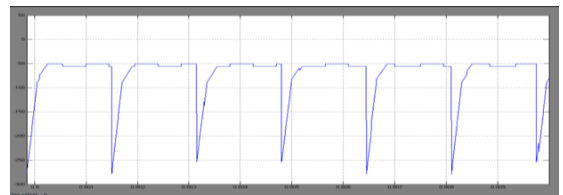
Ia



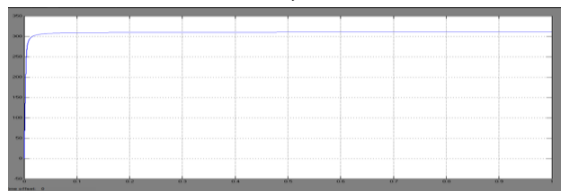
Ib



Ic



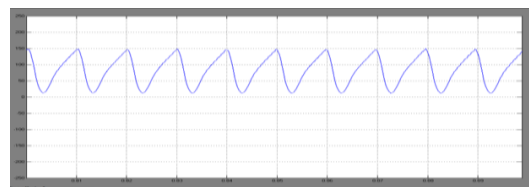
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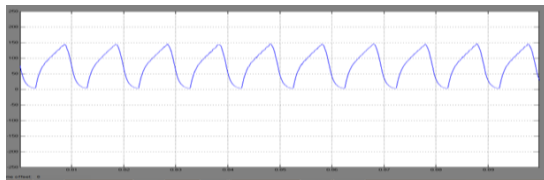
Uin

(a) Simulation results of driving-charging mode (mode 1)

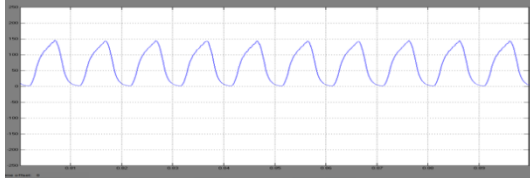
#### Mode3



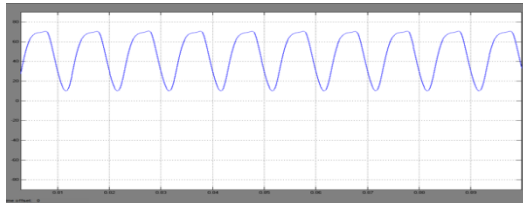
Ia



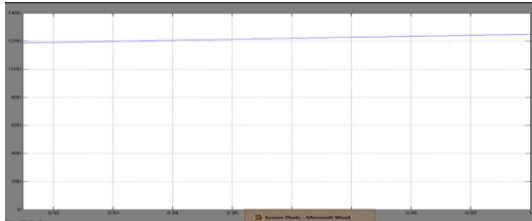
Ib



Ic



Torque

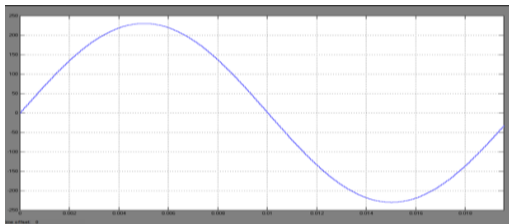


Speed

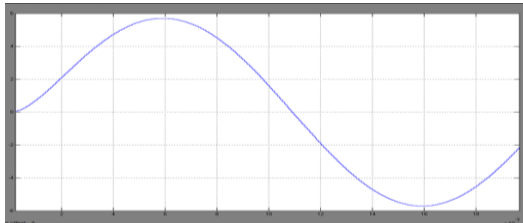
(b) Simulation results of single source driving mode (modes 3)

Figure 15 Simulation results for driving conditions at modes 1, 3 and 4.

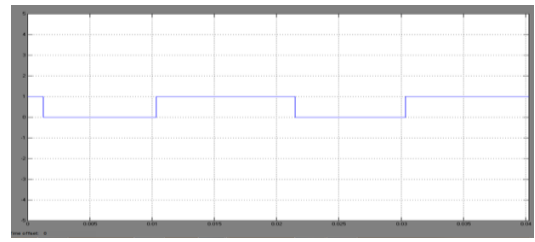
**Mode 5**



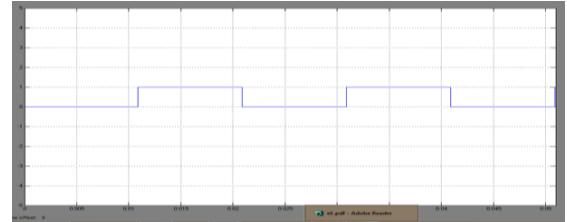
Ugrid



Igrid



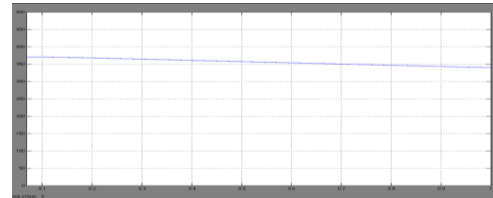
PWM1



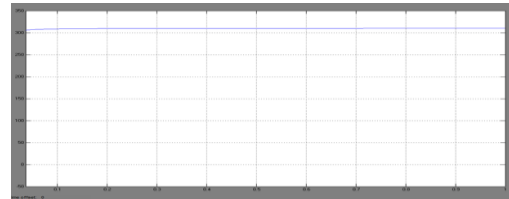
PWM2

(a) Grid charging (mode 5)

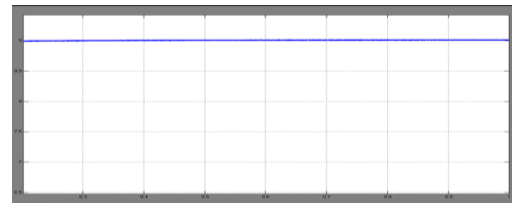
**Mode6\_Stage1**



Ub



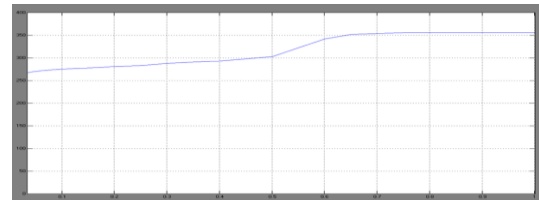
Uin



Ia

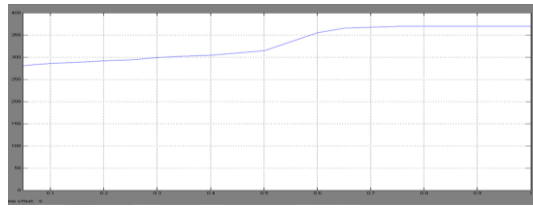
(b) PV charging mode 6 (stage 1)

**Mode6\_Stage2**

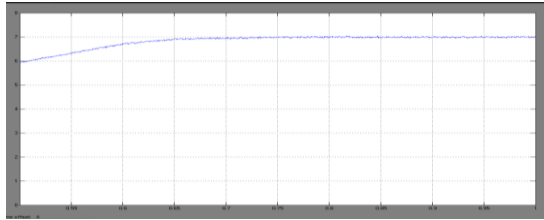


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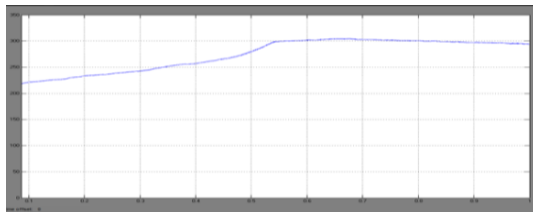
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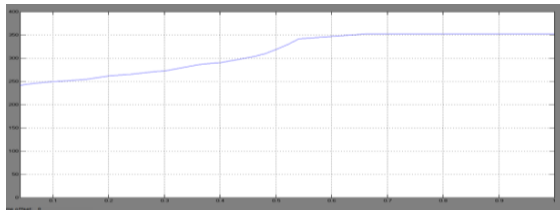
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(c) PV charging mode 6 (stage 2)

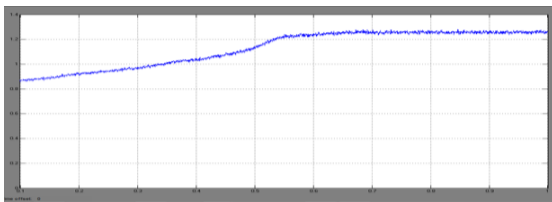
Mode6\_Stage3



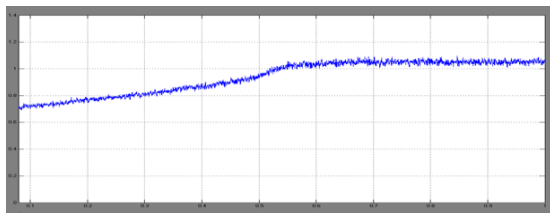
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(d) PV charging mode 6 (stage 3)

Figure 16. simulation results for charging modes.

Table 1. THD values for Proposed and Extension methods.

THD in % proposed method	THD in % extension method
Mode 1: $I_a = 41.43, I_b = 38.12, I_c = 64.58$	Mode 1: $I_a = 25.72, I_b = 19.82, I_c = 27.17$
Mode 2: $I_a = 43, I_b = 31.01, I_c = 71.52$	Mode 2: $I_a = 25.29, I_b = 14.46, I_c = 27.94$
Mode 3: $I_{La} = 82.66, I_{Lb} = 33.68, I_{Lc} = 43.47$	Mode 3: $I_{La} = 51.25, I_{Lb} = 17.51, I_{Lc} = 18.26$
Mode 4: $I_{La} = 64.68, I_{Lb} = 34.25, I_{Lc} = 41.87$	Mode 4: $I_{La} = 40.1, I_{Lb} = 17.51, I_{Lc} = 17.56$
Mode 5: $U_{grid} = 0.004535, I_{grid} = 0.004864$	Mode 5: $U_{grid} = 0.004535, I_{grid} = 0.004864$
Mode 6:stage 1 $I_a = 11.5$	Mode 6:stage 1 $I_a = 5.982$
Mode 6:stage 2 $I_{La} = 2.377$	Mode 6:stage 2 $I_{La} = 0.9965$
Mode 6:stage 3 $I_a = 2.429, I_b = 2.632$	Mode 6:stage 3 $I_a = 1.815, I_b = 1.969$

## V. CONCLUSION

In order to handle the range anxiety of utilizing EVs and decrease the system cost, a mix of the PV panel and SRM is proposed as the EV driving system.

The main contributions of this paper are:

- (i) A tri-port converter is utilized to coordinate the PV panel, battery and SRM.

- (ii) Six working modes are developed to achieve flexible energy flow for driving control, driving/charging hybrid control and charging control.
- (iii) A novel grid-charging topology is formed without a need for external power electronics devices.
- (iv) A PV-fed battery charging control scheme is developed to enhance the solar energy utilization.

Since PV-fed EVs are a greener and more economical innovation than conventional ICE vehicles, this work will give feasible solution to reducing the total costs and CO<sub>2</sub> emissions of electrified vehicles. Moreover, the proposed innovation may likewise be connected to comparable applications, such as fuel cell powered EVs. Fuel cells have a considerably higher power density and are hence more qualified for EV applications.

## **VI. REFERENCES**

1. A. Emadi, L. Young-Joo, K. Rajashekara, "Power electronics and motor drives in electric, hybrid electric, and plug-in hybrid electric vehicles," *IEEE Trans. Ind. Electron.*, vol. 55, no. 6, pp. 2237-2245, Jun. 2008.
2. B. I. K. Bose, "Global energy scenario and impact of power electronics in 21st century," *IEEE Trans. Ind. Electron.*, vol. 60, no. 7, pp. 2638-2651, Jul. 2013.
3. J. de Santiago, H. Bernhoff, B. Ekergård, S. Eriksson, S. Ferhatovic, R. Waters, and M. Leijon, "Electrical motor drivelines in commercial all-electric vehicles: a review," *IEEE Trans. Veh. Technol.*, vol. 61, no. 2, pp. 475-484, Feb. 2012.
4. Z. Amjadi, S. S. Williamson, "Power-electronics-based solutions for plug-in hybrid electric vehicle energy storage and management systems," *IEEE Trans. Ind. Electron.*, vol. 57, no. 2, pp. 608-616, Feb. 2010.
5. A. Kuperman, U. Levy, J. Goren, A. Zafransky, and A. Savernin, "Battery charger for electric vehicle traction battery switch station," *IEEE Trans. Ind. Electron.*, vol. 60, no. 12, pp. 5391-5399, Dec. 2013.

# Autonomous Pv-Array Excited Wind-Driven Induction Generator Using Fuzzy Logic Controller For Off Grid Application In India

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## ABSTRACT

Isolated renewable energy systems that is construct completely in light of renewable resource however in the meantime solid is fundamental for taking care of the power requests of remote spots where utility grid is not accessible and for which hybrid wind-solar system assumes a urgent part. In this paper, a streamlined control conspire has been introduced for a remain solitary crossover PV array energized wind driven induction generator considering a three phase variable load with or without unbalance. The proposed plot abuses the toughness and cost induction generator as a reasonable option for a costly permanent magnet synchronous generator (PMSG) which is constantly utilized as a part of remain solitary little wind turbines. Any remain solitary system utilizes a battery, however the system is assume to convey control even without battery and the battery less method of operation is arrayed in this paper. The control plot has been approved with simulation and equipment comes about. Broad field test has been performed utilizing a 2.4 kW PV boards, 2.2 kW Wind turbine emulator and climate stations for execution assessment. The approval comes about have been introduced which demonstrates the proposed plot is required to be an appealing answer for remote application where utility grid is either not feasible or not economical.

**Keywords:** OFF gird, PV, wind, wind driven induction generator.

## I. INTRODUCTION

Over 400 million individuals in India, including 47.5% of those living in India's provincial zones, still has no entrance to power. As a result of the remoteness of quite a bit of India's un-jolted populace, sustainable power source can offer a financially reasonable methods for giving associations with these gatherings. There is a solid requirement for off grid power generation, to cater those divisions, where either grid augmentation is either not achievable or not savvy. Separated sustainable power source system that is construct completely in light of natural resources and in the meantime solid is vital for taking care of the power requests of remote spots where utility grid is

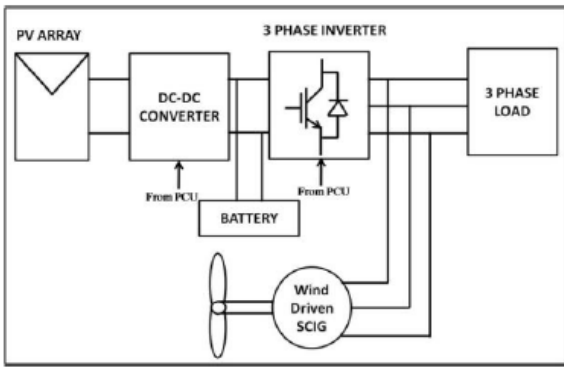
not accessible. For which hybrid wind-solar assume a vital part. Since sun oriented and wind have inalienable complimentary profile, it turns into an appealing decision for a hybrid sustainable power source conspire. Numerous hybrid schemes have been as of now revealed in writing and additionally exists by and by .Normally in cross breed wind-sun oriented schemes, PMSG (permanent magnet Synchronous generators), is constantly utilized as the wind driven generator particularly for an independent applications. In such hybrid schemes in light of PV and wind driven PMSG, the differing adequacy changing frequency of the stator voltage of the PMSG and the variable dc voltage of the PV array must be reasonably molded utilizing complex power-electronic interfaces.

In any case, for any off-lattice system work, it is alluring to introduce segments and their related controls that are without boost and prudent. In this unique circumstance, Self energized induction generators utilizing capacitors have been accounted for in the writing. Squirrel Cage Induction Generator (SCIG) which is hearty, economical, require little upkeep and have higher power-weight proportion over PMSG, substantially less expensive than PMSG would be attractive decision for a remote remain solitary application. Be that as it may, regardless of these preferences, wind-driven capacitor-energized induction generators are not favored in remote power system works because of their unsuitable voltage regulation and frequency variety. However to abuse the benefits of IG and also to defeat the above downside, hybrid system utilizing a dc-dc converter fed 3-phase Voltage Source inverter (VSI) as power interface arrange, battery charged by sun oriented photograph voltaic cells (PV) and the PV energized Induction Generator (IG) driven by wind have been accounted for in the literature. The three phase Load, output of IG and output of the VSI systems a Point of Common Coupling (PCC). This hybrid scheme can work to supply the required load even without battery. However in this work, a settled resistive load has been considered for the controller configuration and additionally unbalance in load has not been considered. Further to this, hybrid scheme in view of PV and IG revealed in the writing, require an utility grid for its operation. The vast majority of them utilize a doubly encouraged induction generator, which is at the end of the day costly. It is endeavored to build up a vigorous and dependable control conspire for self-ruling hybrid system in view of PV source and wind driven induction generator that can give consistent controlled three phase output voltage for a wide range of load with or without unbalance. In the current work, an improved controller for battery less mode operation has been produced for a PV fed Boost Converter encouraged Inverter energized wind driven IG conspire (PVEWIG) to direct the inverter DC

connect without battery. In this scheme, a three phase variable resistive and additionally inductive load with or without unbalance has been considered. The proposed controller guarantees voltage regulation of DC connect and enhances the power quality parameters at purpose of normal coupling (PCC) under shifting illumination, temperature of PV array and wind speed variety in the wind generator. The proposed plot has been actualized in equipment utilizing a 2.4 kW PV cluster and a 2.25 kW Wind turbine emulator driven SCIG. This paper is sorted out as takes after. Area II depicts the power circuit topology of the PVEWIG conspire. The nitty gritty clarification of the control plot is displayed in area III. The displaying and simulation comes about are arrayed in area IV and equipment approval comes about are introduced in segment V.

## **II. POWER CIRCUIT ARRANGEMENT OF THE PV ARRAY FED INVERTER EXCITED WIND DRIVEN IG**

The PVEWIG system comprises of PV array, dc-dc converter, battery, 3 leg inverter, wind driven three phase squirrel cage induction generator and a non-direct load. The PV array sustains a dc-dc boost converter. The voltage over the dc-dc boost converter is associated with a battery, which is modified by a three phase inverter and the IG is coordinated to the inverter output and is lock to inverter voltage and frequency. The IG would require reactive power which it would ordinarily draw from an utility system in a grid associated conspire. In the current scheme, the receptive power required by the induction machine is provided by the PV array fed inverter.



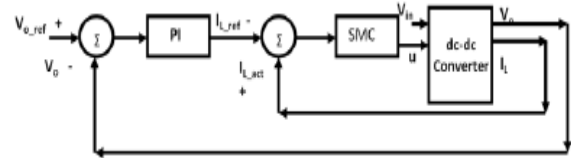
**Figure 1.** Block diagram of the Power Circuit for PVEWIG System with Battery

The output of the inverter goes about as a virtual grid giving a consistent voltage and recurrence. The three-phase load is associated with inverter output and is provided by PV-IG and battery or PV-IG, the load sharing being reliant on illumination and wind speed. The inverter output, IG output and load frames the purpose of normal coupling (PCC). The piece schematic of the whole PVEWIG conspire is appeared in Fig. 1. One of the exceptional elements of this half and half scheme is that, this system utilizes an induction generator without a need of either utility lattice or excitation capacitors, consequently maintaining a strategic distance from every one of the inconveniences related with it. Without battery, the real power adjust is to such an extent that the entirety of PV exhibit power and real power output of IG parallels the inverter control output which is conveyed to the load. The power adjusting is clarified in more detail in the consequent areas.

### III. CONTROL SCHEME OF THE PV ARRAY FED INVERTER EXCITED WIND DRIVEN IG

In this paper, battery less operation of the PVEWIG conspire has been considered. The system should keep on delivering power continuous amid the nonattendance of battery, which may happen either because of profound release or completely charged state of the battery. Additionally it may be important to expel the battery from the system for a concise

term for boost. In this mode, the boost converter will act in a voltage regulation mode and keeps up steady DC connect voltage under all states of climate and load changes. The Inverter is activated by an open circle sinusoidal PWM controller. The control piece chart of the dc-dc boost converter utilized as a part of this scheme is appeared in Figure 2



**Figure 2.** Block diagram of Cascaded PI-SMC controller for output voltage regulation of dc-dc boost converter

output voltage control of dc-dc boost converter. The V-I attributes of PV cluster differs with light also, temperature and this moves the working purpose of the PV cluster. Further, the variety of wind speed changes the pole torque to the induction generator. These fluctuating parameters cause the contribution and in addition load of the dc-dc converter to change. In this occasion, the controller works in voltage regulation mode. The dc-interface voltage is directed utilizing a cascade PI-SMC control in which the external circle comprises of a PI controller and the internal circle comprises of a sliding mode current controller (SMC) as appeared in Fig. 2. The external PI controller creates a current reference from its information voltage blunder between reference ( $V_{o\_ref}$ ) and real output voltage ( $V_o$ ) of dc-dc converter. The blunder between reference ( $I_{L\_ref}$ ) and real Inductor current ( $I_{L\_act}$ ) is given as contribution to SMC which creates the entryway pulse for the boost converter IGBT. The essential standard of SMC includes scheme of a sliding surface in its control law which would coordinate the regulation of the state factors towards a coveted source. Ordinarily in a solitary switch dc-dc converter, the control law that receives an switching work is given by  $u = \frac{1}{S} \text{sign}(S)$  where „u“ is the

switching capacity (rationale state) of the converter's control switch and the state variable is the inductor current. In light of the general sliding mode control hypothesis, the state variable mistake is characterized as the distinction amongst real and reference esteem (of the inductor current), which shapes the sliding work given by  $|i_{ref} - i|$ .

A. Inverter Control of PVEWIG At the point when an IG is interfaced with the lattice or in the proposed scheme with a "PV fed DC-DC converter encouraged inverter", at first there is a colossal contrast between the initiated emf of the IG and the inverter voltage which causes a sudden inrush. The extent of this inrush relies on upon the underlying velocity of the rotor and the remaining flux of the stator of the IG. On the off chance that the rotor begins from zero speed then the size of inrush is exceptionally extreme, this is typically 5 to 6 times that of the appraised current (which is the situation of an induction motor). In this hybrid scheme, the IG is electrically incorporated with the inverter output when the speed of the IG is somewhat over the synchronous speed which relates to the cut in speed of the wind turbine. In this manner in such condition the extent what's more, span of the inrush is very little extreme and could be withstood by the information dc source of the inverter. In any case, the output voltage of the inverter Nonetheless, the output voltage of the inverter is bit by bit expanded, by gradually expanding the tweak record of the sine PWM controller to absolutely dispense with any plausibility of inrush current.

#### IV. MODELING AND SIMULATION OF THE PVEWIG SYSTEM

The simulation is performed utilizing the numerical models of PV exhibit, dc-dc boost converter, induction machine, voltage source inverter (VSI) and the load keeping in mind the end goal to decrease the memory size and calculation time of the simulation,

which would somehow or another make the simulation more complex as the whole cross breed conspire with control comprises of a few subsystems. The square graph of the whole hybrid scheme utilized for simulation is appeared in Figure 3. The scientific conditions re correcting the scientific models of various subsystem appeared in figure 3 are recurrented in Table I. The PV show is communicated as given in what's more, the dc-dc boost converter display is given by The established dq demonstrate is utilized for speaking to induction generator. The inverter conditions and load circuit are spoken to utilizing. In this scheme, the aggregate real energy of the load is shared amongst inverter and IG. The receptive energy of the load and additionally the IG is met by the inverter. The real, receptive and evident power appropriations accepting the misfortunes in the inverter and dc-dc converter are irrelevant, are given by (6) to (8)

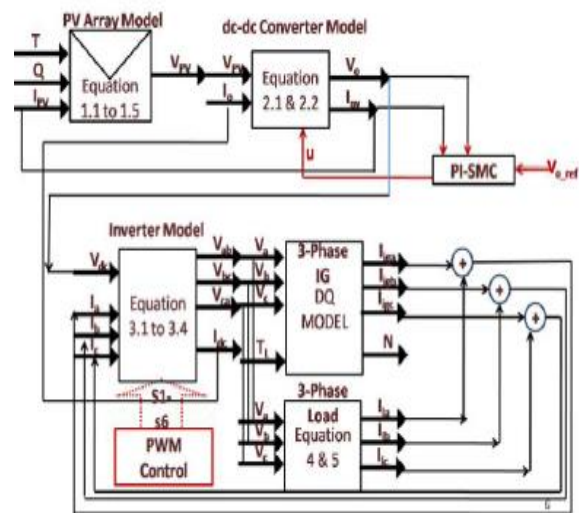


Figure 3. Block Diagram Recurrenting the Mathematical Model of PVEWIG System

**Table 1.** Mathematical Models used for recurring the PVEWIG system

Subsystem	Circuit Schematic
PV Array Voltage Calculation block Equation 1.1 to 1.5	
$I_{pv} = I_{sc} - I_d$ (1.1), $I_d \cong 10^{-9} I_{sc} \exp \frac{20.7}{V_{oc}} (V_{pv} + I_{pv} R_s)$ (1.2) $I_{sc}(Q, T) \cong I_{scQ} (1 + \alpha \Delta T)$ (1.3), $V_{pv} = (I_{sc} - I_d) R_s - I_{pv} R_s$ (1.4) $V_{oc}(Q, T) \cong V_{ocQ} (1 - \gamma \Delta T) \ln(1 + \beta \Delta Q)$ (1.5)	
dc-dc Converter O/p Voltage & Input Current Calculation Block Equation 2.1 & 2.2	
$\frac{dI_L(t)}{dt} = \frac{E - V_o(t)}{L} (1-u)$ (2.1), $\frac{dV_o(t)}{dt} = \frac{I_L(t)}{C} (1-u) - \frac{I_o(t)}{C} u$ (2.2) ( $i_{pv} = i_L$ , $V_{DC} = V_o$ ) u is the switching function	
3-Phase IG block DQ Model	<p>Dq model of Induction machine is used</p>
Inverter Model Equation 3.1 to 3.4	
$I_{dc} = I_1 + I_2 + I_3$ $I_1 = I_{S1} - I_{D1}$ (3.1) $I_2 = I_{S2} - I_{D2}$ $I_3 = I_{S3} - I_{D3}$	$I_{S1} = I_c \times S1(\text{for } I_c > 0)$ $I_{S2} = I_c \times S3(\text{for } I_c > 0)$ $I_{S3} = I_c \times S5(\text{for } I_c > 0)$ (3.3)
$v_c = (S1 - S4)V_{dc}$ (3.2) $v_b = (S3 - S6)V_{dc}$ $v_a = (S5 - S2)V_{dc}$	$I_{D1} = -I_c \times S1(\text{for } I_c < 0)$ $I_{D2} = -I_c \times S3(\text{for } I_c < 0)$ $I_{D3} = -I_c \times S5(\text{for } I_c < 0)$ S1 to S6 are switching functions (Gate Pulses)
3-Phase Load Equation 4 & 5	
$\frac{di_{l1}}{dt} = \frac{v_a - i_{l1} R_{c1}}{L_{load}}$ (4.1)	$i_{l2} = \frac{v_c}{R_{c2}}$ (5.1)
$\frac{di_{l2}}{dt} = \frac{v_b - i_{l2} R_{b1}}{L_{load}}$ (4.2)	$i_{l2} = \frac{v_b}{R_{b2}}$ (5.2)
$\frac{di_{l3}}{dt} = \frac{v_c - i_{l3} R_{c1}}{L_{load}}$ (4.3)	$i_{l2} = \frac{v_c}{R_{c2}}$ (5.3)

The instantaneous distribution at the point of common coupling (PCC) is given by (9).

$$P_{Inverter} + P_{IG} = P_{load}$$

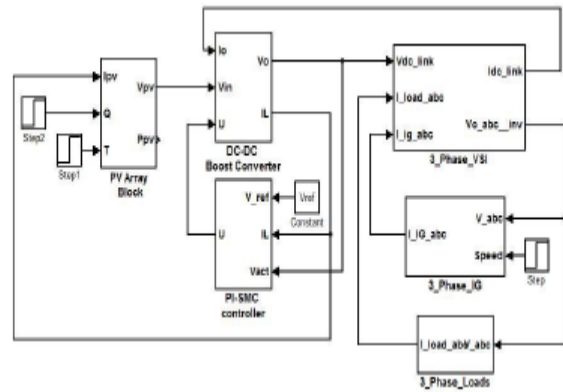
$$Q_{Inverter} = Q_{IG} + Q_{load}$$

$$S_{load} = S_{Inverter} + S_{IG}$$

$$i_{Inverter\_abc} + i_{IG\_abc} = i_{load\_abc}$$

The simulation piece graph of the whole hybrid plot alongside the controller executed in MATLAB/Simulink is appeared in Fig. 4. The beginning reaction of the PVEWIG system is appeared in figure 5. It could be watched the real energy of load is shared amongst inverter and IG, while the receptive energy of the load and IG is provided by the inverter. Amid beginning, the regulation file of the sine PWM inverter is step by step expanded from its underlying

zero esteem, which encourages mix of IG with the inverter without any inrush current as appeared in figure 6. The unfiltering state waveforms of voltage at PCC and current of PVEWIG system counting load, IG and inverter are appeared in figure 7. The conveyance of real power among PV exhibit and IG under unsettling influences in light, wind turbine speed and load is appeared in figure 8a. For this situation the temperature is kept up consistent at 35 deg Celsius. It can be watched the system rms voltage stays steady with the exception of a brief term unsettling influence as appeared in figure 8a. Additionally the real power adjust is guaranteed among the two sources PV exhibit and IG, giving a directed yield voltage to the load. The reaction of the system for a wind speed variety at a steady load and light is appeared in figure 8b. It can be watched, the controller guarantees the power adjust what's more, keeping up consistent DC connect voltage.

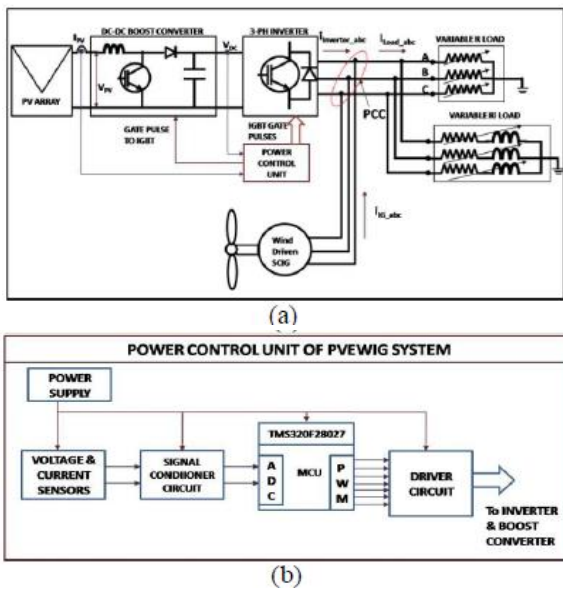


**Figure 4.** Simulation Block Diagram in Matlab Recurring the Mathematical Model of PVEWIG System

Further, for this situation the power conveyed by the IG increments with the wind speed while the PV control diminishes as needs be, not as much as its accessible power for the given illumination. Be that as it may, the target of the controller here is to direct the DC connect voltage in the battery less method of operation.

## V. HARDWARE IMPLEMENTATION AND VALIDATION

The proposed PVEWIG conspire is actualized utilizing a 2.4 kW PV cluster and a 2.25 kW Wind turbine emulator driven induction generator. The control conspire which involves a cascade PI-SMC control for the lift converter and open circle sine-PWM control for the inverter is actualized utilizing a Texas Instruments microcontroller TMS320F28027. Hall Impact Voltage and current sensors are utilized to detect the inverter DC connect voltage and PV exhibit current individually. The equipment piece outline of the power circuit and the control circuit are appeared in figure 9a and 9b individually. Furthermore climate Sensors including pyrometer, temperature sensors, voltage and current sensors are utilized alongside an information data logger to screen the execution of the system for a long span. The circuit parameters including evaluations of load, PV and IG utilized for equipment execution are given in Table II, which is same as the one considered for reenactment.



**Figure 5.** (a) Hardware Block diagram of PVEWIG system (b) Block diagram of the Power Control Unit of PVEWIG System

The beginning grouping of battery less PVEWIG system is clarified as takes after with reference to

figure 9. Before beginning, it is required that the IG is running at a speed, more prominent than or equivalent to its synchronous speed. At first the pulse to the dc-dc boost converter alone is turned ON by the power control unit (PCU). Currently the, dc interface voltage begins getting charged till it achieves its reference esteem. The inrush current of the DC connect capacitor is constrained to the short out current of the PV cluster. Once the DC interface voltage comes to close to its reference esteem, the sine PWM pulses to the inverter is turned ON by the PCU. The tweak list of the sine PWM pulses is expanded bit by bit from zero an incentive to its last esteem by the PCU to confine the inrush current of the IG. At that point the load is associated with the inverter yield by methods for turning ON MCB (miniature circuit breaker) which is not appeared in the graph for effortlessness, between the load and inverter. The auto machine of associating and disengaging the IG from the system in view of its speed should be possible by designing the PCU with extra speed sensors and a controllable switching device like an electromagnetic contactor associated in the middle of the IG and inverter. The three phase line voltage and phase voltage of PVEWIG system alongside the load current are appeared in figure 10a and 10b separately. The different voltages including PV, inverter DC connect, system line voltage alongside IG current is appeared in figure 11a. The three phase voltage of PVEWIG system alongside the inverter current is appeared in figure 11b. The current sharing amongst inverter and IG for a consistent resistive load and resistive-inductive load current is portrayed in figure 12a and 12b separately. As clarified in the past area, amid beginning of the PVEWIG system, the system voltage increments bit by bit, which is empowered by the progressive increment in the tweak record of the sine pwm inverter by the controller consequently. This expels the likelihood of inrush current while coordinating the IG with the inverter and furthermore exhibits the capacity of beginning a PVEWIG system without a battery as appeared in



figure 13a. The PVEWIG system is equipped for conveying the load even without IG because of low wind speed, gave the load right then and there is inside the PV limit comparing to the illumination right then and there. This is clear from figure 13b, the load current stays unaltered even after the IG current ends up noticeably zero. The cascade PI-SMC controller manages the DC connection of the inverter in spite of climate and load unsettling influences as portrayed in figure 14a and 14b. The PVEWIG system is fit for managing unbalance in load and keeps on giving a controlled yield, which is apparent from the system reaction for lopsided resistive load and unequal resistive-inductive load appeared in figure 15a and 15b individually. The system reaction for change in wind turbine emulator (WTE) speed driving the IG alongside load change is shown in figure 16, which demonstrates the programmed modification in load share amongst PV and IG relating to change in WTE speed and load extent. Figure 17 demonstrates the regular load sharing reaction alongside the light information caught for a brief span of 10 minutes. It can be watched the system RMS voltage stays steady regardless of the adjustments in illumination, load and WTE speed.

## VI. FUZZY CONTROLLER

**Fuzzy logic** is a complex numerical strategy that permits taking care of troublesome reenacted issues with many data sources and yield factors. Fuzzy logic can give brings about the type of suggestion for a particular interim of yield state, so it is basic that this scientific strategy is entirely recognized from the more commonplace logics, for example, Boolean algebra math. This paper contains an essential diagram of the standards of fuzzy logic.

**Fuzzy Logic System** Today control system are generally portrayed by scientific models that take after the laws of material science, stochastic models or models which have risen up out of numerical logic. A

general trouble of such developed model is the manner by which to move from an offered issue to an appropriate scientific model. Without a doubt, today's propelled PC innovation makes it conceivable; however overseeing such system is still excessively intricate.

These unpredictable system can be streamlined by utilizing a resistance edge for a sensible measure of imprecision, dubiousness and instability amid the displaying stage. As a result, not totally idealize system comes to presence; in any case in the greater part of the cases it is fit for taking care of the issue in suitable way. Notwithstanding missing info data has officially ended up being palatable in information based system.

Fuzzy logic permits to lower many-sided quality by permitting the utilization of flawed data in sensible way. It can be actualized in equipment, programming, or a blend of both. As it were, fuzzy logic way to deal with issues' control emulates how a man would decide, just significantly quicker

The fuzzy logic examination and control strategies appeared in Figure 1 can be portrayed as:

1. Receiving one or huge number of estimations or other appraisal of conditions existing in some system that will be dissected or controlled.
2. Processing every got contribution as per human based, logic "assuming at that point" rules, which can be communicated in straightforward dialect words, and consolidated with conventional non-logic preparing.
3. Averaging and weighting the outcomes from all the individual tenets into one single yield choice or flag which chooses or guides a controlled system what to do. The outcome yield flag is an exact defuzzify esteem.

The following is Fuzzy Logic Control/Analysis Method diagram.

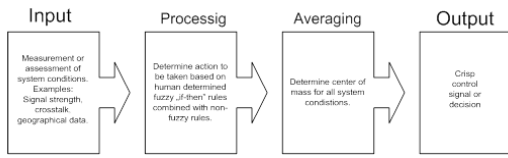


Figure 6. The fuzzy logic Control-Analysis method

To work fuzzy logic should be spoken to by numbers or portrayals. For instance, speed can be spoken to by esteem 5 m/s or by depiction "moderate". Term "moderate" can have diverse significance if utilized by various people and should be deciphered regarding the watched condition. A few esteems are anything but difficult to order, while others can be hard to decide as a result of human comprehension of various circumstances. One can state "moderate", while other can state "not quick" while depicting a similar speed. These distinctions can be recognized with help of alleged fuzzy sets.

Typically fuzzy logic control system is made from four noteworthy components displayed on Figure 2: fuzzification interface, fuzzy induction motor, fuzzy govern network and defuzzification interface. Each part alongside essential fuzzy logic operations will be portrayed in more detail underneath.

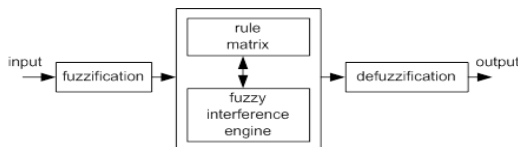


Figure 7. Fuzzy logic controller

### Fuzzy Logic Basic Operations

Underneath some fundamental data about fuzzy logic will be introduced, while an exhaustive hypothesis of fuzzy logic can be found in [2].

#### • Universe of Discourse

It is a scope of every single conceivable esteem considered as fuzzy system input.

#### • Fuzzy Set

A fuzzy set  $\mu$  is a capacity from the reference set  $X$  to the unit interim, i.e.

$\mu(X)$  speaks to the arrangement of every fuzzy arrangement of  $X$ .

### • Membership Function

It is a graphical portrayal of fuzzy sets,  $\mu F(x)$ .

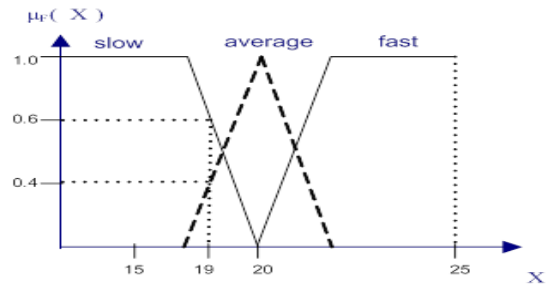


Figure 8. A case of fuzzy logic enrollment work

Figure 8 demonstrates the enrollment elements of three fuzzy sets, "moderate", "normal", and "quick", for a fuzzy variable Velocity. The universe of talk makes every single conceivable estimation of Velocity, i.e.,  $X = 19$ . For Velocity esteem 19 km/h, the fuzzy set "moderate" has the enrollment esteem 0.6. Thus,  $\mu_{\text{slow}}(19) = 0.6$ . Also,  $\mu_{\text{average}}(19) = 0.4$ , and  $\mu_{\text{fast}}(19) = 0$ .

• **Support** The support of a fuzzy set  $F$  is the fresh arrangement of all focuses in the Universe of Discourse  $U$  to such an extent that participation capacity of  $F$  does not equivalent zero

• **Crossover point** It is a component in  $U$  where its participation work rises to 0.5.

#### • Center

The focal point of a fuzzy set  $F$  is the point (or focuses) at which  $\mu F(u)$  accomplishes its most extreme esteem.

### Fuzzification Method

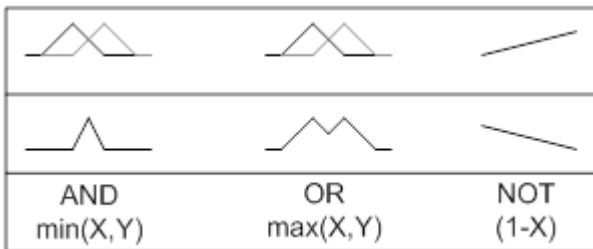
To start with period of fuzzy logic continuing is to convey input parameters for given fuzzy system in light of which the yield result will be computed. These parameters are fuzzified with utilization of pre-characterized input enrollment capacities, which can have diverse shapes. The most widely recognized are: triangular shape, however ringer, trapezoidal, sinusoidal and exponential can be additionally utilized. Less difficult capacities won't require complex processing and won't over-burden the execution. The level of participation capacity is dictated by putting a picked input variable on the flat pivot, while vertical

hub indicates evaluation of review of enrollment of the information variable. The main condition a participation work must meet is that it must shift in the vicinity of zero and one. The esteem zero implies that information variable is not an individual from the fuzzy set, while the esteem one implies that information variable is completely an individual from the fuzzy set.

With each info parameter there is a one of a kind enrollment work related. The participation capacities relate a weighting element with estimations of each information and the powerful principles. These weighting variables decide the level of impact or level of participation (DOM) every dynamic govern has. By figuring the intelligent result of the participation weights for every dynamic administer, an arrangement of fuzzy yield reaction extents are created. All that remaining parts is to consolidate and defuzzify these yield reactions.

**Control Matrix**

The rule grid is utilized to depict fuzzy sets and fuzzy administrators in type of restrictive proclamations. A solitary fuzzy if-then administer can be as per the following In the event that x is A then y is Z, Where A will be an arrangement of conditions that must be fulfilled and Z is an arrangement of results that can be deduced. In control with different parts, fuzzy administrators are utilized to consolidate more than one information: AND = min, OR = max and NOT = added substance supplement. Geometrical exhibit of fuzzy administrators is appeared in Figure 4.



**Figure 9.** Graphical elucidation of fuzzy administrators

The administer system is a straightforward graphical apparatus for mapping the fuzzy logic control system rules. It suits at least two info factors and communicates their sensible item (AND OR) as one yield reaction variable. The level of enrollment for run network yield can take estimation of greatest, least of the level of past of the run the show. It is frequently plausible, that after assessment of the considerable number of standards relevant to the information, we get more than one incentive for the level of enrollment. For this situation, the reproduction needs to mull over, each of the three potential outcomes, the base, the greatest or a normal of the enrollment degrees.

**Derivation Mechanisms** Derivation component enables mapping offered contribution to a yield utilizing fuzzy logic. It utilizes all pieces depicted in past segments: participation capacities, sensible operations and if-then guidelines. The most well-known sorts of derivation systems are Mamdani and Sugeno. They differ in methods for deciding yields.

**Mamdani technique** Beneath cases depend on two fuzzy control administrators as

R1: if x is A1 and y is B1 then z is C1

R2: if x is A2 and y is B2 then z is C2

Result: z is C, where x measures up to x0 and y breaks even with y0. The terminating levels of the standards, indicated by  $\alpha_i, i = 1, 2$  are ascertained by (3) (4) The individual govern yields are inferred by (5) (6)

At that point the general system yield is ascertained by oring the individual control yields (7)

At last, to get a deterministic control activity, picked defuzzification instrument must be actualized.

**Sugeno strategy**

Underneath cases depend on two fuzzy control leads as

R1: if x is A1 and y is B1 then z is  $z_1 = a_1x_1 + b_1y_1$

R2: if x is A2 and y is B2 then z is  $z_2 = a_2x_2 + b_2y_2$

Result:  $z_0$ , where  $x$  measures up to  $x_0$  and  $y$  breaks even with  $y_0$ .

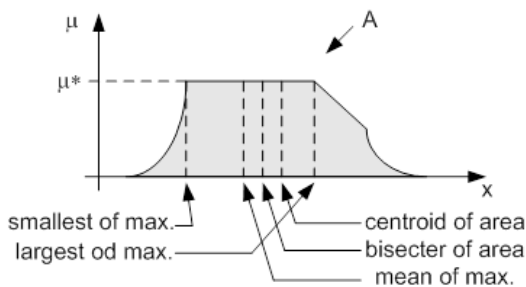
The terminating levels of the govern are figured in an indistinguishable path from in Mamdani technique, in light of (3) and (4) conditions. The individual manage yields are figured from the beneath connections (8) (9) On the off chance that there is  $n$  governs in the lead network, the fresh control result gotten from the accompanying conditions (10)

where  $\alpha_i$  is a terminating level of the  $i$  administrator, and  $i = 1, \dots, n$ .

The Sugeno strategy functions admirably with straight methods, as it is computationally proficient. It is reasonable to apply enhancement and versatile strategies. Besides, it ensures coherence of the yield surface and it is appropriate to scientific examination. Leverage of the Mamdani technique is that is it instinctive and has across the board of acknowledgment. It can be appropriate to human information.

**Defuzzification Mechanisms**

Defuzzification undertaking is to discover one single fresh esteem that compresses the fuzzy set. There are a few numerical procedures accessible: centroid, bisector, mean, most extreme, greatest and weighted normal. Figure 5 exhibit delineation of how esteems for every technique are picked.



**Figure 10.** Graphical show of defuzzification techniques

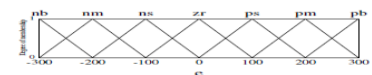
**Centroid defuzzification** is the most regularly utilized technique, as it is exceptionally precise. It gives focus of the zone under the bend of participation capacity. For complex enrollment capacities it puts levels of popularity on calculation. It can be communicated by the accompanying recipe (11) Where  $z_0$  is defuzzified yield,  $u_i$  is an enrollment capacity and  $x$  is yield variable. Bisector defuzzification utilizes vertical line that partitions range under the bend into two equivalent zones. (12) Mean of greatest defuzzification technique utilizes the normal estimation of the accumulated enrollment work yields. (13) Where  $x' = \{x; \mu_A(x) = \mu^*\}$ . Littlest of greatest defuzzification technique utilizes the base estimation of the accumulated enrollment work yields. (14)

Biggest of most extreme defuzzification strategy utilizes the greatest estimation of the amassed enrollment work yields. (15) Weighted normal defuzzification technique, in view of pinnacle estimation of each fuzzy sets, figures weighted entirety of these pinnacle esteems [4]. As indicated by these weight esteems and the level of enrollment for fuzzy yield, the fresh estimation of yield is controlled by the accompanying equation (16) Where  $\mu_i$  is the level of participation in yield singleton  $i$ ,  $W_i$  and is the fuzzy yield weight an incentive for the yield singleton.

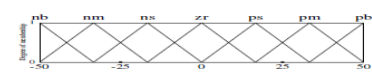
**IN OUR VENTURE WE UTILIZED THE ACCOMPANYING RULES AND PARTICIPATION CAPACITIES:**



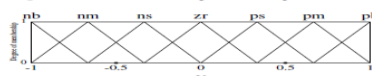
**Figure 5:** Fuzzy logic control scheme



**Figure 6 (a):** Membership function plots for 'e'



**Figure 6(b):** Membership function plots for 'Δe'



**Figure 6(c):** Membership function plots for 'U'

**Figure 11**

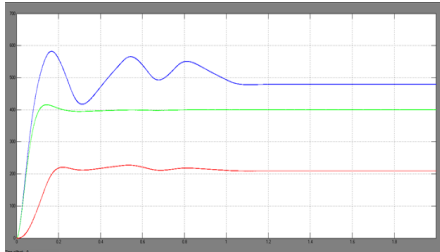
**Advantages of Fuzzy Controller over PI Controller**

Execution of conventional control "PI", its reaction is not all that great for non-straight system. The change is momentous when controls with Fuzzy logic are utilized, acquiring a superior dynamic reaction from the system.

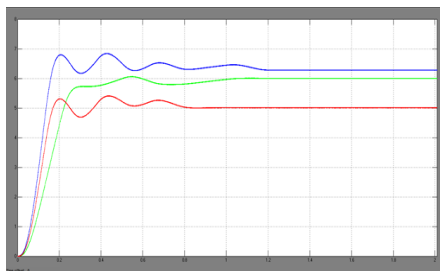
Or, on the other hand

The PI controller requires exact straight numerical models, which are hard to acquire and may not give agreeable execution under parameter varieties, stack unsettling influences, and so on. As of late, Fuzzy Logic Controllers (FLCs) have been presented in different applications and have been utilized as a part of the power gadgets field. The upsides of fuzzy logic controllers over customary PI controllers are that they needn't bother with an exact numerical model, Can work with loose information sources and Can deal with non-linearities and are more strong than ordinary PI controllers

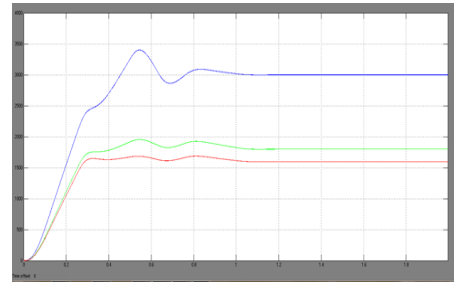
**Proposed:**



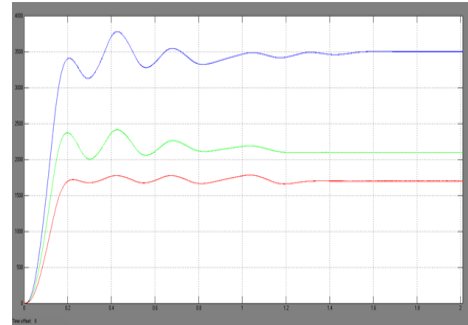
**Figure 12.** DC link, PV and Load RMS voltages under constant weather and load conditions



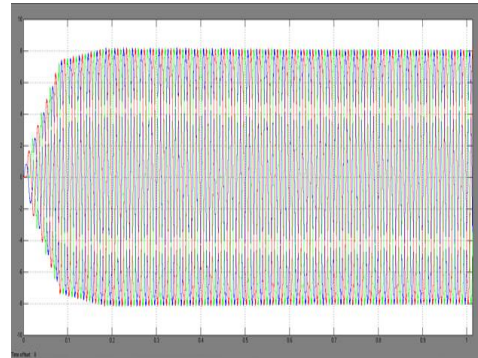
**Figure 12.** Inverter, Load and IG RMS currents under constant weather and load conditions



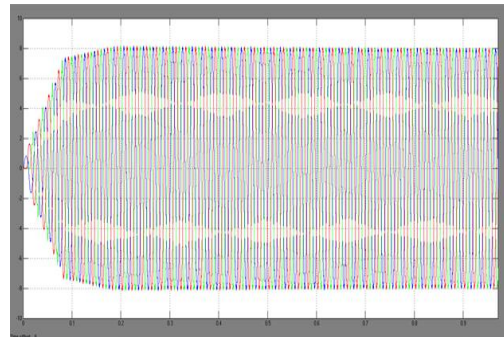
**Figure 12.** Load, IG and Inverter Real powers under constant weather and load conditions



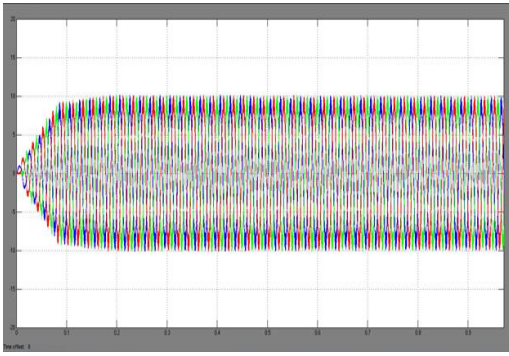
**Figure 12.** Inverter, IG and Load reactive powers under constant weather and load conditions



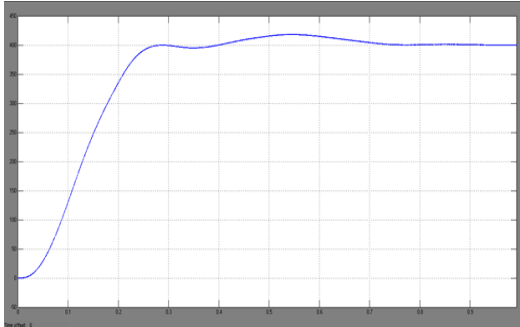
**Figure 13.** Starting Load current under constant weather and load conditions



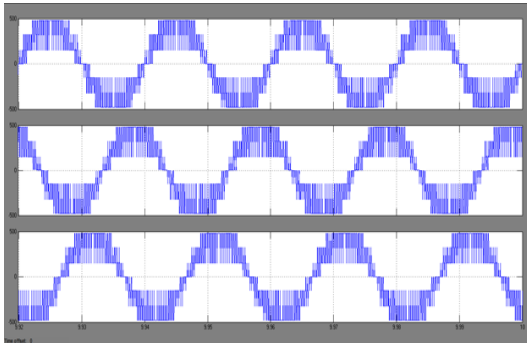
**Figure 13.** Starting IG current under constant weather and load conditions



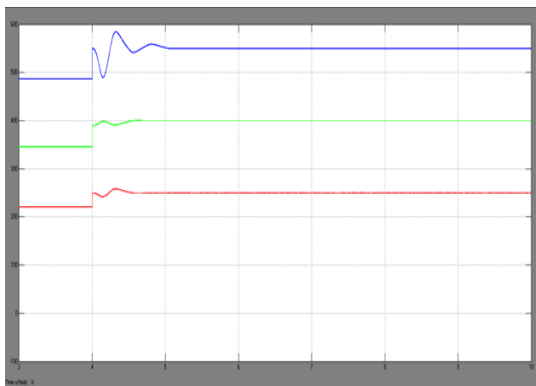
**Figure 13.** Starting Inverter current under constant weather and load conditions



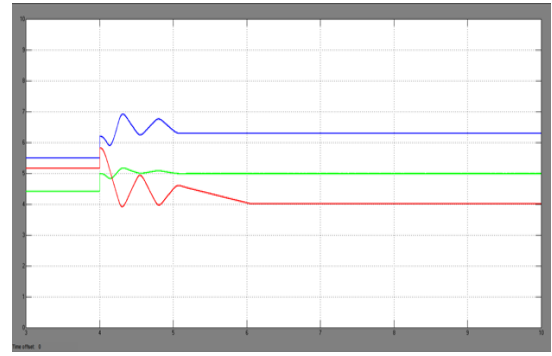
**Figure 13.** PCC RMS Line Voltage under constant weather and load conditions



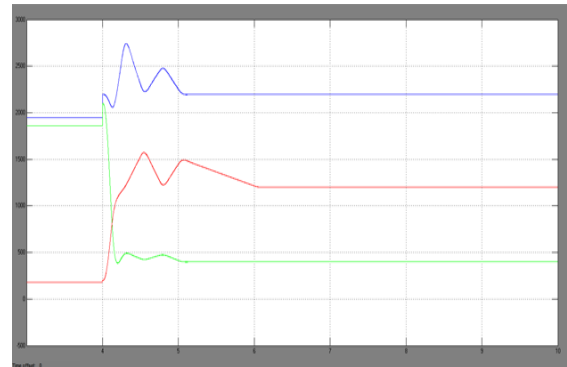
**Figure 14.** Steady State Voltage Inverter Voltages under constant weather and load conditions



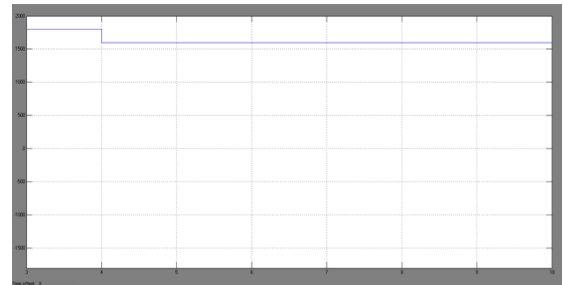
**Figure 15a.** DC link, PV and Load RMS voltages under change in Irradiation and wind turbine Speed with a constant load



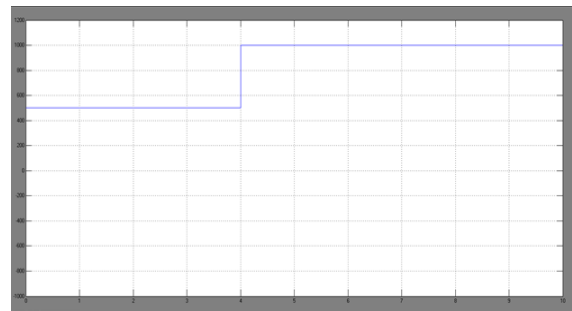
**Figure 15a.** Load, PV and Inverter RMS currents under change in Irradiation and wind turbine Speed with a constant load



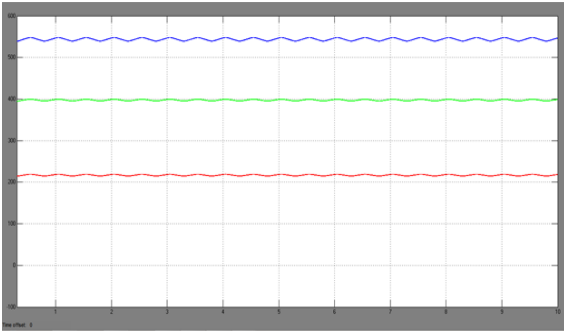
**Figure 15a.** Load, IG and Inverter Real powers under change in Irradiation and wind turbine Speed with a constant load



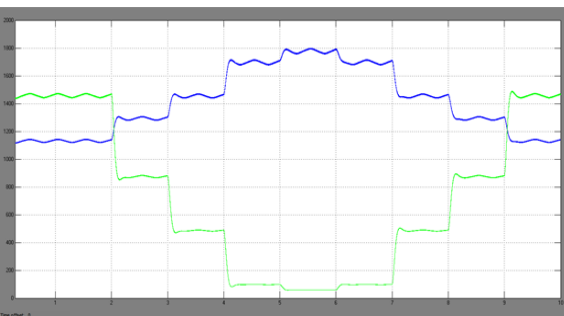
**Figure 15a.** IG speed under change in Irradiation and wind turbine Speed with a constant load



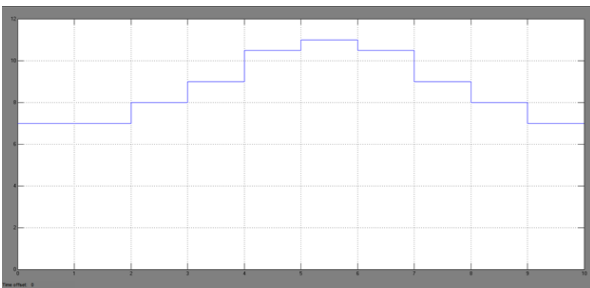
**Figure 15a.** Irradiation under change in Irradiation and wind turbine Speed with a constant load



**Figure 15b.** Dc Link, PV and Load RMS Voltages with change in wind speed and constant load and constant irradiation ( $Q=0.6 \text{ kW/Sq.mtr}$ )



**Figure 15b.** IG and Inverter Real powers with change in wind speed and constant load and constant irradiation ( $Q=0.6 \text{ kW/Sq.mtr}$ )



**Figure 15b.** Wind Speed with change in wind speed and constant load and constant irradiation ( $Q=0.6 \text{ kW/Sq.mtr}$ )

**Table 1**

Proposed method THD in %	Extension method THD in %
Fig 12.13.14, 2.01%	Fig12.13.14 , 1.84% load
Fig12.13.14, 4.62%	Fig 12.13.14 , 2.82%

In	in
Fig12.13.14 , 1.34%	Fig 12.13.14, 1.47%
Ig	Ig
Fig 15a , 1.93%	Fig 15a , 1.89%
Ig	Ig
Fig 15a , 1.99%	Fig 15a, 1.89%
il	IL
Fig 15a, 4.64%	Fig 15a, 2.55%
In	in
Fig 15a, 1.94%	Fig 15a , 1.89%
Ig	Ig
Fig 15b, 2.08%	Fig 15b, 2.42%
Il	Il

## VII. CONCLUSION

A cascade PI-SMC control has been effectively executed for a dc-dc boost converter interfaced between PV cluster and a three phase voltage source inverter of a PVEWIG system for managing the inverter DC connect voltage. The demonstrating and reenactment aftereffects of the battery less operation of PVEWIG plot have been introduced. The battery less mode operation of PVEWIG system has been effectively executed and tried in equipment utilizing a 2.4 kW PV board and 2.25 kW IG driven by WTE. A thorough equipment comes about have been displayed which approves the proposed control scheme and its simulation comes about. Additionally the PVEWIG system was put into operation in ordinary working conditions for an entire day from morning to night and all the climate and electrical parameters were checked and recorded. The total field test consequences of the PVEWIG without battery is displayed, which shows the roughness and the dependability of the system. The equipment comes about substantiates that the proposed control plot is equipped for giving a controlled yield voltage to the load under a wide range of unsettling influences incorporating variety in illumination, temperature, wind speed, load and also unbalance in load, for a

battery less method of PVEWIG system. The outcomes additionally imply that the PVEWIG system with the proposed control conspire is an appealing answer for disengaged off-grid applications where utility grid is not accessible.

### VIII. REFERENCES

1. O. Honorati, G. L. Bianco, F. Mezzetti, and L. Solero, "Power electronic interface for combined wind/PV isolated generating system," in Proc. European Union Wind Energy Conf., Goteborg, Sweden, 1996, pp. 321–324.
2. B. S. Borowy and Z. M. Salameh. (1997, Mar.). Dynamic response of a stand-alone wind energy conversion system with battery energy storage to a wind gust. *IEEE Trans. Energy Conversion*. On line]. 12(1), pp. 73–78. Available: DOI: 10.1109/60.577283.
3. S. Kim, C. Kim, J. Song, G. Yu, and Y. Jung, "Load sharing operation of a 14 kW photovoltaic/wind hybrid power system," in Proc. 26th IEEE Photovoltaic Specialists Conf., 1997, pp. 1325–1328.
4. K. Kurosumi et al., "A hybrid system composed of a wind power and a photovoltaic system at NTT kumejima radio relay station," in Proc. 20th Int. Telecommun. Energy Conf., 1998, pp. 785–789.
5. N.A Orlando, M. Liserre, R.A.A. Mastromauro. A. (2013, July). Survey of Control Issues in PMSG-Based Small Wind-Turbine Systems. *IEEE Transactions on Industrial Informatics*. On line]. 9(3), pp. 211 – 221. Available: DOI: 10.1109/TII.2013.2272888.
6. H. Shariatpanah, R. Fadaeinedjad, M. Rashidinejad. (2013, Sept.). A New Model for PMSG-Based Wind Turbine with Yaw Control. *IEEE Transactions on Energy Conversion*. On line]. 8(4), pp 929-937. Available: DOI: 10.1109/TEC.2013.2281814
7. Md.E.Haque, M. Negnevitsky, K.M. Muttaqi. (2010, Nov.) A Novel Control Strategy for a Variable-Speed Wind Turbine with a Permanent-Magnet Synchronous Generator. *IEEE Transactions on Industrial Applications*. On line]. 46(1), pp. 331-339. Available: DOI: 10.1109/TIA.2009.2036550
8. M. Kuschke and K. Strunz. (2014, Mar.). Energy-Efficient Dynamic Drive Control for Wind Power Conversion with PMSG: Modeling and Application of TransferFunction Analysis. *IEEE Journal of Emerging and Selected Topics in Power Electronics*. On line]. 2(1), pp. 35-46. Available: DOI: 10.1109/JESTPE.2013.2293632
9. S. Li, T.A. Haskew, R.P. Swatloski, W. Gathings. (2012, May). Optimal and Direct-Current Vector Control of Direct-Driven PMSG Wind Turbines. *IEEE Trans on Power Electronics*. 2. On line]. 7(5) pp. 2325-2337. Available: DOI: 10.1109/TPEL.2011.2174254
10. M. Fatu, F. Blaabjerg, F.; I. Boldea. (2014, July) Grid to Standalone Transition Motion-Sensorless Dual-Inverter Control of PMSG with Asymmetrical Grid Voltage Sags and Harmonics Filtering. *IEEE Trans on Power Electronics*. On line]. 29(7), pp. 3463-3472. Available: DOI: 10.1109/TPEL.2013.2279883



# A Survey on Hand Gesture Using Imageprocessing

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## ABSTRACT

As technology becomes the part of human life for decades, the relationship between human and computer called human-computer interaction (HCI) is important to study for improving the system to serve the human need. HCI can be applied in various areas including medical system which is valuable for the elder who is not able to walk or express the feelings by words. The intuitive approach is the development of algorithm by using hand gestures. The proposed system called dynamic hand gesture recognition algorithm can be applied for elder people. The algorithm implements in a vision-based hand gesture recognition using optical flow and blob analysis to track six dynamic hand gestures and classify their meanings. The experiment provided good results for all six hand gestures in detection, tracking and classification procedures.

**Keywords :** Human-Computer Interaction, Hand Gesture Recognition, Digital Color Image, Grayscale Images, Binary Images

## I. INTRODUCTION

### 1.1 OBJECTIVE

The main objective is to implement hand gestures using contour technique. The aim is classifying the image segmentation and threshold image for hand gestures and deal with the preprocessing.

### 1.2 IMAGE PROCESSING

The image processing is process in which a two dimensional image is treated as an input and the specified output image is obtained by setting some parameter over the two dimensional input image. This process would probably start with image processing techniques such as noise removal, followed by (low-level) feature extraction to locate lines, regions and possibly areas with certain textures. The clever bit is to interpret collections of the shapes as a single objects, e.g. cars on a road, boxes on a conveyor belt or cancerous cells on a microscope slide. One reason in

the AI problem is that an object can appear very different when viewed from different angles or under different lighting. Another problem is deciding what features belong to what object and which are background or shadows etc.

The human visual system performs these tasks mostly unconsciously but a computer requires skillful programming and lots of processing power to approach human performance. Manipulating data in the form of an image through several possible techniques. An image is usually interpreted as a two-dimensional array of brightness values, and is most familiarly represented by such patterns as those of a photographic print, slide, television screen, or movie screen. An image can be processed optically or digitally with a computer.

### 1.3 CLASSIFICATION OF IMAGES:

There are 3 types of images used in Digital Image Processing. They are

- Binary Image
- Gray Scale Image
- Color Image

### 1.3.1 BINARY IMAGE

A binary image is a digital image that has only two possible values for each pixel typically the two colors used for a binary image are black and white though any two colors can be used. The color used for the object(s) in the image is the foreground color while the rest of the image is the background color.

Binary images are also called bi-level or two-level. This means that each pixel is stored as a single bit (0 or 1). This name black and white, monochrome or monochromatic are often used for this concept, but may also designate any images that have only one sample per pixel, such as grayscale images.

Binary images often arise in digital image processing as masks or as the result of certain operations such as segmentation, thresholding, and dithering. Some input/output devices, such as laser printers, fax machines, and bi-level computer displays, can only handle bi-level images

### 1.3.2 GRAY SCALE IMAGE

A grayscale image is digital image is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort, also known as black-and-white, are composed exclusively of shades of gray (0-255), varying from black (0) at the weakest intensity to white (255) at the strongest. Grayscale images are distinct from one-bit black-and-white images, which in the context of computer imaging are images with only the two colors, black, and white (also called bi-level or binary images). Grayscale images have many shades of gray in between. Grayscale images are also called

monochromatic, denoting the absence of any chromatic variation.

Grayscale images are often the result of measuring the intensity of light at each pixel in a single band of the electromagnetic spectrum (e.g. infrared, visible light, ultraviolet, etc.), and in such cases they are monochromatic proper when only a given frequency is captured.

### 1.3.3 COLOUR IMAGE:

A digital color image is a digital image that includes color information for each pixel. Each pixel has a particular value which determines its appearing color. This value is qualified by three numbers giving the decomposition of the color in the three primary colors Red, Green and Blue. Any color visible to human eye can be represented this way. The decomposition of a color in the three primary colors is quantified by a number between 0 and 255. For example, white will be coded as  $R = 255, G = 255, B = 255$ ; black will be known as  $(R,G,B) = (0,0,0)$ ; and say, bright pink will be :  $(255,0,255)$ .

In other words, an image is an enormous two-dimensional array of color values, pixels, each of them coded on 3 bytes, representing the three primary colors. This allows the image to contain a total of  $256 \times 256 \times 256 = 16.8$  million different colors. This technique is also known as RGB encoding, and is specifically adapted to human vision.

## II. LITERATURE SURVEY

### 2.1 INTRODUCTION:

This chapter deals with the previous work done by various authors in the field of hand gesture recognition system and the techniques and algorithms have been used for hand recognition system.

## 2.2 BACKGROUND STUDIES:

### **HUMAN COMPUTER INTERACTION AND MEDICAL DEVICES (C. Acharya, H. Thimbleby, P. Oladimeji )**

C.Acharya Et Al. shows that some healthcare devices fall far short and thus identifies a gap in applied Human Computer Interaction(HCI). The authors are collaborating with design team, medical school, users and manufacturers to redesign the hospital bed, by applying HCI and human factors and fixing programming bugs. To achieve dependable, usable, and well-engineered interactive devices in healthcare requires applied Human Computer Interaction (HCI) research and awareness of HCI issues throughout the lifecycle, from design through to procurement, training and use. Basic, interactive hospital bed as a case study, arguably so routine and simple enough that there should have been very few problems. However, the bed's interactive control panel design violates standard HCI principles. It is also badly programmed by the manufacturer. Evidently, something has gone wrong, somewhere from design to procurement and most of the problems would have been managed or avoided by conventional HCI processes. Driven by the case study, this paper explores the problems and makes recommendations.

There are many similarly poorly designed medical devices. Manufacturers and healthcare purchasing groups should adhere to HCI processes and guidelines, as well as those provided by regulatory agencies for the design, regulation, and procurement of devices, products or systems that contribute to patient safety. The challenge is to make HCI knowledge and priorities available to and effective in this important domain in any places that can make a difference. One of the possibilities is that HCI is complex and that medical devices and environments are complex. It is clearly important to consider how the system is

trained and motivate HCI practitioners to engage or avoid important areas such as healthcare. One might assume with the paucity of healthcare HCI literature that there is no significant problem to be addressed.

### **COMBINATION OF HIDDEN MARKOV MODELS WITH DYNAMIC TIME WARPING FOR SPEECH RECOGNITION (S. Axelrod and B. Maison)**

S.Axelrod Et Al. proposes a combine Hidden Markov Models of various topologies and Nearest Neighbor classification techniques in an exponential modeling framework with a model selection algorithm to obtain significant error rate reductions on an isolated word digit recognition task. This work is a preliminary investigation of large scale modeling techniques to be applied to large vocabulary continuous speech recognition. Increases in computational power, storage capacity and training data available for use by automatic speech recognition (ASR) systems, combined with the perception that the performance of such systems has reached a plateau motivate us to consider modeling strategies for speech recognition that, while more resource intensive, have the potential to obtain significant reductions in error rate.

#### **Advantages**

- It can be applied to large vocabulary continuous speech recognition.
- The potential to obtain significant reduction in error rate.
- Increases in computational power , storage capacity and training data.

### **A DYNAMIC GESTURE RECOGNITION AND PREDICTION SYSTEM USING THE CONVEXITY APPROACH (P. Barros, N. T. Maciel-Junior, B. J. Fernandes, B. J. Bezerra, and S. M. Fernandes)**

Real-time recognition of dynamic gestures is a problem for most of the applications nowadays. The

prediction approach can be used as a solution for the above problem. This approach uses an incomplete gesture input and it tries to predict which gesture the given input is represented. This study proposes a system for dynamic gesture recognition and prediction using an innovation feature extraction technique called the Convexity Approach. The proposed system generates a smaller feature vector to describe the hand shape with a minimal amount of data. Two data sets one for data recognition and another for prediction. Dynamic gesture recognition and prediction system is implemented using two independent modules based on Hidden markov modules and Dynamic time wrapping.

The paper presents the application of the dynamic gesture feature extraction technique called Convexity Local Contour Sequence (CLCS) as the extractor for the prediction task. Two predictor systems are used to achieve this task and results are compared and discussed.

## **A HEALTH MONITORING SYSTEM FOR ELDER AND SICK PERSONS**

**(A. Chaudhary and J. Raheja)**

**A. Chaudhary Et Al.** discusses a vision based health monitoring system which would be very easy in use and deployment. The system works on the principles of Computer Vision and it uses image processing for acquiring gesture and preprocessing. The system have 2D camera only and its cost is very much affordable. Elder and sick people who are not able to talk or walk, they are dependent on other human beings for their daily needs and need continuous monitoring. The developed system provides facility to the sick or elder person to describe his or her need to their caretaker in lingual description by showing particular hand gesture with the developed system.

The system uses fingertip detection technique for gesture extraction and artificial neural network for

gesture classification and recognition. The system is able to work in different light conditions and can be connected to different devices to announce user's need on a distant location. Hand Gesture Recognition is very easy and natural way to interact with the machines where no training for the user is required. So future of this technique is very bright in systems for handicap and disabled persons.

The technique can be applied in the field of disaster management so that lives of more people could be saved. In the damage situations i.e. in mining where, workers are always in danger zone. This system will be placed on the body of each miner or persons staying or working in such dangerous places and will put the transceiver on the nearby wall. So in any case of disaster, if the user is in danger and can't go to ground level, he can show predefined gesture syntax to system that will interpret it and send a signal to transceiver nearby and it will forward the signal further to the rescue team in the control room.

In this scenario an advanced version of this system is required, which would be GPS enabled to detect the exact location of the user in the mine. It will work in the case of suffocation, gas poisoning or fire hazards where the person is not able to shout or to tell even a single word. This system is based on human to machine interaction, in which machine would be able to do action according to the predefined syntax of the gesture made by user. In gesture recognition color based methods are applicable because of their characteristic color footprint of human skin. The developed system helps the elder/sick person to express their wish or need in predefined lingual description to a specified place. This place can be hospital staff room or living room in home, where generally people stay.

## **VISION BASED HAND GESTURE RECOGNITION FOR HUMAN COMPUTER INTERACTION(S. S. Rautaray and A. Agrawal)**

**S.S. Rautaray Et Al.** explains about the human-computer interaction (HCI) will have a positive impact on their use. Hence, there has been growing interest in the development of new approaches and technologies for bridging the human-computer barrier. The ultimate aim is to bring HCI to a regime where interactions with computers will be as natural as an interaction between humans, and to this end, incorporating gestures in HCI is an important research area. Gestures have long been considered as an interaction technique that can potentially deliver more natural, creative and intuitive methods for communicating with our computers.

The paper provides an analysis of comparative surveys done in this area. The use of hand gestures as a natural interface serves as a motivating force for research in gesture taxonomies, its representations and recognition techniques, software platforms and frameworks which is discussed briefly in this paper. It focuses on the three main phases of hand gesture recognition i.e. detection, tracking and recognition. Different application which employs hand gestures for efficient interaction has been discussed under core and advanced application domains. It further discusses the advances that are needed to further improvise the present hand gesture recognition system for further perspective that can be widely used for efficient human computer interaction. Gestures have long been considered as an interaction technique that can potentially deliver more natural, creative and intuitive methods for communicating with our computers. The main goal of this survey is to provide researchers in the field of gesture based HCI with a summary of progress achieved to date and to help identify areas where further research is needed. This paper also provides an analysis of existing literature related to gesture recognition systems for human computer interaction by categorizing it under different key parameters.

**Yee Yong Nor Azman Ismail Et Al.** proposes about

the human-computer interaction (HCI) has been an interest research in recent years which witnessed the development from text-based like using a keyboard to graphic user interface (GUI) based on a mouse, from cumbersome data gloves and tracking devices to visual-based computer application. One of the interest fields is by using hand gestures to interact with computer. Gesture recognition is one of the popular methods for Human Computer Interaction. This paper is mainly focused on the application of this technology in computer environment. The idea is to construct such a system which can take gesture inputs and on the basis of that controlling and commanding of the computer is performed. This module basically performs the finger counting and then on the basis of which actions are performed.

These actions are used to control various functions of operating system. One of the interest fields is by using hand gestures to interact with computer. However, the complexity of a hand set a lot of challenges to be tracked. In real-time, the application requires high accurate detection and recognition. In additional the real and clutter environments have a big impact on recognition process because it included with irrelevant information from the application point of view. In this paper, a real time vision based hand gesture interaction prototype was proposed. Currently a prototype has built for controlling the desktop cursor and concerned the tasks involving in navigation the desktop cursor by using hand gesture input modality. Results reveal that the proposed technique works well with the robust condition.

**OPTICAL FLOW HAND TRACKING AND ACTIVE CONTOUR HAND SHAPE FEATURES FOR CONTINUOUS SIGN LANGUAGE RECOGNITION WITH ARTIFICIAL NEURAL NETWORKS (P. Kishore and M. Prasad)**

**P.Kishore Et Al.** proposes about the Horn Schunck optical flow (HSOF) extracts tracking features and

Active Contours (AC) extract shape features. To extract hand tracks and hand shape features from continuous sign language videos for gesture classification using back propagation neural network. A feature matrix characterizes the signs in continuous sign videos. A neural network object with back propagation training algorithm classifies the signs into various words sequences in digital format. Digital word sequences are translated into text with matching and the suiting text is voice translated using windows application programmable interface (Win-API).

Ten signers, each doing sentences having 30 words long tests the performance of the algorithm by computing word matching score (WMS). Learning skills of a hearing impaired person are seriously hampered because of the missing hearing sense. A mute person has to depend largely on visual sense and any learning and communication aids will help them learn faster and communicate better. Usually human interpreter trained in sign language understanding acts as a bridge between normal people and mute people.

#### **RULE-BASED APPROACH TO RECOGNITION HUMAN BODY POSES AND GESTURES IN REAL TIME(T. Hachaj and M. Ogiela)**

**T Hachaj Et Al.** proposed a classifier capable of recognizing human body static poses and body gestures in real time. The method is called the gesture description language (GDL). The proposed methodology is intuitive, easily thought and reusable for any kind of body gestures. The very heart of our approach is an automated reasoning module. It performs forward chaining reasoning (like a classic expert system) with its inference engine every time new portion of data arrives from the feature extraction library. All rules of the knowledge base are organized in GDL scripts having the form of text files that are parsed with a LALR-1 grammar . Gestures might also be recognized using a neural

network and fuzzy sets.

The main novelty of this paper is a complete description of our GDL script language, its validation on the large dataset and the presentation of its possible application. The recognition rate for examined gestures is within the range of 80.5 – 98.5 %. There is also implementation of the application that uses this method: it is a 3D desktop visualizing 3D dataset that is controlled by gestures recognized by the GDL module. In GDL, the letter case does not matter. The GDL script is a set of rules. Each rule might have an unlimited number of premises that are connected by conjunction or alternative operators.

In GDL, premises are called logical rules. A logical rule can take two values: true or false. Apart from logical rules, the GDL script also contains numeric rules (3D numeric rules) which are simply some mathematical operations that return floating-point values (or floating three-dimensional points). A numeric rule might become a logical rule after it is combined with another numeric rule by a relational operator. The brackets in logical and numeric (3D) rules are used to change the order in which instructions are executed. The GDL script description of this gesture is very straightforward. GDL has the ability to detect and classify many techniques described by the GDL script rule in one recording. GDL also eliminates the problem of body proportions between users. This approach has proven to be reliable tool for recognizing human body static poses and body gestures. In this approach, static poses the so-called key frames form components of dynamic gestures.

#### **HAND SEGMENTATION USING SKIN COLOR AND BACKGROUND INFORMATION (Wei Wang and Jing Pan)**

**Wei wang Et Al.** proposed about the Skin color based

hand segmentation using skin color models shows poor performance in complex background where similar colors of the skin and non-uniform illumination exist. A new method has been proposed for hand segmentation by using an adaptive skin color model and the background information around the hand. Precise hand segmentation is crucial for gesture based Human-machine interaction. Recognizing hand signs and tracking hand motion is crucial for human machine interface which has always been a hot topic in recent years. The purpose of hand signals recognizing and hand fingers tracking is to make the machine get our instructions in a non-contact way. Other applications such as helping the disabled people communicate with the normal people also show the importance of the research in this area. Hand segmentation is the first and also the critical step for recognizing hand signs and tracking hand motion. The excellence of the hand segmentation affects the accuracy of its following applications in a straight way. Firstly, our method captures pixel values of the hand and the background then converts them into YCbCr color space.

Secondly, skin and background Gaussian models based on the color space of CbCr are proposed. Lastly, these models are taken to segment the whole image respectively, and then required for the intersection. The main contribution of the paper is that the background information is taken into account to split image in reversed side to enhance the performance. Hand segmentation is the first and also the critical step for recognizing hand signs and tracking hand motion. Experimental results show that our method outperforms the method that uses the skin color model only.

#### **DETERMINING OPTICAL FLOW (B. Horn and B.Schunck )**

**B. Horn Et Al.** described about Optical flow cannot be computed locally, since only one independent

measurement is available from the image sequence at a point, while the flow velocity has two components. The optical flow cannot be computed at a point in the image independently of neighboring points without introducing additional constraints, because the velocity field at each image point has two components while the change in image brightness at a point in the image plane due to motion yields only one constraint.

Optical flow is the distribution of apparent velocities of movement of brightness patterns in an image. Optical flow can arise from relative motion of objects. Consequently optical flow can give important information about the spatial arrangement of the objects viewed and the rate of change of this arrangement. Discontinuities in the optical flow can help in segmenting images into regions that correspond to different object. A second constant is needed for the above calculation. A method for finding the optical flow pattern is presented which assumes that the apparent velocity of the brightness pattern varies smoothly almost everywhere in the image.

An iterative implementation is shown which successfully computes the optical flow for a number of synthetic image sequences. Algorithm is robust in that it can handle image sequences that are quantized rather coarsely in space and time. It is also insensitive to quantization of brightness levels and additive noise. A method has been developed for computing optical flow from a sequence of images. It is based on the observation that the flow velocity has two components and that the basic equation for the rate of change of image brightness provides only one constraint. Smoothness of the flow was introduced as a second constraint. An iterative method for solving the resulting equation was then developed. The computed optical flow is somewhat inaccurate since it is based on noisy, quantized measurements. Proposed methods for obtaining information about the shapes of objects using derivatives (divergence and curl) of the

optical flow field may turn out to be impractical since the inaccuracies will be amplified.

## **AN AGING NATION:THE OLDER POPULATION IN THE UNITED STATES**

**(J. M. Ortman, V. A Velkoff and H. Hogan)**

J M. Ortman Et Al. proposes one of the interest fields is by using hand gestures to interact with computer. The aging of the population will have wide-ranging implications for the country. The age structure of the U.S. population is expected to change over the coming decades and focuses on the older population in terms of age, sex, race, and Hispanic origin. The size and structure of the older population is important to public and private interests, both socially and economically. The aging demographers often mean that the proportion of the population in the older ages increases.

As the United States ages over the next several decades, its older population will become more racially and ethnically diverse. The projected growth of the older population in the United States will present challenges to policy makers and programs, such as Social Security and Medicare. It will also affect families, businesses, and health care providers. However, the complexity of a hand set a lot of challenges to be tracked. In real-time, the application requires high accurate detection and recognition. In additional the real and clutter environments have a big impact on recognition process because it included with irrelevant information from the application point of view. In this paper, a real time vision based hand gesture interaction prototype was proposed.

## **HAND GESTURE RECOGNITION WITH MULTI-SCALE WEIGHTED HISTOGRAM OF CONTOUR DIRECTION (MSWHCD) NORMALIZATION FOR WEARABLE APPLICATIONS ( Yiyi Ren, Xiang Xie, Guolin Li and Zhihua Wang)**

Y. Ren Et Al. proposes a static hand gesture

recognition method with low computation and memory consumptions for wearable applications. The hand contour is chosen as the hand gesture feature and SVM is used to classify the feature. Multi-Scale Weighted Histogram of Contour Direction (MSWHCD) based direction normalization is proposed to ensure a good recognition performance. In order to improve efficiency, the proposed histogram only counts the direction of contour point to focus on the most significant hand feature in the first person view of wearable devices.

Scanline-based stereo matching is used to find the scene's depth in order to lower the computation and memory consumptions. The stereo matching algorithm works scanline by scanline. First, each scanline is segmented into small intervals by edge detector, such as Canny edge detector. Stereo correspondences are found among these intervals. Until now, only intra-scanline information is used for the stereo matching. To utilize the inter-scanline information, maximum spanning forest (MSF) is constructed between adjacent scanlines. The edges of MSF are weighted by the consistencies of the interval's color and position. Therefore, inter-scanline disparity information (in stereo matching, depth is represented by disparity) can propagate along the edges of MSF to refine the disparity between adjacent intervals and to get rid of horizontal disparity streaks. At last, the hand is segmented by using depth information.

Based on hand anatomy, the proposed histogram is weighted by considering each contour point's position and direction jointly using Direction-Angle Map (DAM), so as to ensure the robustness. Experimental results show that the proposed method can give a recognition accuracy of 97.1% with a frame rate of 30fps on PC.

## **RULE-BASED APPROACH TO RECOGNIZING HUMAN BODY POSES AND GESTURES IN REAL**



### **TIME(Tomasz Hachaj , Marek R. Ogiela)**

A method called the gesture description language (GDL) is introduced to recognize human body static poses and body gestures in real time. The proposed methodology is intuitive, easily thought and reusable for any kind of body gestures. The very heart of our approach is an automated reasoning module. It performs forward chaining reasoning with its inference engine every time new portion of data arrives from the feature extraction library. All rules of the knowledge base are organized in GDL scripts having the form of text files that are parsed with a LALR-1 grammar. The main novelty of this method is a complete description of our GDL script language, its validation on a large dataset (1,600 recorded movement sequences) and the presentation of its possible application. The recognition rate for examined gestures is within the range of 80.5–98.5 %.

GDL scripts contain many numerical rules. A numeric rule might become a logical rule after it is combined with another numeric rule by a relational operator. The brackets in logical and numeric (3D) rules are used to change the order in which instructions are executed. The first rule checks if the right elbow and the right hand are situated to the right of the torso, if the right hand is above the right elbow and if the vertical coordinates of the right hand and the right elbow are no more than 50 mm different. The last part of the rule is the premise that checks if the horizontal coordinates of the right shoulder and the right elbow are no more than 50 mm different. The second rule is similar to first one, but it describes the left arm, shoulder and elbow. The last rule checks if both previous rules are satisfied. This is done by checking the logical conjunction of both previous conclusions.

The last very important ability of GDL scripts to check the presence of particular sequences of body joints that appeared in a constrained time range. A gesture is defined in GDL as a series of static poses (so-called key

frames) appearing one after another within given time constraints. All gestures are based on arm movements, which make the gestures easier to make for test participants, as a result of which they may be more relaxed and make the gestures naturally.

It has been proven to be reliable tool for recognizing human body static poses and body gestures. In the above approach, static poses, the so-called key frames form components of dynamic gestures. The recognition rate for all of the tested gestures ranges from 80.5 to 98.5 %.

### **COMBINATION OF HIDDEN MARKOV MODELS WITH DYNAMIC TIME WARPING FOR SPEECH RECOGNITION (Scott Axelrod and Benoit Maison)**

The above method combines the hidden markov models of various technologies and neighbourhood algorithm to avoid error reductions in recognitions. Increases in computational power, storage capacity and training data available for use by automatic speech recognition (ASR) systems, combined with the perception that the performance of such systems has reached a plateau to consider modeling strategies for speech recognition that, while more resource intensive, have the potential to obtain significant reductions in error rate.

The acoustic modeling uses Dynamic Time Warping (DTW) techniques to match segments of test utterances to stored training data. DTW systems can capture long-range dependencies in the acoustic data and can potentially adapt to differences in gender, speaker, and accent by pinpointing, at decode time, similar data in the training set.

Hidden Markov models are created with 5000 words in the training set. Models are built with the condition in which the number of states in each branch was fixed independently of the data as well as models where the number of states varied with the branch.

The models in the fixed length case as

$F(B, N, S)$

where  $B$  = number of branches,

$N$  = number of Gaussian components for each of the state models and

$S$  = training set size

All the models were trained from a flat start without reference to any auxiliary data such as baseforms or a reference model. For the seed models we use uniform transition probabilities and a choice of initial hard state alignments. For efficiency, the seed Gaussian mixture models for each states was obtained by first applying a few rounds of k-means to the data aligned to the state and then training with the usual Expectation Maximization algorithm.

Dynamic Time Warping(DTW) is a technique that allows the computation of distances between sequences of speech frames of different lengths. The symmetric DP algorithm permits the matching of sequences of any length. However, since each frame of each sequence must be matched to some frame of the other sequence, the total DTW cost is dominated by the length of the longest of the two sequences. This effect makes it harder to compare the matching cost of a test sequence against templates of different durations.

Nearest Neighbor techniques can be significantly enhanced by distance modeling, smoothed voting, and normalization. The error rate reductions are done by combining DTW and multi-branch HMM models using maximum entropy techniques and a greedy model selection algorithm.

### **SUPPORT VECTOR MACHINE (SVM) CLASSIFICATION THROUGH GEOMETRY (Michael E. Mavroforakis, and Sergios Theodoridis)**

**M.E. Mavroforakis Et Al** proposes the geometric framework for the support vector machine (SVM) classification problem. It provides an intuitive ground

for the understanding and the application of geometric optimization algorithms, leading to practical solutions of real world classification problems.

In this work, the notion of reduced convex hull is employed and supported by a set of new theoretical results. These results allow existing geometric algorithms to be directly and practically applied to solve not only separable, but also non separable classification problems both accurately and efficiently. As a practical application of the new theoretical results, a known geometric algorithm has been employed and transformed accordingly to solve separable problems successfully.

Support Vector Machine (SVM) formulation of pattern recognition problems brings along a bunch of advantages over other approaches. Some of the problems are:

- 1) the assurance that once a solution has been reached, it is the unique solution,
- 2) good generalization properties of the solution,
- 3) sound theoretical foundation based on learning theory and Optimization theory,
- 4) common ground / formulation for the class separable and the class non-separable problems as well as for linear and non-linear problems and
- 5) clear geometric intuition on the classification task.

Due to the above properties, SVM have been successfully used to a number of applications. The SVM approach to machine learning is known to have both theoretical and practical advantages. Among these, are the sound mathematical foundation of SVM, overcoming of the “curse of dimensionality” and the intuition that is displayed.

Reduce convex hull is represented by  $R(C, \mu)$  is calculated based on upper bound  $\mu$ . The overlapping convex hulls are overcome by the proper selection of  $\mu$ . Once the upper bound is properly fixed the

overlapping becomes separable and hence geometric algorithm gets applied.

The algorithm presented here does not use any heuristics and provides a clear understanding of the convergence process and the role of the parameters used. Furthermore, the penalty factor  $\mu$  can be set different for each class, reflecting the importance of each class.

### III. EXISTING SYSTEM

#### THE VISION-BASED HAND GESTURE RECOGNITION USING BLOB ANALYSIS

Image acquisition is done by importing file with dynamic hand gestures. The video frames are separated into single frame. RGB image frame is converted into grayscale image frame because grayscale level provides effective processing on pixels more than RGB channels. It is easier and faster to implement on grayscale image as it only requires the gray levels which have less colors than the RGB channels and do not affect to other pixels. Before applying the optical flow for motion analysis, the sequence of inputs or image frames set with specified value must be calculated by an object to find the mean. This process is based on two dimensional mean block which is able to calculate over single or multiple inputs and track the mean value of each channel in a sequence of image frames over a period of time. Hence each element is treated as a channel.

After calculating the mean of each channel in a time sequence of image frames, the median filter process calculates the two dimensional moving median filtering of the image frames along each channel independently over time by using the sliding window method. In this method, a window of specified length moves over each channel sample by sample and computes the median of the data. The Morphological

Close technique is used for extracting interested region and remove out noises in the image frames. It is applied with an intensity image to improve the quality of the input. Intensity or gray level closing consists of the gray level dilation followed by the gray level erosion.

Dilation operation enlarges the boundaries of the hand shape from the background and contains the original boundary of the hand shape in the intensity image. It also removes undesirable objects such as small holes on the hand as well. Blob Analysis is used to calculate statistics for labeled regions in an intensity image. It proceeds quantities such as the centroid, bounding box, label matrix, and blob count. The goal of this method is to detect corresponding regions in scaled versions of the same image. According to the goal, the scale selection mechanism is needed for finding characteristic region size that is covariant with the image transformation. For spatial selection, the magnitude of the Laplacian response will achieve a maximum at the center of the blob in which the scale of the Laplacian and blob is matched.

The dynamic six hand gestures are defined including the close fist, one finger, two finger, three finger, four finger, and open palm gestures. The main methods include the use of optical flow and blob analysis. The optical flow detects the motion vector of the hand movement in detection process. Additionally, the blob analysis detects and tracks the hand area in tracking and classification processes. The algorithm performs good results at detection, tracking and classification for all hand gestures even it is blurred because of the motion.

### IV. CONCLUSION AND FUTURE WORK

The main goal is to introduces multi finger touch input based authentication system for mobile devices the characteristics hand movement based five number of gestures based on the hand movements have been

taken into account from the users. The main method includes the uses of DWT and Contour detection. DWT detects the approximate image and the detailed images using the low pass and high pass filter. Additionally Contour detection detects the boundaries in an image. Users data patterns of the gestures are taken and features are sensed based on DWT algorithm and then the five finger position are sensed and based on the location features of the five position hand gestures are sensed. Based on the location features of the five finger, already defined functions of hand gestures and the given input ratio is compared and the Equal Error Rate (EER) is sensed over the images. Finally the images are compared with the contour counts and send the respective messages to the caretaker.

The future research can be applied to monitor many immobilized people at the same time using skin color detection. It will focus more on pre-processing process to improve the algorithm to be more robust and practical.

## V. REFERENCES

1. C Acharya, H. Thimbleby, P. Oladimeji ?Human computer interaction and medical devices?, In: the 24th BCS Interaction Specialist Group Conference, British Computer Society, pp. 168-176, 2010.
2. S Axelrod and B. Maison, "Combination of hidden Markov models with dynamic time warping for speech recognition, 2004 IEEE International Conference on Acoustics, Speech, and Signal Processing, vol.1, pp. I- 173-6, 2004.
3. P Barros, N. T. Maciel-Junior, B. J. Fernandes, B. J. Bezerra, and S. M. Fernandes, "A dynamic gesture recognition and prediction system using the convexity approach", *Computer Vision and Image Understanding*.
4. A Chaudhary and J. Raheja, "A Health Monitoring System for Elder and Sick Persons", *International Journal of Computer Theory and Engineering*, pp. 428-431, 2013.
5. T Hachaj and M. Ogiela, "Rule-based approach to recognizing human body poses and gestures in real time", *Multimedia Systems*, vol. 20, no. 1, pp. 81-99, 2013.
6. B Horn and B. Schunck, "Determining optical flow", *Artificial Intelligence*, vol. 17, no. 1-3, pp. 185-203, 1981.
7. C Hsieh and D. Liou, "Novel Haar features for real-time hand gesture recognition using SVM", *Journal of Real Time Image Processing*, vol. 10, no.2, pp. 357-370, 2015.
8. P Kishore and M. Prasad, "Optical Flow Hand Tracking and Active Contour Hand Shape Features for Continuous Sign Language Recognition with Artificial Neural Networks", *International Journal of Software Engineering and Its Applications*, vol. 9, no. 12, pp. 231-250, 2015.
9. M E. Mavroforakis and S. Theodoridis, "Support Vector Machine (SVM) classification through geometry, 2005 13th European Signal Processing Conference, Antalya, 2005, pp. 1 4. 41
10. T. Pringsheim, N. Jette, A. Frolkis and T. Steeves, "The prevalence of Parkinson's disease: A systematic review and meta-analysis", *Movement Disorders*, vol. 29, no. 13, pp. 1583-1590, 2014.
11. S S. Rautaray and A. Agrawal, Vision based hand gesture recognition for human computer interaction: a survey. In: *Artificial Intelligence Review*, vol. 43, no.1, pp. 1-54, 2015.
12. Y. REN, X. Xie, G. Li and Z. Wang, "Hand Gesture Recognition with Multi-Scale Weighted Histogram of Contour Direction (MSWHCD) Normalization for Wearable Applications", *IEEE Transactions on Circuits and Systems for Video Technology*, pp. 1-1, 2016.
13. J P. Wachs, M. Kolsch, H. Stern and Y. Edan, ?Vision-based handgesture applications?, *Communications of the ACM*, vol. 54, no. 2, pp. 60-71, 2011.
14. Wei Wang and Jing Pan, "Hand segmentation using skin color and background information, 2012 International Conference on Machine Learning and Cybernetics, Xian, pp. 1487-1492 , 2012.

# Some Studies with GEM Equations - A Note

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## ABSTRACT

Considering GEM equations expressions for electrostatic ( $u_e$ ), magnetic ( $u_m$ ) and gravitational ( $u_G$ ) energy densities were found out. The ratios  $\frac{u_e}{u_m}$ ,  $\frac{u_G}{u_e}$ ,  $\frac{u_G}{u_m}$  and their sum have, also, been obtained. Studies were made to find out the correct form of these ratios i.e.  $\frac{u_G}{u_e}$  or  $\frac{u_e}{u_G}$  and  $\frac{u_G}{u_m}$  or  $\frac{u_m}{u_G}$  and proper arguments are presented in their favour. In similar way the correct form of the wave impedances for electromagnetic ( $Z_{EM}$  or  $Z_{ME}$ ), gravitomagnetic ( $Z_{GH}$  or  $Z_{HG}$ ) and gravitoelectric ( $Z_{GE}$  or  $Z_{EG}$ ) portions of the GEM wave have been derived. Lastly, mention has been made to a mathematical concept which would introduce an error in deducing some expressions. Steps have been provided to show how this error may be avoided and arrive at the speculated result.

**Keywords :** GEM, EM, GE and GH waves

## I. INTRODUCTION

It is well known that energy density and impedance of any type of wave could be found out easily as done in literatures [ 1 ]. Thus expressions for electrostatic ( $u_e$ ), magnetic ( $u_m$ ) and gravitational ( $u_G$ ) energy densities and wave impedances are closely related to the GEM waves. Using GEM equations one could find out the expressions for these parameters as well as different types of ratios of the energy densities. It should be mentioned here that the above parameters depend upon the constants like  $\mu_{G0}, \epsilon_{G0}, \mu_{E0}, \epsilon_{E0}$  etc. Depending upon the values of these constants the energy densities, their ratios and the impedances may be either finite or infinite. In this work trial would be made to find out the correct form of the above parameters so that they are finite. Again, in some cases certain mathematical steps could be used which are mathematically correct apparently

but erroneous so far as physical concept is concerned. This type of error could be avoided if physical reasoning be given importance while writing a mathematical step. In this dissertation such an error would be avoided by providing proper arguments having physical concepts.

## II. THE PROBLEM

We have GEM (Gravitoelectromagnetic) equations proposed in [ 2,3 ] are given by

$$\begin{aligned} (i) \nabla \cdot \mathbf{E} &= 0, \quad (ii) \nabla \cdot \mathbf{G} = 0, \quad (iii) \nabla \cdot \mathbf{H} = 0, \\ (iv) \nabla \times \mathbf{E} &= -\mu_{G0} \frac{\partial \mathbf{H}}{\partial t}, \quad (v) \nabla \times \mathbf{G} = -\mu_{E0} \frac{\partial \mathbf{H}}{\partial t} \text{ and} \\ (vi) \nabla \times \mathbf{H} &= \epsilon_{G0} \frac{\partial \mathbf{E}}{\partial t} - \epsilon_{E0} \frac{\partial \mathbf{G}}{\partial t} \end{aligned} \quad (1)$$

Here  $\mathbf{E}$ ,  $\mathbf{H}$  and  $\mathbf{G}$  are respectively the electric, magnetic and gravitational field vectors. These are connected by electric and magnetic constants  $\epsilon_{G0}$ ,  $\epsilon_{E0}$  and  $\mu_{G0}$ ,  $\mu_{E0}$  which are related to gravitational

and electrical space-time designated by the suffix  $G$  and  $E$  respectively. It may be assumed that in absence of gravitational interaction  $\mu_{G0} = \mu_0$  and  $\epsilon_{G0} = \epsilon_0$  and  $\mu_{E0} = 0 = \epsilon_{E0}$ . It is easily seen that GEM wave in a medium is due to the mutual interaction of electric, magnetic and gravitational fields. From ( 1 ) we could obtain [ 4,5 ]

$$\begin{aligned} a) \nabla^2 \mathbf{E} &= \mu_{G0} \epsilon_{G0} \frac{\partial^2 \mathbf{E}}{\partial t^2} - \mu_{G0} \epsilon_{E0} \frac{\partial^2 \mathbf{G}}{\partial t^2} \\ b) \nabla^2 \mathbf{G} &= \mu_{E0} \epsilon_{G0} \frac{\partial^2 \mathbf{E}}{\partial t^2} - \mu_{E0} \epsilon_{E0} \frac{\partial^2 \mathbf{G}}{\partial t^2} \end{aligned} \quad (2)$$

and  $c) \nabla^2 \mathbf{H} = (\mu_{G0} \epsilon_{G0} - \mu_{E0} \epsilon_{E0}) \frac{\partial^2 \mathbf{H}}{\partial t^2}$

The solution of these are

$$\begin{aligned} a) \mathbf{E} &= \mathbf{E}_0 \exp(i\mathbf{k} \cdot \mathbf{r} - i\omega t) \\ b) \mathbf{G} &= \mathbf{G}_0 \exp(i\mathbf{k}' \cdot \mathbf{r} - i\omega' t) \\ c) \mathbf{H} &= \mathbf{H}_0 \exp(i\mathbf{k} \cdot \mathbf{r} - i\omega t) \end{aligned} \quad (3)$$

where

$\omega, \omega'$  and  $\mathbf{k}, \mathbf{k}'$  are respectively the frequencies and propagation vectors for the oscillations of EM and gravitational waves respectively.

Now, we have the ratios of EM(electromagnetic), GE(gravitoelectric) and GM(gravitomagnetic) energy densities respectively to be

$$\begin{aligned} a) \frac{u_e}{u_m} &= \frac{\mu_{G0}}{\mu_{G0} - \epsilon_{E0}} \\ b) \frac{u_G}{u_e} &= \frac{\mu_{E0}}{\mu_{G0}} \end{aligned} \quad (4)$$

and  $c) \frac{u_G}{u_m} = \frac{\mu_{E0}}{\mu_{G0} - \epsilon_{E0}}$

where, similar to [ 5 ], we have

Electrostatic energy density  $u_e = -\frac{1}{2} \epsilon_{G0} (\mathbf{E})^2$

Magnetic energy density  $u_m = -\frac{1}{2} (\mu_{G0} - \epsilon_{E0}) (\mathbf{H})^2$  (5)

and Gravitational energy density  $u_G = -\frac{1}{2} \epsilon_{E0} (\mathbf{G})^2$

In order that the relations may be viable they should be written as in ( 4 ) so that the ratios  $\frac{u_e}{u_m}$  and  $\frac{u_G}{u_m}$  become zero in absence of the effect of gravity. Also, the total ratio

$$X \text{ (say)} = \frac{u_e}{u_m} + \frac{u_G}{u_e} + \frac{u_G}{u_m} = \frac{\mu_{G0}}{\mu_{G0} - \epsilon_{E0}} + \frac{\mu_{E0}}{\mu_{G0}} + \frac{\mu_{E0}}{\mu_{G0} - \epsilon_{E0}} \quad (6)$$

would have a finite value in presence of  $\mathbf{G}$  and unity in absence of it. Otherwise, if we write the ratios as  $\frac{u_e}{u_G}$  and  $\frac{u_m}{u_G}$  then these ratios as well as X would become infinity in absence of the effect of gravity which is impossible.

Now, we may consider GEM waves as a combination of EM, GE and GH waves. Hence, GEM waves should have three impedances combined together. These may be written as  $Z_{EM}, Z_{GE}$  and  $Z_{GH}$ . But, the question is what type of combination it is? Whether the three Z 's would be combined in series or in parallel? Let us try to study it.

Using ( 3 ) we get respectively from (iv), (v) and (vi) of ( 1 )

$$\begin{aligned} (a) \mathbf{k} \times \mathbf{E} &= \mu_{G0} \omega \mathbf{H}, \quad (b) \mathbf{k}' \times \mathbf{G} = \mu_{E0} \omega \mathbf{H} \text{ and} \\ (c) \mathbf{k} \times \mathbf{H} &= -\epsilon_{G0} \omega \mathbf{E} + \epsilon_{E0} \omega' \mathbf{G} \end{aligned} \quad (7)$$

We can easily find out the impedances of EM, GM and GE waves from ( 7 ). These are shown below.

$$Z_{EM} = \left| \frac{\mathbf{E}}{\mathbf{H}} \right| = \mu_{G0} c_1 \quad (8)$$

$$Z_{GH} = \left| \frac{\mathbf{G}}{\mathbf{H}} \right| = \mu_{E0} c_2 \quad (9)$$

$$Z_{GE} = \left| \frac{\mathbf{G}}{\mathbf{E}} \right| = \frac{\mu_{E0} c_2}{\mu_{G0} c_1} \quad (10)$$

where  $c_1 = \frac{1}{\sqrt{\mu_{G0} \epsilon_{G0}}}$  and  $c_2 = \frac{1}{\sqrt{\mu_{E0} \epsilon_{E0}}}$  (11)

It is clearly seen that in absence of gravity only  $Z_{EM}$  exists while other two impedances would be zero

( since  $\mu_{E0} = 0 = c_2$ ). Again, if we take series combination of them then, also, the resultant impedances would be finite in presence or in absence of gravity. In the later case it is, again,  $Z_{EM}$ . This is justified.

But, if we write  $Z_{GH}$  and  $Z_{GE}$  in the inverse form then  $Z_{HG}(= \frac{1}{\mu_{E0}c_2})$  and  $Z_{EG}(= \frac{\mu_{G0}c_1}{\mu_{E0}c_2})$  would

become infinity in absence of gravitational interaction. Let us take the series combination of these impedances. Then, the resultant

$$Z_S = Z_{EM} + Z_{EG} + Z_{HG} = \mu_{G0}c_1 + \frac{\mu_{G0}c_1}{\mu_{E0}c_2} + \frac{1}{\mu_{E0}c_2}$$

would become infinity in absence of gravitational interaction. This means that in absence of gravity the energy of EM wave will not propagate at all. This is not true for all media. Hence, the impedances should be written in the forms as in ( 8 ), ( 9 ) and ( 10 ).

Let us study the effect in case the impedances in ( 8 ), ( 9 ) and ( 10 ) are combined in parallel. Using these equations the resultant impedance  $Z_p$  would be

$$Z_p = \frac{\mu_{G0}\mu_{E0}c_1c_2}{\mu_{E0}c_2 + \mu_{G0}^2c_1^2 + \mu_{G0}c_1} \tag{12}$$

This  $Z_p$  has a finite value. Now, in absence of gravitational interaction  $\mu_{E0} = 0 = c_2$ . Hence,  $Z_p$  becomes zero leading to the fact that the GEM wave would travel with infinite velocity in any type of medium. This is, again, impossible.

Thus, in case of any resultant wave formed by superposition of several waves ( GEM wave = EM wave + GE wave + GM wave ), the resultant impedance should be found out by combining the individual impedances in series. This is a well known fact valid for any type of wave. So, it is also valid for GEM waves.

Again, using ( 1- vi ) we have in ( 7- c )

$$\mathbf{k} \times \mathbf{H} = -\epsilon_{G0}\omega\mathbf{E} + \epsilon_{E0}\omega'\mathbf{G} \tag{13}$$

Substituting  $\mathbf{G}$  from ( 10 ) it will lead to

$$\left| \frac{\mathbf{E}}{\mathbf{H}} \right| = \frac{\mu_{G0}\omega}{-\epsilon_{G0}\mu_{G0}\omega c_1 + \epsilon_{E0}\mu_{E0}\omega'c_2} \tag{14}$$

as  $k = \frac{\omega}{c_1}$ .

Now, equating ( 8 ) and ( 14 ) we get

$$\frac{c_1}{c_2} = 2 \frac{\omega}{\omega'} \tag{15}$$

Again, using ( 3 ) we get from ( 2 a ) and ( 2 c ) respectively

$$k^2\mathbf{E} = \mu_{G0}\epsilon_{G0}\omega^2\mathbf{E} - \mu_{G0}\epsilon_{E0}\omega'^2\mathbf{G} \tag{16}$$

$$\text{and } k^2 = (\mu_{G0}\epsilon_{G0} - \mu_{E0}\epsilon_{E0})\omega^2 \tag{17}$$

Using ( 17 ) we get from ( 16 )

$$\frac{\omega}{\omega'} = \sqrt{\frac{c_2}{c_1}} \tag{18}$$

Also, applying ( 18 ) we obtain from ( 15 )

$$\frac{c_1}{c_2} = 2^{\frac{2}{3}} \tag{19}$$

This gives the relation between the velocities of EM and gravitational part of the GEM wave.

Now, from ( 18 ) we have  $\frac{c_2}{c_1} = \frac{\omega^2}{\omega'^2}$ . Hence, from ( 15 )

$$\frac{\omega}{\omega'} = 2^{-\frac{1}{3}} \tag{20}$$

It is seen that ( 19 ) gives the relation between the velocities of EM and gravitational waves while ( 20 ) is that between their frequencies. We have to note that the results obtained in ( 19 ) and ( 20 ) seem to be fallacious and unusual. Since, in ( 8 ) and ( 14 ) values of the parameters describing the characteristics of the medium and the wave are unknown to us then how can we arrive at the equations like ( 19 ) or ( 20 ) with numerical values on the right hand side?

### III. SOLUTION OF THE PROBLEM

The possible explanations to solve the fallacy may be as follows:-

i) To obtain ( 15 ) we have equated ( 8 ) and ( 14 ). The entity  $\left| \frac{\mathbf{E}}{\mathbf{H}} \right|$  in ( 8 ) seems to be independent of  $\mathbf{G}$ . But, that in ( 14 ) depends on  $\mathbf{G}$ . So, while deducing ( 15 ) we have equated the same entities but with different characteristics. This is improper.

ii) Relation (14) is not proper as in absence of  $\mathbf{G}$  it will lead to  $\left| \frac{\mathbf{E}}{\mathbf{H}} \right| = -\frac{1}{\epsilon_{G0}c_1} = -\sqrt{\frac{\mu_{G0}}{\epsilon_{G0}}} = -\sqrt{\frac{\mu_0}{\epsilon_0}}$ . But the modulus of an entity cannot be negative. Also, this does not tally with ( 8 ).

Again,  $\mathbf{E}$  and  $\mathbf{G}$  are oppositely directed as seen from ( 1 – vi ) and ( 16 ). Hence, ( 14 ) may be written as

$$\left| \frac{\mathbf{E}}{\mathbf{H}} \right| = \frac{\mu_{G0}\omega}{\epsilon_{G0}\mu_{G0}\omega c_1 - \epsilon_{E0}\mu_{E0}\omega' c_2} \quad (21)$$

equated to ( 8 ) gives

$$\omega' = 0 \quad (22)$$

This is justified. Since, we are dealing only with  $\mathbf{E}$  and  $\mathbf{H}$  when  $\mathbf{G}$  is not included, then the fact is that the impedance of the EM part of GEM wave has been dealt with. As a result, no gravitational wave exists and frequency  $\omega'$  of gravitational part of the wave becomes zero. Thus, by slight modification of the mathematical understanding the above self-contradictory relations ( 19 ) and ( 20 ) could be explained and the fallacy may be resolved.

#### IV. REFERENCES

[1]. Satya Prakash ( 1989 ), Electromagnetic Theory and Electrodynamics, Kedernath Ramnath, Meerut, India.  
 [2]. Vadim y. Kosyev (2003), Electromagnetic Gravitational Interaction, Conference “Time Machine”, Moscow, New Energy Technologies, Issue 3, May-June.  
 [3]. S. J. Clark and R. W. Tucker (2000), Gauge Symmetry and Gravitoelectromagnetism, Classical and Quantum Gravity, 17(19), p-4125-4157.

[4]. R. Misra and M. C. Das (2017), A Step Towards Gravitoelectromagnetism, International Journal of Research in Science, Engineering and Technology, 3 (6), p-543.  
 [5]. R. Misra and M. C. Das (2017), GEM equations and their Validity, International Journal of Scientific Research in Science and Technology, 3 ( 8 ), 842-849.



# Planning Support System for Urban and Regional Area Using GIS

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## ABSTRACT

The Planning Support System (PSS) is an architecture that, using computer science, supplies decision support information in the field of planning. PSS or the DSS contributes to rationalizing planning process by providing necessary support to systematically structure and formulate problems, develop alternative plans or policy scenarios, assess and evaluate their impacts and to choose the proper decision, policy or plan. In this research work one prototype PSS model developed and suggested for the urban and regional planners. This will help to planners for the efficient planning process.

**Keywords:** Planning Support System, DSS, GIS & RS.

## I. INTRODUCTION

Some people believe that the way to improve planning support is to combine the planning model and GIS technique to formulate an integrated system for planning and decision support system purposes. The concept of PSS with combining a range of computer-based methods and models into an integrated system that is used to support a particular planning function. PSS as information technology that are used specifically by planners to undertake their unique professional responsibilities. However, the Planning Support System (PSS) is an architecture that, using computer science, supplies decision supports information in the field of planning.

PSS or the DSS contributes to rationalizing planning process by providing necessary support to systematically structure and formulate problems, develop alternative plans or policy scenarios, assess and evaluate their impacts and to choose the proper decision, policy or plan.

## II. Development of PSS tool

There are so many geospatial data processing as well as image processing software's are available in the market. But the actual users at the urban and regional level are not having expertise in those software's. Here in this PSS tool we have providing the all map overlay management through enabling or disabling of different loaded map. Through this feature the planners can use this map overlay as like the layers in geospatial software. We can also easily add or remove the different map through the coding part. In addition to user can filter the different attributes provided in map. We can also able to use the query function.

In this study we have developed the PSS tool which will used to assist the planners of urban and regional area. This PSS tool is developed using .Net platform. This tool will used to perform all map overlay management through enabling or disabling of different loaded map layers like, village locations, digital elevation model (DEM), ASTER Satellite Imageries, Multicolored elevation contour line, etc.

### III. Study Area

The district has an area of 10,502 km<sup>2</sup> while according to 2011 census its population is 3,361,292 of which 27.19% were urban. The Godavari River flows through the district. Nanded District is situated in the southeastern part of the Indian state of Maharashtra. The District lies in the eastern portion of Marathwada region, which corresponds to Aurangabad Division of Maharashtra. Nanded city is the district headquarters of the district. Nanded District shares its border with Andhra Pradesh.

### IV. Proposed Information System

The tool is working like geo-server providing information in the form of Maps. The front is used as the .Net and Back end is used as the SQL. The concept of relational database management was implemented in this framework.

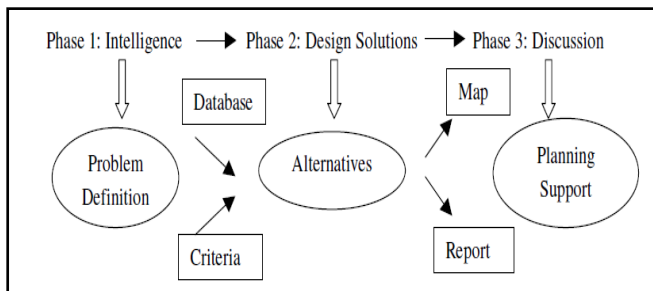


Figure 1. Conceptual Framework of Proposed PSS

### V. Developed PSS Software and Discussion

Following are the some screenshots of the developed PSS software for the Planning related analysis. In this PSS software easy access to all developed maps as well as different scenario studied in regards of planning of urban and regional area. As we discussed above, while discussing the difference between PSS and DSS, the users of PSS are the technocrats. These technocrats will easily understand the importance of planning in the geographic visualised format. In this PSS software we providing access to all GIS based digitised maps which will attract the planners and the stakeholders

of urban and regional area according to their interest. Therefore planning will became the more nourished. Some screenshots of PSS software are as follows:

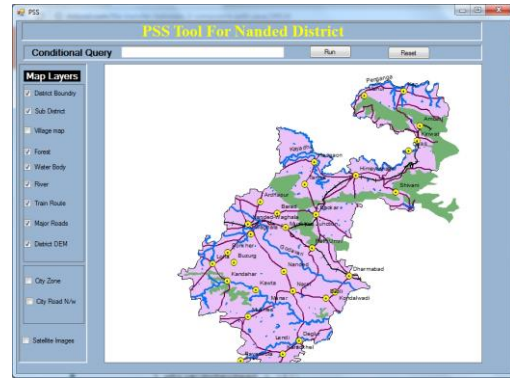


Figure 2. PSS software displaying several layers of Nanded district

In the above figure the on the left panel the list of available layers are displayed and in the work area according to selected layer the layer features are represented in GIS data formats.

The above figure shows the layers of Nanded district such as District administrative boundary, Sub-district locations, Forest area, water bodies River network , District road network, Rail routes, etc.



Figure 2. (a) : Displaying River Layer

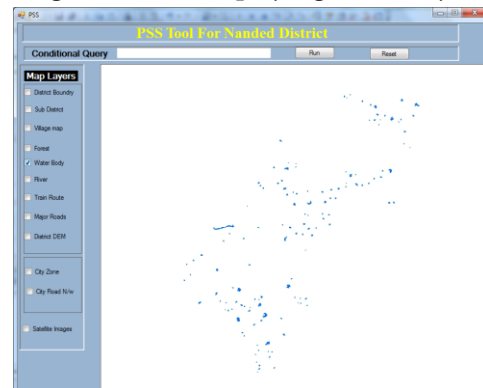


Figure 2. (b): Displaying Water body Layer

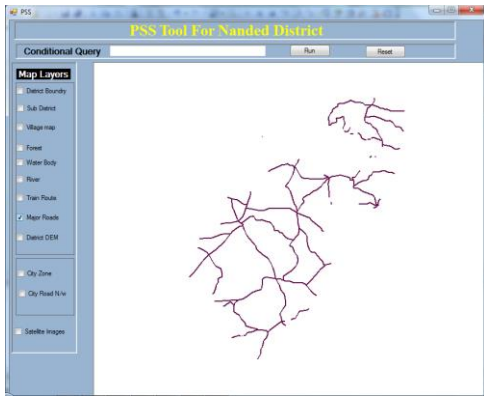


Figure 2. (c): Displaying District Roads Layer

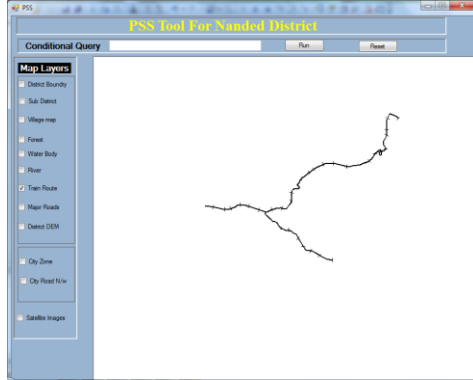


Figure 2. (d) Displaying District Rail Route Layer

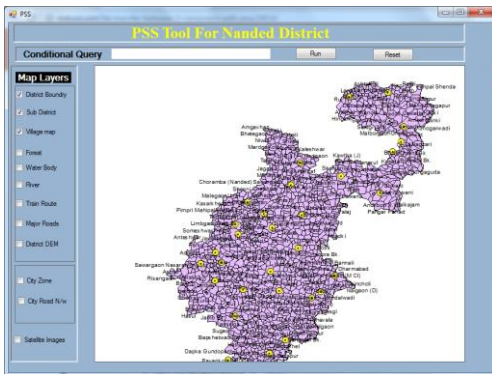


Figure2. (e) Displaying District Village Map Layer

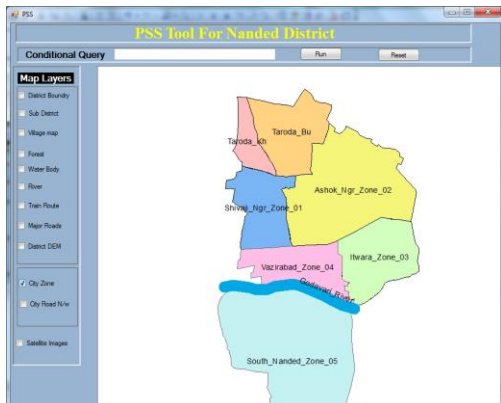


Figure 2. (f) Displaying NWMC City Zones

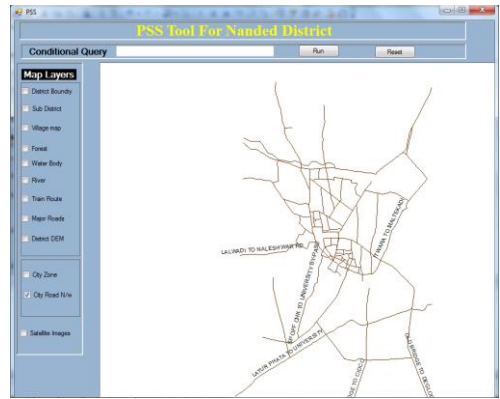


Figure 2. (g) Displaying NWMC City Road Network Layer

All above figure (a) to (g) are displaying the different geographical layers of Nanded district. All these layers are supported with geodatabase, therefore planners can use these maps for effective planning to satisfy the following objectives:

- To understand the concept of planning and sustainable development
- To understand the concept of stakeholder involvement in urban planning
- To analyze the limits of current planning support systems
- To show a picture of current planning support practice in the world
- To explain how PSS can be used to improve planning support system

## V. Conclusion

In this chapter we developed new approach of Planning Support System, which is an integration of different advanced technologies used in this thesis. Development of this Planning Support System is an ultimate goal of this research study, this is being try to achieve in this chapter. It needs spatial analysis functions to incorporate the decision space into intuitive scenarios. GIS can provide strong function for data management and spatial analysis as well as combining with some models and analysis methods to generate alternatives. In this research work, it has been supposed that PSS emphasizes on design stage while DSS pay more attention on making choice, as

well as the users of the PSS are technocrats while the users of the DSS are decision-makers.

## **VI. References**

- [1] Official Website of Nanded District:  
<http://nanded.nic.in>
- [2] Nanded District Gazetteer:  
<https://cultural.maharashtra.gov.in/english/gazetteer/Nanded/chapters.html>
- [3] Harris, B. and Batty, M. Location Models, geographic information and planning support system, *Journal of Planning Education and Research*, 12:184-198.
- [4] Anji Reddy M, Text book of Remote Sensing and Geographical Information System, 3rd ed., B.S. Publications, Hyderabad (India), 2010.
- [5] Geertman S, Stillwell J, 2003c, "Planning support systems: an introduction", in *Planning Support Systems in Practice* Eds S Geertman, J Stillwell (Springer, Berlin) pp 3-23.
- [6] Batty M, 2003, "Planning support systems: technologies that are driving planning", in *Planning Support Systems in Practice* Eds S Geertman, J Stillwell (Springer, Berlin).
- [7] Brail R, Klosterman R (Eds), 2001 *Planning Support Systems: Integrating Geographic Information Systems, Models and Visualization Tools* (ESRI Press).

# Usage of Machine Learning In Business Industries And Its Significant Impact

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## ABSTRACT

The researcher focused on the usage of machine learning (ML) in business industries and its significant impact with respect to extracts meaningful insights from raw data to quickly solve complex, data-rich business problems. ML algorithms learn from the data iteratively and allow computers to find different types of hidden insights without being explicitly programmed to do so. ML is evolving at such a rapid rate and is mainly being driven by new computing technologies. Machine learning in business helps in enhancing business scalability and improving business operations for companies across the globe. Artificial intelligence tools and numerous ML algorithms have gained tremendous popularity in the business analytics community. Factors such as growing volumes, easy availability of data, cheaper and faster computational processing, and affordable data storage have led to a massive machine learning boom. Therefore, organizations can now benefit by understanding how businesses can use machine learning and implement the same in their own processes.

**Keywords :** ML, HFT, AI

## I. INTRODUCTION

Machine learning has had fruitful applications in finance the researcher before the advent of mobile banking apps, proficient chat bots, or search engines. Given high volume, accurate historical records, and quantitative nature of the finance world, few industries are better suited for artificial intelligence. There are more uses cases of machine learning in finance than ever before, a trend perpetuated by more accessible computing the researcher and more accessible machine learning tools (such as Google's Tensorflow). Today, machine learning has come to play an integral role in many phases of the financial ecosystem, from approving loans, to managing assets, to assessing risks. Yet, few technically-savvy professionals have an accurate view of just how many ways machine learning finds its way into their daily financial lives.

At TechEmergence, the researcher fortunate enough to speak with hundreds of AI and machine learning executives and researchers in order to accumulate a more informed lay-of-the-land for current uses and applications.

The term "robo-advisor" was essentially unheard-of just five years ago, but it is now commonplace in the financial landscape. The term is misleading and doesn't involve robots at all. Rather, robo-advisors (companies such as Betterment, The researcherfront, and others) are algorithms built to calibrate a financial portfolio to the goals and risk tolerance of the user. The system then calibrates to changes in the user's goals and to real-time changes in the market, aiming always to find the best fit for the user's original goals. Robo-advisors have gained significant traction with millennial consumers who don't need a physical advisor to feel comfortable investing, and who are less able to validate the fees paid to human advisors.

## ALGORITHMIC TRADING

With origins going back to the 1970's, algorithmic trading (sometimes called "Automated Trading Systems," which is arguably a more accurate description) involves the use of complex AI systems to make extremely fast trading decisions. Algorithmic systems often making thousands or millions of trades in a day, hence the term "high-frequency trading" (HFT), which is considered to be a subset of algorithmic trading. Most hedge funds and financial institutions do not openly disclose their AI approaches to trading (for good reason), but it is believed that machine learning and deep learning are playing an increasingly important role in calibrating trading decisions in real time. There some noted limitations to the exclusive use of machine learning in trading stocks and commodities, see this Quora thread for a good background on machine learning's role in HFT today.

## FRAUD DETECTION

Combine more accessible computing researcher, internet becoming more commonly used, and an increasing amount of valuable company data being stored online, and you have a "perfect storm" for data security risk. While previous financial fraud detection systems depended heavily on complex and robust sets of rules, modern fraud detection goes beyond following a checklist of risk factors – it actively learns and calibrates to new potential (or real) security threats. This is the place of machine learning in finance for fraud – but the same principles hold true for other data security problems. Using machine learning, systems can detect unique activities or behaviours ("anomalies") and flag them for security teams. The challenge for these systems is to avoid false-positives – situations where "risks" are flagged that the researchers never risks in the first place. Here at TechEmergence the researcherinterviewthe researcher half a dozen fraud and security AI executives, all of whom seem convinced that given the

incalculably high number of ways that security can be breached, genuinely "learning" systems will be a necessity in the five to ten years ahead.

## LOAN / INSURANCE UNDERWRITING

Underwriting could be described as a perfect job for machine learning in finance, and indeed there is a great deal of worry in the industry that machines will replace a large swath of the underwriting positions that exist today. Especially at large companies (big banks and publicly traded insurance firms), machine learning algorithms can be trained on millions of examples of consumer data (age, job, marital status, etc...) and financial lending or insurance results (did this person default, pay back the loan on time, get in a car accident, etc...?).The underlying trends that can be assessed with algorithms, and continuously analysed to detect trends that might influence lending and insuring into the future (are more and more young people in a certain state getting in car accidents? Are there increasing rates of default among a specific demographic population over the last 15 years?).These results have a tremendous tangible yield for companies – but at present are primarily reserved for larger companies with the resources to hire data scientists and the massive volumes of past and present data to train their algorithms.The researcher compared the AI investments of insurance giants like State Farm, Liberty Mutual, and others – in our complete article on AI insurance applications.

## II. BACKGROUND OF RESEARCH STUDY

The researcher focused on the deep neural nets with a large number of parameters are very the research machine learningsystems. Researcherver, over fitting is a serious problem in such networks. Large networks are also slow to use, making it difficult to deal with over fitting by combining the predictions of many different large neural nets at test time. Dropout is a technique for addressing this problem. The key idea is

to randomly drop units (along with their connections) from the neural network during training. This prevents units from co-adapting too much. During training, dropout samples from an exponential number of different “thinned” networks. At test time, it is easy to approximate the effect of averaging the predictions of all these thinned networks by simply using a single untinned network that has smaller the research rights. This significantly reduces over fitting and gives major improvements over other regularization methods. The researchers show that dropout improves the performance of neural networks on supervised learning tasks in vision, speech recognition, document classification and computational biology, obtaining state-of-the-art results on many benchmark data sets by Hinton, G.E., Krizhevsky, A., Srivastava, N., Sutskever, I., &Salakhutdinov, R. (2014).

The researchers presented a residual learning framework to ease the training of deep neural networks that are substantially deeper than those used previously. The researcher explicitly reformulate the layers as learning residual functions with reference to the layer inputs, instead of learning unreferenced functions. The researcher provide comprehensive empirical evidence showing that these residual networks are easier to optimize, and can gain accuracy from considerably increased depth. Deeper neural networks are more difficult to train by He, K., Ren, S., Sun, J., & Zhang, X. (2016).

In this research, the researcher emphasized the Neural Networks is complicated by the fact that the distribution of each layer's inputs changes during training, as the parameters of the previous layers change. The researcher refer to this phenomenon as internal covariate shift, and address the problem by normalizing layer inputs. Applied to a state-of-the-art image classification model, Batch Normalization achieves the same accuracy with 14 times the researcher training steps, and beats the original model

by a significant margin. Training Deep Neural Networks is complicated by the fact that the distribution of each layer's inputs changes during training, as the parameters of the previous layers change. This slows down the training by requiring lotheresearcher learning rates and careful parameter initialization, and makes it notoriously hard to train models with saturating nonlinearities. The researcher refer to this phenomenon as internal covariate shift, and address the problem by normalizing layer inputs. Our method draws its strength from making normalization a part of the model architecture and performing the normalization for each training mini-batch. Batch Normalization allows us to use much higher learning rates and be less careful about initialization, and in some cases eliminates the need for Dropout by Sergey Ioffe, Christian Szegedy (2015). The researcher focused on the Convolutional Neural Networks (CNNs) have been established as a potheresearcherrful class of models for image recognition problems. Encouraged by these results, the researcher provide an extensive empirical evaluation of CNNs on large-scale video classification using a new dataset of 1 million YouTube videos belonging to 487 classes. The researcher study multiple approaches for extending the connectivity of a CNN in time domain to take advantage of local spatio-temporal information and suggest a multiresolution, foveated architecture as a promising way of speeding up the training by Fei-Fei, L., Karpathy, A., Leung, T., Shetty, S., Sukthankar, R., &Toderici, G. (2014).

The researcher represented a new dataset with the goal of advancing the state-of-the-art in object recognition by placing the question of object recognition in the context of the broader question of scene understanding. This is achieved by gathering images of complex everyday scenes containing common objects in their natural context to provide baseline performance analysis for bounding box and segmentation detection results using a Deformable

Parts Model by S.J., Dollár, P., Hays, J., Lin, T., Maire, M., Perona, P., Ramanan, D., & Zitnick, C.L. (2014).

In this research section, the researcher introduce the Scene recognition is one of the hallmark tasks of computer vision, allowing definition of a context for object recognition. Whereas the tremendous recent progress in object recognition tasks is due to the availability of large datasets like Image Net and the rise of Convolutional Neural Networks (CNNs) for learning high-level features, performance at scene recognition has not attained the same level of success. This may be because current deep features trained from Image Net are not competitive enough for such tasks by Lapedriza, À., Oliva, A., Torralba, A., Xiao, J., & Zhou, B. (2014).

The researcher proposed a new framework for estimating generative models via an adversarial process, in which the researcher simultaneously train two models: a generative model  $G$  that captures the data distribution, and a discriminative model  $D$  that estimates the probability that a sample came from the training data rather than  $G$ . The training procedure for  $G$  is to maximize the probability of  $D$  making a mistake. This framework corresponds to a minimax two-player game. In the space of arbitrary functions  $G$  and  $D$ , a unique solution exists, with  $G$  recovering the training data distribution and  $D$  equal to 1/2 everywhere. In the case where  $G$  and  $D$  are defined by multilayer perceptron, the entire system can be trained with back propagation by Bengio, Y., Courville, A.C., Goodfellow, I.J., Mirza, M., Ozair, S., Pouget-Abadie, J., Warde-Farley, D., & Xu, B. (2014).

The researcher focused on the core component of most modern trackers is a discriminative classifier, tasked with distinguishing between the target and the surrounding environment. To cope with natural image changes, this classifier is typically trained with translated and scaled sample patches. Such sets of samples are riddled with redundancies –

any overlapping pixels are constrained to be the same. Based on this simple observation, the researcher propose an analytic model for datasets of thousands of translated patches by J., Caseiro, R., Henriques, J.F., & Martins, P. (2015).

Multi-label learning studies the problem where each example is represented by a single instance while associated with a set of labels simultaneously. During the past decade, significant amount of progresses have been made toward this emerging machine learning paradigm. This paper aims to provide a timely review on this area with emphasis on state-of-the-art multi-label learning algorithms. Firstly, fundamentals on multi-label learning including formal definition and evaluation metrics are given. Secondly and primarily, eight representative multi-label learning algorithms are scrutinized under common notations with relevant analyses and discussions. Thirdly, several related learning settings are briefly summarized by Zhang, M., & Zhou, Z. (2014).

The researcher emphasized the neural networks trained on natural images exhibit a curious phenomenon in common: on the first layer they learn features similar to Gabor filters and color blobs. Such first-layer features appear not to be specific to a particular dataset or task, but general in that they are applicable to many datasets and tasks. Features must eventually transition from general to specific by the last layer of the network, but this transition has not been studied extensively. In this paper the researcher experimentally quantify the generality versus specificity of neurons in each layer of a deep convolutional neural network and report a few surprising results. Transferability is negatively affected by two distinct issues: (1) the specialization of higher layer neurons to their original task at the expense of performance on the target task, which was expected, and (2) optimization difficulties related to splitting networks between co-adapted



neurons, which was not expected by Bengio, Y., Clune, J., Lipson, H., & Yosinski, J. (2014).

The researcher evaluated 179 classifiers arising from 17 families (discriminant analysis, Bayesian, neural networks, support vector machines, decision trees, rule-based classifiers, boosting, bagging, stacking, random forests and other ensembles, generalized linear models, nearestneighbours, partial least squares and principal component regression, logistic and multinomial regression, multiple adaptive regression splines and other methods), implemented by Amorim, D.G., Barro, S., Cernadas, E., & Delgado, M.F. (2014).

### III. PROBLEM STATEMENT

Machine learning is one of the significant research issues in business industries to optimize the business problem in efficient ways with respect to predictive maintenance, credit card fraud detection, eliminate manual data entry, customer life time values protection, medical diagnosis, detecting span and improving cyber security. In this researcher paper, the researcher focused on the usage of machine learning in business industries and its significant impact.

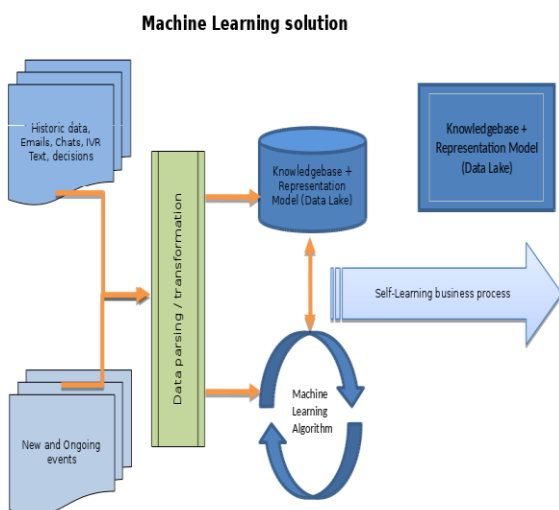


Fig 1: Machine Learning Solution

### IV. RESEARCH OBJECTIVES

1. Analysis the usage of machine learning capabilities in business industries.
2. Identify its significant study in business industries.

3. To study the current research issues with respect to cyber security and fraud detection.
4. Identification of obstacle for improving customer services during implementation of machine learning.

### V. PROPOSED FRAMEWORK OF RESEARCH STUDY

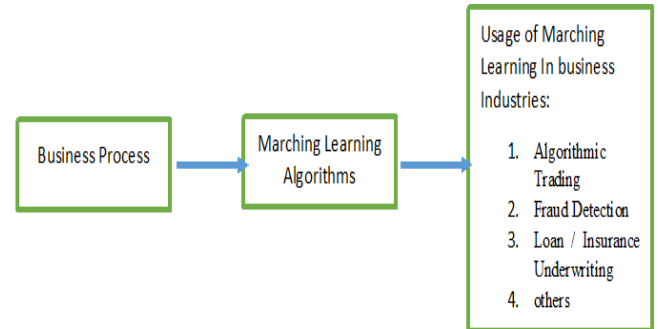


Fig 2: Conceptual framework of the research study

The conceptual framework of the research study is based on the business needs and requirements of the business process towards the improving overall business activities. In this research section, the researcher proposed a research model which can optimize the business activities with the help of machine learning algorithms, as per need and requirement of the business industries they can implement the machine learning algorithms to optimize the loan and insurance services, credit card fraud detection and various algorithms trading.

### V. SIGNIFICANT OF MACHINE LEARNING IN BUSINESS INDUSTRIES

#### 1. Customer Lifetime Value Prediction

Customer lifetime value prediction and customer segmentation are some of the major challenges faced by the marketers today. Companies have access to huge amount of data, which can be effectively used to derive meaningful business insights. ML and data mining can help businesses predict customer behaviours, purchasing patterns, and help in sending

best possible offers to individual customers, based on their browsing and purchase histories.

## 2. Predictive Maintenance

Manufacturing firms regularly follow preventive and corrective maintenance practices, which are often expensive and inefficient. The researcher, with the advent of ML, companies in this sector can make use of ML to discover meaningful insights and patterns hidden in their factory data. This is known as predictive maintenance and it helps in reducing the risks associated with unexpected failures and eliminates unnecessary expenses. ML architecture can be built using historical data, workflow visualization tool, flexible analysis environment, and the feedback loop.

## 3. Eliminates Manual Data Entry

Duplicate and inaccurate data are some of the biggest problems faced by THE businesses today. Predictive modelling algorithms and ML can significantly avoid any errors caused by manual data entry. ML programs make these processes better by using the discovered data. Therefore, the employees can utilize the same time for carrying out tasks that add value to the business.

## 4. Detecting Spam

Machine learning in detecting spam has been in use for quite some time. Previously, email service providers made use of pre-existing, rule-based techniques to filter out spam. the researcher, spam filters are now creating new rules by using neural networks detect spam and phishing messages.

## 5. Product Recommendations

Unsupervised learning helps in developing product-based recommendation systems. Most of the e-commerce the researcher sites today are making use of machine learning for making product recommendations. Here, the ML algorithms use customer's purchase history and match it with the

large product inventory to identify hidden patterns and group similar products together. These products are then suggested to customers, thereby motivating product purchase.

## 6. Financial Analysis

With large volumes of quantitative and accurate historical data, ML can now be used in financial analysis. ML is already being used in finance for portfolio management, algorithmic trading, loan underwriting, and fraud detection. Hotheresearcher, future applications of ML in finance will include Chatbots and other conversational interfaces for security, customer service, and sentiment analysis.

## 7. Image Recognition

Also, known as computer vision, image recognition has the capability to produce numeric and symbolic information from images and other high-dimensional data. It involves data mining, ML, pattern recognition, and database knowledge discovery. ML in image recognition is an important aspect and is used by companies in different industries including healthcare, automobiles, etc.

## 8. Medical Diagnosis

ML in medical diagnosis has helped several healthcare organizations to improve the patient's health and reduce healthcare costs, using superior diagnostic tools and effective treatment plans. It is now used in healthcare to make almost perfect diagnosis, predict readmissions, recommend medicines, and identify high-risk patients. These predictions and insights are drawn using patient records and data sets along with the symptoms exhibited by the patient.

## 9. Improving Cyber Security

ML can be used to increase the security of an organization as cyber security is one of the major problems solved by machine learning. Here, ML allows new-generation providers to build the researcher

technologies, which quickly and effectively detect unknown threats.

### 10. Increasing Customer Satisfaction

ML can help in improving customer loyalty and also ensure superior customer experience. This is achieved by using the previous call records for analysing the customer behaviour and based on that the client requirement will be correctly assigned to the most suitable customer service executive. This drastically reduces the cost and the amount of time invested in managing customer relationship. For this reason, major organizations use predictive algorithms to provide their customers with suggestions of products they enjoy.

## VI. CONCLUSION

In this research study, the researcher focused on the usage of machine learning in business industries and its significant impact on the business processes to improve the business services. Through the number of research article, the researcher analysed the usage of machine learning is one of the significant component of the business industries with respect to customer lifetime value prediction, prediction maintenance, eliminate manual entry, detecting span, production recommendation, medical diagnosis, improved cyber security, and increased customer satisfaction.

Furthermore, the researcher do not follow a "one-scale-fits-all" strategy because the researcher understand that the requirements vary from one client to another. So, the researcher provide custom software development services that precisely cater to the varying needs of our clients, within a quick turnaround time. With a vast, multi-domain industry expertise, the researcher understand how businesses use ML and try to incorporate them in a way that will be beneficial for the company.

## VII. REFERENCES

- [1]. Hinton, G.E., Krizhevsky, A., Srivastava, N., Sutskever, I., &Salakhutdinov, R. (2014), 'Dropout: a simple way to prevent neural networks from over fitting', *Journal of Machine Learning Research*, 15, 1929-1958. (cited 2084 times, HIC: 142 , CV: 536).
- [2]. He, K., Ren, S., Sun, J., & Zhang, X. (2016), 'Deep Residual Learning for Image Recognition', *CoRR*, abs/1512.03385. (cited 1436 times, HIC: 137 , CV: 582).
- [3]. Sergey Ioffe, Christian Szegedy (2015), 'Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shift', *ICML*. (cited 946 times, HIC: 56 , CV: 0).
- [4]. Fei-Fei, L., Karpathy, A., Leung, T., Shetty, S., Sukthankar, R., &Toderici, G. (2014), 'Large-Scale Video Classification with Convolutional Neural Networks', *IEEE Conference on Computer Vision and Pattern Recognition* (cited 865 times, HIC: 24 , CV: 239).
- [5]. Belongie, S.J., Dollár, P., Hays, J., Lin, T., Maire, M., Perona, P., Ramanan, D., &Zitnick, C.L. (2014), 'Microsoft COCO: Common Objects in Context', *ECCV*. (cited 830 times, HIC: 78 , CV: 279)
- [6]. Lapedriza, À.,Oliva, A., Torralba, A., Xiao, J., & Zhou, B. (2014), ' Learning deep features for scene recognition using places database', *NIPS*. (cited 644 times, HIC: 65 , CV: 0)
- [7]. Bengio, Y., Courville, A.C., Goodfellow, I.J., Mirza, M., Ozair, S., Pouget-Abadie, J., Warde-Farley, D., &Xu, B. (2014), ' Generative adversarial nets', *NIPS*. (cited 463 times, HIC: 55 , CV: 0)
- [8]. J., Caseiro, R., Henriques, J.F., & Martins, P. (2015), ' High-Speed Tracking with Kernelized Correlation Filters, by Batista', *IEEE Transactions On Pattern Analysis And Machine Intelligence* *CoRR*, abs/1404.7584. (cited 439 times, HIC: 43 , CV: 0).

- [9]. Zhang, M., & Zhou, Z. (2014), 'A Review on Multi-Label Learning Algorithms', IEEE Transactions on Knowledge & Data Engineering 2014 vol. 26 Issue No. 08 - Aug, (cited 436 times, HIC: 7 , CV: 91), Issue No. 08 - Aug. (2014 vol. 26), ISSN: 1041-4347, pp: 1819-1837.
- [10]. Bengio, Y., Clune, J., Lipson, H., & Yosinski, J. (2014), 'How transferable are features in deep neural networks', CoRR, abs/1411.1792. (cited 402 times, HIC: 14 , CV: 0)
- [11]. Amorim, D.G., Barro, S., Cernadas, E., & Delgado, M.F. (2014), 'Do the researcher need hundreds of classifiers to solve real world classification problems', Journal of Machine Learning Research (cited 387 times, HIC: 3 , CV: 0)
- [12]. Dong, X., Gabrilovich, E., Heitz, G., Horn, W., Lao, N., Murphy, K. & Zhang, W. (2014, August), 'Knowledge vault: a the researcherb-scale approach to probabilistic knowledge fusion', In Proceedings of the 20th ACM SIGKDD international conference on Knowledge discovery and data mining ACM. (cited 334 times, HIC: 7 , CV: 107).
- He worked as IT Management and leading roles in companies like Reliance Industry, Future Group, Times of India Group, Midday Group, Allied Blenders & distillers. Result-oriented professional, recognized for taking on major initiative, adopting to rapidly changing environment and resolving mission critical issues to ensure bottom line success with standard operation of ITIL –V3, ISO 9001, 14001, 27001 and Six Sigma Standards etc.

## VIII. ABOUT AUTHOR

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# Anti-Inflammatory Activity of Alkaloids from *Murraya Koenigii* Leaves In Animal Models

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## ABSTRACT

Alkaloids have a wide range of pharmacological properties, including anti-inflammatory activity. The purpose of the present study was to investigate the anti-inflammatory and antioxidant activity of *Murraya koenigii* leaves. The hind paw edema was produced in rats by subplantar injection of Carageenan. Pet ether extract (PMK) of *Murraya koenigii* leaves and alkaloids (AMK) isolated from PMK at doses of 100 and 300 mg/kg/day, p.o. were given for 11 days to observe % inhibition of paw edema which was comparable with Aspirin (100 mg/kg, p.o.) used as a reference drug. PMK and AMK produced a significant ( $p < 0.05$ ) inhibition of paw edema. PMK and AMK treatment significantly reversed the Carageenan induced decrease in paw Superoxide dismutase (SOD), Catalase (CAT), reduced glutathione (GSH) levels as compared to Carageenan treated rats. Lipid peroxidation (LPO) induced by Carageenan treatment was significantly reversed after administration of PMK and AMK. Hematological analysis of carageenan-treated rats exhibited significant ( $p < 0.05$ ) decrease in RBC count, Hb content and PCV after treatment with aspirin, compared to the control. PMK or AMK treated animals showed normal erythrocyte (RBC) count, hemoglobin (Hb), packed cell volume (PCV), near to control group. The total leukocyte (WBC), lymphocyte, neutrophils, and basophils count were higher in rats treated with aspirin compared to control. PMK and AMK treatment showed decreased platelet count compared to control. The significant reductions observed in the activity of ALT and AST in PMK and AMK treated animals compared to control.

**Keywords :** Inflammation, Carbazole Alkaloid, Carageenan, *Murraya Koenigii*

## I. INTRODUCTION

Inflammation is an essential protective process preserving the integrity of organisms against physical, chemical and infective insults which frequently and erroneously leads to the damaging of normal tissues (Serhan and Levy 2003). The process of inflammation is characterized by increased vascular permeability at inflamed site followed by localization and margination of neutrophils. An acute inflammatory process is comprised of inflammation mediators including neutrophil-derived reactive oxygen species (ROS), nitric oxide (NO<sup>-</sup>) (Syahida et al. 2010; Valko et al.

2006), prostaglandins (PGs), and cytokines (FitzGerald and Patrono 2001). Oxidative mechanisms are reported at the origin of inflammation and ROS such as superoxide anion, hydroxyl radical and peroxynitrite participate in the process of inflammation in various tissues and has suggested the use of antioxidant substances (Trenam 1992; Bermond 1989). Therefore, compounds that have scavenging activities toward these radicals and/or suppressive activities on lipid peroxidation may be expected to have therapeutic potentials for several inflammatory diseases (Serhan and Levy 2003).

NSAIDs, including cyclooxygenase (COX)-2 inhibitors, exhibit anti-inflammatory effect through inhibition of COX and are among the most widely prescribed medications for the clinical treatment of inflammatory diseases such as arthritis, lumbago and rheumatism. However, NSAIDs have been associated with gastrointestinal (GI) toxicity. The cardiovascular (CV) toxicity is associated with COX-2 inhibitors (Scheiman and Hindley 2010). Numerous clinical observations have associated the use of aspirin with blood disorders like anemia and cytopenias (Raybak, 1992). In this context, there arise new scopes for Herbs and Herbal Formulation in treatment of inflammatory disorders.

*Murraya koenigii* L. (Rutaceae), commonly known as curry tree, is a tropical to sub-tropical tree native to India. Traditionally the plant is used as tonic, stomachic and carminative (Kirtikar and Basu 1993). Methanolic extract of *Murraya koenigii* leaves is known to possess analgesic and anti-inflammatory activity (Gupta et al. 2010). *Murraya koenigii* contains carbazole alkaloids (Narasimhan et al. 1968; Chowdhury and Chakraborty 1971) having antioxidant (Rao et al. 2006, Arulselvan and Subramanian 2007; Gupta and Sharma 2010) anti-inflammatory, anti-tumour (Muthumani et al. 2009), anti-trypanocidal (Das and Chakraborty 1965) and mosquitocidal activities (Chakraborty et al. 1997).

The present research was aimed to evaluate the anti-inflammatory and antioxidant activity of pet ether extract of *Murraya koenigii* L. leaves (PMK) and total alkaloids separated from pet ether extract of *Murraya koenigii* leaves L. (AMK). The anti-inflammatory activity of PMK and AMK was evaluated using carrageenan induced rat paw edema (Winter et al. 1962). The antioxidant activity revealed by in vitro radical scavenging assays is further confirmed by evaluating cellular antioxidant defense system. The study was further extended to assess effect of PMK

and AMK on haematological profile of experimental animals.

## II. METHODS AND MATERIAL

### 1) Animals

Albino Wistar rats (100-150 g) of either sex were used for this study. The animals were housed at  $24 \pm 2^\circ\text{C}$  and relative humidity  $55 \pm 5$  with 12:12 h light and dark cycle. They had free access to food and water ad libitum. The animals were acclimatized for a period of seven days before the study. The experimental protocol was approved by the Institutional Animal Ethics Committee (IAEC) of MGV's Pharmacy College, Nasik.

### 2) Drugs and chemicals

Carrageenan and 1, 1-diphenyl-2-picryl hydrazyl (DPPH) (Sigma-Aldrich, MO, USA), aspirin (Research Lab, Mumbai) were used for this study.

### 3) Plant material and extraction

Leaves of *Murraya koenigii* (1 Kg) were purchased from the local market and were identified by Dr. P.G. Diwakar, Jt. Director, Botanical Survey of India, Pune, where a voucher specimen (MUKKID 1) has been retained. The leaves were dried in shade and powdered mechanically. Powdered leaves of *Murraya koenigii* were defatted with the Petroleum ether ( $60-80^\circ\text{C}$ ). The filtrate was concentrated to get pet ether extract of *Murraya koenigii* (PMK) (yield: 12.6 % w/w).

The extract was further subjected to isolation of alkaloids according to method of Cordell GA (1981). The aqueous portion was dried to get crude alkaloidal fraction of pet ether extract of *Murraya koenigii* leaves (AMK) (yield: 48.33 % w/w).

### 4) Treatment

Rats were randomly divided into 6 groups, each containing 5 animals. The previous studies carried out in our lab revealed that PMK and AMK

administration for 11 days exhibit highest antinociceptive activity. Accordingly, PMK (100 and 300 mg/kg) was suspended in 0.1 % CMC and AMK (100 and 300 mg/kg) was dissolved in water and administered orally to animals for 11 days. Control group received 0.1% CMC, p.o., for 11 days.

#### 5) Phytochemical analysis

Phytochemical analysis of PMK was carried out according to methods described earlier (Trease and Evans, 2002).

#### Identification

UV-visible spectra: AMK revealed peak at 295.0, 256.50 and 246.50 nm when spectra was run using Shimadzu-2450.

FTIR: AMK depicted presence of functional groups like N-H stretch (3394.83 to 3556.85  $\mu$ ) Aliphatic C-H stretch superimposed on N-H stretch (2974.33  $\mu$ ), N-H bend (1610.61), C-N vibration (aromatic, secondary) (1276.92).

#### 6) In vitro Antioxidant activity

In vitro antioxidant activity of PMK was evaluated by DPPH method (Molyneux 2004). Scavenging free radical potential was evaluated against ethanolic solution of DPPH, a stable free radical.

Total antioxidant activity was determined using ammonium thiocyanate method (Mistuda et al. 1996). Scavenging activity against H<sub>2</sub>O<sub>2</sub> (Ruch et al. 1989) was tested to determine ability of PMK to inhibit the formation of hydroxyl radical.

#### 7) Anti-inflammatory activity

On 11<sup>th</sup> day of experiment, 1 h after test drug administration, pedal inflammation was induced in rats as described by (Winter et al. 1962). A suspension of 0.1 ml of 1% Carrageenan was injected into the sub

plantar tissue of right hind paw of each rat. The paw volume was measured at 0, 1, 2, 3 and 4 h using Plethysmometer (UGO Basile, Italy) (Vogel, 2002). Aspirin (100 mg/kg, p.o.) was used as reference drug.

#### 8) Biochemical estimation in Carrageenan treated paw tissue:

After measurement of volume, the rat paws were dissected out, immediately washed in ice-cold saline and weighed. A 10 % homogenate was prepared in 0.1 M Tris buffer, pH 7.4. The homogenate was centrifuged at 15,000 g for 20 min. The supernatant was used for estimation of SOD, Catalase, GSH and LPO. Blood was collected by cardiac puncture and used for estimation of hematological parameters like erythrocyte (RBC) count, hemoglobin (Hb), packed cell volume (PCV), total leukocyte (WBC) count, lymphocyte count, neutrophils count, basophils count, glucose, alanine aminotransferase (ALT) and aspartate aminotransferase (AST).

##### 8.1 Superoxide dismutase

The assay of SOD was based on the ability of SOD to inhibit spontaneous oxidation of adrenaline to adrenochrome (Saggu et al. 1989; Misra and Fridovich 1972). The results were expressed as nmol SOD U/mg wet tissue.

##### 8.2 Catalase

The Catalase activity assay was based on the ability of CAT to induce the disappearance of hydrogen peroxide (Beers and Sizer, 1952). The results were expressed as catalase U/g wet tissue.

##### 8.3 Reduced glutathione

GSH (S-glutamyl sisteinylglycine) plays an important role in protection of cells against damage from endogenous and exogenous free radicals and oxidants. (Ellman, 1959). The results were expressed as nmol GSH/g wet tissue

#### 8.4 Extent of Lipid peroxidation

LPO as evidenced by the formation of Thiobarbituric acid reactive substances (TBARS) was measured by the method of Niehaus et al., (1968). The results were expressed as LPO nmol/g wet tissue.

#### 9) Statistical analysis

The mean  $\pm$  SEM values were calculated for each group. One-way ANOVA followed by Dunnett's multiple comparison tests were used for statistical analysis. Values of  $P < 0.05$  was considered statistically significant.

### III. RESULTS AND DISCUSSION

Phytochemical analysis of PMK revealed presence of alkaloids, triterpenoids, flavonoids, tannins and phenols.

#### In vitro antioxidant study

In DPPH assay, the % scavenging activity increased with the increase in concentration of PMK. The  $IC_{50}$  value was found to be 98.5 (Fig.1). Total antioxidant activity assay and  $H_2O_2$  assay also showed increased % scavenging activity of PMK with the increase in concentration of the extract. The  $IC_{50}$  value was found to be 101.7 ppm (Fig.2) and 99.5 ppm (Fig.3) respectively.

#### Anti-inflammatory activity

Carrageenan treated rats showed gradual increase in paw volume from 1-3 h while the paw volume was decreased at 4<sup>th</sup> h. Treatment with PMK and AMK (100 and 300 mg/kg/day, p.o., for 11days) significantly ( $p < 0.05$ ) inhibited the extent of carrageenan induced paw edema at 1<sup>st</sup> and 3<sup>rd</sup> h. Maximum inhibition was observed with AMK (300), 71.87%, at 3<sup>rd</sup> h after carrageenan administration. Aspirin exhibited 72.91% inhibition at 3<sup>rd</sup> h.

#### Biochemical estimations in Carrageenan treated paw tissue

Carrageenan treated rats showed decreased levels of SOD, CAT and GSH in paw tissue homogenates. Administration of PMK and AMK (100 and 300 mg/kg/day, p.o., for 11days) significantly reversed the Carrageenan induced decrease in paw SOD, CAT and GSH levels as compared to Carrageenan treated rats. On the other hand, Carrageenan treatment induced lipid peroxidation, as indicated by significant high MDA levels in inflamed paw tissue. Administration of PMK and AMK (100 and 300 mg/kg/day, p.o., for 11 days) significantly reversed the extent of lipid peroxidation as compared to Carrageenan treated rats. Further, hematological analysis of carrageenan-treated rats exhibited significant ( $p < 0.05$ ) decrease in RBC count, Hb content and PCV after treatment with aspirin, compared to the control. PMK or AMK treated animals showed normal RBC count, Hb content and PCV near to control group. The WBC count, lymphocyte count, neutrophils count, basophils count were higher in rats treated with aspirin compared to control. No significant alterations were observed in blood glucose level. After treatment with PMK and AMK, platelet count was decreased compared to control.

The significant reductions observed in the activity of ALT and AST levels in PMK and AMK treated animals compared to control.

#### Discussion

*In vitro* antioxidant assay revealed that PMK has potent free radical scavenging activity. Carrageenan induced rat paw edema is a most commonly used animal model for evaluating the anti-inflammatory activity. It is believed to be biphasic (Winter et al. 1962), the first phase is due to release of histamine and serotonin (1 h), plateau phase is maintained by kinin like substance (2 h) and second accelerating phase of swelling is attributed to PG release (3 h) (Di Rosa and Willoughby 1971). It is well known that the acute



inflammatory process, in which vascular permeability increases and leukocyte migration occurs, involves inflammation mediators including neutrophil derived reactive oxygen species and free radicals, such as hydrogen peroxide, superoxide and the hydroxyl radical (Da Motta et al.1994), nitric oxide, prostaglandins (PG) and cytokines (Gualillo et al.2001). Polymorphonuclear leucocytes (Jain et al. 2001), which are the first cells to arrive at inflammatory site in the body, release free oxygen radicals ( $O_2^-$ ) and free hydroxyl ( $OH\cdot$ ) radicals (Mc Cord and Roy 1982). Based on this, second phase may be explained by an inhibition of cyclooxygenase or exerting of antioxidant properties (Boughton-Smith et al. 1999). As the extract exhibited significant ( $P<0.05$ ) protection against increase in paw volume at first hour as well as third hour of carrageenan injection, it might be having Histamine, 5-Hydroxy tryptamine and PG synthesis inhibitory activity.

In order to explore the effect of antioxidant defenses on the acute inflammation process, in paw tissues, the levels of SOD, CAT and GSH and extent of LPO was evaluated. Preventive antioxidants, such as SOD and CAT enzymes are the first line endogenous defense mechanism against reactive oxygen species. GSH is a major low molecular weight scavenger of free radicals in the cytoplasm and an important inhibitor of free radical mediated LPO (Halliwell 1995). SOD scavenges the superoxide radicals  $O_2^-$ , one of the ROS responsible for lipid peroxidation (Fridovich 1986). This reaction leads to increase in generation of peroxide radical  $H_2O_2$ , which is also capable of producing more oxidative damage (Das et al. 1997). CAT and other peroxidases further reduce  $H_2O_2$ . Hence, increase in SOD and CAT levels result in decreased LPO levels. Lipid peroxidation is a free radical mediated process, which has been implicated in a variety of diseased states. It involves the formation and propagation of lipid radicals, the uptake of oxygen and rearrangement of disulphide bonds in unsaturated lipids which eventually results

in destruction of membranes. Biological membranes are often rich in unsaturated fatty acids and bathed in oxygen and metal containing fluid. Therefore, membrane lipids are susceptible to peroxidative attack (Cheeman 1993).

According to this study, administration of PMK, AMK and Aspirin showed significant ( $P<0.05$ ) increase in the SOD, CAT and GSH levels compared to the control animals. This suggests efficacy of PMK, AMK and aspirin in preventing free radical induced damage. Similarly, a significant ( $P<0.05$ ) inhibition of lipid peroxidation by PMK, AMK was observed which may be attributed to prevention of, a decomposed product of disrupted membrane, calculated in terms of TBARS. This further supports protective effect of *M. koenigii*. Therefore, antioxidant activity of PMK and AMK as exhibited in the *in vitro* test gets clarified.

The various biochemical and haematological parameters investigated in this study are useful indices of evaluating the toxicity of plant extract in animals (Yakubu et al. 2008). The lower RBC count, Hb content and PCV after 11 days administration of aspirin suggest that it had induced anemia associated with leucocytosis as revealed by increased WBC, lymphocyte, neutrophils and basophils count (Raybak, 1992). PMK or AMK treated animals showed normal RBC count, Hb and PCV levels near to control group suggesting that rats were not anemic. Increase in WBC, lymphocyte, neutrophils and basophils count is a normal reaction of rats to foreign substances indicating stimulation of the immune system. Aspirin, PMK and AMK exerts a significant reduction in the platelets which indicates antiplatelet property and hence the usefulness in cardiovascular diseases (Aliyu et al. 2006). The significant reductions observed in the activity of ALT and AST indicate that PMK and AMK may not be harmful to the liver.

The IR spectrum of AMK showed characteristic absorption bands in the range 3394.83 to 3556.85 $\mu$  (N-

H), 2974.33  $\mu$  (C-methyls), 1610.61  $\mu$  (aromatic system) suggesting presence of pyranocarbazole nucleus. The UV spectrum of AMK showing absorption peaks at 295.0, 256.50 and 246.50 nm also supports the presence of pyranocarbazole nucleus. (Bhattacharya et al. 1982; Reisch et al.1992; Joshi et al. 1970)

The presence of carbazole alkaloids, triterpenoids and flavonoids in *Murraya koenigii* may be responsible for anti-inflammatory activity as all the three constituents have been reported to posses anti-inflammatory activity (Fernanda et al. 2004; Onasanwo and Elegbe 2000).

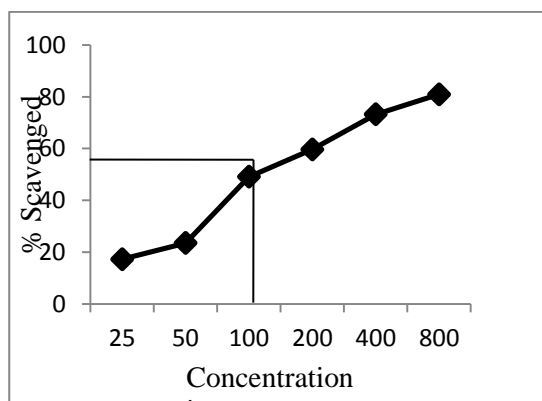


Fig.1. Free radical scavenging activity of PMK by DPPH method.

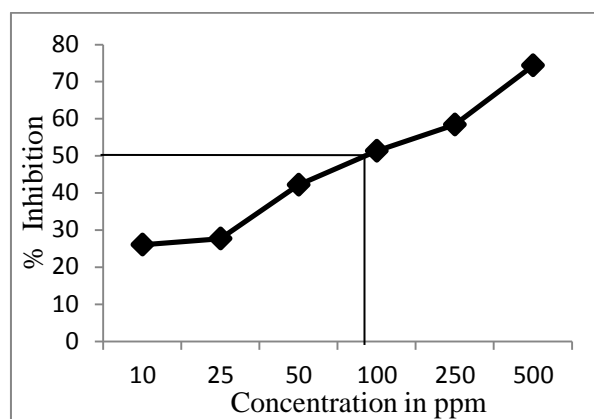


Fig.2 Total antioxidant activity of PMK by ammonium thiocyanate method.

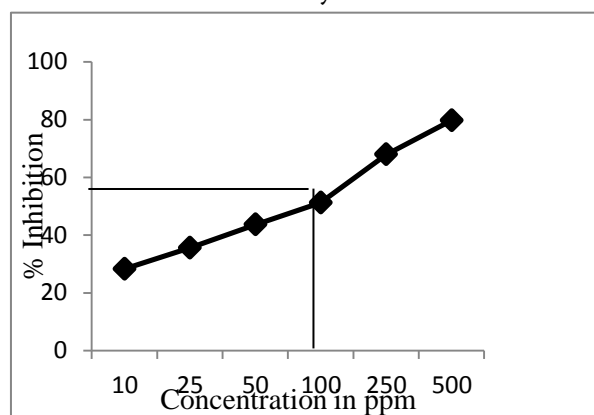


Fig.3 Hydrogen peroxide scavenging activity of PMK.

Table 1 Effect of *Murraya koenigii* on Carrageenan induced rat paw edema

Treatment (mg/kg, p.o.)	Mean increase in paw volume (ml)				% Decrease in paw volume at 3 <sup>rd</sup> h
	1 h	2 h	3 h	4 h	
Control	0.31±0.02	0.76±0.02	0.96±0.04	0.72±0.06	-
Aspirin 100	0.09±0.01*	0.16±0.02*	0.26±0.02*	0.16±0.01	72.91
PMK 100	0.12±0.04*	0.26±0.06*	0.40±0.08*	0.28±0.05*	58.30
PMK 300	0.21±0.06*	0.29±0.04*	0.32±0.02*	0.36±0.10*	66.60
AMK 100	0.10±0.05*	0.24±0.01*	0.33±0.03*	0.22±0.02	65.62

AMK 300	0.11±0.04*	0.22±0.02*	0.27±0.01*	0.25±0.02*	71.87
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n=5. The observations are mean ± SEM. \*p < 0.05, compared to control (one-way ANOVA followed by Dunnett's test).

Table 2: Effect of *Murraya koenigii* on SOD, Catalase, GSH & LPO levels in Carrageenan-induced paw edema in rats.

Treatment (mg/kg p.o.)	SOD (U/g wet tissue)	Catalase (U/g wet tissue)	GSH (nmol/mg wet tissue)	LPO (µM/mg wet tissue)
Control	52.07±4.22	3.558±0.20	2.117±0.09	2.27±0.03
Aspirin 100	105.5±2.32*	12.21±0.60*	7.696±0.52*	0.58±0.05*
PMK 100	70.07±1.39*	5.965±0.52*	3.841±0.16*	1.37±0.02*
PMK 300	95.74±7.17*	9.507±0.29*	5.49±0.08*	0.91±0.05*
AMK 100	85.86±4.13*	8.72±0.66*	4.541±0.41*	0.87±0.02*
AMK 300	107±2.20*	11.53±0.21*	6.306±0.29*	0.61±0.03*

n=5. The observations are mean ± SEM. \*p < 0.05, compared to control (one-way ANOVA followed by Dunnett's test).

Table 3: Effect of *Murraya koenigii* on the hematological parameters in carrageenan-induced inflammation in rat

Treatment (mg/kg )	Control	Aspirin 100	PMK 100	PMK 300	AMK 100	AMK 300
Glucose (mg dl <sup>-1</sup> )	116.56 ±2.23	102.53 ±3.26*	112.32 ±2.69*	115.39 ±3.5*	118.23 ±2.5*	109.45 ±1.6*
Hemoglobin (g dl <sup>-1</sup> )	13.93±0.75	6.2±1.59*	11.8±0.68*	12.1±0.29*	12.23±0.95*	14.29±1.97*
Red blood cells (Million.m.mm)	4.96±0.02	2.96±0.04*	4.03±0.02*	4.26±0.1*	4.03±0.09*	4.12±0.08*
Total leukocyte count (cells m <sup>-1</sup> mm <sup>-1</sup> )	3800±5.4	5300±6.9*	4200±4.32*	4100±4.8*	3900±5.08*	4500±4.4*
Lymphocyte	26±2.09	46±1.65*	32±1.78*	39±2.65*	38±0.9	42±1.09

					8*	*
Neutrophils	39±1.56	55±2.12*	52±1.89*	63±0.68*	65±1.6	77±3.36
					3*	*
Basophils	2.5±0.98	1.12±0.65*	2.69±0.87*	3.12±	2.79±0.	3.42±1.2
				0.85*	76*	4*
Plateletcount (lakhs.m.mm)	2.97±0.0	1.90±0.15*	2.22±0.55*	2.12±	2.08±0.	1.95±1.6
	9			0.87*	98*	
PCV (%)	44±0.69	28±0.60*	32±0.93*	40±0.5*	39±1.3	42±4.86
					5*	*
AST (U/L)	122.32±		75.58±7.2*	62.5±3.6	66.42±	55.64±4.
	5.72			5*	5.78*	90*
ALT (U/L)	129.13±		72.44	65.29	62.98	52.33
	5.34		+5.71*	+5.32*	+5.69*	+4.65*

n=5. The observations are mean ± SEM. \*p< 0.05, compared to control (one-way ANOVA followed by Dunnett's test).

#### IV. CONCLUSION

A significant % inhibition of paw edema and alterations in associated biochemical parameters by pet ether extract (PMK) of *Murraya koenigii* leaves and alkaloids (AMK) isolated from PMK at doses of 100 and 300 mg/kg/day, p.o., for 11days, suggest its usefulness as an anti-inflammatory agent.

#### V. REFERENCES

- [1] Aliyu R, Adebayo AH, Gatsing D, Garba IH (2006). The Effects of Ethanolic Leaf Extract of *Commiphora africana* (Burseraceae) on Rat Liver and Kidney Functions. J. Pharmacol. Toxicol. 2: 373-379.
- [2] Arulselvan P, Subramanian SP (2007) Beneficial effects of *Murraya koenigii* leaves on antioxidant defense system and ultra structural changes of pancreatic beta-cells in experimental diabetes in rats" Chem Biol Interact 165 :155-64
- [3] Beers R. F. Jr, and Sizer I.W. (1952). A spectrophotometric method for measuring the breakdown of hydrogen peroxide by catalase. J.Biol.Chem. 133:140
- [4] Bermond, P. (1989) Analgesic and anti-inflammatory properties of vitamins. Int. J. Vitam. Nutr. Re. 30:153-160
- [5] Bhattacharya L, Roy SK and Chakraborty DP (1982). Structure of the carbazole alkaloid isomurrayazoline from *murraya koenigii*. Phytochemistry. 21: 2432-2433
- [6] Boughton-Smith NK, Deakin AM, Follen Fant RL, Whittle BJR, Corlant LG (1999). Role of oxygen radicals and arachidonic acid metabolites in the reserve passive arthus reaction and carrageenan paw edema in rats. British J Pharmacol 110: 896-902
- [7] Chakrabarty M, Nath A, Khasnobis S (1997) Carbazole alkaloids from *Murraya koenigii*. Phytochemistry 46 :751-756
- [8] Cheesman KH (1993) Lipid peroxidation in the biological systems In: Halliwell B, Arouma OI (Eds.). DNA and free radicals, Ellis Horwood, London, pp: 12-17
- [9] Chowdhury BK & Chakraborty DP (1971) Mukeic acid, The first carbazole Carboxylic acid from plant source, Phytochemistry10:1967-1970

- [10] Cordell G A (1981) Introduction to the alkaloids: A Biogenetic approach, Wiley Interscience, New York
- [11] Da Motta JI, Cunha FQ, Vargafrig BB, Ferreira SH (1994). Drug modulation of antigen induced paw edema in Guinea pig: Effect of lipopolysaccharides, tumor necrosis factor and leucocyte depletion. Br.J. Pharmacol 112: 111-116
- [12] Das D, Bandyopadhyay D, Bhattacharya M, Banerjee RK (1997) Hydroxyl radical is the major causative factor in stress induced gastric ulceration. Free Radical Biol. Med 23:8-18
- [13] Das K, Chakraborty D (1965) Antifungal activity of some constituents of *Murraya koenigii* Spreng. Experientia 21:340
- [14] Di Rosa M, Willoughby DA (1971). Screens of anti-inflammatory drugs. J Pharm Pharmacol. 23: 297-298.
- [15] Ellman G.L. (1959). Tissue sulfhydryl groups. *Arch. Biochem. Biophys.* 82:70 - 77.
- [16] Fernanda LB, Victor AK, Amelia TH (2004) Analgesic property of Umbellatin from *Psychotria umbellata*., *Pharmaceutical Biology* 44: 56
- [17] FitzGerald G, Patrono C (2001) The coxibs, selective inhibition of cyclooxygenase-2. *New Engl J Med* 345:433-442
- [18] Fridovich I (1986). Biological effects of superoxide radical. *Archives Biochem Biophysics* 247: 1-11
- [19] Gualillo O, Eiras S, Lago F, Dieguez C, Casanueva F (2001) Evaluated serum leptin concentrations induced by experimental acute inflammation. *J. Ethnopharmacol.*75:213-218
- [20] Gupta S, George M, Singhal M, Sharma G, Garg V. (2010) Leaves extract of *Murraya koenigii* Linn. for Anti-inflammatory Analgesic and activity in animal models, *Journal of advanced Pharmaceutical Technology & Research* 1:68-77
- [21] Gupta V, Sharma M, (2010) Protective effect of *murraya koenigii* on lipid peroxide formation in isolated rat liver homogenate. *International journal of pharma and bio sciences*1:1-6
- [22] Halliwell B. (1995) Antioxidant characterization: Methodology and mechanism. *Biochem Pharmacol* 49: 1341-48
- [23] Jain NK, Kulkarni SK, Singh A (2001) Role of cysteinyl leukotrienes in nociceptive and inflammatory condition in experimental animals. *European J Pharmacol* 415:85-94
- [24] Joshi BS, Smut VN and Gawad DH(1970) On the structures of girinimbine, Mahanimbine, isomahanimbine, koenimbidine and murrayacine. *tetrahedron.* 26: 1475-1482.
- [25] Kirtikar K.R, Basu B.D. *Indian Medicinal Plants* Vol 1, 2<sup>nd</sup> edition, Bishen Singh Mahendra Pal Singh, India. 1993:472-474
- [26] Mc Cord JM, Roy RS (1982) The pathology of superoxide: Roles in inflammation and ischemia. *Can J Physiol Pharm* 60: 1346-52
- [27] Misra HP, Fridovich I (1972). The generation of superoxide radical during the auto-oxidation of haemoglobin. *J.Biol.Chem.*247: 6960-6962
- [28] Mitsuda H, Yuasumoto K, Iwami K (1996). Antioxidation action of indole compounds during the autoxidation of linoleic acid. *J. Jpn. Soc. Food Nutr.* 19: 210-214
- [29] Molyneux P.(2004) Use of DPPH to testing antioxidant activity. *J Sci Technol* 26: 212-219
- [30] Muthumani P, Venkatraman S (2009) Pharmacological studies of anticancer, anti inflammatory activities of *Murraya koenigii* (Linn) Spreng in experimental animals. *J. Pharm. Sci. & Res* 1: 137-141
- [31] Narasimhan NS, Paradhar MV and Chitguppi VP (1968) Structure of Mahanimbin and Koenimbin. *Tetrahedron Lett.* 53: 5501-5504
- [32] Niehaus WG, Samuelsson B (1968) Formation of malondialdehyde from phospholipids arachidonate during microsomal lipid peroxidation. *Eur J Biochem.* 6: 126-130
- [33] Onasanwo SA, Elegbe RA (2000) Antinociceptive and anti-inflammatory effect of

- leaf extract of *Hedranthera barter* in rats and mice. African J Biomed Res 14: 418
- [34] Rao LJM, Ramalakshmi K, Borse BB, Raghavan B (2006) Food Chemistry 100: 742-747
- [35] Raybak MEM (1992) Hematologic effects of Nonsteroidal anti-inflammatory drugs. In: Borda IT, Koff RS ( eds) NSAIDs a profile of adverse effects, Hanley & Belfus, Philadelphia, pp. 113-32.
- [36] Reisch J, Wickramasinghe A, Herath B and Henkel G (1992) Carbazole alkaloids from seeds of *murraya koenigii*. Phytochemistry 31:2877-2879
- [37] Ruch RJ, Cheng SJ and Klauning JE (1989) Prevention of cytotoxicity and inhibition of intercellular communication antioxidant catechins isolated from Chinese green tea. Carcinogenesis. 10: 1003-1008
- [38] Saggi H, Cooksey J, and Dexter D. (1989). A selective increase in particulate superoxidase dismutase activity in parkinsonian substantia nigra. *J. Neurochem.* 53:692-697
- [39] Scheiman J M and Hindley CE (2010) Strategies to optimize treatment with NSAIDS in patients at risk for gastrointestinal and cardiovascular adverse events. Clinical Therapeutics 32:667-677
- [40] Serhan C N and B. Levy ( 2003) Success of prostaglandin E2 in structure-function is a challenge for structure-based therapeutics. Proc. Natl. Acad. Sci. 100:8609-8611.
- [41] Syahida A, Israf DA, Lajis NH, Khozirah S, Habsah M, Permana D, Norhadiani I (2006) Effect of compounds isolated from natural products on IFN-c/LPS-induced nitric oxide production in RAW 264.7 macrophages. Pharm Biol 44:50-59
- [42] Trease G E, Evans W C (Eds) (1996) Pharmacognosy. 14<sup>th</sup> ed. Hawoust Brace and company, London.pp 293
- [43] Trenam CW, Blake DR, Morris CJ. (1992) Skin Inflammation: Reactive oxygen species and the role of iron. J Invest Dermatol 99: 675.
- [44] Valko M, Rhodes CJ, Moncol J, Izakovic M, Mazur M (2006) Free radicals, metals and antioxidants in oxidative stress-induced cancer. Chem-Biol Interact 160:1-40
- [45] Vogel HG, Vogel Wolfgang H (2002) Drug discovery and evaluation of pharmacological assay. In: 2<sup>nd</sup> Edn. Springer New York, Springer; pp. 670
- [46] Winter CA, Risley EA, Nuss GW(1962) Carrageenan induced edema in hind paw of the rat as an assay for anti-inflammatory drugs. Proc Soc Exp Biol 111: 544-547.
- [47] Yakubu MT, Akanji MA, Oladiji AT (2008). Alterations in serum lipid profile of male rats by oral administration of aqueous extract of *Fadogia argrestis* stem. Res. J. Med. Plant. 2: 66-73.

# Direct Torque Control of Induction Motor Drive By using Fuzzy Logic Controller and Feedback Linearization Technique

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## ABSTRACT

This paper presents a Direct Torque Controlled (DTC) Induction Motor (IM) drive that utilizes feedback linearization and Sliding-Mode Control (SMC). Another feedback linearization approach is proposed which is Fuzzy logic controller (FLC), which outputs a decoupled direct IM display with two state factors: torque and stator flux. This inherent linear model is utilized to actualize a DTC sort controller that preserves all DTC favorable circumstances and takes out its primary disadvantage, the flux and torque swell. Robust, quick, and swell free control is accomplished by utilizing FLC with corresponding control in the region of the sliding mode. Fuzzy logic controller guarantees robustness as in DTC, while the corresponding segment robustness out the torque and flux swell. The torque time reaction is like traditional DTC and the proposed arrangement is adaptable, profoundly tunable because of the P component. The controller design is displayed and its robustness solidness is analyzed in simulations. The FLC controller is contrasted and a direct DTC scheme with and without Feedback linearization. By using FLC controller extensive investigative comes about for dynamic response of a sensorless IM drive approve the proposed solution.

**Keywords :** Direct Torque Control, Adjustable Speed Drives, Feedback Linearization, Induction Motor Drives, Sliding Mode Control, Fuzzy Logic Controller

## I. INTRODUCTION

Direct Torque Control (DTC) is a robust, quick responding control technique for Induction Machine (IM) drives [1]. Customary DTC utilizes shut circle hysteresis torque also, flux controllers and a changing table to choose the voltage vector connected to the motor. DTC accomplishes quick and robust torque and flux control without utilizing current controllers. DTC operation is related with expansive torque swell which causes ripple, vibrations, and expanded misfortunes, while the switching frequency of the Voltage Source Inverter (VSI) is variable and low. Enhanced DTC arrangements that keep running at

consistent switching frequency and utilize present day control hypothesis have as of late been created to reduce the torque ripple. Novel DTC procedures in light of discrete Space Vector Modulation (SVM) techniques are portrayed in. DTC in light of linear torque and flux controllers (Linear DTC) and SVM was presented in [2]. A few designs utilizing the variable structure control standards have been proposed in [3].

Feedback Linearization (FBL) is a nonlinear control approach. The fundamental thought of FBL is to change a nonlinear system into a proportionate direct system, design a linear controller for the direct system,

and afterward utilize the opposite change to acquire the desired controller for the first nonlinear system. Since the technique is touchy to displaying errors and disturbances, it has been once in a while connected to IM drives. FBL is utilized as a part of [4]-[5] to linearize the IM display with regard to speed, flux, and current. Two linearization designs in which just a single control amount is changed are discussed about in [5]. All arrangements in [4]-[5] depend on current linearization and control. Utilizations of FBL to control devices and PMSM drives are displayed. An error affectability investigation in demonstrates that the control performance may fall apart because of perturbations, parameter detuning, and estimation errors.

Sliding Mode Control (SMC) is a robust control strategy appropriate for control systems with uncertainties or demonstrating errors [6]. It has been effectively connected to IM drives and gives superb dynamic performance to a wide speed extend operation [3]. The switching conduct can be directed with the VSI operation as appeared in [6]. Fact be told, the customary DTC is a type of SMC which was composed to nearly direct the switching idea of the VSI.

This paper proposes another DTC controller that incorporates Feedback linearization together with fuzzy logic controller (FLC). The principle preferred advantage of FBL over traditional DTC is that the linear control hypothesis results can without much of a extend be connected to acquire a superior performance. We utilize this property to design and after that hypothetically explore the robustness and dependability of the proposed control strategy. Besides, the controller-spectator division rule enables the controller and the spectator to be autonomously designed, if the design display is around linear and estimation errors are small. The FBL load is the affectability of the linearized model to uncertainties

and parameter detuning, which motivates the utilization of FLC.

The nonlinear IM demonstrate considered in this paper is fourth arrange with the state factors: torque, stator flux, rotor flux, described more, another flux subordinate state. The feedback linearized IM show is second order, with just the torque and stator flux magnitude as decoupled state factors. In this way, the new direct display is natural, extremely linear forward, and it generously rearranges the controller design. The flux and torque are controlled by the new DTC conspire and the proposed controllers utilize FLC to keep up robustness sensorless operation of the drive. This approach in light of torque-flux linearization and control is not the same as existing techniques in [4]-[5], which are based on current control. The mix of these systems preserves the quick and robustness reaction of traditional DTC while altogether taking out the torque and flux ripple.

## **II. FEEDBACK LINEARIZATION OF IMMODEL**

Regular linearization of a nonlinear system depends on a first-arrange estimation of the system dynamic at a chosen working point while dismissing high-arrange flow. This linearization is satisfactory in numerous applications where typical system operation stays in the region of a settled or gradually differing balance, however it is generally wrong. In specific, linearization is proper for IM drives working at consistent rotor speed. Something else, the IM conduct is intrinsically nonlinear and different methodologies must be utilized.

Feedback linearization is a method that permits the designer to utilize linear control methodologies with naturally nonlinear systems, for example, the IM. The FBL logarithmically changes a nonlinear system display into a direct one, so that direct control systems can be utilized. Dissimilar to regular linearization, the linearization and the direct conduct are substantial



comprehensively, as opposed to in the region of a harmony point. When all is said in done, the linearizing change is very hard to discover, however at times it is anything but difficult to acquire by a basic redefinition of factors [7]. Fortunately the FBL of an IM is achievable by a natural change of the state factors and an info redefinition.

The IM state space show in the stator reference design is

$$\frac{d\psi_s}{dt} = -\frac{1}{T_s\sigma}\psi_s + \frac{L_m}{L_r T_s\sigma}\psi_r + u_s \quad (1)$$

$$\frac{d\psi_r}{dt} = \frac{L_m}{L_s T_r\sigma}\psi_s - \left(\frac{1}{T_s\sigma} - j\omega_r\right)\psi_r \quad (2)$$

where  $\psi_s$ ,  $\psi_r$  are stator and rotor flux space vectors,  $R_s$  and  $R_r$  are the stator and rotor resistances,  $L_s$ ,  $L_r$  and  $L_m$  are the stator, rotor and magnetizing inductances,  $T_s = L_s / R_s$ ,  $T_r = L_r / R_r$ ,  $\sigma = (L_s L_r - L_m^2) / L_s L_r$ ,  $\omega_r$  is the rotor speed, and  $u_s = u_{sd} + j u_{sq}$  is the stator voltage vector which acts as Feedback.

The model can be linearized by selecting the new states:

$$M = \psi_s \psi_r d - \psi_s d \psi_r q \quad (3)$$

$$R = \psi_s d \psi_r d + \psi_s q \psi_r q \quad (4)$$

$$F_s = \psi_s d^2 + \psi_s q^2 \quad (5)$$

$$F_r = \psi_r d^2 + \psi_r q^2 \quad (6)$$

Where  $M$  is the scaled torque,  $F_s$  and  $F_r$  are the squared extents of the stator and rotor flux, individually. The variable  $R$  relies upon the rotor and stator flux. For linear forwardness, we refer  $M$  as the torque and  $F_s$  as the flux size. We are essentially intense on controlling the torque  $M$  and the stator flux  $F_s$ . In any case, we should likewise safeguard that the remaining state factors,  $F_r$  and  $R$ , are limited.

The IM state conditions with the state factors (3) - (6) are

$$\frac{dM}{dt} = -\left(\frac{1}{T_r\sigma} + \frac{1}{T_s\sigma}\right)M - \omega_r R - \psi_r q u_{sd} + \psi_r d u_{sq} \quad (7)$$

$$\frac{dF_s}{dt} = -\frac{2}{T_s\sigma}F_s + \frac{2L_m}{L_r T_s\sigma}R + 2\psi_s d u_{sd} + 2\psi_s q u_{sq} \quad (8)$$

$$\frac{dF_r}{dt} = -\frac{2}{T_r\sigma}F_r + \frac{2L_m}{L_s T_r\sigma}R \quad (9)$$

$$\frac{dR}{dt} = -\left(\frac{1}{T_r\sigma} + \frac{1}{T_s\sigma}\right)R + \omega_r M + \frac{L_m}{L_r T_s\sigma}F_s + \frac{L_m}{L_r T_s\sigma}F_r + \psi_r d u_{sd} + \psi_r q u_{sq} \quad (10)$$

The first three state equations are feedback linearized if the Feedbacks redefined as

$$w_q = -\omega_r R - \psi_r q u_{sd} + \psi_r d u_{sq} \quad (11)$$

$$w_d = \frac{2L_m}{L_r T_s\sigma}R + 2(\psi_s d u_{sd} + \psi_s q u_{sq}) \quad (12)$$

Now the linearized system is

$$\frac{dM}{dt} = -\left(\frac{1}{T_r\sigma} + \frac{1}{T_s\sigma}\right)M + w_q \quad (13)$$

$$\frac{dF_s}{dt} = -\frac{2}{T_s\sigma}F_s + w_d \quad (14)$$

$$\frac{dF_r}{dt} = -\frac{2}{T_r\sigma}F_r + \frac{2L_m}{L_s T_r\sigma}R \quad (15)$$

$$\frac{dR}{dt} = -\left(\frac{1}{T_r\sigma} + \frac{1}{T_s\sigma}\right)R + \frac{L_m}{L_r T_s\sigma}F_s + \frac{F_r}{2R}w_d - \frac{M}{R}w_q \quad (16)$$

Solving (11) and (12) gives the control signals

$$u_{sd} = \frac{\psi_{rd}}{2R}\left(w_d - \frac{2L_m}{L_r T_s\sigma}\right) - \frac{\psi_{sq}}{R}(\omega_q + \omega_r R) \quad (17)$$

$$u_{sq} = \frac{\psi_{rq}}{2R}\left(w_d - \frac{2L_m}{L_r T_s\sigma}\right) - \frac{\psi_{sd}}{R}(\omega_q + \omega_r R) \quad (18)$$

FBL decouples the state factors of interest; specifically, the torque  $M$  and the stator flux  $F_s$  and in this manner fundamentally improves the controller design for the IM drive system. In expansion, since the subsequent system is linear, the traditional linear control approaches can be utilized. Since the  $M$ ,  $F_s$  and  $F_r$  have elements with left design posts, the info output dependability of the rest of the state factors can be effortlessly ensured gave that  $R$  remains limited. The  $R$  state condition (16) demonstrates that its correct hand side is unbounded for zero  $R$ , which just happens in the unimportant condition when the stator or rotor flux is zero. With the exception of the startup, this condition never happens during normal operation. In the physical drive, the controller guarantees that the flux has been introduced before beginning the drive. Activity brings about Segment IV demonstrate that the torque control is begun with a 40 ms delay after the flux control, when flux are at apparent levels. It is in this manner accepted that the variable  $R$  has a

lower bound,  $R_i$ .  $R$  is likewise upper limited practically speaking on the grounds that the flux extents are restricted because of attractive immersion.

### III. DIRECT TORQUE CONTROL VIA SLIDING MODE

Sliding Mode Control (SMC) is utilized to accomplish a quick and robust operation of an IM drive. Fig. 1 demonstrates the block diagram of the proposed drive. The block Controllers and SVM contains the FBL and the torque and flux controllers portrayed next. The drive utilizes linear forward speed, torque, and flux observer, described more, a PI speed controller. Drive information and a concise representation of the spectators are given in the Appendix.

The control objective is to control the torque and stator flux level in the machine, i.e. to understand a DTC sort controller. To this end, we design controllers for the torque  $M$  described more, the stator flux  $F_s$  in the linearized demonstrate. Since the state conditions (13) and (14) representing  $M$  and  $F_s$  individually are decoupled, the design of their controllers to acquire the data sources  $w_d$  and  $w_q$  is very linear forward. These are then substituted in (17) described more, (18) to acquire the physical sources of info  $usd$  and  $usq$  separately. Be that as it may, errors in the computation of the physical sources of info are unavoidable and must be represented and corrected to give controlling performance.

The errors in the physical control sources of info can be represent to as proportionate errors in the direct state conditions (13) and (14).

Condition (13) can be reworked in the frame

$$\frac{dM}{dt} = G_m + W_q \tag{19}$$

Where  $gM$  represents the uncertain dynamics of the FBL torque equation. The term  $gM$  is not exactly known; from (13) an estimate of the dynamics

$$Is \hat{g}M = -\left(\frac{1}{T_{r\sigma}} + \frac{1}{T_{s\sigma}}\right)M$$

We assume that the estimation error for  $gM$  is bounded as

$$|gM - \hat{g}M| \leq GM \tag{20}$$

To design the SMC for the linear system of (19), we define the sliding mode as the torque error

$$SM = M - Md \tag{21}$$

For this choice of sliding mode, we use the SMC

$$wq = -\hat{g}M - kM \operatorname{sgn}(SM), kM > 0 \tag{22}$$

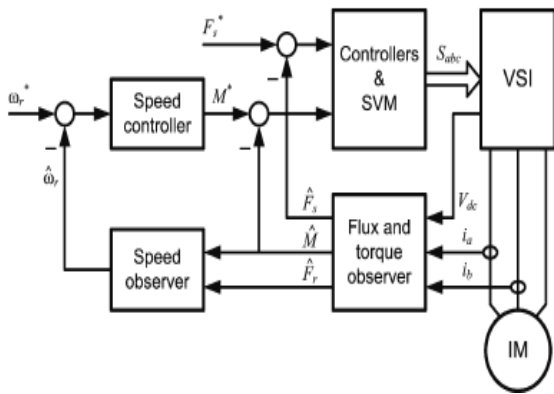
The term  $-kM \operatorname{sgn}(SM)$  is known as the corrective control.

We choose the quadratic Lyapunov function candidate  $V = SM^2 / 2$ . The system converges to the sliding mode if the derivative of a Lyapunov function is negative along all the trajectories of the system. The derivative of  $V$  is

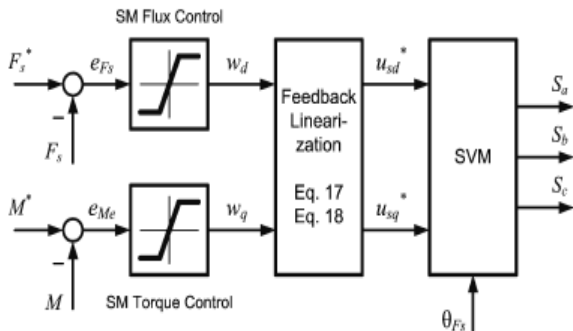
$$\frac{1}{2} \frac{d}{dt} SM^2 = (gM - \hat{g}M - kM \operatorname{sgn}(SM)) = (gM - \hat{g}M) - kM |SM| \tag{23}$$

For robust convergence to the sliding mode the derivative must remain negative in the presence of uncertainties. We choose the corrective control gain  $kM$  as in eq. (24).

$$kM = GM + \eta M \tag{24}$$



**Fig. 1** Block diagram of the sensorless DTC IM drive with feedback linearization.



**Fig. 2** Torque and flux SMC with feedback linearization for IM control.

This gives the sliding condition, eq. (25)

$$\frac{1}{2} \frac{d}{dt} SM^2 \leq -\eta M |SM| \tag{25}$$

Where  $\eta M$  is a positive constant. The gain  $kM$  of (24) includes the term  $GM$  to ensure robust stability and the term  $\eta M$  to control the speed of convergence to the sliding controller. A bigger  $\eta M$  makes the system trajectory to reach the sliding mode in a shorter time but can result in higher chattering. Similar results can be obtained by using an integral sliding mode

$$SM = \left( \frac{d}{dt} + \lambda M \right) \int_0^t (M - M_d) dt \tag{26}$$

Where  $\lambda M$  is a positive constant design parameter. This parameter determines how fast the error goes to zero once the State is on the mode. The SMC effort can be chosen as

$$wq = -gM - (M -) - kM \text{sgn} (SM), \quad kM > 0 \tag{27}$$

and the sliding condition holds for  $kM = GM + \eta M$ . To avoid chattering we define a boundary layer around the sliding mode,  $(t) = \{x, | (x)| \leq hM\}$ , where  $hM > 0$  is the boundary layer thickness. Inside the boundary layer, a proportional control term is added to the control of (22). Outside the boundary layer ( $| (x)| > hM$ ), the corrective control drives the system to the sliding mode.

The stator flux dynamics in eq. (14) are almost identical to (13) and are similarly handled. Most of the analysis is omitted, for brevity. Similarly to torque, the sliding mode is

$$SFs = Fs - Fsd \tag{28}$$

and the linear system control Feedback is

$$wd = -gFs - kFs \text{sgn} ( ), \quad kFs > 0 \tag{29}$$

As for torque, we use a narrow boundary layer around the sliding mode, with proportional control to avoid chattering. Figure 2 shows the block diagram of the SMC with FBL torque and flux controller. To summarize, the controllers are given by (22) and (29) and the reference voltages are produced by (17) and (18) in the stator reference frame. A SVM unit produces the VSI switching signals Sa, Sb, Sc.

#### IV. ROBUSTNESS STUDY AND CONTROLLER DESIGN

This segment gives a design system to the sliding mode FBL controller that accomplishes powerful steadiness in face of the most imperative errors which influence the IM display: motor parameter detuning and speed perception errors. We consider these uncertainties limited, as in eq. (20) and explore how these uncertainties affect the decision of remedial additions for torque and flux control. For FBL performance we utilize consistent motor parameter

esteems and design the controller to stay robustness as they change during operation. Rotor speed is gotten from observers with estimation errors, especially during homeless people and low speed operation. Then again, flux and torque observers give moderately great evaluations, and the effect of their errors on FBL is not discussed about here.

The errors in the control flux because of these uncertainties are indicated as  $\Delta u_{sd}$  and  $\Delta u_s$ . To assess these errors in terms of the rotor speed and parameter errors, and to dissect the impact of uncertainties on the SMC design we consolidate (17) described more, (18) in vector shape:

$$u_s = \left( \frac{wd}{2R} - \frac{LmR_s}{L_s L_r - L_m^2} \right) \Psi_r + j(w_q/R + \omega_r) \quad (30)$$

Although  $wd$  and  $wq$  are produced by the SMC and have no uncertainty, we can replace the error in the control signal  $u_s$  with equivalent errors in  $wd$  and  $wq$ . The equivalent error is  $\Delta w = \Delta wd + j\Delta wq$ , and (30) can be rewritten as (31).

$$u_s = \left( \frac{wd + \Delta wd}{2R} - \frac{\widehat{Lm}\widehat{R}_s}{(\widehat{Lm} + L_{s\sigma})(\widehat{Lm} + L_{r\sigma}) - L_m^2} \right) \Psi_r + j \left( \frac{wd + \Delta wd}{R} + \omega_r \right) \Psi_s \quad (31)$$

Where  $\widehat{L}_m$  is the measured magnetizing inductance,  $\widehat{R}_s$  is measured stator resistance and  $\widehat{\omega}_r$  is the rotor speed estimate.

Using (30) and (31), the equivalent error is (32).

$$\Delta w = \Delta wd + j\Delta wq = 2 \left( \frac{\widehat{Lm}\widehat{R}_s}{(\widehat{Lm} + L_{s\sigma})(\widehat{Lm} + L_{r\sigma}) - L_m^2} - \frac{LmR_s}{L_s L_r - L_m^2} \right) R + j(\omega_r \widehat{\omega}_r) R \quad (32)$$

The feedback linearized torque and stator flux dynamics in the presence of errors in  $wd$  and  $wq$  are

$$\frac{dM}{dt} = - \left( \frac{1}{T_{r\sigma}} + \frac{1}{T_s\sigma} \right) M + wd + \Delta wd \quad (33)$$

$$\frac{dFs}{dt} = - \frac{2}{T_s\sigma} F_s + wd - \Delta wd \quad (34)$$

It can be assumed that the maximum deviation of each uncertain parameter and the maximum measurement or estimation error for the rotor speed are known. For this analysis we use  $\eta M = 10$ ,  $\eta F_s = 10$ , which give a realistic dynamic response for torque and flux. The main focus for this section is robust stability rather than dynamic response.

### A. Speed ( $\omega_r$ )

Errors in speed estimation cause model perturbations that may influence the system response. Speed errors have no effect on stator flux dynamics but change the torque equation (13) to

$$\frac{dM}{dt} = - \left( \frac{1}{T_{r\sigma}} + \frac{1}{T_s\sigma} \right) M + (\widehat{\omega}_r - \omega_r) R + w_q \quad (35)$$

Knowing the maximum speed estimation error, the corrective control gain can guarantee robust performance. The IM has a nominal value of  $R$ ,  $R = 0.25$  (parameters are listed in Appendix). Assuming a speed measurement with a maximum error of  $\pm 10$  rad/s ( $\pm 1.6$  Hz), we have  $|(\widehat{\omega}_r - \omega_r) R| < 2.5$ , which corresponds to  $GM = 2.5$  and  $kM = GM + \eta M = 12.5$ . We use  $kM = 20$ , as in our experiments, which handles even larger errors. Since the speed error does not affect the stator flux dynamics, we use  $kF_s = \eta F_s + 0 = 10$ . Simulation results in Fig. 3 show the torque and flux response for the drive starting from standstill with  $\pm 10$  rad/s speed errors. The torque control is almost identical for any speed error and it remains stable and ripple-free. For bigger errors we simply choose a larger gain for robust stability, at the expense of increased chattering.

### B. Stator resistance ( $R_s$ )

The stator resistance changes with temperature, and it impacts the stator flux dynamics. Introducing a perturbation due to stator resistance error, the stator flux dynamics (34) is

$$\frac{dFs}{dt} = - \frac{2}{T_s\sigma} F_s + \frac{2L_m}{L_s T_r\sigma} R (R_s - \widehat{R}_s) wd \quad (36)$$

Where  $\hat{R}_s$  is the nominal stator resistance and  $R_s$  is its actual value. We consider a maximum error in the stator resistance of  $\pm 50\%$ , i.e.  $|R_s - \hat{R}_s| < 0.5 \times \hat{R}_s = 1.15$ . The corresponding model perturbation for the parameter values is  $GFs = \frac{2L_m}{L_s T_r \sigma} R \times 0.69 = 28.16$ . We choose the corrective control gain  $kFs = \eta Fs + GFs = 40 > 38.16$ . Since the torque dynamics is independent of the resistance error, we use the same value  $kM = 20$ , for similar dynamic performance. Simulation results in Fig. 4 show the stator flux and torque response for the drive starting from standstill with  $\pm 50\%$  stator resistance dynamic uncertainty. Note how the resistance error impact the flux response time, which is faster for lower resistances and due to larger gain. However, the steady state operation is ripple-free and robust with respect to  $R_s$  errors.

**C. Rotor resistance ( $R_r$ )**

Rotor resistance changes with temperature. The prominent advantage of the proposed FBL is that the changes in  $R_r$  do not change the dynamics of stator flux and torque and do not affect the control. However, they do change the dynamics of the other two state variables ( $R, Fr$ ); this substantially impacts the speed estimate. Therefore, the rotor resistance errors are accounted for by speed errors discussed in section IV.A.

**D. Magnetizing inductance ( $L_m$ )**

The magnetizing inductance deviate from its measured value due to magnetic saturation. Changes in the magnetizing inductance create changes in together the stator and rotor inductances. This has no effect on torque dynamics, but changes the stator flux dynamics (34), as follows:

$$\frac{dFs}{dt} = -\frac{2}{T_{s\sigma}} Fs + \frac{2L_m}{L_s T_r \sigma} R \left( \frac{L_m}{L_s L_r - L_m^2} - \frac{\hat{L}_m}{(\hat{L}_m + L_{s\sigma})(\hat{L}_m + L_{r\sigma}) - L_m^2} \right) + wd \tag{37}$$

We consider a maximum change in the magnetizing inductance of  $\pm 30\%$ , i.e.  $0.7\hat{L}_m \leq L_m \leq 1.3\hat{L}_m$ . We examine the term  $\Delta L = \frac{L_m}{L_s L_r - L_m^2} - \frac{\hat{L}_m}{(\hat{L}_m + L_{s\sigma})(\hat{L}_m + L_{r\sigma}) - L_m^2}$  in (37) that depends on  $L_m$ . For  $L_m = 0.7\hat{L}_m$  we have  $\Delta L = -0.42467$ , and for  $L_m = 1.3\hat{L}_m$  we have  $\Delta L = 0.23176$ . For robust stability we use the maximum value of  $|\Delta L|$ . The corresponding perturbation is  $GFs = 2RR_s \times 0.42467 = 0.49$ . We use the gain  $kFs = 12 > 10.49$ . Since the torque dynamics is independent of the magnetizing inductance, we use  $kM = 20$ .

Simulation results in Fig. 5 show the stator flux and torque for the drive first from standstill with  $\pm 30\%$  magnetizing inductance errors. Again, it is proved that SMC provide robust and ripple-free steady state performance. Overall, the largest gains can be used for all situations. All simulations are for the sensorless drive shown in Fig. 1. The proposed SMC design is based on the required dynamic response ( $\eta M, \eta Fs$ ) and the maximum uncertainty ( $GM, GFs$ ). The dynamic response is application-dependent and is chosen by the designer. Equation (34) gives the maximum uncertainty caused by FBL. Given  $\eta$  and  $G$  for flux and torque, the designer chooses a sliding gain larger than  $GM + \eta M$  for the torque controller and better than  $GFs + \eta Fs$  for the flux controller. This choice of the corrective control gains results in a robust and stable scheme that operates at the required speed while suppressing chattering. Comparing all simulation results, we terminate that larger gains result in a quicker and robust control, but can cause chatter if the increase in gain is excessive.

**V. Extension Topic**

**FUZZY LOGIC CONTROLLER**

Fuzzy logic is a complex mathematical method that allows solving difficult simulated problems with many inputs and output variables. Fuzzy logic is able to give results in the form of recommendation for a specific

interval of output state, so it is essential that this mathematical method is strictly distinguished from the more familiar logics, such as Boolean algebra.

### Advantages of Fuzzy Controller over PI Controller

Usage of conventional control "PI", its reaction is not all that great for non-linear systems. The change is striking when controls with Fuzzy logic are utilized, acquiring a superior dynamic reaction from the system.

The PI controller requires exact direct numerical models, which are hard to get and may not give tasteful execution under parameter varieties, load unsettling powers, and so forth. As of late, Fuzzy Logic Controllers (FLCs) have been presented in different applications and have been utilized as a part of the power devices field. The benefits of fuzzy logic controllers over ordinary PI controllers are that they needn't bother with a precise scientific model, Can work with uncertain information sources and can deal with non-linearities and are more dynamic than traditional PI controllers.

## VI. SIMULATION RESULTS

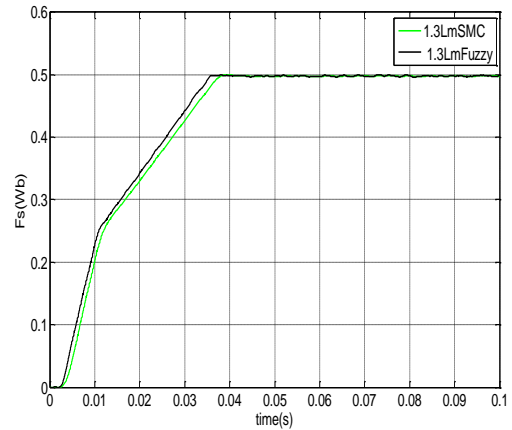
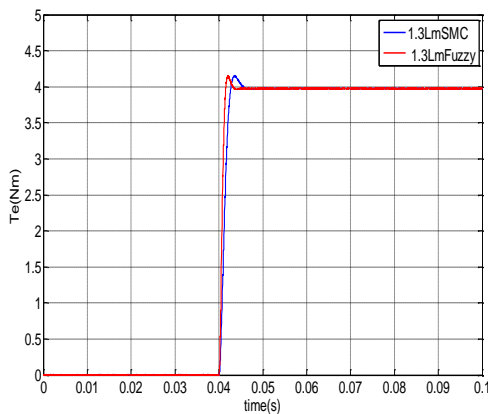


Fig 3: Simulation results for SMC and FBL for proposed and extinction with +30%  $L_m$  errors, at startup, torque  $T_e$ , and stator flux  $\Psi_s$ .

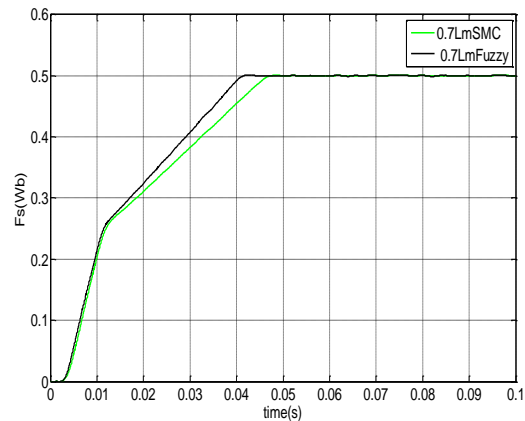
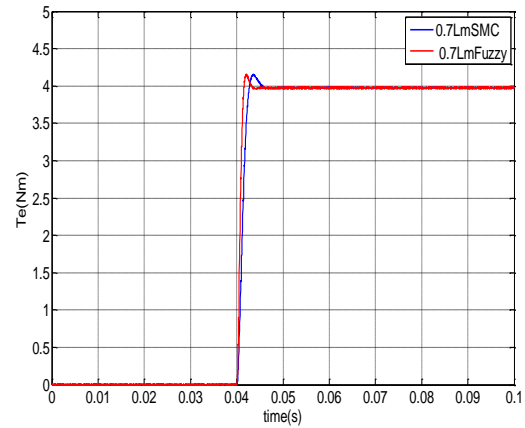


Fig4: Simulation results for SMC and FBL for proposed and extinction with -30%  $L_m$  errors, at startup, torque  $T_e$ , and stator flux  $\Psi_s$ .

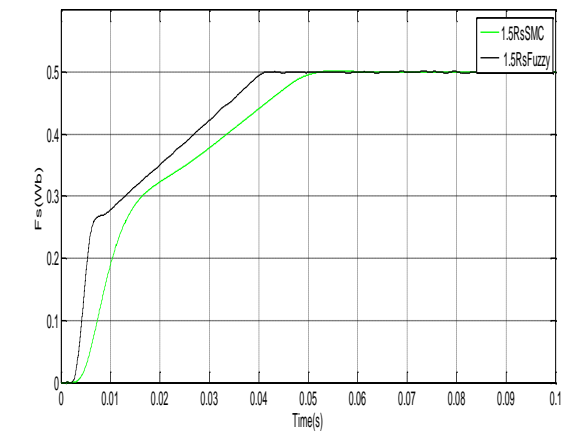
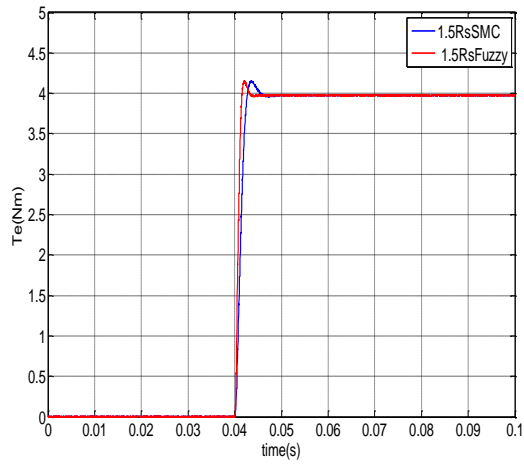


Fig 5: Simulation results for SMC and FBL for proposed and extinction with +50%  $R_s$  errors, at startup, torque  $T_e$ , and stator flux  $\Psi_s$ .

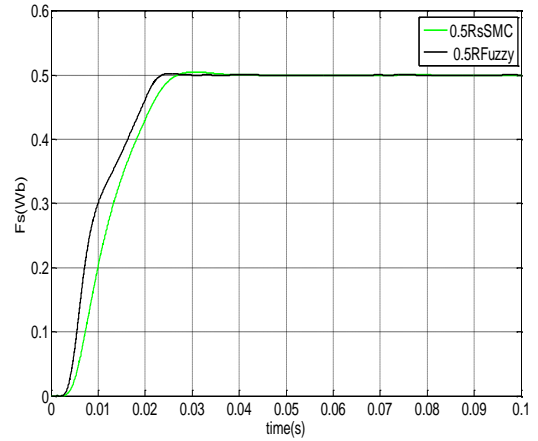


Fig 6: Simulation results for SMC and FBL for proposed and extinction with -50%  $R_s$  errors, at startup, torque  $T_e$ , and stator flux  $\Psi_s$ .

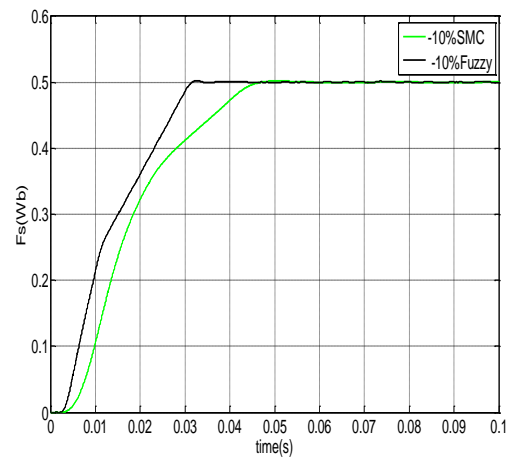
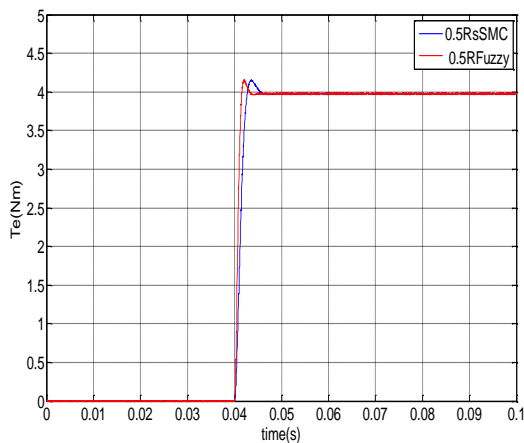
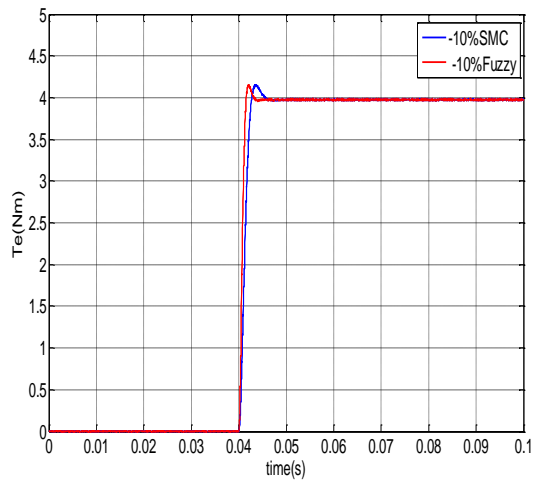


Fig 7: Simulation results for SMC and FBL for proposed and extinction with -10 rad/s speed errors, at startup, torque  $T_e$ , and stator flux  $\Psi_s$ .

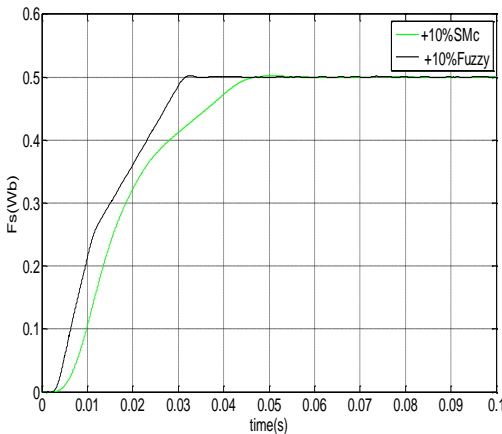
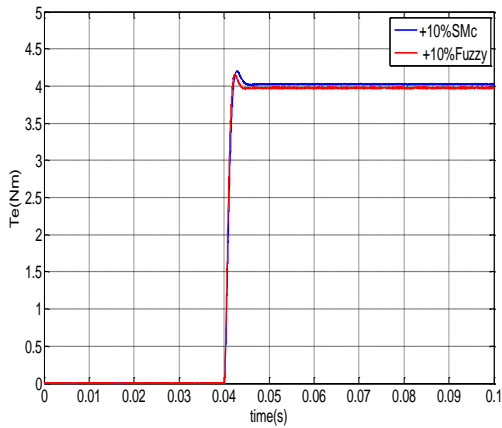
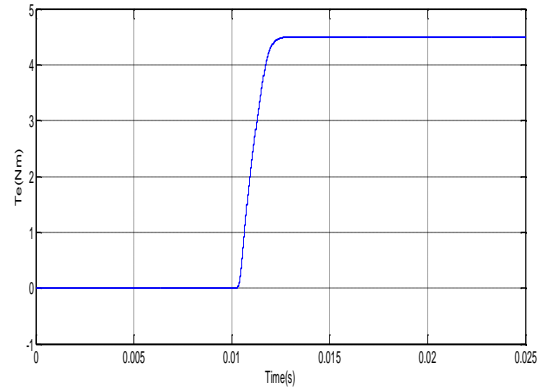
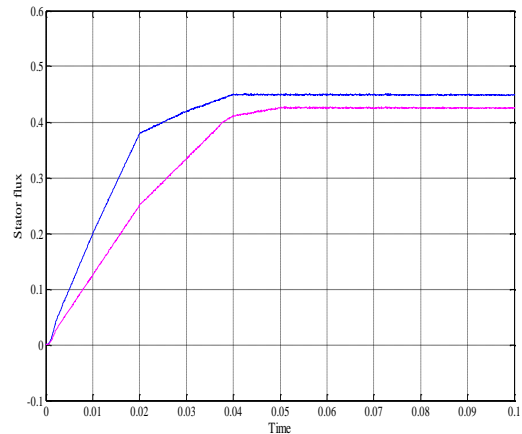


Fig 8: Simulation results for SMC and FBL for proposed and extinction with +10 rad/s speed errors, at startup, torque  $T_e$ , and stator flux  $\Phi_s$ .

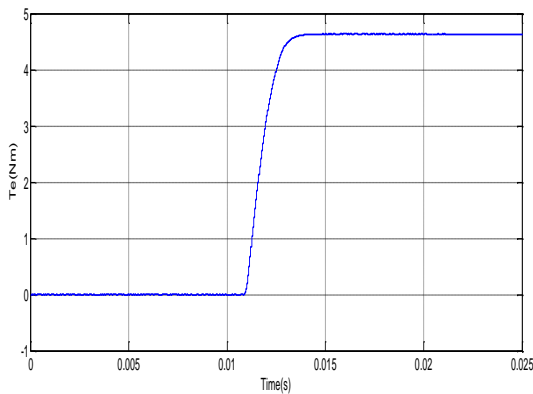


(b)

Fig 9: Torque response to 4.5 Nm step command for proposed and extinction with (a) PI controllers (Linear DTC) and (b) PI controllers and FBL. Startup from standstill.



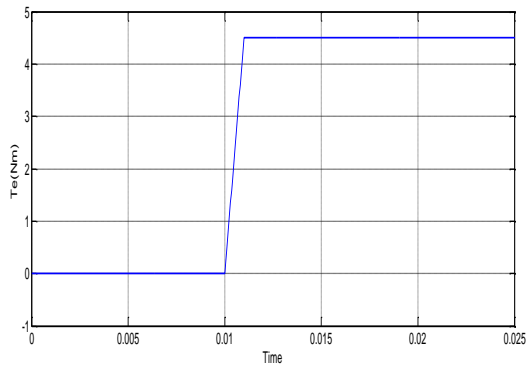
(a)



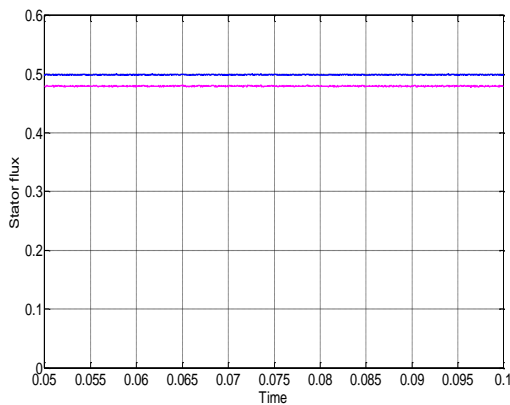
(b)

Fig 10: Stator (blue) and rotor (red) flux magnitude control at startup, for proposed and extinction with (a) PI controllers (Linear DTC) and (b) PI controllers and FBL.





(a)



(b)

fig 11: Torque transients for startup from standstill with feedback linearization and SMC (a) torque, (b) stator and rotor flux magnitudes.

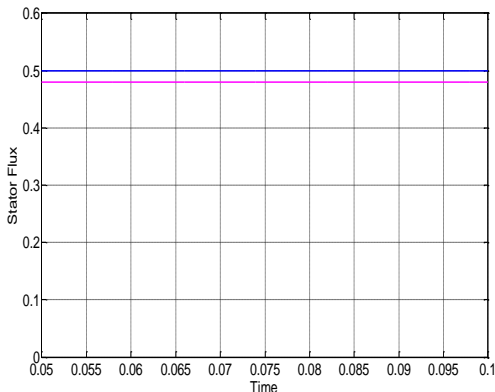
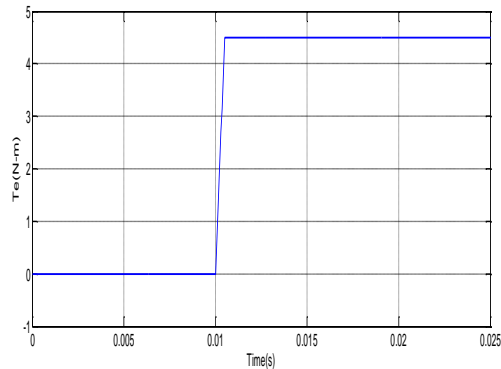


fig 12: Stator (blue) and rotor (red) flux magnitude response to 0.5 Wb step command for proposed and extinction with feedback linearization and SMC, at standstill.

## VII. CONCLUSION

This paper proposes another design advance which incorporates Feedback linearization and Fuzzy logic controller with a DTC drive. This novel agreement in light of torque-flux linearization creates an automatic linear model of the IM, with torque and flux as decoupled state factors. For the linear IM show, the controller-observer partition guideline holds if estimation errors are little, which permit the controller and observer to be autonomously designed.

Fuzzy logic controller direct torque and flux control gives robustness against parameter uncertainties and their dynamics, as demonstrated by the correlation with a linear controller. The chattering related with sliding mode operation is disposed of by the corresponding controller utilized inside the limit layer. The drive has a similar quick and robust reaction, as a regular DTC drive and totally disposes of the torque and flux swell. Generally speaking, the arrangement consolidates the benefits of ordinary and linear DTC. These favorable circumstances are because of the sliding mode controller and the linearization which decouples the torque and stator flux extent.

## VIII. REFERENCES

1. I Takahashi, T. Noguchi, "A New Quick Response and High Efficiency Control Strategy of an Induction Motor," *Rec. IEEE IAS*, 1985 Annual Meeting, pp. 495-502, 1995.
2. G Buja, M.P. Kazmierkowski, "Direct torque control of PWM inverter-feed ac motors - A survey," *IEEE Trans. Industrial Electronics*, vol. 51, no. 4, Aug. 2004, pp. 744-757.
3. Y-S. Lai, W.-K. Wang, Y-C. Chen, "Novel switching techniques for reducing the speed ripple

- of ac drives with direct torque control," IEEE Trans. Industrial Electronics, vol. 51, no. 4, Aug. 2004, pp. 768-775.
4. C Lascu, A.M. Trzynadlowski, "A sensorless hybrid DTC drive for high volume low-cost applications," IEEE Trans. Industrial Electronics, vol. 51, no. 5, Oct. 2004, pp. 1048-1055.
  5. C Lascu, I. Boldea, F. Blaabjerg, "Variable-Structure Direct Torque Control A Class of Fast and Robust Controllers for Induction Machine Drives," IEEE Trans. Industrial Electronics, vol. 51, no. 4, Aug. 2004, pp.785-792.
  6. MP. Kazmierkowski, D. Sobczuk, "High performance induction motor control via feedback linearization," Proc. IEEE ISIE-95, vol. 2, pp. 633-638, July 1995.
  7. MP. Kazmierkowski, D. Sobczuk, "Sliding mode feedback linearization of PWM inverter fed induction motor," Proc. IEEE IECON 1996, vol. 1, pp. 244-249, Aug. 1996.
  8. TK. Boukas, T.G. Habetler, "High-performance induction motor speed control using exact feedback linearization with state and state derivative feedback," IEEE Trans. Power Electronics, vol. 19, no. 4, July 2004, pp. 1022-1028.
  9. D Sobczuk, M. Malinowski, "Feedback linearization control of inverter fed induction motor with sliding mode speed and flux observers," IEEE IECON 2006, pp. 1299-1304.
  10. G. Luckjiff, I. Wallace, D. Divan, "Feedback linearization of current regulated induction motors," IEEE PESC 2001, pp. 1173-1178.
  11. John Chiasson, Modeling and high-performance control of electric machines, John Wiley and Sons Inc., 2005.
  12. J. Chiasson "A new approach to dynamic feedback linearization control of an induction motor," IEEE Trans. Automatic Control, vol. 43, no. 3, Mar 1998, pp. 391-397.

# Closed Loop Fuzzy Logic Control of an Open Ended Induction Machine using a Dual Inverter System with a Floating Capacitor Bridge

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## ABSTRACT

This paper shows a dual three stage open end winding induction motor drive. The drive comprises of a three stage induction machine with open stator stage windings and dual extension inverter provided from a single DC voltage source. To accomplish multi-level output voltage waveforms a floating capacitor bank is utilized for the second of the dual extensions. The capacitor voltage is controlled utilizing excess switching states at half of the principle dc interface voltage. The primary controller (master controller) is designed as a Fuzzy logic controller. This specific voltage proportion (2:1) is utilized to make a multi-level output voltage waveform with three levels. An altered modulation conspire is utilized to enhance the waveform nature of this dual inverter. This paper likewise thinks about the losses in dual inverter system conversely with single sided three-level NPC converter. At last, point by point simulation and experimental comes about are exhibited for the motor drive working as an open loop v/f controlled motor drive and as a shut loop field oriented motor controller.

**Keywords :** Field oriented control, floating bridge, Open End Winding Induction Machine (OEWIM), space vector.

## I. INTRODUCTION

VARIOUS multi-level converter topologies have been proposed during the most recent two decades [1-4]. A few converter topologies have been researched to accomplish multi-level output voltage waveforms, among them the diode braced [3], flying capacitor [5, 6] and cell [4] converters are normally utilized. Multi-level converters have bring down dv/dt and reduced harmonics distortion alongside bring down semiconductor switchingdevice blocking voltage prerequisites, in this manner multi-level converters are beneficial in medium voltage, high power or low voltage, high frequency applications [7-9].

Among the cascaded converters, dual two-level inverter topology has received consideration because of the effortlessness of the control organize and the scheme's fault tolerant limit [10, 11]. Conventional

dual two-level inverter topologies utilize two standard three-stage inverters to accomplish a multi-level voltage output. This topology does not have the neutral point vacillations found in NPC converters, utilizes less capacitors than the flying capacitor topology and requires less isolated supplies than H-bridge converters [5, 12, 13].

Besides dual inverters are more dependable, in light of the fact that in instance of a disappointment in one converter the outputs of the converter can be shortcircuited and the system would then be able to work as a standard single sided three stage inverter[14]. To accomplish multi-level voltage waveforms and to cut the way of basic mode current flow two isolated dc sources are utilized for traditional dual inverter topology, expanding the size and weight of the system. In this paper a dual two-level inverter is displayed which lessens the size and

weight of the system for an open end winding induction motor drive application. Dual inverter topologies have been considered in various papers for various applications. The traditional dual inverter topologies (utilizing two confined dc sources) has been analyzed [15-20], with various space vector modulation schemes used to create the multi-level output voltage waveforms. A block diagram of a conventional open stage load and converters is appeared in Fig. 1. It is conceivable to utilize a single supply for the dual inverters with a typical mode end strategy [15, 21, and 22]. These topologies utilize particular switching combinations that create level with normal mode voltages which cross out at load terminals. A decrease in the quantity of voltage levels and lower dc transport voltage usage are the principle detriments of this variety of the topology.

A modulation technique to adjust the power flow between the two inverters in a dual inverter system has too been proposed [23-27]. This topology still uses isolation transformer; the extent of this transformer can be decreased at the cost of decreased modulation index. The floating capacitor bridge topology alongside a reasonable control scheme to permit the supply of receptive power was presented in [28]. Different creators [29, 30] have displayed strategies to make up for supply voltage droop so as to keep the drive operational in steady power mode. This topology utilizes a floating capacitor extension to balance the voltage droop in fast machines.

In this paper, a circuit topology is investigated which is utilized as a three-level open end winding induction motor drive. This topology utilizes dual inverters with just a single DC voltage source at the essential side of the converter. The second bridge converter is associated with a floating capacitor bank.

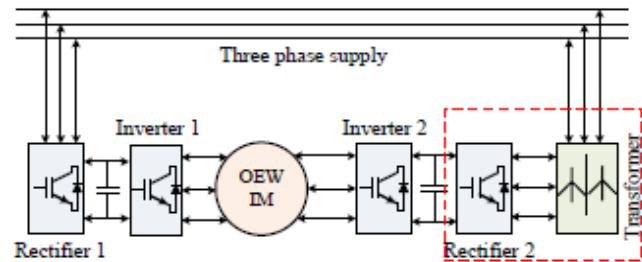


Fig. 1. Conventional open end winding IM drive topology.

The point of this topology is to dispense with the necessity for a massive isolation transformer while accomplishing multi-level output voltage waveforms. The voltage over the floating capacitor bank is controlled utilizing the excess switching vectors alongside an altered SVM conspire which stays away from undesirable voltage levels in the stage voltage waveforms during the dead-time interims, in this manner enhancing the by and large waveform quality.

## II. PROPOSED SYSTEM

### A. Floating capacitor bridge inverter

The floating extension capacitor dual inverter based topology has been analyzed for various applications [28, 31]. The topology can be utilized to supply reactive energy to a machine and to make up for any supply voltage droop [28, 32], however the likelihood of multi-level output voltage waveforms were not considered. A control scheme to charge the floating capacitor bridge alongside multi-level output voltage waveforms has been exhibited [33-35]. In this technique the fundamental converter works in six stage mode and the floating converter is called molding inverter as it is enhancing the waveform quality.

The work depicted in this paper is to control the voltage over the floating inverter bridge capacitor utilizing the repetitive switching states, consequently expelling the requirement for any separation

transformer and enabling the converter to accomplish multi-level output voltage waveforms. Fig. 2 appears a block diagram of the dual inverter with a floating bridge what's more, related capacitor. The utilization of a dc interface voltage proportion of 2:1 enables the dualbridge inverter to deliver up to a three levels in the output voltage waveform [36, 37]. The power phase of the proposed topology is appeared in Fig.3.

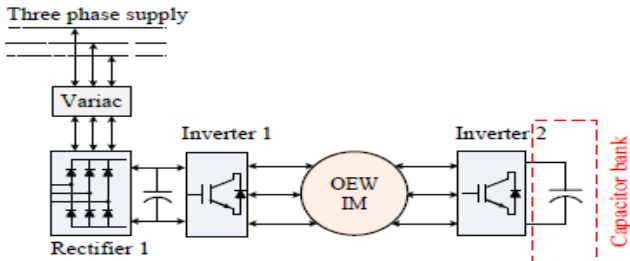


Fig. 2. Block diagram of proposed floating bridge topology.

**B. Principles of operation**

Keeping in mind the end goal to indicate how the floating capacitor can be charged and released the conceivable switching states are examined. The space vector outline for the topology is appeared in Fig.4, which is determined by accepting that both converters as being provided from separated DC sources with a voltage proportion of 2:1. In Fig.4 the red numbered switching combinations release the floating capacitor, while the green numbered switching combinations charge the floating capacitor. The blue numbered switching combinations hold the last condition of capacitor and are subsequently unbiased in wording of the condition of charge of the floating capacitor. As an illustration state (74) appeared in Fig.5 gives the switching successions for both converter's best switches 7 (1) represents to the best three switches for primary inverter and 4 (0 1 1) represents to the switching states for top three switches of the floating converter.

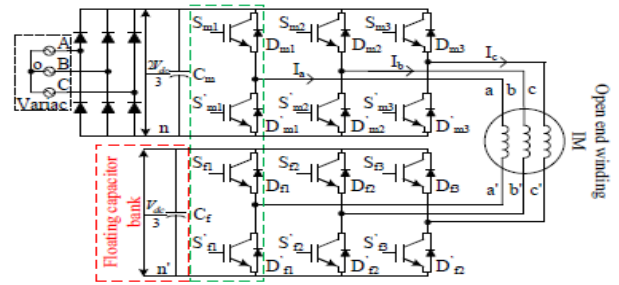


Fig. 3. Power stage of the floating bridge topology (the floating capacitor is charged to half of the main DC link voltage).

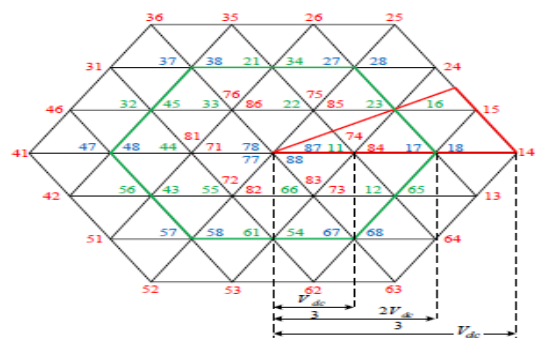


Fig. 4. Space vector of dual two-level inverter (source ratio 2:1).

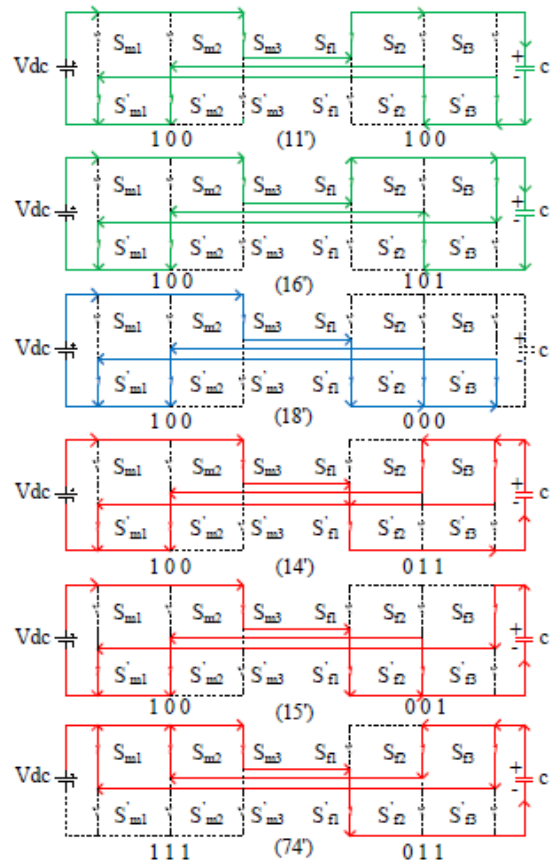


Fig. 5. Current flow for different switching state.

It can be seen from the Fig. 5 that combinations (11) and (16) will guide the current through the positive to negative terminal of the floating capacitor along these lines will act to charge the capacitor. Mixes (14), (15) and (74) will bring about a current the other way and will consequently act to release the capacitor. Mixes finishing with 7 (111) or, on the other hand 8 (000) are zero states and will in this manner have no effect of floating capacitor's voltage. It is apparent from Fig. 4 that if the reference voltage is in external hexagon at that point there are as it were two switching mixes in every area to charge the floating capacitor. During inductive load operation capacitor release rate will be slower and will cause cheating if the reference voltage lies in external hexagon. Additionally, because of need of charging states, the floating capacitor will release if the machine is drawing dynamic power. To maintain a strategic distance from these two marvel a limitation must be forced on modulation record. Subsequently the most extreme useable number voltage levels over the load will be diminished to nine (thirteen for detached sources) alongside a somewhat lower than perfect DC transport voltage use. In this manner the floating capacitor can charge to half of the primary DC bridge capacitor voltage just if the balance record (m) is constrained as appeared in condition (1).

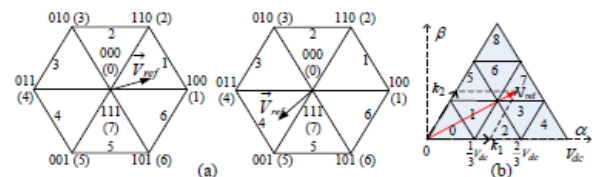
$$m=0.66 \quad (1)$$

This is 33% diminishment of DC transport use conversely with a dual inverter provided by two disengaged sources. The dual inverter with a zero arrangement disposal method moreover utilizes single supply with 15% diminishment in DC transport use what's more, can accomplish five-level voltage over the load [21].

### C. Modulation system

A decoupled space vector modulation system has been utilized for this dual inverter floating bridge topology. Switching combinations are chosen such that the

normal produced voltage for each of the converters is 180 degree stage moved from the other [Fig.6 (a)]. These voltages will then include at load terminal to coordinate in general voltage reference [Fig.6 (b)]. Recognizable proof of the subsectors, abide time estimation and the switching succession outline can be found in [38, 39]. To accomplish better outcomes, the outputswitching successions are adjusted. The change of the pulses is important to limit the undesirable voltage levels because of dead-time interims in each stage leg [40, 41]. In general, the output voltage of a converter is administered by load current during dead-time interims and the voltage is equivalent to one of the voltage levels earlier or after the dead-time interims. The dual inverter with unequal voltage sources will demonstrate an alternate trademark, rather than bracing the output voltage to one of the voltage levels earlier or after the dead-time interim voltage levels, it braces the output voltage to some other voltage levels. This is valid for synchronous switching for each stage legs of the converters.



**Fig. 6.** (a) Space vector diagram of individual converter (not in scale). (b) Space vector diagram of the dual inverter system with source ratio of 2:1.

For an illustration, consider stage legs inside green specked line in Fig. 3 for positive load (current flowing from main to floating converter). In the event that the best switches of the legs ( $S_{m1}$  and  $S_{f1}$ ) are on then the load current will experience switch  $S_{m1}$  and diode  $D_{f1}$ . Presently, if the two legs go to its dead-time in the meantime the load current will alter cascaded what's more, will experience diode  $D'_{m1}$  and diode  $D_{f1}$ . At long last when both the converter legs base switches ( $S'_{m1}$  and  $S'_{f1}$ ) turned on current will

experience diode  $D'$  and switch  $S'_{fi}$ . It is clear that during dead-time interim, voltage level is unique to the voltage levels previously, then after the fact the dead-time interim.

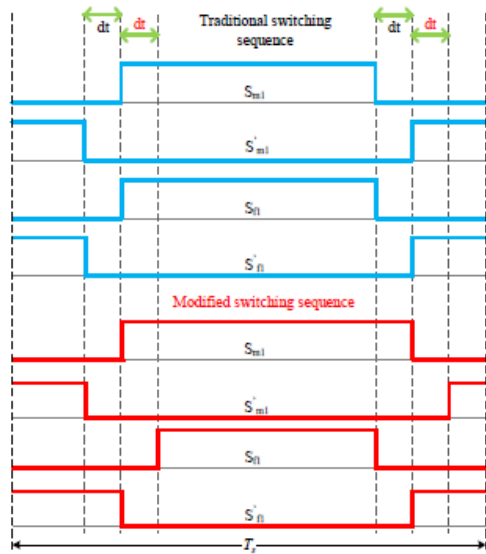


Fig. 7. Delayed dead-time intervals in both converters when current direction is positive.

To keep away from this undesirable voltage level, in this situation, the primary converter leg will go into its dead-time first and after that second converter will go to its dead-time interim when the fundamental converter relaxes interim. A summed up arrangement is appeared in Fig. 7 for positive load current. It can be seen from the Fig. 7 that the pulses are postponed relying upon the switching states advances. Table I demonstrates the summed up answer for positive and negative loadflows to stay away from the undesirable voltage levels.

Because of the modified switching groupings, the current bearing does not changeduring the dead-time. The condition of the floating capacitor will rely upon the current just some time recently the event of dead-time interim. For instance, if the capacitor was charging then it will continue charging when the converter is in dead-day and age. The estimation of dead-time is too little for the any cheat or release to change the capacitor voltage definitely.

TABLE I

DELAY TIME DEPENDING ON CURRENT DIRECTION				
	Inv-1 Top	Inv-1 Bot	Inv-2 Top	Inv-2 Bot
$I > 0$	Turn off	Turn on	Turn on	Turn off
$I < 0$	Turn on	Turn off	Turn off	Turn on

III. FUZZY LOGIC

Fuzzy logic is a complex scientific strategy that permits taking care of troublesome reproduced issues with many sources of info and yield factors. Fuzzy logic can give brings about the type of suggestion for a particular interim of yield state, so it is basic that this scientific technique is entirely recognized from the more natural logics, for example, Boolean polynomial math. This paper contains a fundamental outline of the standards of Fuzzy logic. The Fuzzy logic investigation and control techniques appeared in Figure 3 can be depicted as:

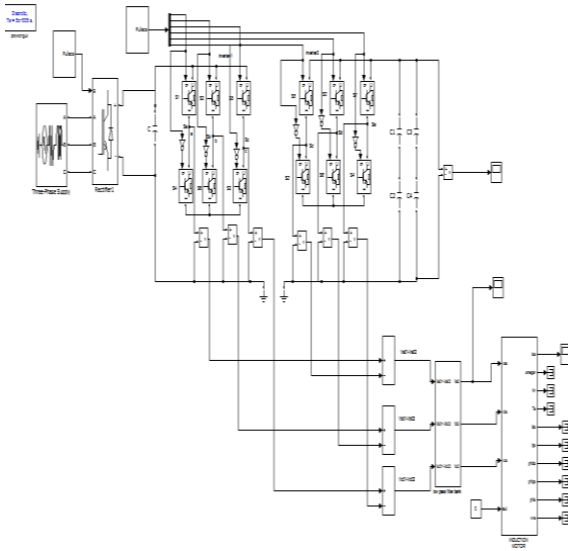
1. Receiving one or vast number of estimations or other appraisal of conditions existing in some framework that will be broke down or controlled.
2. Processing every got contribution as per human based, Fuzzy "assuming at that point" rules, which can be communicated in straightforward dialect words, and joined with conventional non-Fuzzy handling.

Averaging and weighting the outcomes from all the individual tenets into one single yield choice or flag which chooses or instructs a controlled framework what to do. The outcome yield flag is an exact defuzzified esteem.

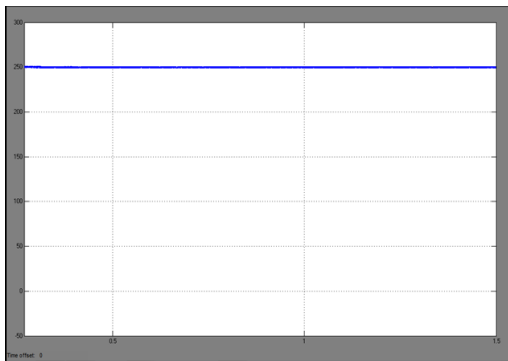
In FLC, fundamental control activity is dictated by an arrangement of semantic principles. These tenets are dictated by the framework. Since the numerical factors are changed over into etymological factors, scientific demonstrating of the framework is not required in FC..

The FLC involves three sections: fuzzification, obstruction motor and defuzzification. The FC is portrayed as I. seven fuzzy sets for each info and yield. ii. Triangular enrollment capacities for effortlessness. iii. Fuzzification utilizing nonstop universe of talk. iv. Suggestion utilizing Mamdani's, "min" administrator. v. Defuzzification utilizing the tallness technique.

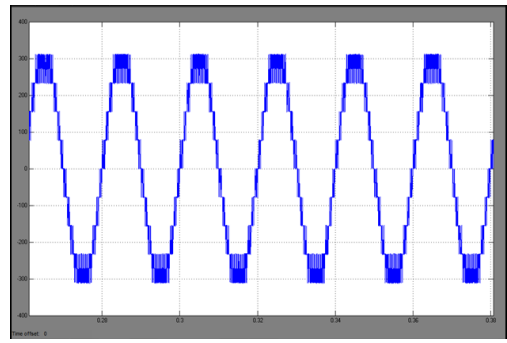
### III. SIMULATION RESULTS



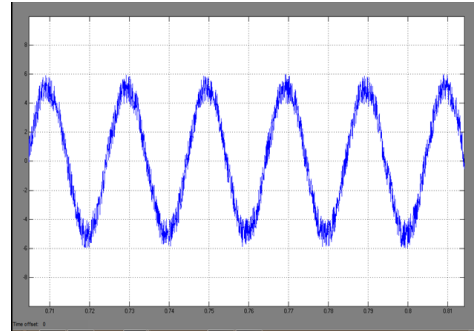
**Fig. 8.** Open loop v/f control IM drive Top to bottom: Simulink Model



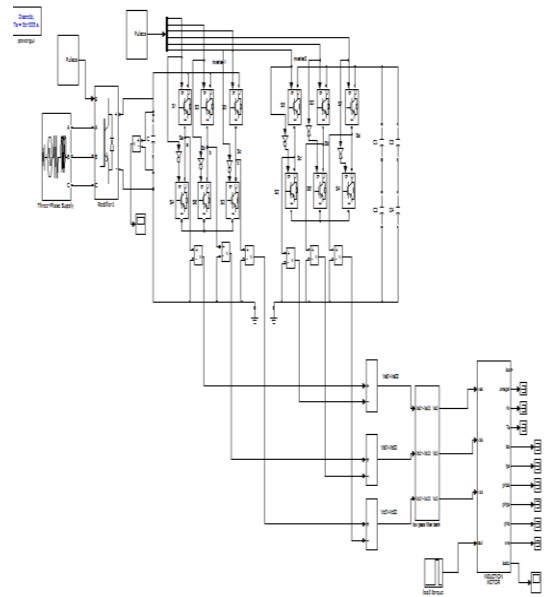
**Fig. 9.** Open loop v/f control IM drive Top to bottom: Floating DC link Voltage



**Fig. 10.** Open loop v/f control IM drive Top to bottom: Phase Voltage

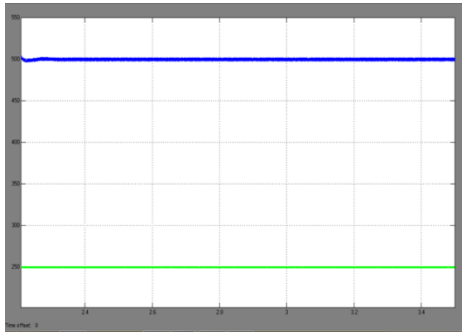


**Fig. 11.** Open loop v/f control IM drive Top to bottom: Phase current

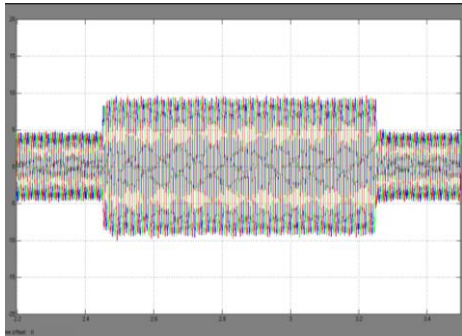


**Fig. 12.** Open loop v/f control IM drive Top to bottom: Simulink Model

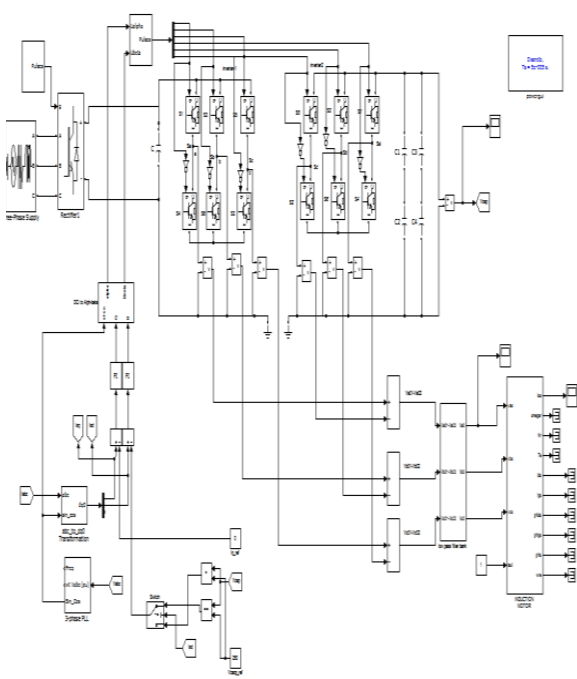




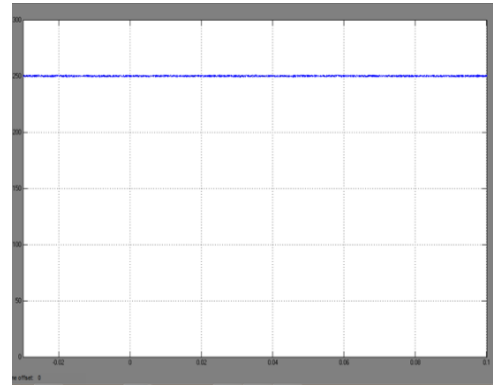
**Fig. 13.** Open loop v/f control IM drive Top to bottom: Main DC link Voltage (Blue) and Floating Dc Link voltage (Green)



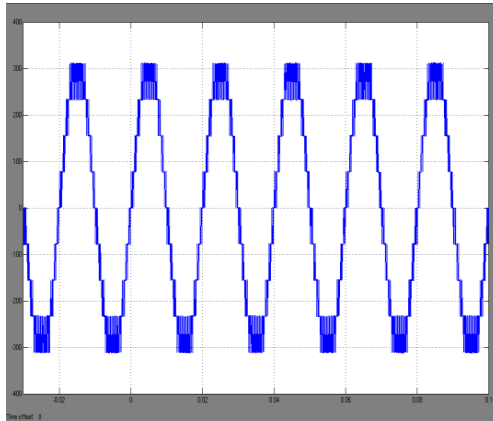
**Fig. 14.** Open loop v/f control IM drive Top to bottom: Three Phase current



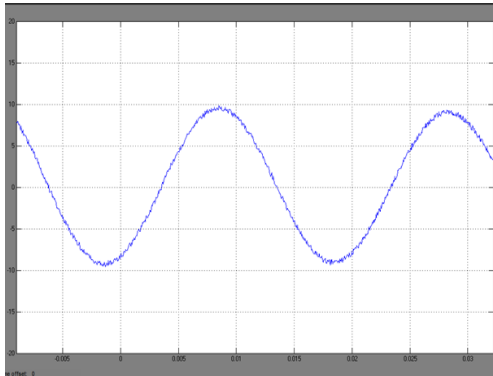
**Fig. 15.** Vector control when machine is loaded. Top to bottom: Simulink Model



**Fig. 16.** Vector control when machine is loaded. Top to bottom: Floating DC link Voltage



**Fig. 17.** Vector control when machine is loaded. Top to bottom: : Phase Voltage



**Fig. 18.** Vector control when machine is loaded. Top to bottom: Phase current

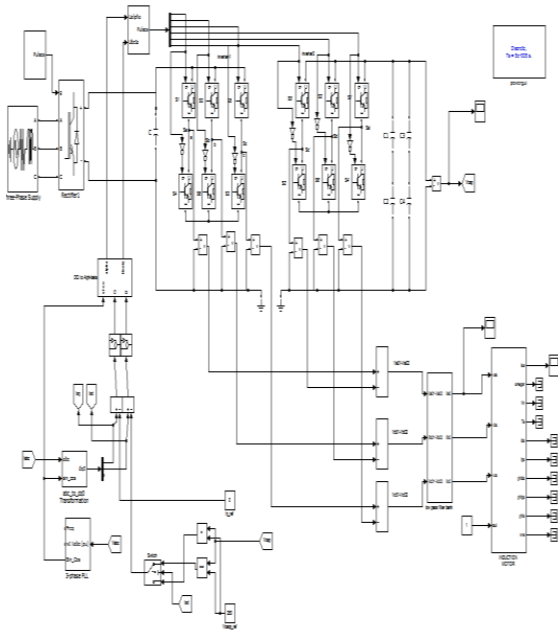


Fig 19. Extension Simulink Model

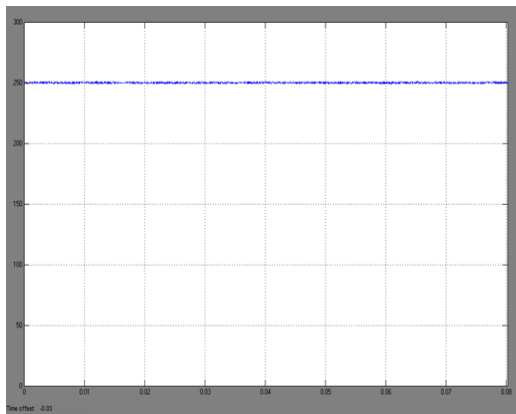


Fig 20. Extension: Floating DC link Voltage

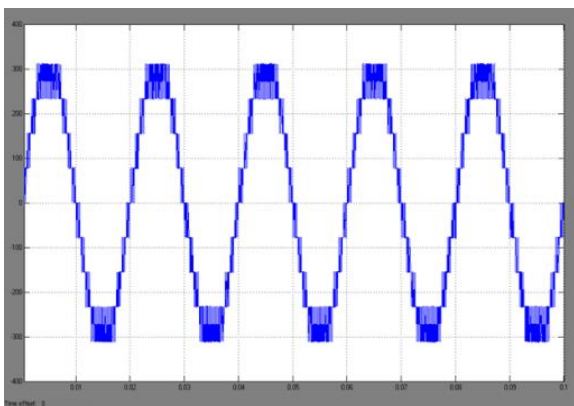


Fig 21. Extension: Phase Voltage

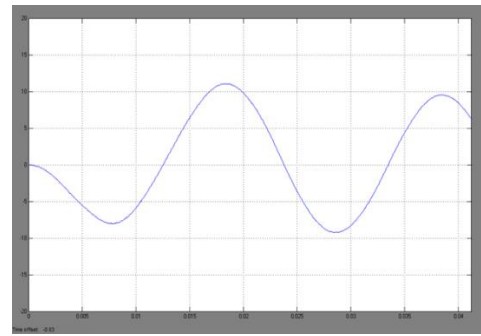


Fig 22. Extension: Phase current

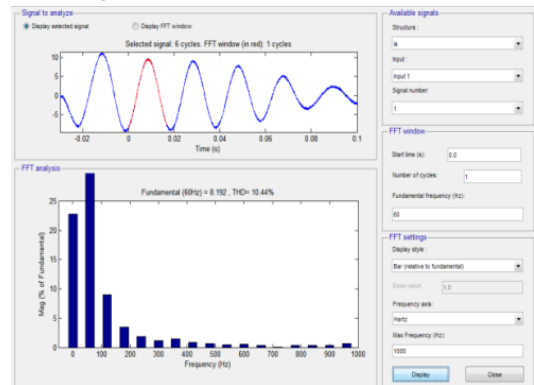


Fig 23. Vector control THD of Current Is

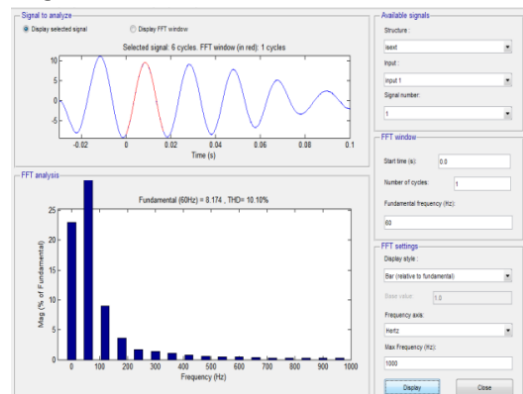


Fig 24. Extension THD of Current Is

#### IV. CONCLUSIONS

An motor drive utilizing open stator winding induction machine and a dualbridge inverter topology with a floating capacitor bridge has been broke down and pragmatic outcomes are illustrated. The proposed system charges the floating bridge capacitor to a proportion of 2:1 as for principle bridge DC interface voltage abundance. This specific DC bridge voltage proportion enables the converter to accomplish multi-level output voltage waveform. The floating DC interface voltage is kept at a consistent voltage by the methods for charging and releasing the floating bridge

capacitor. This is accomplished by choosing between the charging and releasing repetitive conditions of the converter. The fuzzy logic control plot has been planned and actualized in a less demanding and faster path than an established fundamental control strategy. The adjustment of recurrence deviation in a three zone interconnected system were recreated utilizing fuzzy logic controller.

A changed space vector modulation methodology is embraced to dispose of the undesirable voltage levels during the dead-time interims, in this manner enhanced the waveform quality for this floating bridge topology. An open loop v/f control drive was executed to approve the execution of the capacitor control. At last, the dynamic execution of the proposed system was assessed utilizing a nearby loop field oriented controlled motor drive, the outcomes demonstrated that the proposed topology accomplishes multi-level output voltage waveforms. The outcomes show that this topology has potential for applications where estimate, weight, losses and excess are critical, for instance in aviation, EV or HEV motor drives.

## V. REFERENCES

1. P Wheeler, L. Xu, L. MengYeong, L. Empringham, C. Klumpner, and J. Clare, "A review of Multi-level Matrix Converter topologies," IET Conf. on Power Electron., Machines and Drives PEMD, pp. 286-290, 2008.
2. J Rodriguez, L. Jih-Sheng, and P. Fang Zheng, "Multilevel inverters: a survey of topologies, controls, and applications," IEEE Trans. Ind. Electron., vol. 49, pp. 724-738, 2002.
3. J Rodriguez, S. Bernet, P. K. Steimer, and I. E. Lizama, "A Survey on Neutral-Point-Clamped Inverters," IEEE Trans. Ind. Electron., vol. 57, pp. 2219-2230, 2010.
4. M Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Perez, "A Survey on Cascaded Multilevel Inverters," IEEE Trans. Ind. Electron., vol. 57, pp. 2197-2206, 2010.
5. D Janik, T. Kosan, P. Kamenicky, and Z. Peroutka, "Universal precharging method for dc-link and flying capacitors of four-level Flying Capacitor Converter," IEEE Conf. on Ind. Electron. Soc. IECON, pp. 6322-6327, 2013.
6. E C. dos Santos, F. Gulpinar, and E. R. C. da Silva, "Flying capacitor four-level H-Bridge converter," Power and Energy Conf. at Illinois PECEI, pp. 1-6, 2014.
7. E Levi, "Multiphase Electric Machines for Variable-Speed Applications," IEEE Trans. Ind. Electron., vol. 55, pp. 1893-1909, 2008.
8. S Kouro, J. Rodriguez, W. Bin, S. Bernet, and M. Perez, "Powering the Future of Industry: High-Power Adjustable Speed Drive Topologies," IEEE Industry App. Mag., vol. 18, pp. 26-39, 2012. [9] F. Betin, G. A. Capolino, D. Casadei, B. Kawkabani, R. I. Bojoi, L. Harnefors, et al., "Trends in Electrical Machines Control: Samples for Classical, Sensorless, and Fault-Tolerant Techniques," IEEE Ind. Electron. Mag., vol. 8, pp. 43-55, 2014.
9. F. Meinguet, N. Ngac-Ky, P. Sandulescu, X. Kestelyn, and E. Semail, "Fault-tolerant operation of an open-end winding five-phase PMSM drive with inverter faults," IEEE Conf. on Ind. Electron. Soc. IECON, pp. 5191-5196, 2013.
10. N. Ertugrul, W. Soong, G. Dostal, and D. Saxon, "Fault tolerant motor drive system with redundancy for critical applications," IEEE Power Electron. Spec. Conf. PESC, pp. 1457-1462 vol.3, 2002.
11. O. A. Taha and M. Pacas, "Hardware implementation of balance control for three-phase grid bridgeion 5-level Cascaded H-Bridge converter using DSP," IEEE Int. Symp. Ind. Electron. ISIE, pp. 1366-1371, 2014.

# Performance evaluation of Improvement in BER Performance using DWT Based OFDM AND DFT Based OFDM for Different Modulation Approaches

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## ABSTRACT

Orthogonal frequency division multiplexing (OFDM) is a multicarrier modulation (MCM) technique which seems to be an attractive candidate for fourth generation wireless communication systems. OFDM offer high spectral efficiency, immune to the multipath delay, low inter-symbol interference (ISI), immunity to frequency selective fading and high power efficiency. Due to these merits OFDM is chosen as high data rate communication systems such as Digital Video Broadcasting (DVB) and based mobile worldwide interoperability for microwave access (mobile Wi-MAX). However OFDM system suffers from serious problem of high PAPR. In OFDM system output is superposition of multiple sub-carriers. In this case some instantaneous power output might increase greatly and become far higher than the mean power of system. To transmit signals with such high PAPR, it requires power amplifiers with very high power scope. These kinds of amplifiers are very expensive and have low efficiency-cost. If the peak power is too high, it could be out of the scope of the linear power amplifier. This gives rise to non-linear distortion which changes the superposition of the signal spectrum resulting in performance degradation. If no measure is taken to reduce the high PAPR.

**Keywords :** OFDM, MCM, ISI, mobile Wi-MAX, PAPR, CCDF, BER, HPA, PTS, SLM

## I. INTRODUCTION

PAPR can be described by its complementary cumulative distribution function (CCDF). In this probabilistic approach certain schemes have been proposed by researchers. These include clipping, coding and signal scrambling techniques. Under the heading of signal scrambling techniques there are two schemes included. Which are Partial transmit sequence (PTS) and Selected Mapping (SLM). Although some techniques of PAPR reduction have been summarized in, it is still indeed needed to give a comprehensive review including some motivations of PAPR reductions, such as power saving, and to compare some typical methods of PAPR reduction

through theoretical analysis and simulation results directly. An effective PAPR reduction technique should be given the best trade-off between the capacity of PAPR reduction and transmission power, data rate loss, implementation complexity and Bit-Error-Ratio (BER) performance. The goal of precoding techniques is to obtain a signal with lower PAPR than in the case of OFDM without precoding techniques and to reduce the interference produced by multiple users. The PAPR reduction must compensate the nonlinearities of the HPA having as effect the reduction of the bit error rate (BER).

Traditional single carrier modulation techniques can achieve only limited data rates due to the restrictions imposed by the multipath effect of

wireless channel and the receiver complexity. High data-rate is desirable in many recent wireless multimedia applications. However, as the data-rate in communication system increases, the symbol duration gets reduced. Therefore, the communication systems using single carrier modulation suffer from severe intersymbol interference (ISI) caused by dispersive channel impulse response, thereby needing a complex equalization mechanism. Orthogonal Frequency Division Multiplexing (OFDM) is a special form of multicarrier modulation scheme, which divides the entire frequency selective fading channel into many orthogonal narrow band flat fading sub channels. In OFDM system high-bit-rate data stream is transmitted in parallel over a number of lower data rate subcarriers and do not undergo ISI due to the long symbol duration.

Large envelope fluctuation in OFDM signal is one of the major drawbacks of OFDM. Such fluctuations create difficulties because practical communication systems are peak power limited. Thus, envelope peaks require a system to accommodate an instantaneous signal power that is larger than the signal average power, necessitating either low operating power efficiencies or power amplifier (PA) saturation. In order to amplify the OFDM signal with large envelope fluctuations, PAs with large linear range are required, which makes it very expensive. If PA has limited linear range then its operation in nonlinear mode introduces out of band radiation and in band distortion. It is also necessary to have D/A and A/D converters with large dynamic range to convert discrete time OFDM signal to analog signal and vice versa. PAPR is generally used to characterize the envelope fluctuation of the OFDM signal and it is defined as the ratio of the maximum instantaneous power to its average power. In addition to this, OFDM system requires tight frequency synchronization in comparison to single carrier systems, because in OFDM, the subcarriers are narrowband. Therefore, it is sensitive to a small frequency offset between the

transmitted and the received signal. The frequency offset may arise due to Doppler Effect or due to mismatch between transmitter and receiver local oscillator frequencies. The carrier frequency offset (CFO) disturbs the orthogonality between the subcarriers, and therefore the signal on any particular subcarrier will not remain independent of the remaining subcarriers. This phenomenon is known as inter-carrier interference (ICI), which is a big challenge for error-free demodulation and detection of OFDM symbols.

## II. REVIEW OF LITERATURE

Imran Baig and Varun Jeoti. 2010, "DCT Precoded SLM Technique for PAPR Reduction in OFDM", have proposed a Discrete Cosine Transform (DCT) precoding based SLM technique for PAPR reduction in OFDM systems. This technique is based on precoding the constellation symbols with DCT precoder after the multiplication of phase rotation factor and before the Inverse Fast Fourier Transform (IFFT) in SLM-OFDM System. The scheme is faster and easier to deploy with lower operational costs for network maintenance but a null is placed in the direction of the interferers, so the antenna gain is not maximized at the direction of the desired user.

Mohamed A. Aboul-Dahab, Esam A. A. A. Hagra, and Ahmad A. Elhaseeb. 2013, in "PAPR Reduction Based on DFT Precoding for OFDM Signals", have presented Discrete Fourier Transform (DFT), Discrete Hartley Transform (DHT) and Zadoff-Chu Transform (ZCT) precoders for both clipping and clipping and filtering to reduce PAPR. The DFT precoder provides better PAPR compared with clipping, clipping and filtering OFDM. The most obvious benefit is the reduction in complexity and cost because of less hardware usage but there is no provision to the encoder.

SeyranKhademi ,Alle-Jan Van der Veen , Thomas Svantesson. 2012,in “Precoding Technique For Peak-To-Average-Power-Ratio (Papr) Reduction In MIMO OFDM/A Systems”, This paper presents a new technique to reduce the peak to average power ratio (PAPR) in OFDM modulation for a MIMO system. This method exploits the Eigen-beamforming mode (EM) in MIMO systems which is a common feature in 4th generation standards. This scheme shows significant cost reduction and improved design flexibility due to the absence of the inter-connection between the MMIC and the antenna but suffers from low total efficiency.

Srishtansh Pathak and Himanshu Sharma, 2013 “Channel Estimation in OFDM Systems”, have focused on investigating the effect of fading in modern digital communication techniques such as orthogonal frequency division multiplexing (OFDM).

Although channel estimation can be avoided by using differential modulation techniques, these techniques will fail catastrophically in the fast fading channel, where the channel impulse response (CIR) varies significantly within the symbol duration. The major advantage of OFDM lies in processing frequency-selective channels as multiple flat-fading sub-channels but suffers from high peak-to-average-power ratio (PAPR), bit error rate (BER) and high sensitivity to carrier frequency offset (CFO).

Z. Wang and G. B. Giannakis, 2001“Linearly precoded or coded OFDM against wireless channel fades”, have integrated , LSE, MMSE, LMMSE, Low rank (Lr)-LMMSE channel estimators with the physical layer. The performance of estimation algorithms is analyzed in terms of BER, SNR, MSE and throughput. Simulation results proved that increment in modulation scheme size causes to improvement in throughput along with BER value. There is a trade-off among modulation size, BER value and throughput. It can accomplish a bandwidth efficiency but is not

suitable for applications with fast varying fading channels.

B. Muquet, Z. Wang, G. B. Giannakis, M. de Courville, and P. Duhamel, 2002,“Cyclic prefixing or zero padding for wireless multicarrier transmissions”, have presented evaluations and comparisons over the performance of these handover techniques. The effect of the mobile station speed on the handover techniques’ performance is also studied. The performance metric is the overall average downlink spectral efficiency which depends on the downlink carrier to interference and noise ratio (CINR).

The scheme is more stable and gives better performance and smoother transition, however there are some drawbacks with the use of two connections, system overhead will increase and the MS will use more network resources. MDHO is more complex than HHO

### III. PROBLEM IDENTIFICATION

#### 3.1 PROBLEM IDENTIFICATION

Wireless communication, or sometimes simply wireless, is the transfer of information or power between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio waves. With radio waves distances can be short, such as a few meters for Bluetooth or as far as millions of kilometers for deep-space radio communications. Somewhat less common methods of achieving wireless communications include the use of other electromagnetic wireless technologies, such as light, magnetic, or electric fields or the use of sound.

#### 3.2 EXISTING SYSTEM

In the existing system the discrete Fourier transform is used for the orthogonal basis function. First the

Random data is generated and then the data is encoded by the encoder and the corresponding modulation is processed. The modulated signal is applied with the inverse Fourier transform is performed. After that the cyclic prefix data is added to the modulated signal and then the signal is passed into the channel with the noise. And the aforementioned process are performed on the transmitter side and then the reversal operations of the aforementioned processes are performed. In the receiver side the cyclic prefix is removed from the channel output data and then the pilot synchronization is performed after that the Fourier transform is applied on the synchronized data and then the demodulation is performed. And the demodulated data is decoded at the receiver. Finally the BER performance is estimated.

#### Disadvantage:

- By adding cyclic prefix which occupies the 20% bandwidth.
- Spectral efficiency is less.

### 3.3 SOLUTION OF THE PROBLEM

In the proposed system we are using inverse discrete Fourier transform IDWT and discrete Fourier transform DWT at the place of IDFT and DFT. SUI - 2 channel is used for transmission and cyclic prefixing is not used. In the transmission side conventional encoding is performed and then interleaving is performed on the encoded data. Then the data is converted to decimal form and modulation is done. Here we are use the QPSK, QAM-16 and QAM-64 is performed. After modulation the pilot insertion and sub carrier mapping is performed on the data and then IDWT of the data, which provides the orthogonality to the subcarriers. IDWT will convert time domain signal to the frequency domain. After passing through the channel on the signal DWT will be performed and then pilot synchronization where the inserted pilots at the transmitter are removed then the demodulation is performed. Demodulated data is converted to binary

form and the de-interleaved and decoded to obtain the original data transmitted. Finally the performance of the system is evaluated by using the BER analysis.

#### Advantage:

- Computational complexity is low.
- Encoding signal at a low bit rate.
- They have better Power spectral density.
- Does not occupy much bandwidth.

## IV. METHODOLOGY

Wavelet transform show the potential to replace the DFT in OFDM. Wavelet transform is a tool for analysis of the signal in time and frequency domain jointly. It is a multi resolution analysis mechanism where input signal is decomposed into different frequency components for the analysis with particular resolution matching to scale. Using any particular type of wavelet filter the system can be designed according to the need and also the multi resolution signal can be generated by the use of wavelets. By the use of varying wavelet filter, one can design waveforms with selectable time/frequency partitioning for multi user application. Wavelets possess better orthogonality and have localization both in time and frequency domain. Because of good orthogonality wavelets are capable of reducing the power of the ISI and ICI, which results from loss of orthogonality. To reduce ISI and ICI in conventional OFDM system use of cyclic prefix is there, which uses 20% of available bandwidth, so results in bandwidth inefficiency but this cyclic prefix is not required in wavelet based OFDM system. Complexity can also be reduced by using wavelet transform as compared with the Fourier transform because in wavelet complexity is  $O[N]$  as compared with complexity of Fourier transform of  $O[N \log_2 N]$ . Wavelet based OFDM is simple and the DFT based OFDM is complex. Wavelet based OFDM is flexible as well and because better orthogonality is provided by it, there is no any need of cyclic prefixing in wavelet

based OFDM, which is required in DFT based OFDM to maintain orthogonality so wavelet based system is more bandwidth efficient as compared with the DFT based OFDM. In discrete wavelet transform (DWT), input signal presented will pass through several different filters and will be decomposed into low pass and high pass bands through the filters. During decomposition the high pass filter will remove the frequencies below half of the highest frequency and low pass filter will remove frequencies that are above half of the highest frequency. The decomposition halves the time resolution because half of the samples are used to characterize the signal similarly frequency resolution will be doubled and this decomposition process will be repeated again for obtaining the wavelet coefficients of required level. Two types of coefficients are obtained through processing, first ones are called detailed coefficients obtained through high pass filter and second ones are called coarse approximations obtained through low pass filter related with scaling process. After passing the data through filters the decimation process will be performed. The whole procedure will continue until the required level is obtained.

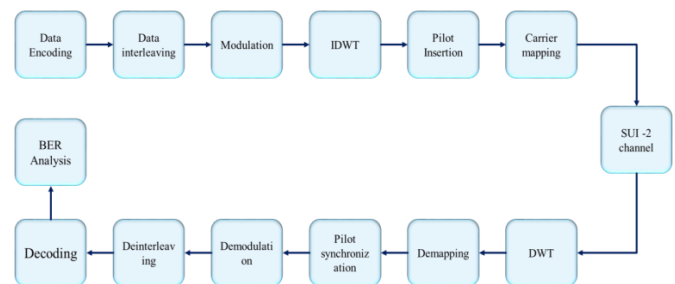
#### 4.1 METHODOLOGY

As shown in figure 4.1, in this proposed model we are using IDWT and DWT at the place of IDFT and DFT. AWGN channel is used for transmission and cyclic prefixing is not used. Here first of all conventional encoding is done followed by interleaving then data is converted to decimal form and modulation is done next. After modulation the pilot insertion and sub carrier mapping is done then comes the IDWT of the data, which provides the orthogonality to the subcarriers. IDWT will convert time domain signal to the frequency domain. After passing through the channel on the signal DWT will be performed and then pilot synchronization where the inserted pilots at the transmitter are removed then the demodulation is done. Demodulated data is converted to binary form and the de-interleaved and decoded to obtain the

original data transmitted. This system is implemented in following 4 stages.

1. OFDM Symbol Generation Model
2. Modulation Model
3. SUI – 2 Channel Model
4. Performance Analysis Model

The flow diagram of the methodology is shown in figure 4.1.



**Figure 4.1:** Flow Diagram

##### 4.1.1 OFDM Symbol Generation Model

In an OFDM scheme, a large number of orthogonal, overlapping, narrow band sub-channels or subcarriers, transmitted in parallel, divide the available transmission bandwidth. The separation of the subcarriers is theoretically minimal such that there is a very compact spectral utilization. The attraction of OFDM is mainly due to how the system handles the multipath interference at the receiver. Multipath generates two effects: frequency selective fading and intersymbol interference (ISI). The "flatness" perceived by a narrow-band channel overcomes the former, and modulating at a very low symbol rate, which makes the symbols much longer than the channel impulse response, diminishes the latter. Using powerful error correcting codes together with time and frequency interleaving yields even more robustness against frequency selective fading, and the insertion of an extra guard interval between consecutive OFDM symbols can reduce the effects of



ISI even more. Thus, an equalizer in the receiver is not necessary.

#### 4.1.2 Modulation Model:

QAM (quadrature amplitude modulation) is a method of combining two amplitude-modulated (AM) signals into a single channel, thereby doubling the effective bandwidth. QAM is used with pulse amplitude modulation (PAM) in digital systems, especially in wireless applications. This modulation technique is a combination of both Amplitude and phase modulation techniques. QAM is better than QPSK in terms of data carrying capacity. QAM takes benefit from the concept that two signal frequencies; one shifted by 90 degree with respect to the other can be transmitted on the same carrier. For QAM, each carrier is ASK/PSK modulated. Hence data symbols have different amplitudes and phases. QPSK: quadrature phase shift keying. Quadrature means the signal shifts among phase states that are separated by 90 degrees. The signal shifts in increments of 90 degrees from 45° to 135°, -45° (315°), or -135° (225°). Data into the modulator is separated into two channels called I and Q. Two bits are transmitted simultaneously, one per channel. Each channel modulates a carrier. The two carrier frequencies are the same, but their phase is offset by 90 degrees (that is, they are “in quadrature”). The two carriers are combined and transmitted • Four states because  $2^2 = 4$ . Theoretical bandwidth efficiency is two bits/second/H.

#### 4.1.3 SUI – 2 Channel Model:

Broadband Wireless Access working group proposed the standards for the frequency band below 11 GHz containing the channel model developed by Stanford University, namely the SUI models. The SUI model describes three types of terrain; they are terrain A, terrain B and terrain C. Terrain A can be used for hilly areas with moderate or very dense vegetation. OFDM has been incorporated into WiMAX technology to enable it to provide high speed data without the

selective fading and other issues of other forms of signal format.

#### 4.1.4 Performance Analysis Model:

The bit error rate (BER) is the number of bit errors divided by the total number of transmitted bits over a channel. BER although unit-less also expressed in terms of percentage. The bit error rate (BER) is the number of bit errors per unit time. The bit error ratio (also BER) is the number of bit errors divided by the total number of transferred bits during a studied time interval. Bit error ratio is a unit less performance measure, often expressed as a percentage. The BER may be improved by choosing a strong signal strength, by choosing a slow and robust modulation scheme or line coding scheme, and by applying channel coding schemes such as redundant forward error correction codes. The BER may be evaluated using stochastic (Monte Carlo) computer simulations. If a simple transmission channel model and data source model is assumed, the BER may also be calculated analytically.

## V. RESULTS AND DISCUSSIONS

By using MATLAB performance characteristic of DFT based OFDM and wavelet based OFDM are obtained for different modulations that are used for the LTE, as shown in figures 3-5. Modulations that could be used for LTE are QPSK, 16 QAM and 64 QAM (Uplink and downlink). QPSK does not carry data at very high speed. When signal to noise ratio is of good quality then only higher modulation techniques can be used. Lower forms of modulation (QPSK) does not require high signal to noise ratio. For the purpose of simulation, signal to noise ratio (SNR) of different values are introduced through AWGN channel. Data of 9600 bits is sent in the form of 100 symbols, so one symbol is of 96 bits. Averaging for a particular value of SNR for all the symbols is done and BER is obtained and same process is repeated for all the values of SNR and final BERs are obtained. Firstly the performance of DFT based OFDM and wavelet based OFDM are obtained for different modulation techniques.

Different wavelet types daubechies2 and haar is used in wavelet based OFDM for QPSK, 16-QAM, 64-QAM. It is clear from the fig. 3, fig. 4 and fig. 5 that the BER performance of wavelet based OFDM is better than the DFT based OFDM. Fig. 3 indicates that db2 performs better when QPSK is used. Fig. 4 shows that when 16-QAM is used db2 and haar have similar performance but far better than DFT. Fig. 5, where 64-QAM is used haar and db2 performs better than DFT.

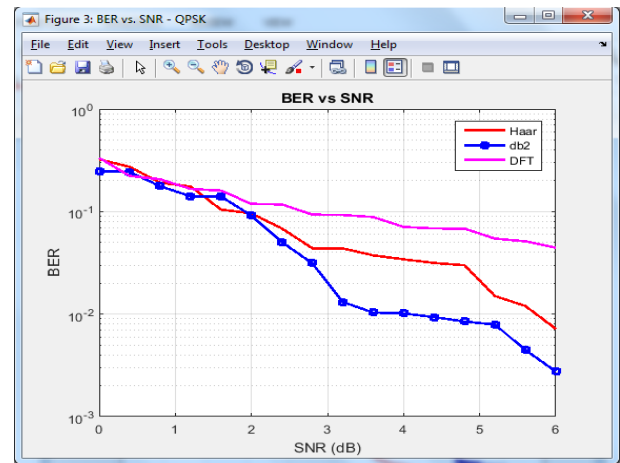


Figure 5.3. BER performance of wavelets and DFT based OFDM system using QPSK modulation.

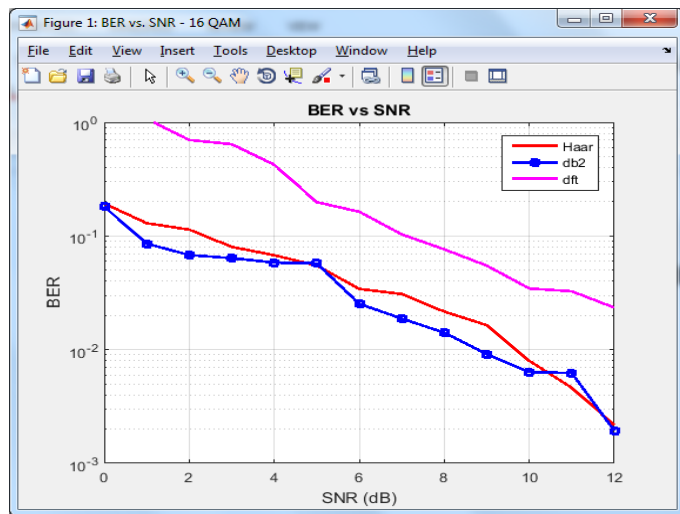


Figure 5.1. BER performance of wavelets and DFT based OFDM system using 16- QAM modulation.

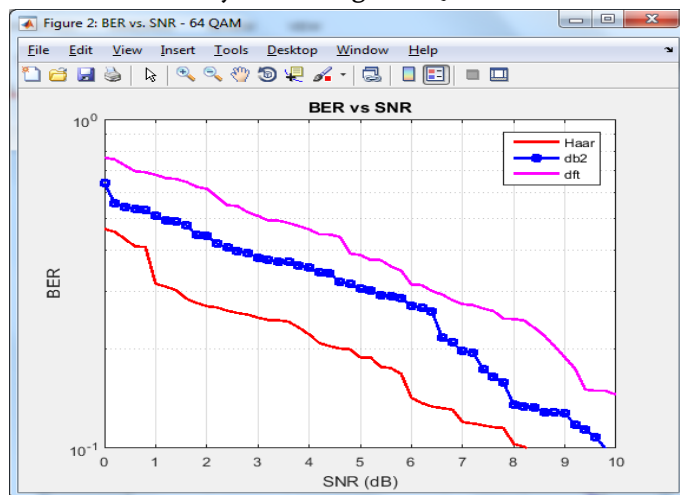


Figure 5.2. BER performance of wavelets and DFT based OFDM system using 64- QAM modulation.

## VI. Conclusion and Scope of Further Work

In this paper we analyzed the performance of wavelet based OFDM system and compared it with the performance of DFT based OFDM system. Thus in this proposed system, we analyzed the performance of the system based on the wavelet based OFDM system and the proposed system is compared with the performance of DFT based OFDM system. The performance of the proposed system which shows that the proposed system which gives better results than the DFT based OFDM system. In wavelet based OFDM different types of filters can be used with the help of different wavelets available. Wavelet based OFDM at the place of Discrete Fourier Transform (DFT) can be used with more accuracy.

# RFID Based Automatic Student Attendance and Parent SMS Notification System

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## ABSTRACT

Attendance plays very important role in many fields. Manual attendance system is used to monitor login and logout information of employees or students in various organizations. But that system is not accurate. This paper elaborates the implementation of RFID Based Automatic Student Attendance and Parent SMS Notification System. RFID based attendance system is designed using .Net and database. RFID Database is used to send alert to parents about absent student as well as to keep the attendance. This paper gives clear idea that how we have implemented RFID based automatic student attendance and parent sms notification system.

**Keywords:** RFID, Attendance System, RFID tags, Students, SMS

## I. INTRODUCTION

The current attendance framework is manual and it expends parcel of time. In numerous businesses organisations attendance is utilized to note down the participation of their workers or employees. In manual system papers are used to maintain attendance record. In college or universities, attendance is taken by professors manually on the paper. One method is Professor roll call the roll number and the student gives attendance by responding to it. The second method is that students do sign on the paper and it is possible that one student can make the proxy for other students. This is the problem in the manual system. To eliminate this problem RFID based automatic student attendance system is proposed.

This new system will use RFID cards. Organisation can provide Identity card cum RFID card to students which small in size. Student has to show this card to card reader on entrance of the college. Organisation can place this reader on entrance so that student can show the card to reader while entering into the

college and while going to home. Advantage of RFID based attendance system is that card does not need to be inserted in machine like we do in other systems. We swap cards, while swapping card should be inserted in machine. But in RFID based system student can keep the card in wallet. Student can take wallet near to the reader and card will be accepted by reader.

## II. History of RFID

On January 23, 1973 Mario W. Cardullo claims to have received the first patent for an active RFID tag with rewritable memory.

The team of the scientists who have developed RFID based detection system of US government in 1970 founded own company and developed automatic road toll pay system which became popular later.

In 1990 IBM developers developed RFID system with longer read range up to 20 feet.<sup>[1]</sup>

### III. Overview of RFID Technology

Basically RFID systems consists of 3 basic core components –

1. RFID tag
2. RFID Reader
3. Controller

**RFID TAG:** Tag is the transponder which consists of battery and semiconductor chip. Battery life is limited in tag. Active tag has on board battery whereas passive tag is smaller and cheaper because it has no battery. Tag contains three parts integrated circuit, antenna and DC power. [2]

**READER:** RFID Reader is read write device which contains antenna RF and control electronic module. Readers can be mounted anywhere to interrogate various objects.

**CONTROLLER:** Controller is the host software which controls database and working of RFID system. [3]

### IV. Proposed System

The design and development of RFID Based Automatic Student Attendance and Parent SMS Notification System aims to provide an interface for the parent to monitor their child’s attendance to college; specifically has the following functionalities:

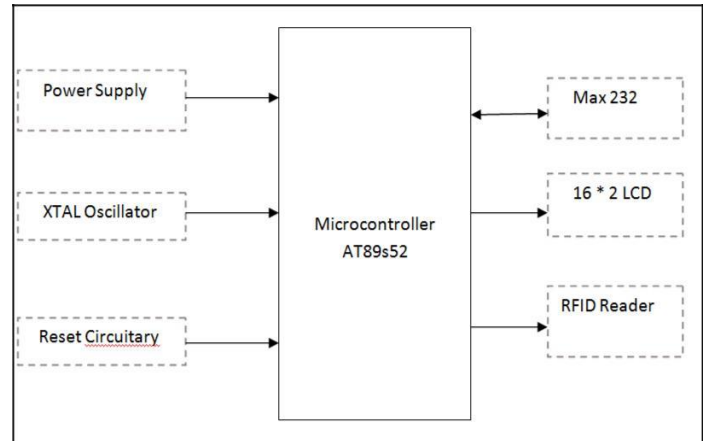
#### Window-based System

- ✓ A system that will record the student’s attendance.
- ✓ Web based system can be used from remote location.
- ✓ A system that will create an account for parents to have an access to the parent portal

#### SMS Notification Sending System

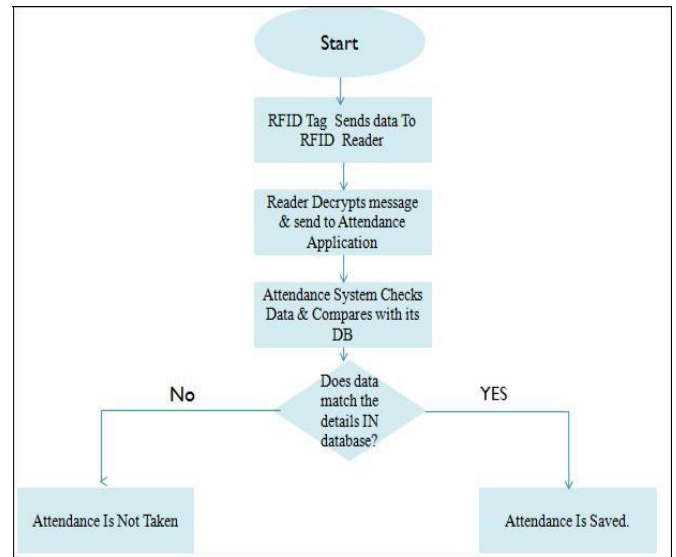
Send an SMS to the parents telling them if their son/daughter is absent.

#### Block Diagram



Block diagram shows block of components used in this system. Power supply, XTAL Oscillator, Reset circuitry, RFID reader and Microcontroller are the major components.

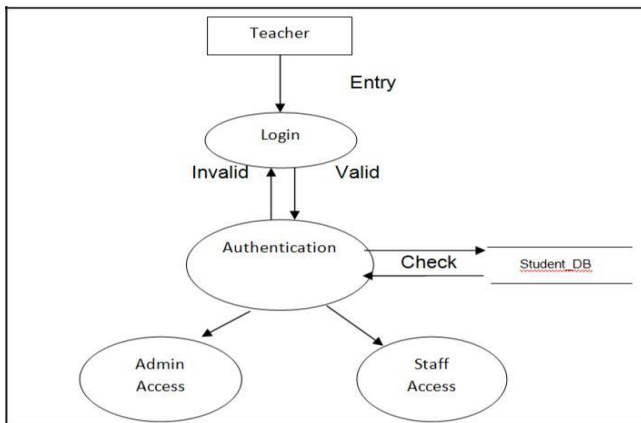
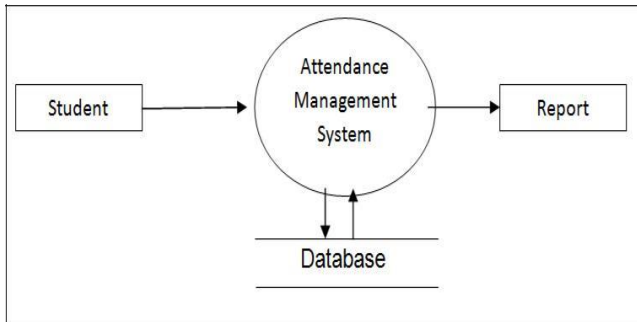
#### Flow Chart of the System



Flow chart diagram shows that RFID tag send data to RFID reader. Reader reads that data and decrypts message and sends attendance to application. RFID Based Automatic Student Attendance and Parent SMS Notification System checks data and compare with its database. If data is matched with details in database

then attendance is saved otherwise attendance will not be taken.

### Data Flow Diagrams



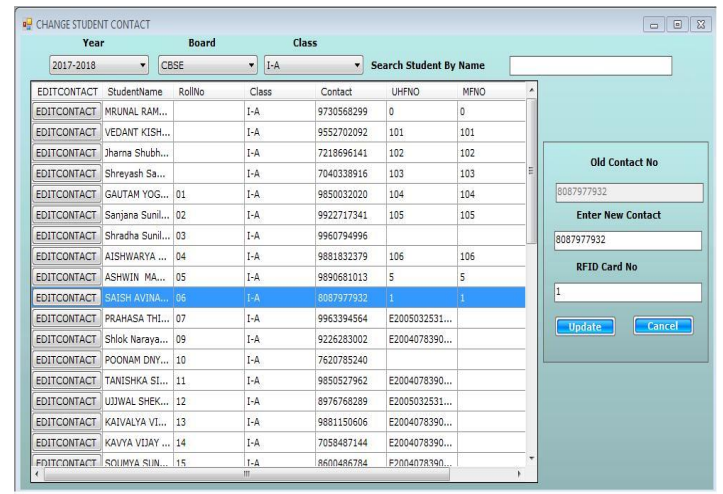
### V. Implementation

Column Name	Data Type	Allow Nulls
AttendanceLogId	int	<input type="checkbox"/>
AttendanceDate	datetime	<input checked="" type="checkbox"/>
StudentId	int	<input checked="" type="checkbox"/>
InTime	datetime	<input checked="" type="checkbox"/>
OutTime	datetime	<input checked="" type="checkbox"/>
Status1	nvarchar(50)	<input checked="" type="checkbox"/>
SMSIn	nvarchar(50)	<input checked="" type="checkbox"/>
RecordStatus	nvarchar(50)	<input checked="" type="checkbox"/>
IsUploaded	nvarchar(50)	<input checked="" type="checkbox"/>
MachineIp	nvarchar(150)	<input checked="" type="checkbox"/>
FingerId	nvarchar(50)	<input checked="" type="checkbox"/>

Column Name	Data Type	Allow Nulls
MachineNo	int	<input type="checkbox"/>
MachineName	nvarchar(100)	<input checked="" type="checkbox"/>
MachineIP	nvarchar(50)	<input checked="" type="checkbox"/>
INOUT	char(10)	<input checked="" type="checkbox"/>
SerialNo	varchar(50)	<input checked="" type="checkbox"/>

Column Name	Data Type	Allow Nulls
SRNO	int	<input type="checkbox"/>
fingerid	nvarchar(50)	<input type="checkbox"/>
chktime	datetime	<input checked="" type="checkbox"/>
SN	nvarchar(100)	<input checked="" type="checkbox"/>
Status	nvarchar(1)	<input checked="" type="checkbox"/>
PunchDate	datetime	<input checked="" type="checkbox"/>
AntennaNo	nvarchar(50)	<input checked="" type="checkbox"/>
IP	nvarchar(50)	<input checked="" type="checkbox"/>

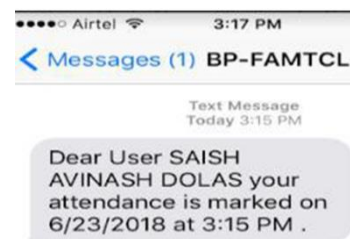
### Change Student Contact Form



### Class wise Report

SANSKAR GURUKUL CBSE SCHOOL																																
ATTENDANCE REPORT OF CLASS I A MONTH January																																
S.No.	Student Name	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	KANVIA VINOD JOSHI	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
2	SHIKH NARAYAN SHINDE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
3	SHARDUL DATTATRAY CHORBADE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
4	SOOBY VENKATESH SACHINRAO	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
5	KRISHNARAJ SATISH KUMHDE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
6	PARIKSHIT SANDIP PANDE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
7	ASHWINI MANISH DATAL	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
8	SUSHANVINDR DOL	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
9	KULSHANESH TALARE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
10	SHRIRAM NITIN KULKARNI	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
11	MRUNAL RAJKRISHNA LODHE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
12	YEDHAALPESH HELAM	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
13	YASHVIKA SURESH HANSE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
14	NAVYA KISHORSHIKHARJESHA	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
15	KRISHNA MANISH NEHRE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
16	SARTHAK CHANDRANANTH	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
17	SACHIN YOGESH SURESHRAO	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
18	KAVESH SHASHIKUMAR PATIL	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
19	PRANASA THAMMA REDDY SAUNKA	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
20	KARTHIK ABRHAM SHINDE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
21	ASHWINEKA VINODSUNIL DARBARE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
22	KANVIA VINOD SHINDE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
23	SHABANTOSH HANSE	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
24	SOURAB SUNIL KARDAM	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
25	ALPITA SAMIR KARAN	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
26	PAARVI JYOTHI KARNIK	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
27	ADITHYAN SHEKHAR JADHAV	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
28	Sannidhya Yogesh Chaudhari	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
29	Shreyash Sambhaji Sinde	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	

### SMS Notification



## **VI. CONCLUSION**

As the RFID technology advances more sophisticated applications will be designed and implemented with capability of more accurate reading, writing of data, more range. In this paper we presented application designed by us which can be used to store attendance record of student and able to send sms notification to parents. This application is RFID based and student has to carry RFID card.

## **VII. REFERENCES**

- [1] Chirag S. Khandhar. 2018. International Journal of Advanced Research in Electrical, Electronics and Instrumentation. (March 2018), ISSN (Online): 2278 –8875
- [2] L. Sandip, “RFID Sourcebook”, IBM Press, USA, (2005) ISBN: 0-13-185137-3.
- [3] Intermec, “ABCs of RFID: Understanding and using radio frequency identification”, White Paper, (2009).
- [4] Mohd Firdaus Bin Mahyidin (2008). Students’ attendance system using RFID technology. Malaysia.
- [5] Dawes A.T. (2004),”Is RFID Right for Your Library”, Journal of Access Services, Volume 2(4)
- [6] RFIDSensNet Lab (2005), A white paper on Automatic Attendance System. Texas A & M University, Texas, USA.
- [7] Bardaki, C., Kourouthanassis, P. and Pramataris, K., (2012), Deploying RFID-Enabled Services in the Retail Supply Chain: Lessons Learned toward the Internet of Things, Information Systems Management, Vol. 29: no.3, pp. 233-245.
- [8] Nambiar A.N. (2009),” A supply chain perspective of RFID Systems”, World Academy of Science, Engineering and Technology Journal, Volume 6, pp1-5.

# Facial Emotion Recognition using Concept Mapping and Feature Extraction

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## ABSTRACT

In recent years there has been a rapid growth in study of emotions. Humans use facial expression as a non-verbal communication channel. Human Computer Interaction(HCI) is a developing and interesting field and is useful for further development in recent technology. We have developed a computer vision system that recognizes human expressions based on various action units of upper and lower face parts. Firstly, the face is detected from the input video clip then preprocessing, feature extraction is done and the classification of expression is obtained. Six primary expressions happiness, sadness, fear, disgust, surprise and anger are classified using Facial Action Units. Our process considers Facial Action Coding System(FACs) for classification. Concept Map is used to improve the expression classification accuracy, speed of execution and to reduce the confusion between emotions.

**Keywords :** Facial Expression, Human-Computer Interaction(HCI), Video, Concept Map, Facial, Action Units

## I. INTRODUCTION

Identifying the facial activities in a video sequence is an interesting and a major challenging problem. Presently, many techniques have been developed for the recognition of the facial expressions. Computer should be made more intelligent for an efficient HCI like the way human interact with other human. Humans interact mostly through speech and some physical gestures which provides sensitive cues about facial emotion and are vital for human interaction and non-verbal communication [Automated Facial Expression Recognition Based on FACS Action Units].

The availability of low cost imaging and computational devices are helpful in automatic facial recognition systems to be used in several day-to-day application environments. Emotions are a feeling to a particular situation, as one smile to show greeting,

raise voice when they are angry, frown when they are not pleased. This is because we are able to understand other emotions and interact based on that expression, but computers are emotionally challenged, they need someone to teach them those expressions. Machine with the capability to interact with humans will lead to a better Human Computer Interface. By enhancing the communication that exist between humans and computers we will open variety of possibilities in robotics and human computer interaction.

Facial expressions are recognized by certain facial movements depending on the emotional state of humans. The basic need for the identification of facial expression is Face detection, it is followed by feature extraction which helps us to extract relevant features like eyes, nose, eyebrows and mouth from face. Depending upon the features extracted the facial expression is classified.

## II. LITERATURE SURVEY

In [11], Velusamy, Sudha, et al have proposed a feature descriptor which is effective in representing the Facial action units(AUs) by considering only the informative region of interest(ROI) on human face. They had performed an in-depth analysis of the state-of-art FER methods to understand their performance gaps under practical conditions. It develops an appropriate ROI selection strategy for every AU and also designed robust Local Binary Pattern(LBP) based descriptor that applies spatially spinning bin support for histogram estimation. Their method is robust in handling challenges likes tracking errors and achieved an advanced performance. an appropriate ROI selection strategy for every AU and also designed robust Local Binary Pattern(LBP) based descriptor that applies spatially spinning bin support for histogram estimation. Their method is robust in handling challenges likes tracking errors and achieved an advanced performance.

In [10] Maninderjit Singh, Anima Majumder and Laxmidhar Behera proposed a hierarchical technique for modelling emotions from facial expressions images using Bayesian Network.

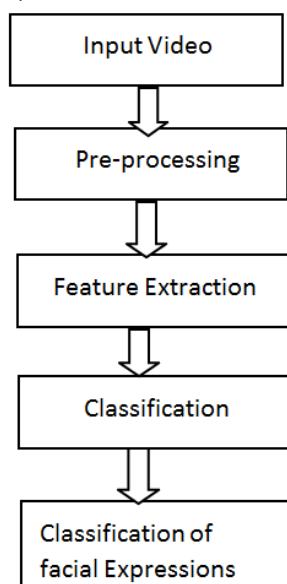


Fig 1: Basic Flow of Facial Expression Recognition System

Probabilistic modelling is used to train the network that draws relationship between facial features, AUs and finally detect six basic emotions. Extended Cohn-Kanade dataset is used which has 327 instances of image sequences from 123 subjects with peak emotions, annotated landmarks and AUs. An average emotion recognition accuracy of 95.7% is achieved.

In [2] Yang Li has introduced a new face recognition algorithm that depends on adaptive 3-D Local Binary Pattern and Singular Value Decomposition technique. This method can successfully extract features of face images with faster recognition rate than other traditional algorithms, they have concentrated on the set of discriminate vectors obtained from test samples as initial knowledge. FEGCv2.0 face database is used which contains 2D face images as well as 3D face images having different expression of different people. In [3] Latif, M.H,Md.yusof, H.,Sidek,S.N and Rusli,N proposed a method for affective states recognition depended on frontal face(supraorbital, periorbital, mouth and nose region) thermal images. The GLCM features derived from the PCA of the four-level decomposition of 2D-DWT (Daubechies4 Mother wavelet) and LBP features are used to provide useful information related to the affective states.it classified six basic emotions depend on Ekman's Emotion Model exploiting the frontal face thermal images. Thermal image dataset is used which includes six different expression of emotions derived from 30 subjects.

In [9] El Meguid, Mostafa K, Abd and Martin D.Levine discusses the implementation and design of a fully automated comprehensive facial expression detection and classification schema. Proprietary face detector (PittPatt) and a novel classifier including a set of Random Forests paired with support vector machine labellers is used. In addition, this approach achieved real-time performance in a spontaneous environment. For training purpose the acted still-image Binghamton University 3D Facial Expression database was used, while a number of spontaneous



expression labelled video database were used for testing.

In [8] Gaus, Yona Falinie A., et al presented an automatic affective dimension recognition system which depends on wavelet filtering and PLS regression for naturalistic facial expressions. Proposed approach is tested on the Audio/Visual Emotion Challenge (AVEC 2014) dataset, the audio and video recordings were divided into three partitions: training, development and testing set of 150 Northwind-Freeform pairs, In total 300 task recordings.

### III. CHALLENGES

The challenges related with face expression recognition can be specified as below:

**Occlusion:** Face may be partially obstructed by other objects. In an Image is the face is obstructed by some other face part or object like mask, glasses or hairs etc. In such case the extraction of expression features is complex.

**Pose:** The relative camera and face position has a major impact on image of face. There can be a case in which the face has a distinct angle so some facial features such as nose or eyes may become partially or whole occluded. A good pre-processing technique implementation which are invariant to translation, rotation and scaling helps us overcome the above challenges.

**Illumination:** If the images are taken in different light shades. Then the expression feature can be detected inaccurately and that results in a lower rate of facial expression recognition and thus lead to difficulty in the process of feature extraction. To deal with the variation of light in an input image, image preprocessing techniques like DCT normalization, Histogram Equalization, Rank Normalization can be applied before feature extraction.

### IV. PROPOSED APPROACH

The system is working in following phases:

1. Acquiring Video clip as Input
2. Framing of clip
3. Preprocessing
4. Feature Extraction
5. Classification

#### a) Framing

For input of the expression recognition system, Video clips are randomly taken from YouTube and GitHub database. Firstly, the video clip is divided into number of frames. Xuggler library is used for framing, it allows java programs to modify any format of video. The video is framed at every 0.1th second with the help of Xuggler library. These frames are further used as input to the facial expression system.

#### b) Preprocessing

In this step, the facial features like face, eyes, nose and mouth is detected from each video. The haar like features (digital image features) are used to detect face, eyes, nose and mouth [11,12], with these features, detection accuracy is improved with less computation time [13]. Haar feature is a single value which is obtained with calculation of pixels. Adjacent rectangular area at a specific location of image is considered for Haar like feature calculation. Then the pixel intensities in each separate region is added and the difference between the sums is obtained. This difference is used as a feature to differentiate the subsections of an image.

#### Face detection process:

The Video clip is given as input to the system which gets divided into frames and later the face, eyes, nose and mouth is detected.

- i. Load the required XML classifiers OpenCV as of now contains numerous pretrained classifiers for confront, eyes, grin and so forth.
- ii. Load input picture in grayscale design.

iii. Use `vz.CascadeClassifier.detectMultiScale()` to discover faces or eyes

Once get areas, make Region of Interest (ROI) for confront and apply eye recognition on the ROI

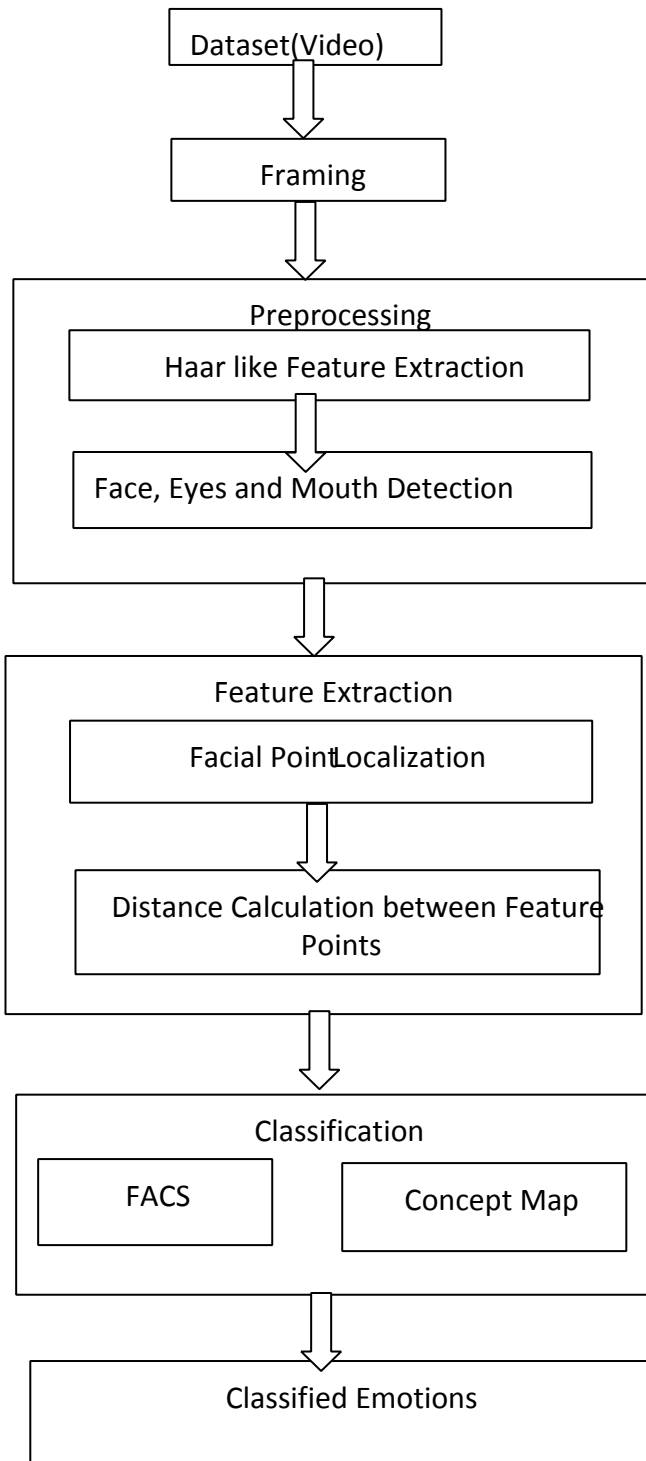


Fig 2: Proposed System Architecture

iv. If faces are discovered, it restores the situation of distinguished faces as  $Rect(x, y, w, h)$

### c) Feature Extraction

In this progression, highlights of eyes, mouth and face are extricated with following strategies:

**Feature point Localization:** In this progression, boundaries are distinguished and include focuses are restricted on eyes, eyebrows, lips, cheek and nose. Feature point localization is the vital advance for feature extraction. This will assist us with calculating the feature vector. Feature point localization [14] is an iterative technique which at first gauges the underlying position of feature points. At that point look through the neighbouring vertices around each element point on a face picture. In this framework, 17 Feature points are utilized as appeared in figure 3, including:

- 6 Points on Left and Right eyebrows
- 4 Points on left and right eyes corner
- 2 Points on left and right upper eye covers
- 1 Points on nose 2 Points on left and right cheeks 2 Points on lip corners.

This framework makes utilization of Flandmark model for localization pf points. For each frame, Flandmark\_model.dat file is call to put 17 focuses on face legitimately.

### Feature Vector Formation:

Here, distance between [15, 16] each feature point is ascertained for each frame picture. As the separation between feature points fluctuates in all condition of emotion and expression. In this manner this feature vector assumes critical part in feeling recognizable proof framework. This separation is figured based of X and Y directions of each component point. Every

one of these separations are put away in vector arrange. This feature vector is utilized to choose the emotion label and action unit of each frame.

**Feature Vector taken as follows:**

FV = {d1, d2, d3, d4, d5, d6, d7} Where, d1 = Distance amongst F1 and F6 d2 = Distance amongst F3 and F4 d3 = Distance amongst F2 and F8 d4 = Distance amongst F5 and F11 d5 = Distance amongst F13 and F16 d6 = Distance amongst F14 and F16 d7 = Distance amongst F15 and F17

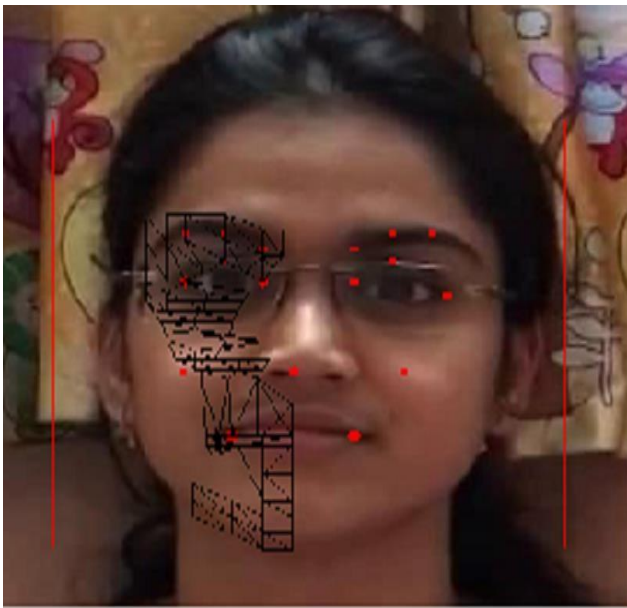


Fig 3: Facial Feature Points

For each picture, we have to distinguish the emotion label. This emotion label is processed with the assistance of FACS [17] and feature vector of each picture. The action units of upper face and lower face are delineated in figure 4 and 5 individually.

NEUTRAL	AU 9	AU 10	AU 20
Lips relaxed and closed.	The infraorbital triangle and center of the upper lip are pulled upwards. Nasal root wrinkling is present.	The infraorbital triangle is pushed upwards. Upper lip is raised. Causes angular bend in shape of upper lip. Nasal root wrinkle is absent.	The lips and the lower portion of the nasolabial furrow are pulled back laterally. The mouth is elongated.
AU 12	AU 15	AU 17	AU 25
Lip corners are pulled obliquely	The corners of the lips are pulled down.	The chin boss is pushed upwards.	Lips are relaxed and parted.
AU 26	AU 27	AU 23+24	AU 9+17
Lips are relaxed and parted; mandible is lowered.	Mouth stretched open and the mandible pulled downwards.	Lips tightened, narrowed, and pressed together.	
AU 9+25	AU 9+17+23+24	AU 10+17	AU 10+25
AU 10+15+17	AU 12+25	AU 12+26	AU 15+17
AU 17+23+24	AU 20+25		

Fig 4: Action units of Lower face [18]

NEUTRAL	AU 1	AU 2	AU 4
Eyes, brow, and cheek are relaxed.	Inner portion of the brows is raised.	Outer portion of the brows is raised.	Brows lowered and drawn together.
AU 5	AU 6	AU 7	AU 1+2
Upper eyelids are raised.	Cheeks are raised.	Lower eyelids are raised.	Inner and outer portions of the brows are raised.
AU 1+4	AU 4+5	AU 1+2+4	AU 1+2+5
Medial portion of the brows is raised and pulled together.	Brows lowered and drawn together and upper eyelids are raised.	Brows are pulled together and upward.	Brows and upper eyelids are raised.
AU 1+6	AU 6+7	AU 1+2+5+6+7	
Inner portion of brows and cheeks are raised.	Lower eyelids cheeks are raised.	Brows, eyelids, and cheeks are raised.	

Fig 5. Action units of Upper face [18]

The NetBeans (variant 6.9) is utilized as development tool. The system doesn't require any specific hardware to run; any standard machine is equipped for running the application. For framing of video FFmpeg tool is utilized and for Face detection, Haar like features [25] are extracted by utilizing the OpenCV library.

Figure 6 portrays the outcome correlation of classifiers utilized for influence acknowledgment. Classification time is estimated as far as milliseconds. Concept Map is speedier than SVM, since it does not get confused to classify the confusing emotions.

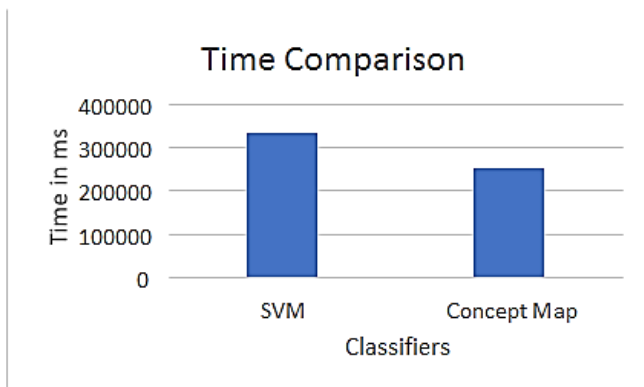


Fig 6: Time Comparison

Figure 7 portrays the precision correlation of Concept Map and SVM classifier. Exactness is estimated as a false rate. Concept Map precisely orders the feelings like happy, sad, disgust, fear, surprise and angry based on action units. Along these lines, Concept Map is more precise than SVM.

#### d) Classification with Concept Map.

Here, the test video is ordered by 6 emotions portrayed in table 1. Test video is likewise experiencing framing, preprocessing and feature extraction steps. For classification, Concept Map [19] and FACS is utilized. After feature extraction of all frames of information video, among feature, individual value and distinguished emotion label. This progression is rehased for all frames. This information is dealt with as training data. For test video, concept map is produced which is classified against the trained concept map. It will restore the fitting emotion label of test video.

## V. RESULTS AND DISCUSSION

The system is fabricated utilizing Java framework (version jdk 6) on Windows stage.

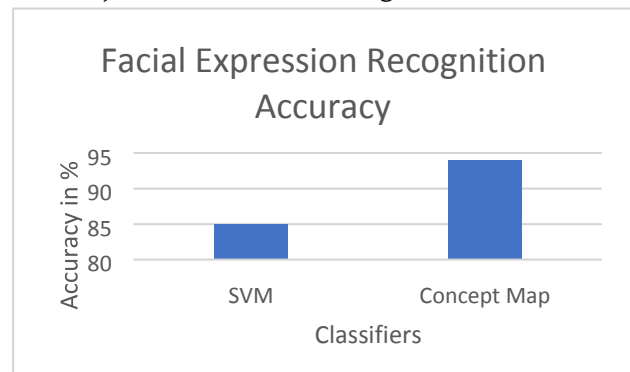


Fig 7: Facial Expression Recognition Accuracy

## VI. CONCLUSION

This Paper shows the human facial expression recognition system for given input video. Framework consolidates different strategy to achieve the high recognition rate. At first, framework makes utilization of Xuggler library for framing, after this Haar like highlights are utilized for Face recognition, at that point FACS and feature points are utilized for feature extraction and at last Concept map is used to fitting characterization of human feeling in given video. This system achieves higher speed and precision than SVM classification algorithm.

## VII. REFERENCES

- [1] Kim, Jonathan C., and Mark A. Clements, "Multimodal affect classification at various temporal lengths," *IEEE Transactions On Affective Computing* 6.4, 2015, pp. 371-384.
- [2] Li, Yang. "Novel face recognition algorithm based on adaptive 3D local binary pattern features and improved Singular Value Decomposition method." *Inventive Computation Technologies (ICICT), International Conference on*. Vol. 3. IEEE, 2016.

- [3] Latif, Mohd, Shahrul Na'im Sidek, and Nazreen Rusli. "Texture descriptors based affective states recognition-frontal face thermal image." (2016): 1-6.
- [4] M. Z. Uddin; M. M. Hassan; A. Almogren; A. Alamri; M. AlRubaian; G. Fortino, "Facial Expression Recognition Utilizing Local Direction-based Robust Features and Deep Belief Network," in *IEEE Access*, vol. PP, no.99, pp.1-1.
- [5] Matlovic, Tomas, et al. "Emotions detection using facial expressions recognition and EEG." *Semantic and Social Media Adaptation and Personalization (SMAP)*, 2016 11th International Workshop on. IEEE, 2016.
- [6] Mayya, Veena, Radhika M. Pai, and MM Manohara Pai. "Combining temporal interpolation and DCNN for faster recognition of micro-expressions in video sequences." *Advances in Computing, Communications and Informatics (ICACCI)*, 2016 International Conference on. IEEE, 2016.
- [7] Das, Arundhati, Mameeta Pukhrambam, and Ashim Saha. "Realtime robust face detection and tracking using extended haar functions and improved boosting algorithm." *Green Computing and Internet of Things (ICGIoT)*, 2015 International Conference on. IEEE, 2015.
- [8] Gaus, Yona Falinie A., et al. "Automatic affective dimension recognition from naturalistic facial expressions based on wavelet filtering and PLS regression." *Automatic Face and Gesture Recognition (FG)*, 2015 11th IEEE International Conference and Workshops on. Vol. 5. IEEE, 2015.
- [9] El Meguid, Mostafa K. Abd, and Martin D. Levine. "Fully automated recognition of spontaneous facial expressions in videos using random forest classifiers." *IEEE Transactions on Affective Computing* 5.2 (2014): 141-154.
- [10] Singh, Maninderjit, Anima Majumder, and Laxmidhar Behera. "Facial expressions recognition system using Bayesian inference." *Neural Networks (IJCNN)*, 2014 International Joint Conference on. IEEE, 2014.
- [11] Velusamy, Sudha, et al. "Improved feature representation for robust facial action unit detection." *Consumer Communications and Networking Conference (CCNC)*, 2013 IEEE. IEEE, 2013.
- [12] Özmen, Gonca. "Facial expression classification with haar features, geometric features and cubic bézier curves." (2013).
- [13] Wilson, Phillip Ian, and John Fernandez. "Facial feature detection using Haar classifiers." *Journal of Computing Sciences in Colleges* 21.4 (2006): 127-133.
- [14] Viola, Paul, and Michael Jones. "Rapid object detection using a boosted cascade of simple features." *Computer Vision and Pattern Recognition*, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on. Vol. 1. IEEE, 2001.
- [15] Guan, Peng, Yaoliang Yu, and Liming Zhang. "A novel facial feature point localization method on 3D faces." *Image Processing, 2007. IICIP 2007. IEEE International Conference on*. Vol. 3. IEEE, 2007.
- [16] Punitha, A., and M. Kalaiselvi Geetha, "HMM Based Real Time Facial Expression Recognition," *International Journal of Emergine Technology and Advanced Engineering* 3.1 2013, pp. 180-185.
- [17] Wang, Liwei, Yan Zhang, and Jufu Feng. "On the Euclidean distance of images." *IEEE transactions on pattern analysis and machine intelligence* 27.8 (2005): 1334-1339.
- [18] Tian, Y-I., Takeo Kanade, and Jeffrey F. Cohn. "Recognizing action units for facial expression analysis." *IEEE Transactions on pattern analysis and machine intelligence* 23.2 (2001): 97-115.
- [19] Lien, James J., et al. "Automated facial expression recognition based on FACS action units." *Automatic Face and Gesture Recognition*, 1998. Proceedings. Third IEEE International Conference on. IEEE, 1998.
- [20] Novak, Joseph D., and Alberto J. Caas. "The theory underlying concept maps and how to construct and use them." (2008).

# Effect of Organophosphate Pesticides on The Oxygen Consumption of A Freshwater Leech, *Hirudo Birmanica* (Blanchard)

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## ABSTRACT

The present study was conducted to track changes in the rate of oxygen consumption freshwater leech *Hirudo birmanica* exposed to sublethal concentration of malathion (0.98 ppm at 96 h) and monocrotophos (1.2 ppm at 96 h). The gradual depletion was observed in oxygen consumption rate after initial couple of hours.

**Keywords :** *Hirudo birmanica*, Malathion, Monocrotophos, Oxygen consumption.

## I. INTRODUCTION

The pollution of aquatic ecosystem with chemical contaminants has become critical environmental concern. The freshwater animals including medicinally important leeches are adversely affected by agricultural pesticides. Pesticide is defined by United Nations Environment Programme (UNEP, 2005) as any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. The health of aquatic ecosystem is being adversely affected due to indiscriminate use of pesticides. Such pesticides reach to aquatic ecosystem through rains, wind and surface runoff.

Malathion (O,O-dimethyl phosphorodithioate of diethyl mercaptosuccinate) and monocrotophos are synthetic organophosphate, non-systemic, broad spectrum insecticides are extensively used in agriculture and household practices for pest eradication. These organophosphates are highly toxic to non-target organisms. Both represent major source of environmental pollution. Organophosphate pesticides are highly soluble in water and can therefore easily contaminate aquatic ecosystem, thereby increasing the exposure risk of aquatic flora

and fauna (Agdi *et al.*, 2000). Once malathion is introduced into the environment, it may cause serious intimidation to the aquatic organisms and is notorious to cause severe metabolic disturbances in non-target species (USEPA, 2005 Ojha *et al.*, 2011).

Leeches are medicinally important animals which are adversely affected by pesticide pollution in freshwater ecosystem. Leeches are hermaphrodite which carries both the male and female reproductive organs. For the present study, *Hirudo birmanica* were selected as a test animal.

Assessment of rate of oxygen consumption is an important parameter to assess and understand the physiological state of metabolic activity of an organism and the toxicants stress on aquatic organisms. Since it is also an index of energy expenditure to fulfill the demands due to environmental and biological alterations (Nagabhushnam and Kulkarni, 1981; Kale and Kulkarni, 2003).

The present work is aimed to observe changes in oxygen consumption of a freshwater leeches *Hirudo birmanica* exposed to malathion and monocrotophos.

## II. METHODS AND MATERIAL

The freshwater leeches *Hirudo birmanica* (length  $10 \pm 1$  cm and weight  $8 \pm 0.5$  gm) were procured from freshwater ponds around Partur Dist. Jalna. These leeches were acclimatized to the laboratory conditions in wet mud for 10-15 days at a room temperature ( $27 \pm 2^\circ\text{C}$ ) prior to the experiment. 10 leeches were exposed to 96 h LC50 (0.98 ppm) concentration of malathion and monocrotophos (1.2 ppm) to quantify their oxygen consumption rate by standard Winkler's method (Welsh *et al.*, 1968). The quantity of oxygen consumed was calculated in relation to the unit wet weight of animal and the values obtained were expressed as the rate of oxygen consumed in  $\mu\text{l/h/l/g}$  body weight. The data was statistically analysed using student 't' test

## III. RESULTS AND DISCUSSION

In general, the rate of oxygen consumption of poikilothermic animals is highly complex process and it is subjected to the influence of various extrinsic and intrinsic factors. The respiration rate of animal is an indicator of environmental stress (Capuzzo, 1977). The results of the present study show oxygen consumption rate was decreased in both organophosphate pesticides exposure after initial couple of hours. In exposure of malathion it shows depletion in 4 h 6 h 8 h 10 h and 12 h for -09.86% - 14.75%, -23.65%, -36.43%, -44.29% respectively in compare to control, where in initial two hours it shows elevation in oxygen consumption viz. +41.13% and +63.92% for 1 h and 2 h respectively. Similar depletion was observed in monocrotophos exposure for 4 h 6 h 8 h 10 h and 12 h at -12.21% -15.68%, -19.84%, -32.54%, -38.86% respectively in compare to control and elevation in first couple of hours was also observed 31.62% as and +45.94%). The observed values of oxygen consumption rate are presented in Table no. 1.

Leeches increase their respiration by undulating movement while adhering to the vegetation with the posterior sucker. They have haemoglobin in the haemoelomic fluid and use oxygen normally. The present study showed that the normal respiratory rate of *Hirudo birmanica* was affected due to sublethal exposure of Malathion (0.98 ppm) and Monocrotophos (1.2 ppm). Oxygen consumption rate of *Hirudo birmanica* was constantly decreased from 4 h to 12 h of exposure to both the pesticides which shows as the period of exposure is increase the rate of oxygen consumption is decrease.

The pesticides alter the rate of respiratory metabolism in invertebrates are reported in somewhat detail. Mane *et al.*, (1984) observed decrease in the respiratory activity, when freshwater bivalve molluscs exposed to cythion-malthion. *Metapenaeus monoceros* a marine prawn was exposed to phosphomidon, DDT and fenvalerate, showed significant reduction in oxygen consumption rate (Reddy 1987). Sagar (1989) noted that malathion produced a significant hike in the rate of oxygen consumption for the first couple of hours and after that it reduced when another freshwater leech was *Poecilobdella granulosa* exposed to malathion. Jaiswal *et al.*, (1990) reported constant decline in the rate of oxygen consumption of a crab *Barytelphusa cunicularis* after exposure to the organophosphate pesticide. Chaudhari (1997) reported the significant decline in oxygen consumption rate in *Hirudo birmanica* when exposed to endosulfan. Changes in respiration rate indicate the probable modulations in the metabolism of the animals (Kondekar, 1998). There was an elevation in the rate of oxygen consumption for the first two hours when *H. birmanica* exposed to malathion and monocrotophos, as the exposure period increase the rate of oxygen uptake gradually decreased with a severe fall after four hours and continued till the animal death. This variation in oxygen consumption is due to impaired

oxidative metabolism and stress caused by toxicants (Pakhare, 2017).

**Table 1 :** The rate of oxygen consumption ( $\mu\text{l/g/h/l}$ ) of *H. birmanica* exposed to sublethal exposure of Malathion and Monocrotophos at 96 h.

Concentration (in ppm)	% change after.....hours						
	1	2	4	6	8	10	12
Control	22.2 3 ± 0.40 *	22.2 8 ± 0.36 *	22. 39 ± 0.3 4*	22. 46 ± 0.2 5*	22. 51 ± 0.2 0*	22. 56 ± 0.1 7*	22. 59 ± 0.1 4*
Malathion 0.98 ppm	+41. 13	+63. 92	- 09. 86	- 14. 75	- 23. 65	- 36. 43	- 44. 29
Monocrotophos 1.2 ppm	+31. 62	+45. 94	- 12. 21	- 15. 68	- 19. 84	- 32. 54	- 38. 86

[\* Values are the original values in  $\mu\text{l/g/h/l}$ ] [Values are significant at  $p < 0.05$ ]

#### IV. CONCLUSION

The present study reveals that malathion and monocrotophos interfere in respiratory metabolism leading to lowering of oxygen consumption rate which causes death of leeches.

#### V. ACKNOWLEDGEMENT

Authors are very much thankful to R.G Pradhan Head, Dept. of Zoology, L. B. S. Sr. College, Partur, Tq. Partur, Dist. Jalna and S.S. Shinde Head, Dept. of Zoology, Vivekanand College, Aurangabad for providing the necessary facilities during the present work.

#### VI. REFERENCES

- [1]. Agdi, K, Bouaid, A, Esteban, A.M, Hernando, PF, Azmani, A, Camara, C, (2000). Removal of atrazine and four organophosphorus pesticides from environmental waters by diatomaceous earth remediation method. *J. Environ. Monit.* 2(5), 420-423.
- [2]. Capuzzo, J. N. (1977): The effects of free chlorine and chloramines on growth and respiration rates of larval lobsters *Homarus americanus*. *Water. Res.* 11:1021-1024.
- [3]. Chaudhari P. D. (1997): Histomorphological and physiological changes induced by organic and inorganic pollutants in the freshwater leech *Hirudo birmanica* (Blanchard). PhD. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- [4]. Jaiswal, K., Naidu, D., Deshmukh, B. D. and Sarojini, R. (1990): Exposure to organophosphorus insecticide (Ekalux EC 25) alters oxygen consumption in the freshwater crab, *Barytelphusa cunicularis*. *Uttarpradesh J. Zool.* 10(1): 108-110.
- [5]. Kale M. and Kulkarni G. K. (2003): Correlative changes in the cadmium bioaccumulation and oxygen consumption in a freshwater fish *Rasbora daniconius*. *J. Aqua. Biol.*, 18(1): 97-102.
- [6]. Kondekar (1998): Physiological responses of freshwater leech *Pecilobdella viridis* (Blanchard) to organic pesticidal pollutants. PhD. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
- [7]. Mane, U. H., Akarte, S. R. and Muley, D. V. (1984): Effect of cythion-malathion on respiration in three freshwater bivalve molluscs from Godavari River near Paithan. *J. Environ. Biol.* 5: 71-80.
- [8]. Nagabhushnam R. and Kulkarni G. K. (1981): Freshwater palaemonid prawn *Macrobrachium kistnensis* (Tiwari) effect of



- various heavy metals proc. *Indian Natn. Sci. Acad.* B47 (3): 380-386.
- [9]. Ojha A, Yaduvanshi SK, Srivastava N. (2011). Effect of combine exposure of commonly used pesticides on lipid peroxidation and antioxidant enzymes in rats tissues. *Pest Biochem Physiol* 99:148-156.
- [10]. Pakhare, N. B. (2017): Quinalphos Insecticide Induced Toxicity on Biochemical and Histopathological changes in freshwater fish, *Channa gachua* (Hamilton, 1822). PhD. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- [11]. Sagar C.R. (1989): Impact of some pesticidal pollutants on the physiological activities of a freshwater leech. PhD. Thesis, Marathwada University, Aurangabad.
- [12]. Reddy, M. S. (1987): Changes in respiratory potentials of the penaeid prawn *Metapenaeus monoceros* exposed to phosphamidon, DDT and fenvalerate. *Environ. Biol.* 5 (4): 643-650.
- [13]. UNEP. (2005): Ridding the world of Persistent Organic Pollutants: A guide to the Stockholm convention on persistent organic pollutants. United Nations Environment Programme, 11-13, Chemin des Anemone, CH-1219, Chatelaine, Geneva, Switzerland, p. 24.
- [14]. USEPA, 2005. United states environmental protection agency.
- [15]. Welsh, J. H., Smith, R. T. and Kamnar A. C. (Eds) (1968): Laboratory exercises in invertebrate physiology. 3<sup>rd</sup> Burgess Publ. Comp. Minneapolis, pp. 170-173.

# Design and Hardware Implementation of a Nine level Inverter with Less Switches Operating in Stand-Alone Mode

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## ABSTRACT

This paper presents a single-phase nine-level (9L) inverter configuration which can be suitable for grid-connected renewable energy systems. The proposed inverter is realized using a T-type neutral point-clamped inverter connected in series to a flying capacitor (FC) H-bridge. A self-voltage balancing based on superfluous switching state is developed and integrated with PWM controller, which is responsible for constrain the FC voltage at one-fourth of the input dc source voltage. The advance PWM technique employs the generation of 9L waveform without using any voltage sensor, thereby reducing the complicacy of the overall control scheme. In comparison to conventional and recent configurations, generation of the 9L waveform using a lower number of components is the notable contribution. Furthermore, a compendious comparison study is included which confirms the merits of the proposed inverter against those of other state-of-the art topologies. Finally, simulation results are included for validating the feasibility of the proposed system.

**Keywords:** Flying Capacitor, Nine-Level Inverter, Power Quality, Sensorless Voltage Control.

## I. INTRODUCTION

In recent days price of petroleum oil is increased and the environmental conditions are also becoming worst so that demand of electrical energy is increased. To supply this demand for electrical energy has elevated the need for generating energy from alternate sources. A simple three-level (3L) inverter presented by Nabae et al. [1] is one of the standard topology that has gained more attention. However, there are also some disadvantages like high switching frequency, high acoustic noise and for voltage levels greater than three level more number of dc sources are used due to that more power loss occurs [2]. The concept of multilevel inverters (MLI) has been introduced since mid-1970. The term multilevel originated with the three-level inverter. Subsequently, several multilevel inverter topologies continue to emerge, especially in the last two decades. Multi-Level inverters are power

conversion systems designed by power semiconductors and DC voltage sources that, when appropriately connected and controlled. They can generate a multiple-level-step voltage waveform with variable and controllable frequency, phase and amplitude [3].

Currently, some of the popular topologies that are considered as suitable for multilevel inverters. These are the cascaded H-bridge (CHB), neutral-point-clamped (NPC), modular multilevel converter (MMC), a flying capacitor and their variants [4], [5]. When the number of levels are increased, harmonic distortion increases. So that to achieve superior waveform quality more components are required. Which is profoundly impacts the inverter size and cost. Such inverters generate low harmonic waveforms; therefore they are most suitable for energy conversion applications to deliver efficient power to the loads

from renewable energy sources like photovoltaic systems [6-9]. Several innovative inverter topologies with a claim of a reduced part count (RPC) are reported in literature [10], [11].

The topology proposed in [12] can generate a Seven Level output voltage waveform with RPC. However it has disadvantage of unbalancing in capacitor voltage and control technique become more complex. An analyzed survey of applicable nine level inverters for distributed generation (DG) system is presented in [13]. Also, a new topology with a cascade connection of 5L active neutral-point-clamped (ANPC) and 3L floating capacitor (FC) H-bridge is proposed. A combination of CHB with FC H-bridge presented in [14] consists of one dc source and eight switches only. However, regulation of FC voltage at  $1/3V_{dc}$  requires additional circuit. A configuration which includes 5L double flying capacitor multicell (DFCM) converters cascaded with FC Hbridge is recommended in [15] to overcome the increased diversity factor in a DFCM converter. A nine level cross-connected intermediate level unit integrated with ANPC is introduced in [16]. Most of these topologies are hybrid combinations of one or more converter families (NPC, FC, and CHB). Many such hybridizations resulting in nine level RPC inverter these are reported in literature [17]–[19]. Although for same voltage levels, the topologies mentioned require a lesser number of components, higher complexity in control mechanism.

This paper presents the Nine-level inverter for single phase system using self-voltage balancing technique integrated PWM technique. The paper is organized as follows. Section II explains nine level inverter. Section III explains the comparative study of the inverter. Section IV explains experimental results with harmonic analysis and Section V summarizes the result.

## II. PROPOSED NINE-LEVEL INVERTER CIRCUIT DESCRIPTION

### A. Circuit Description

Fig. 1 shows the power circuit topology of the proposed nine level inverter. It consists mainly three units; a 3L TNPC cascaded with 3L FC H-bridge unit and two low-frequency switches (LFS) across the dc-link. With  $V_{dc}$  is the total input voltage, the voltages across the dc-link capacitors and FC are equal to  $V_{dc}/2$  and  $V_{dc}/4$  respectively. The idea of seriesing of TNPC with FC yields in the following advantage of less number of power switches, power diodes, and capacitors. Ideally, the inverter is capable of generating nine levels of output voltage:  $\pm V_{dc}$ ,  $\pm 3V_{dc}/4$ ,  $\pm V_{dc}/2$ ,  $\pm V_{dc}/4$ , 0. At a first sight, the series configuration of TNPC and FC with two LFS might seem unnoticeable. In the absence of a LFS unit, with the dc-link midpoint being the return path for the output current, the cascade combination of TNPC and FC can only generate five levels:  $\pm V_{dc}/2$ ,  $\pm V_{dc}/4$ , 0. As a result, it can combine output voltage with additional levels:  $\pm V_{dc}$  and  $\pm 3V_{dc}/4$ . For this, power switches are to be gated appropriately in a sequence. Table I summarizes all the possible switching combinations and their effect on the FC voltage. Assuming the devices to be ideal, FC is large enough and load as pure resistive, the active current path over a positive half cycle of the output voltage for each level is obtained as follows:

- 1) Maximum positive output ( $V_{dc}$ ): This voltage is designated as  $S_{4+}$ . Switches  $S_1$ ,  $S_3$ , and  $S_4$  are ON, connecting the terminal a to  $V_{dc}$ , and  $S_5^-$  is ON, connecting the terminal b to ground.
- 2) Three-fourth positive output ( $3V_{dc}/4$ ): Two switching configurations are available. For  $S_{31+}$ , switches  $S_1^-$ ,  $S_2^-$ ,  $S_3^-$ , and  $S_4$  are ON, connecting the terminal a to  $V_{dc}/4$ , and  $S_5^-$  is ON, connecting the terminal b to ground. Thus the voltage across the load is  $V_0 = V_{dc}/2 + V_{dc}/4 = 3V_{dc}/4$ . For  $S_{32+}$ , switches  $S_1$ ,  $S_2^-$ ,  $S_3$ , and  $S_4^-$  are ON, connecting the

terminal a to  $-V_{dc}/4$ , and  $S_5^-$  is ON, connecting the terminal b to ground.

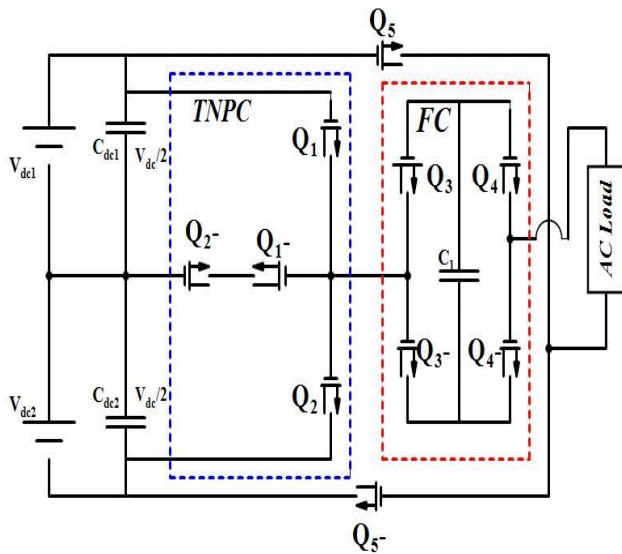


Fig. 1. Circuit topology of the inverter.

- 3) Half-level positive output ( $V_{dc}/2$ ): This voltage is designated as  $S_{2+}$ . Switches  $S_{1-}$ ,  $S_{2-}$ ,  $S_3$  and  $S_4$  are ON, connecting the terminal a to  $V_{dc}/2$ , and  $S_5^-$  is ON, connecting the terminal b to ground. Thus the voltage across the load is  $V_0 = V_{dc}/2 + 0 = V_{dc}/2$ .
- 4) One-fourth positive output ( $V_{dc}/4$ ): Two switching combinations are available. For  $S_{11+}$ , switches  $S_2$ ,  $S_{3-}$  and  $S_4$  are ON, connecting the terminal a to  $V_{dc}/4$ , and  $S_5^-$  is ON, connecting the terminal b to ground. For  $S_{12+}$ , switches  $S_1$ ,  $S_{2-}$ ,  $S_3$ , and  $S_{4-}$  are ON, connecting the terminal a to  $+V_{dc}/4$ , and  $S_5^-$  is ON, connecting the terminal b to ground. Thus the voltage across the load is  $V_0 = V_{dc}/2 - V_{dc}/4 = V_{dc}/4$ .
- 5) Zero output: Two switching combinations are available. For  $S_{0+}$ , switches  $S_2$ ,  $S_3$  and  $S_4$  are ON, connecting the terminal a to ground, and  $S_5^-$  is ON, connecting the terminal b to ground. For  $S_{0-}$ , switches  $S_1$ ,  $S_3$  and  $S_4$  are ON, connecting the terminal a to  $V_{dc}$ , and  $S_5$  is ON, connecting the terminal b to  $V_{dc}$ . In both cases, the terminal ab is short circuited, and the voltage across the load is zero.

Consequently, the number of active power switches in the circuit current path is lower in comparison to and hence, this topology has a better efficiency.

### B. Sensorless voltage balancing controlling integrated into PWM Technique

Nine-level PWM scheme including four carriers' waves and the sinusoidal reference waveform is depicted in Fig. 2. The four carriers' waveforms ( $Cr_1$ ,  $Cr_2$ ,  $Cr_3$ , and  $Cr_4$ ) are shifted vertically to modulate the reference waveform ( $V_{ref}$ ) completely [20, 21]. The firing pulses associated with switching states 1, 2, 3, 4 and 5 (as listed in table I) are generated based on comparing  $V_{ref}$  with those carrier waves. Moreover, surplus switching states of 4 and 5 are used to minimize the switching frequency. If  $V_{ref}$  is positive, then state 4 will be used to produce the zero level at the output. On the other hand, if  $V_{ref}$  is negative, the output zero level voltage will be generated by state 5. The described algorithm is shown in Fig. 2 which can produce the nine-level voltage waveform at the output without any feedback sensor.

TABLE I  
SWITCHING STATES AND THEIR IMPACT ON FC VOLTAGE OF THE PROPOSED INVERTER

States	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	Q <sub>5</sub>	Output voltage	FC voltage
	1	2	3	4	5		
S <sub>4+</sub>	1	0	1	1	0	V <sub>dc</sub>	No effect
S <sub>31+</sub>	0	0	0	1	0	3V <sub>dc</sub> /4	Discharging
S <sub>32+</sub>	1	0	1	0	0	3V <sub>dc</sub> /4	Charging
S <sub>2+</sub>	0	0	1	1	0	V <sub>dc</sub> /2	No effect
S <sub>11+</sub>	0	1	0	1	0	V <sub>dc</sub> /4	Disharging
S <sub>12+</sub>	0	0	1	0	0	V <sub>dc</sub> /4	Charging
S <sub>0+</sub>	0	1	1	1	0	0	No effect
S <sub>0-</sub>	1	0	1	1	1	0	No effect
S <sub>11-</sub>	1	0	1	0	1	-V <sub>dc</sub> /4	Discharging
S <sub>12-</sub>	0	0	0	1	1	-V <sub>dc</sub> /4	Charging
S <sub>2-</sub>	0	0	1	1	1	-V <sub>dc</sub> /2	No effect
S <sub>31-</sub>	0	0	1	0	1	-3V <sub>dc</sub> /4	Discharging

S32-	0	1	0	1	1	$-3V_{dc}/4$	Charging
S4-	0	1	1	1	1	$-V_{dc}$	No effect

NPC	8	0	14	16	38	Very high
FC	1	7	0	16	24	High
Prevented Inverter	2	3	0	10	15	Very Low

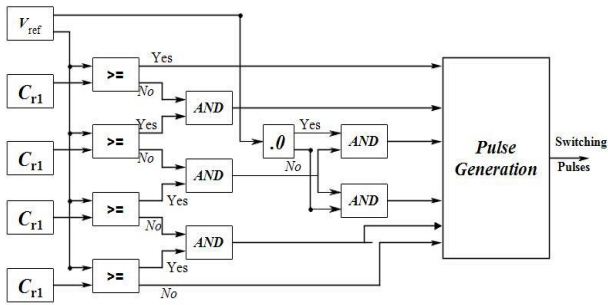


Fig.2 open-loop switching algorithm for self-voltage balancing of inverter

As mentioned before, applying the proposed algorithm on above inverter generates Nine-level voltage waveform at the output without using any voltage sensors and complex calculations in controller. The capacitor voltage would be constant even at start-up and also in load change conditions.

### III. COMPARATIVE STUDY OF MULTILEVEL INVERTER

Table II shows the components count in popular multilevel inverters as well as the presented inverter in case of producing single-phase 9-level output voltage waveform. It is prominent that the presented inverter with the sensor-less voltage balancing technique has the less components as well as its control scheme complexity is very low.

TABLE II  
COMPONENTS COUNT FOR SINGLE-PHASE NINE-LEVEL INVERTERS

Inverter type	DC Source	Capacitor	Clamped Diode	Active Switch	Total Part Count	Control Complexity
CHB	4	0	0	16	20	Low

As a comparison between conventional inverter and the proposed nine level inverter, it should be noted that the other inverters needs a very complicated controller to produce desired voltage levels at the output which requires adjusting a lot of controller gains in practical works[24-26]. Moreover, the controller design needs a lot of effort in modelling the system accurately and using many state variable feedbacks that increase the number of state variables and consequently voltage and current sensors. Mainly, It is highly dependent on the system parameters including load, connection line resistance and inductance, switching frequency, sampling time, DC source voltage amplitude, DC capacitor value, modulation index and output voltage frequency. Less complex controller and lower switching frequency are some advantages of the proposed nine level inverter with less number of components.

### IV. EXPERIMENTAL RESULTS

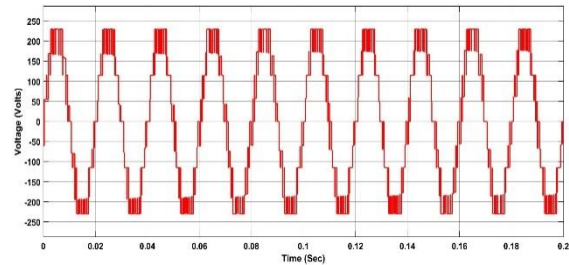
MATLAB simulation of nine level inverter is simulated to check the results. The voltage balancing of capacitor is validated in both stand-alone mode and grid connected modes. The parameters are Grid voltage-240V,50 Hz, Grid link inductor-1.5mH, DC Source Voltage-240V,Switching Frequency-2.5kHz, Stand Alone RL load-10 Ohm,30mH, Dc floating Capacitor-2.5uF

#### A. Stand Alone Mode

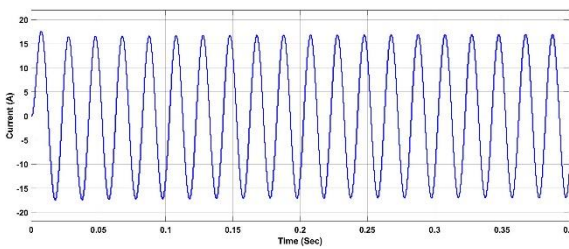
The Nine level inverter is tested under stand-alone mode as Uninterruptible Power Supply (UPS) application. In this application we can change load

and DC supply. Here, the inverter supplies an RL type of Load.

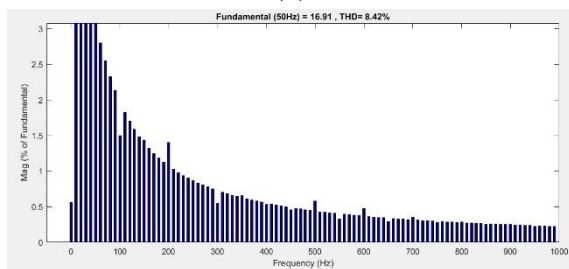
Fig. 4(a) shows the starting of inverter. The capacitor is charged up to the one-fourth of the DC source. This happen because of self-voltage balancing technique and Sinusoidal PWM technique, so that nine level symmetric output voltage is generated. From result we can that Capacitor is need not to be charged previously, because of this switching technique. The Fast Fourier Transform (FFT) analysis of inverter output current is carried out and it is shown in fig.5 (c). It should be mentioned here that the THD of the output current is less than 10% and it is achieved without using any kind of harmonic filters



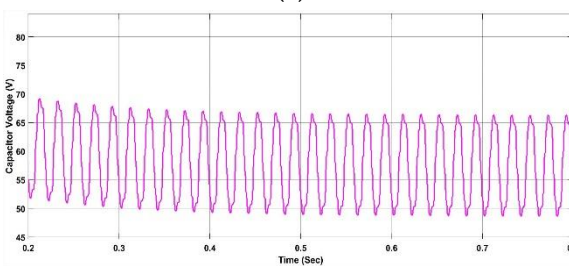
(a)



(b)



(c)



(d)

Fig. 4. Simulation results: (a) Inverter's Nine level output voltage. (b)Output current of RL load (c) THD of the load current from FFT analysis. (d) Voltage across dc-link capacitors for a step change in dc source amplitude

Fig 4 (d) shows that, when the dc source voltage is changed and capacitor voltage is tracking the reference value exactly. This shows that the sensorless voltage regulator technique is integrated into the proposed PWM technique.

### B. Hardware Implementation

The following fig. 5 shows the hardware setup of the proposed inverter. 10 separate power supply given to the 10 gate driver circuits. Dual power supply is used to give two battery supply for the inverter. In this experiment gate pulses for the inverter are given by Arduino MEGA 2560 microcontroller. Digital Oscilloscope is used to check the output waveform of the inverter.



Fig. 5 Hardware setup of multilevel inverter

Fig.6 (a) shows the Output of the inverter. In this the simple R-L load is used. The Rheostat is set on the 50 Ohm value. Thus we got the nine level of the output voltage. The distortion of the capacitor voltage is also shown. The waveform is not smooth. Due to the improper capacitance values and also the loose connections. This whole setup is run by using ARDUINO (Mega2560) micro controller on the low switching frequency (1 KHz), so that the proper nine level output voltage waveform is not getting.

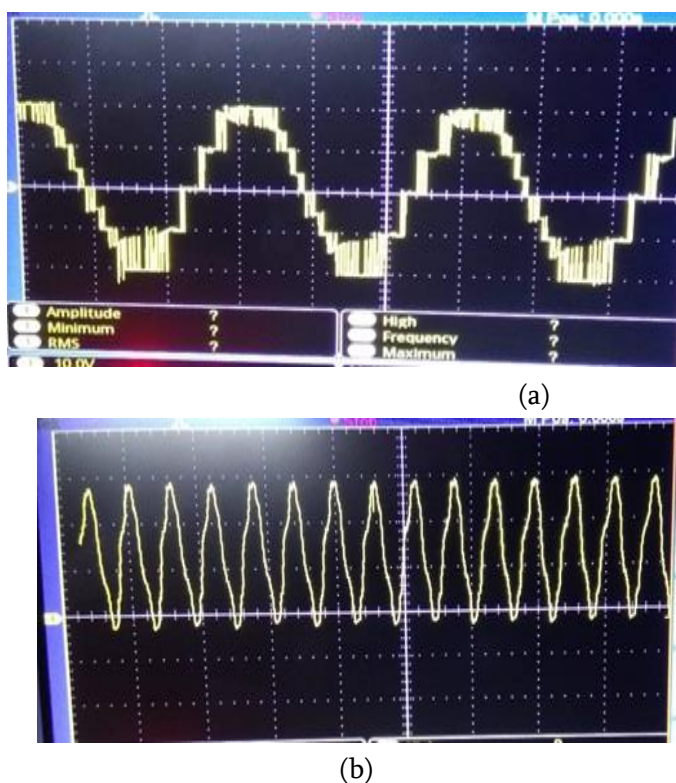


Fig. 6. Hardware results: (a) Inverter's Nine level output voltage of RL load (b) Voltage across dc-link capacitors for a step change in dc source amplitude

Thus we got the nine level of the output voltage. The distortion of the capacitor voltage is also shown. The waveform is not smooth. Due to the improper capacitance values and also the loose connections. This whole setup is run by using ARDUINO (Mega2560) micro controller on the low switching frequency, so that the proper nine level output voltage waveform is not getting. There is also the voltage imbalance between the voltage levels of the capacitor which are connected at the input side. To avoid this imbalance, capacitors of proper value will be used in next setup. There is also the power losses in the wiring of the inverter.

## V. CONCLUSION

Multilevel inverters are being developed and extensively exploited for generating high quality output voltages for numerous medium-voltage application fields. Applications urging a higher number of voltage levels escalate the number of

components required. But use of high number of part counts in conventional multilevel inverters increases both the circuit intricacies as well as the control scheme involved, thereby resulting in higher cost implications and reduced reliability. Therefore, to subdue these disadvantages, this proposes a novel hybrid 9L inverter topology formed by cascading a TNPC and FC with two LFS connected across the dclink. This is achieved using only ten power switches (among which two are operated at line frequency). Only one FC is incorporated in the circuit for generating the 9L output voltage. Further, it is confirmed that the proposed inverter structure has improved reliability and by cascading additional FCs, it can be effortlessly extended to obtain even higher number of voltage levels. In addition, a sensorless PWM technique based on the principle of energy balance for regulating the voltage of FC is suggested. An exhaustive review of recently proposed multilevel inverter topologies with RPC applicable for grid integration of renewable sources is carried out and the ensuing comparison certifies the merits of the proposed topology over conventional inverters.

## VI. REFERENCES

- [1] A. Nabae, I. Takahashi, and H. Akagi, "A new neutral-point-clamped pwm inverter," *IEEE Trans. Ind. Appl.*, vol. IA-17, no. 5, pp. 518-523, Sept 1981.
- [2] V. Agelidis, D. Baker, W. Lawrance, and C. Nayar, "A multilevel pwm inverter topology for photovoltaic applications," in *Industrial Electronics, 1997. ISIE'97., Proceedings of the IEEE International Symposium on*, vol. 2. IEEE, 1997, pp. 589-594.
- [3] Rodriguez, et al, "Multilevel converters: An enabling technology for high-power applications," in *Proc. the IEEE*, vol. 97, no. 11, November 2009, pp. 1786-1817.

- [4] L. G. Franquelo, J. Rodriguez, J. I. Leon, S. Kouro, R. Portillo et al., "The age of multilevel converters arrives," *IEEE Ind. Electron. Mag.*, vol. 2, no. 2, pp. 28–39, 2008.
- [5] S. Kouro, M. Malinowski, K. Gopakumar, J. Pou, L. G. Franquelo, B. Wu, J. Rodriguez, M. A. Perez, and J. I. Leon, "Recent advances' and industrial applications of multilevel converters," *IEEE Trans. Ind. Electron.*, vol. 57, no. 8, pp. 2553–2580, 2010.
- [6] C. Cecati, F. Ciancetta, and P. Siano, "A multilevel inverter for photovoltaic systems with fuzzy logic control," *IEEE Trans. Ind. Electron.*, vol. 57, no. 12, pp. 4115–4125, 2010.
- [7] M. Seyedmahmoudian, S. Mekhilef, R. Rahmani, R. Yusof, and E. T. Renani, "Analytical modeling of partially shaded photovoltaic systems," *Energies*, vol. 6, no. 1, pp. 128–144, 2013.
- [8] H. Mortazavi, H. Mehrjerdi, M. Saad, S. Lefebvre, D. Asber, and L. Lenoir, "A Monitoring Technique for Reversed Power Flow Detection With High PV Penetration Level," *IEEE Trans. Smart Grid*, vol. 6, no. 5, pp. 2221–2232, 2015.
- [9] V. Biagini, P. Zanchetta, M. Odavic, M. Sumner, and M. Degano, "Control and modulation of a multilevel active filtering solution for variable-speed constant-frequency more-electric aircraft grids," *IEEE Trans. Ind. Informat.*, vol. 9, no. 2, pp. 600–608, 2013.
- [10] K. K. Gupta, A. Ranjan, P. Bhatnagar, L. K. Sahu, and S. Jain, "Multilevel inverter topologies with reduced device count: a review," *IEEE Trans. Power Electron.*, vol. 31, no. 1, pp. 135–151, 2016.
- [11] Y.-H. Liao and C.-M. Lai, "Newly-constructed simplified single-phase multistring multilevel inverter topology for distributed energy resources," *IEEE Trans. Power Electron.*, vol. 26, no. 9, pp. 2386–2392, 2011.
- [12] N. A. Rahim, K. Chaniago, and J. Selvaraj, "Single-phase sevenlevel grid-connected inverter for photovoltaic system," *IEEE Trans. Ind. Electron.*, vol. 58, no. 6, pp. 2435–2443, 2011.
- [13] J. Li, S. Bhattacharya, and A. Q. Huang, "A new nine-level active npc (ANPC) converter for grid connection of large wind turbines for distributed generation," *IEEE Trans. Power Electron.*, vol. 26, no. 3, pp. 961–972, 2011.
- [14] G. Buticchi, D. Barater, E. Lorenzani, C. Concari, and G. Franceschini, "A nine-level grid-connected converter topology for single-phase transformerless pv systems," *IEEE Trans. Ind. Electron.*, vol. 61, no. 8, pp. 3951–3960, 2014.
- [15] V. Dargahi, A. K. Sadigh, G. K. Venayagamoorthy, and K. Corzine, "Hybrid double flying capacitor multicell converter and its application in grid-tied renewable energy resources," *IET Gener. Transm. Distrib.*, vol. 9, no. 10, pp. 947–956, 2015.
- [16] T. Chaudhuri, P. Barbosa, P. Steimer, and A. Rufer, "Cross-connected intermediate level (CCIL) voltage source inverter," in *2007 IEEE Power Electronics Specialists Conference*, June 2007, pp. 490–496.
- [17] M. D. Manjrekar, P. K. Steimer, and T. A. Lipo, "Hybrid multilevel power conversion system: a competitive solution for high-power applications," *IEEE Trans. Ind. Appl.*, vol. 36, no. 3, pp. 834–841, 2000.
- [18] M. Veenstra and A. Rufer, "Control of a hybrid asymmetric multilevel inverter for competitive medium-voltage industrial drives," *IEEE Trans. Ind. Appl.*, vol. 41, no. 2, pp. 655–664, March 2005.
- [19] P. Rajeevan, K. Sivakumar, K. Gopakumar, C. Patel, and H. Abu-Rub, "A nine-level inverter topology for medium-voltage induction motor drive with open-end stator winding," *IEEE*



- Trans. Power Electron., vol. 60, no. 9, pp. 3627–3636, 2013
- [20] M. Sharifzadeh, H. Vahedi, A. Sheikholeslami, P.-A. Labbé, and K. Al-Haddad, "Hybrid SHM-SHE Modulation Technique for Four-LegNPC Inverter with DC Capacitors Self-Voltage-Balancing," *IEEE Trans. Ind. Electron.*, vol. 62, no. 8, pp. 4890-4899, 2015.
- [21] H. Vahedi, K. Al-Haddad, and H. Y. Kanaan, "A New Voltage Balancing Controller Applied on 7-Level PUC Inverter," in *IECON 2014-40th Annual Conference on IEEE Industrial Electronics Society, USA, 2014*, pp. 5082-5087K. Elissa, "Title of paper if known," unpublished.
- [22] N. Sandeep, P. Salodkar, and P. S. Kulkarni, "A new simplified multilevel inverter topology for grid-connected application," in *Electrical, Electronics and Computer Science (SCEECS), 2014 IEEE*. IEEE, 2014, pp. 1–5.
- [23] H. Hafezi, E. Akpınar, and A. Balikci, "Cascade PI controller for single-phase STATCOM," in *16th International Power Electronics and Motion Control Conference and Exposition (PEMC), 2014*, pp. 88-93
- [24] J. Rodriguez, S. Bernet, P. K. Steimer, and I. E. Lizama, "A survey on neutral-point-clamped inverters," *IEEE Trans. Ind. Electron.*, vol. 57, no. 7, pp. 2219-2230, 2010.
- [25] M. Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Perez, "A survey on cascaded multilevel inverters," *IEEE Trans. Ind. Electron.*, vol. 57, no. 7, pp. 2197-2206, 2010.
- [26] M. F. Escalante, J. C. Vannier, and A. Arzandé, "Flying capacitor multilevel inverters and DTC motor drive applications," *IEEE Trans. Ind. Electron.*, vol. 49, no. 4, pp. 809-815, 2002

# Green synthesis with antibacterial investigation of Copper nanoparticles using *Azadirachta indica* (neem) leaf extract

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## ABSTRACT

In the present work, green mediated synthesis of copper nanoparticles has wide interest due to its inherent features such as eco-friendliness and low costs. The resulting copper nanoparticles were characterized by X-ray diffraction (XRD) to study the crystalline nature of the synthesised copper nanoparticles. The functional group of the copper nanoparticles was analysed by Fourier transform infrared spectroscopy (FTIR) and energy dispersive spectroscopy (EDAX) was used to detect the presence of elemental copper. The antibacterial activity against Gram positive microorganisms such as *Bacillus cereus* and *Staphylococcus aureus*, Gram negative microorganisms such as *E.coli* and *Klebsiella pneumonia* were studied. The zone of inhibition reveals the good antibacterial activity against these human pathogenic bacteria.

**Keywords:** Azadirachta indica, Copper Nanoparticles, XRD, FTIR, EDAX, Antibacterial activity

## I. INTRODUCTION

In the current research, the green synthesis of nanomaterials using various parts of plant extracts is a growing field in Nanoscience, with accent to avoid the usage of toxic chemicals. It is an ecofriendly technique for synthesis of nanomaterials because of their unique properties compared to the bulk materials. In the green synthesis method, the plant extract used in the synthesis of nanoparticles act as both reducing and capping agents[1].The plant mediated green synthesis of nanoparticles is relatively fast and cost effective technique.

Copper is an essential element for human nutrition. Copper sulphate is a commonly used germicide and antiseptic agent [2]. Copper sulphate also inhibits

bacterial growth such as Escherichia coli. Neem, being a purifying agent, clears toxins from the blood. The amazing health benefit of neem cures acne and skin irritations. It controls the formation of free radicals[3]. It heals the skin infected by strong diseases like chicken pox and small pox when treated with neem tree paste due to antibacterial properties.

## II. METHODS AND MATERIAL

### PREPARATION OF NEEM EXTRACT

The Azadirachta indica (neem) leaves were collected from in and around Erode District. About 100g of the collected leaves are thoroughly washed with water and cut into pieces. Then it was boiled with 100 ml of deionized water for 15 minutes at 80°C. The resulting product was filtered using Whatmann's No.1 filter

paper. The solution was stored in cleaned container and kept in refrigerator for further use.

### SYNTHESIS OF COPPER NANOPARTICLES

The Copper nanoparticles are synthesized by addition of, 20 ml of Azadirachta indica leaf extract with 100 ml of 1.2M aqueous CuSO<sub>4</sub>.5H<sub>2</sub>O solution in a 250 ml beaker. The solution colour changes from sea blue to green this colour changes indicates reduction of copper nanoparticles. The beaker was then kept overnight at room temperature for aging. The Cu nanoparticles solution thus obtained was purified by repeated centrifugation at 12,000 RPM for 15 min. Then the Cu nanoparticles were dried in oven at 80°C. The dried powder was further calcinated in muffle furnace at 400°C. The synthesis flowchart is shown in Fig. 1.

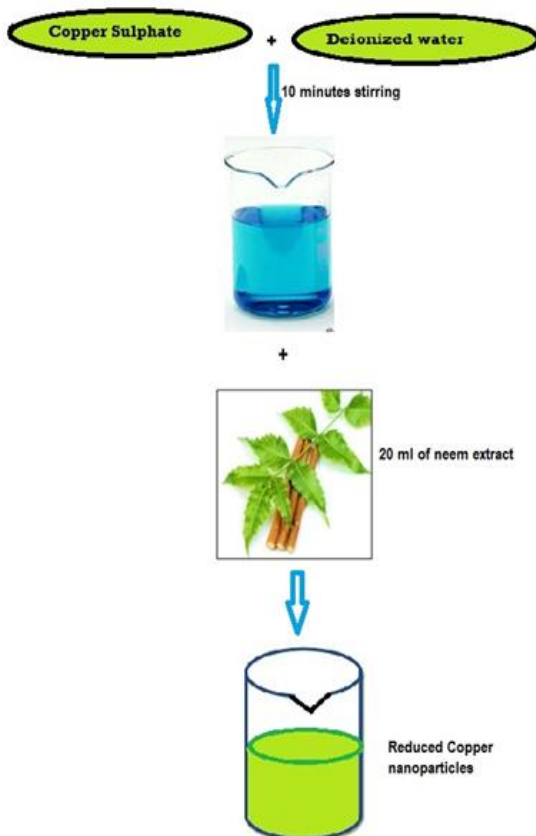


Fig. 1 Synthesis flowchart

### III. RESULTS AND DISCUSSION

#### A) XRD ANALYSIS

The crystallography analysis was carried out by X-ray diffraction method. X-ray diffraction pattern of the prepared Cu nanoparticles is shown in the Fig. 2. The straight line and sharp peaks shows that the synthesized powder containing crystalline nature[4-6]. The average crystalline size is determined using Scherer formula,

$$D = K\lambda / \beta \cos\theta$$

Where,

D- Crystallite size of nanometer,

$\lambda$ - Wavelength of the monochromatic X-ray beam (0.1540nm)

$\beta$ - Full width at the half maximum for the diffraction,

$\theta$ - Diffraction angle (deg).

The characteristics peaks of apatite can be identified in the range of  $2\theta$ , using the Scherer formula. The micro strain can be calculated from the following equation

$$E_{Strian} = \beta / 4 \tan\theta$$

Where,

$\beta$ - Width half maximum of the peak in radians,

$\theta$ - Diffracted angle of X-ray pattern.

The dislocation density can be calculated

$$\delta = 1/D^2$$

Where,

D- Particle size of the sample.

The average crystalline size of Cu nanoparticles synthesised using neem is 21.655 nm.

2θ (deg)	d (Å)	FWHM β (deg)	Crystalline Size D (nm)	Micror Strain (m)	Dislocation Density (δ) ×10 <sup>15</sup> m
35.26	2.52	0.6919	24.098	0.1162	1.722
31.91	2.8	0.7375	22.4098	0.3225	1.991
18.34	4.8	0.8733	18.4566	0.6754	2.935

Tabulation: 1

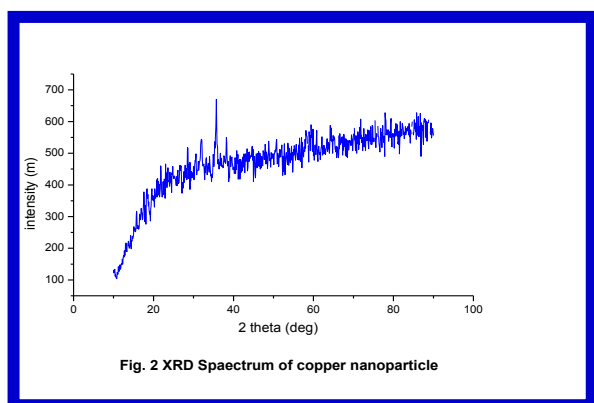


Fig. 2 XRD Spactrum of copper nanoparticle

**B) FTIR ANALYSIS**

The FTIR spectra of copper nanoparticles synthesized by green synthesis method using Azadirachta indica leaf extract shown in the Fig. 3. The IR spectrum of synthesized copper nanoparticles shows band at 1618 cm<sup>-1</sup>, 787.93cm<sup>-1</sup> corresponds to presence of alkene, aromatic ring phenyl group[7]. The peak at 1618 cm<sup>-1</sup> indicates the presence of copper nanoparticles[8] and is listed in tabulation: 2.

WAVELENGTH (Cm <sup>-1</sup> )	STRETCHING
1618	Presence of Carbonyl group
655.28	Presence of C-Cl group
596.49	Presence of C-Br group

Tabulation: 2

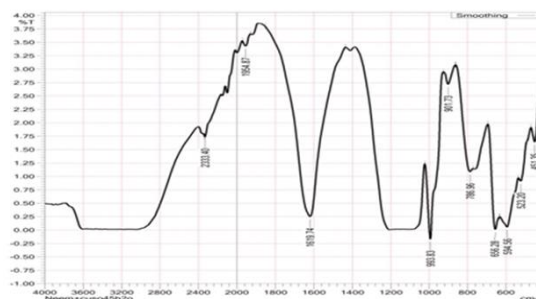


Fig. 3 FTIR Spectrum of Copper nanoparticles

**C) EDAX ANALYSIS**

The elemental composition analysis of copper nanoparticles reveals the presence of Cu, O, S. EDAX spectrum of copper sulphate+neem extract is shown in Fig. 4 confirms the presence of copper nanomaterial.

**D) ANTIBACTERIAL ACTIVITY**

The copper nanoparticles synthesized using neem extract is tested for antimicrobial activity by well diffusion method[9-12]. Liquid nutrient agar media and the Petri plates were sterilized by autoclaving at 121°C for about 30 minutes at 15 lbs pressure. Under aseptic conditions in the laminar airflow chamber, about 20ml of the agar medium was dispensed into each Petri plate to yield a uniform depth of 4mm[13]. After solidification of the media, 24 hrs culture of

Gram positive microorganisms such as *Bacillus cereus*(MTCC 430), *Staphylococcus aureus*(MTCC 3160), Gram negative microorganisms such as *E.coli* (MTCC 1698) and *Klebsiella pneumonia* (MTCC10309) obtained from IMTECH, Chandigarh were swabbed on the surface of the agar plates[14-15]. Well was prepared by using cork borer followed with loading of 100 µl of each sample to the distinct well with sterile distilled water as negative control and Tetracycline (30mcg/disc) as positive control[16-17]. The sample loaded plates were then incubated at 37°C for 24 hours to observe the zone of inhibition shown in Fig. 5(a, b, c, d). The zone of inhibition of synthesised copper nanoparticles against *Bacillus cereus*, *Staphylococcus aureus*, *E.coli* and *Klebsiella pneumonia* is listed in tabulation: 3.

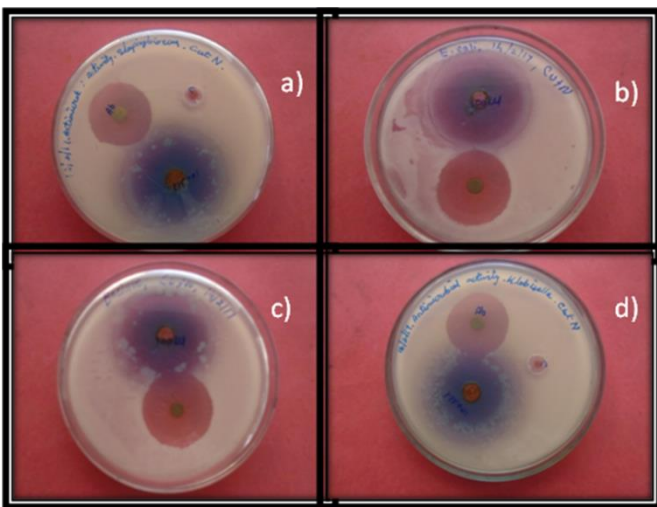
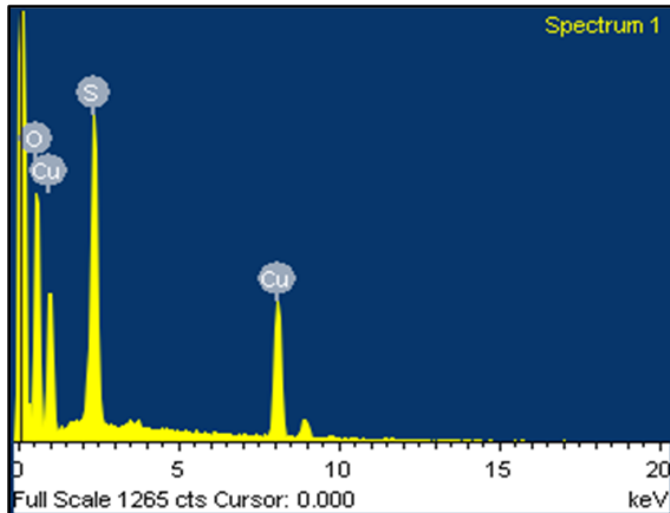


Fig.5 Zone of inhibition against a) *Staphylococcus aureus* b) *E.coli* c) *Bacillus cereus* & d) *Klebsiella pneumoniae* microorganisms

Fig.

4 EDAX Spectrum of Copper Nanoparticles

S. No.	Micro organisms	Zone of Inhibition in Diameter (mm)		Std. Antibiotic (Tetracycline ) 30mcg/disc
		Contro l	Copper nano particles	
		100 µl		
1	<i>Bacillus cereus</i>	Nil	35	32
2	<i>Staphylococcus aureus</i>	Nil	35	28
3	<i>Escherichia coli</i>	Nil	39	29
4	<i>Klebsiella pneumoniae</i>	Nil	30	28

Tabulation : 3

#### IV. CONCLUSION

Copper nanoparticles were successfully prepared by green synthesis method using neem extract. The XRD spectrum reveals that, the synthesised copper nanoparticles using neem extract have average crystalline size of 21.6548 nm. The FTIR spectrum confirms the presence of copper nanoparticles at the peak 1619 cm<sup>-1</sup> and presence C-Cl stretching, C-Br stretching, phenyl, aromatic bending group respectively. The EDAX exhibits elemental composition of CuNPs. The spectrum reveals the presence of copper nanomaterial. The antibacterial activity study confirms the CuNPs synthesised using neem has stronger inhibition against *Bacillus cereus*, *Staphylococcus aureus*, *Escherichia coli* and *Klebsiella pneumoniae*. This green synthesis method is carried

out by easily available starting materials, inexpensive to carry out in any laboratory, use of toxic reagent is avoided and pollution free.

## V. REFERENCES

1. SC. Singh, R.K. Swarnkar and R. Gopal, *J.Nanosci. Nanotech.* (2009) 9.
2. B Balamurugan, B.R. Mehta and S.M. Shivprasad, *Appl. Phys. Lett.* 3176 (2001) 79.
3. H Lin, C. Wang, H.C. Shih, J. Chen and C. Hsieh, *J. Appl. Phys.*, 5889 (2004)95.
4. JJ. Zhang, J.F. Liu and Y.D. Li, *Chem. Mater.* 867 (2006) 18.
5. Dhas NA, Raj CP, Gedanken A.,*Chem. Mater.*, 10(5): (1998) 1446-1452.
6. Samim M, Kaushik N K and Maitra A , *Bull.Mater. Sci.* 30 (2007) 535
7. SMagaldi,S. Mata-Essayag, C. Hartungde Capriles, et al., *Int.J.Infect.Dis.*8(2004)39–45.
8. Mathabe M.C., R.V. Nikolova, N. Lall and N.Z. Nyazema. *South Africa. J. Ethnopharmacol.*, 105: (2006) 286–293.
9. Samy R.P., P. Gopalakrishnakone, P. Houghton and S. Ignacimuthu. *J. Ethnopharmacol.*, 107: (2006) 99–106.
10. C.Valgas, S.M.DeSouza, E.F.A.Smânia,etal., *Braz.J.Microbiol.* (2007)369–380.
11. Bagepalli Srinivasa Ashok Kumar ET AL., *Braz. J. of Pharmacognosy*, 18(4) (2008)527-531.
12. Ipsa Subhankari and P.L. Nayak., *World J. of Nano Sci. Tech.*, 2(1) (2013)10-13.
13. Umesh Kathad, Dr. H.P. Gajera., *Int. J. Pharm. Bio. Sci.*, 5(3) (2014)533-540.
14. M.Jannathul Firdhouse, P.Lalitha, *Asian J. of Pharmaceutical and Clinical Research*,2013; 6(1): 92-95.
15. M.Gopinath et al; *Int. J. Curr. Microbial App. Sci.*, 2014; 3(9): 814-818.
16. Othman M., H. Loh, C. Wiart, T.J. Khoo, K.H. Lim and K.N. Ting. *J. Microbiol. Meth.*, 84: (2011)161–166.
17. Mounyr Balouiri, Moulay Sadiki , Saad Koraichi Ibensouda. *Journal of Pharmaceutical Analysis.* 6 (2016) 71–79.

# Detection of Lesions and Classification of Diabetic Retinopathy

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## ABSTRACT

According to the increasing consumption of sugar materials in human life and growing trend of the machine life, the prevalence of diabetes is on the rise. It is observed all patients with this disease mostly suffer from decrease or loss their vision. Detection of diabetic retinopathy in early stage is essential to avoid complete blindness. The retinal fundus images of the patients are procured by capturing the fundus of the eye with a digital fundus camera. The abnormalities in retinal fundus images due to DR are lesions which includes Microaneurysms and Haemorrhages. The proposed method is to detect the abnormalities in retinal fundus image is based on dynamic shape features and SVM classifier. In this study the Gaussian filter is used to enhance images and separate vessels with a high brightness intensity distribution. In this study canny's edge detector is used for detection of Lesions and features are extracted. SVM is used for classification of DR as NPDR or PDR.

Keywords : Fundus image, Lesions, Gaussian Filter, Canny edge detector, Support Vector Machine (SVM), NPDR & PDR.

## I. INTRODUCTION

Diabetic retinopathy is damage to the retina, specifically blood vessels in the retina, caused by complications of diabetes mellitus. Diabetic retinopathy can eventually lead to blindness if left untreated. Approximately 80% of all patients who have had diabetes for at least ten years suffer from some of diabetic retinopathy. The retina is light sensitive membrane that covers the back of the eye. If diagnosed and treated early blindness is usually preventable. Diabetic retinopathy generally starts without any noticeable changes in vision. However an eye doctor can detect the signs. Blood vessel extraction from fundus poses an important step in automated diagnosis process [1].

In diabetic patients due to increase of glucose level in blood there will be rupturing of the small blood

vessels called capillaries in the eye. Due to this the blood leaks into the retina of the eye. The abnormal features related to DR which can be found can be microaneurysms, haemorrhages, hard exudates, cotton wool spots etc. This disease causing damage to the retina which also leads to the loss of vision if not detected and treated is termed as Diabetic Retinopathy (DR). The presence of any of the abnormal features helps in classifying the stage of the disease. In order to avoid increased screening time and human error, there is a need for efficient and accurate Automated DR detection systems which can provide simple approach for classifying the images as normal or DR [1], [2]. The earliest symptoms of Retinopathy are the Micro aneurysms, which occur due to dilatations of the blood capillaries and they appear as dark red spots on the retina. Haemorrhages occur when the microaneurysms burst. Bright-yellow colored Lesions such as hard exudates occur as a result

of fluid leaking into the retinal surface from the capillaries or from Microaneurysms. The first stage of retinopathy is known as Non-Proliferative Retinopathy (NPDR). In NPDR stage, various features like micro-aneurysms, haemorrhages, soft exudates cotton wool spots are present. Depending upon number of these features the classification is performed. Accordingly, Non-proliferative stage can be categorized as Mild, Moderate, and Severe. In PDR stage, new abnormal blood vessels are formed at very high rate. This may result in severe vision loss [5].

## II. PROPOSED WORK

The main objective of this project work is to detect the early stage of DR using the features extracted from the pre-processed image. The objective is to develop a system for Diabetic Retinopathy detection and classification. Diabetic Retinal image used in the paper is from DIARETDB0 (Standard Diabetic Retinopathy Database Calibration level 0). DIARETDB0 [2] data set contains 130 images and size of [1500x1152] pixels.

The image obtained from the database is subjected to the pre-processing steps such as green channel extraction, contrast enhancement, Gaussian filtering and histogram equalization. [2] After pre-processing, the image is morphologically operated. Detection of Blood vessel [1], Microaneurysms[10], [11], and Exudates , [6] using canny's edge detector. The Gray Level Co-occurrence Matrix (GLCM) is utilized to extract textural features [8]. The classification is done depending on the area of blood vessel, area of microaneurysms, area of exudates, the values of texture features namely contrast, correlation, energy and homogeneity using SVM classifier.

### A. Image Pre-processing

Pre-processing is an important step as it aids in accurate feature extraction and classification with higher accuracy. In case of Diabetic Retinopathy, the retinal images in the dataset are often noisy and

poorly illuminated because of unknown noise and camera settings.

Thus to remove noise and undesired region the images are subjected to pre-processing steps. In pre-processing first green channel is extracted. As green channel has higher contrast than red and blue. The pre-processing includes contrast enhancement, histogram equalization, Gaussian filtering.

#### i. Green Channel Extraction

The green channel is the most contrasted one, that the red channel is saturated and that the blue channel does not contain any information [8]. Green light is less absorbed by the fundus layers than the blue part of the spectrum, but more than red light, which penetrates deeper into the layers of the inner eye. The blood containing elements (as MA or vessels) in the retinal layer are best represented and have highest contrast in the green channel [9].

#### ii. Histogram equalization

Histogram equalization defined as the process of adjusting intensity values of the image [10]. It is a technique used to enhance the contrast of the image using the histogram of the image. The histogram of image represents the frequency of gray levels in the image. The gray levels of image varying from 0 to 255, that is a gray scale image's pixel size of 8 bits. So the histogram contains freq of occurrence of values from 0 to 255. The aim of histogram equalization is used in digital image processing is to generate an image with equally distributed brightness level over the whole brightness scale.

#### iii. Gaussian Filtering

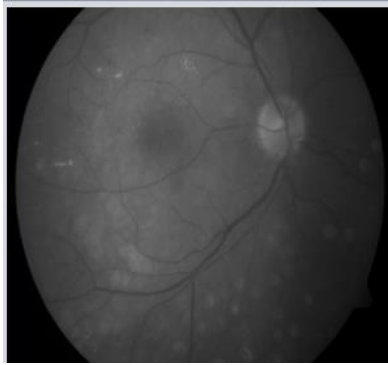
Gaussian smoothing operator performs a weighted average of surrounding pixels based on the Gaussian distribution. It is used to remove Gaussian noise and is a realistic model of defocused lens. Sigma defines the



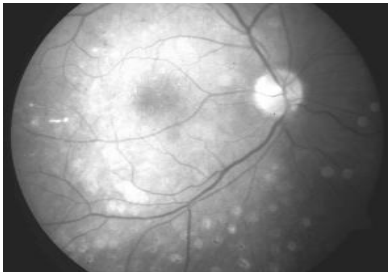
amount of blurring. The radius slider is used to control how large the template is. Large values of sigma will only give large blurring for larger templates sizes. Noise can be added using the sliders. The results are as follows:



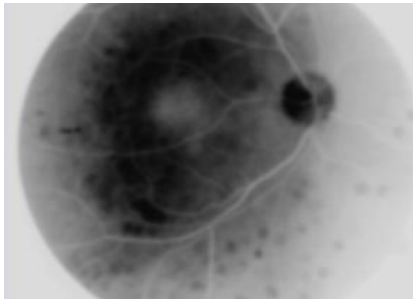
(a)



(b)



(c)



(d)

Fig.1. Pre-processing images a) Input image b) Green channel c) Gaussian filtered image d) Gray scale invert image

## B. Detection of lesions

According to medical term, a lesion means any abnormal changes of tissue or organ as a result of the disease. The enhanced blood vessels from background are segmented by an edge detection method. The purpose of edge detection is to significantly reduce the amount of data in an image, while preserving the structural properties. Among the edge detection methods canny edge detection algorithm is one of the most strictly defined methods that provides good and reliable detection.

Canny edge detection method uses a multi-stage algorithm to determine the blood vessel edges.

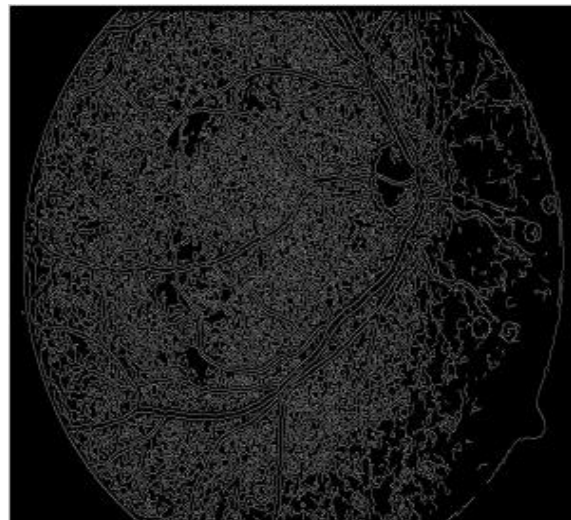


Fig.2. Detection of Blood Vessels using canny edge detector

## C. Feature Extraction

To distinguish between three stages of diabetic retinopathy, various statistical features of segmented vessels are determined. These statistical features are used as input to the classification system to identify the exact stage of diabetic retinopathy disease. Following are various features extracted from segmented vessels [11]:

### 1) Contrast

It is measure of intensity of a pixels and neighbours over the image. It is the difference in color and

brightness of the object and other objects. It is given by,

$$\sum_{i,j=0}^{N-1} (p_{ij})(i-j)^2$$

2) Correlation

It is measure of how correlated a pixel is to its neighbour over the whole image. Correlation is 1 or -1 for a perfectly positively or negatively correlated image. It is calculated as,

$$\sum_{i=0}^{M-1} \sum_{j=0}^{N-1} \frac{(i-\mu_i)(j-\mu_j)p_{i,j}}{\sigma_i\sigma_j}$$

3) Homogeneity

It is a value that measures the closeness of the distribution of an element in grey level co-occurrence matrix to the grey level co-occurrence diagonal. Homogeneity is 1 for diagonal GLCM. It is defined as:

$$\sum_{i,j} \frac{p(i,j)}{1+|i-j|}$$

4) Entropy

It shows the amount of information of the image that is needed for the image compression. Entropy is defined as:

$$\sum_{i,j=0}^{N-1} -\ln(p_{ij})p_{ij}$$

5) Area, Perimeter and Count of microaneurysms, exudates and blood vessels.

**Count** = max (max( l(ROI)));

Where l(ROI) is the labeling the region of interest.

**Area** =  $\sum(\text{weights}(:), [], 'double')/8;$

Where weights(:) is all elements of the set that results from nonlinear neighborhood operation on ROI.

**Perimeter** =  $\sum (\text{Tedges, Ledges, Bedges, Redges})$

Where Tedges, Ledges, Bedges, Redges are the top, left, bottom and right edge of the ROI respectively.

D. CLASSIFICATION

Classification is an essential feature to separate large datasets into classes for the purpose of Rule generation, Decision Making, Pattern recognition, Dimensionality Reduction, Data Mining etc. The Neural networks have emerged as an important tool for classification. The Neural Network techniques can be divided into supervised, unsupervised and reinforced techniques. [12] In this work, two classifiers are implemented and used for classification of diabetic retinopathy stages. They are SVM and ANN classifier. They both lies under supervised learning approach. In the recent years, SVM classifiers and ANN classifiers have demonstrated excellent performance in a variety of pattern recognition problems.

SVM is a supervised machine learning method used for data classification including images. Based on the calculated features, the classification parameters are defined and every data is grouped into its most relevant class. Each data, i.e., image, is given to the SVM as point in n-dimensional space where n represents the number of extracted features. In n-dimensional space, the value of each feature is the value of a particular coordinate. Here, SVM finds all the possible hyper planes that separate the classes linearly. Next, it finds the optimal hyper plane based on the maximum distance, margin, from the nearest data point to the hyper plane of interest. In case of nonlinear data, the training data are mapped into high dimensional feature apace using a nonlinear kernel function. Although there are several image processing techniques for DR classification, SVM has the advantages of high performance in higher dimensional spaces, easier analysis of data, ability to deliver a unique solution, and the ability to perform non-liner classification. Therefore, it is used to classify retinal images.

### III. RESULTS

Performance of classification for both classifiers can be examined by evaluating the performance of sensitivity, specificity, accuracy and precision. For this true positive (TP), true negative (TN), false positive (FP) and false negative (FN) parameters are calculated. From these parameters accuracy is calculated and performance is verified [14].

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{\text{TP} + \text{FN} + \text{TN} + \text{FP}}$$

TABLE I. COMPARISON OF CLASSIFIERS

Classifier	Accuracy	Time
SVM	97%	760ms
ANN	90%	840ms

### IV. CONCLUSION

This proposed system has objective of detecting and classification of DR. This uses 130 fundus images from DIARECTDB0 databases. Detection of blood vessels from input images was done. And then extracted necessary features and classified using SVM classifier. The proposed method performed up to classification accuracy 97% .The execution time took about 760miliseconds. As a future work, the classifier performance can be optimized with more images, extracting details features and using different classifier.

### V. REFERENCES

[1] Du, Ning, and Yafen Li. "Automated identification of diabetic retinopathy stages using support vector machine." *Control Conference (CCC), 2013 32nd Chinese.* IEEE, 2013.

[2] Diabetic retinopathy database and evaluation protocol (DIARETDB0). *Electronic material*

(Online). Available online at: <http://www.it.lut.fi/project/imageret/files/diaretdb0> [referred 19.2.2010].

[3] Niemeijer, Meindert, et al. "Automatic detection of red lesions in digital color fundus photographs." *IEEE Transactions on medical imaging* 24.5 (2005): 584-592.

[4] Yun, Wong Li, et al. "Identification of different stages of diabetic retinopathy using retinal optical images." *Information sciences* 178.1 (2008): 106-121.

[5] Paing, May Phu, Somsak Choomchuay, and MD Rapeeporn Yodprom. "Detection of lesions and classification of diabetic retinopathy using fundus images." *Biomedical Engineering International Conference (BMEiCON), 2016 9th.* IEEE, 2016.

[6] Mumtaz, Rafia, et al. "Automatic detection of retinal hemorrhages by exploiting image processing techniques for screening retinal diseases in diabetic patients." *International Journal of Diabetes in Developing Countries* vol.38, issue 1,pp.80-87, 2018.

[7] Kar, Sudeshna Sil, and Santi Maity. "Automatic Detection of Retinal Lesions for Screening of Diabetic Retinopathy." *IEEE Transactions on Biomedical Engineering* , 2017.

[8] Carrera, Enrique V., Andrés González, and Ricardo Carrera. "Automated detection of diabetic retinopathy using SVM." *Electronics, Electrical Engineering and Computing (INTERCON), 2017 IEEE XXIV International Conference on.* IEEE, 2017.

[9] Seoud, Lama, et al. "Red lesion detection using dynamic shape features for diabetic retinopathy screening." *IEEE transactions on medical imaging* vol.35, issue 4, pp. 1116-1126, 2016.

[10] Paing, May Phu, Somsak Choomchuay, and MD Rapeeporn Yodprom. "Detection of lesions and classification of diabetic retinopathy using fundus images." *Biomedical Engineering*

- International Conference (BMEiCON), 2016  
9th. IEEE, 2016.
- [11] Zhang, Bob, BVK Vijaya Kumar, and David Zhang. "Detecting diabetes mellitus and nonproliferative diabetic retinopathy using tongue color, texture, and geometry features." *IEEE transactions on biomedical engineering*, vol.61,issue 1,pp. 491-501,2014
- [12] Franklin, Sundararaj Wilfred, and Samuelnadar Edward Rajan. "Diagnosis of diabetic retinopathy by employing image processing technique to detect exudates in retinal images." *IET Image processing* vol. 8,issue10 ,pp. 601-609,2014.
- [13] L. Tang, M. Niemeijer, J. M. Reinhardt, M. K. Garvin, and M. D. Abramoff, "Splat feature classification with application to retinal hemorrhage detection in fundus images," *IEEE Transactions on Medical Imaging*, vol. 32, pp. 364–375, Feb 2013.
- [14] Aravind, C., M. Ponnibala, and S. Vijayachitra. "Automatic detection of microaneurysms and classification of diabetic retinopathy images using SVM technique." *IJCA Proceedings on international conference on innovations in intelligent instrumentation, optimization and electrical sciences ICIIIOES* (11). 2013.
- [15] You, Mingli, and Yafen Li. "Automatic classification of the diabetes retina image based on improved BP neural network." *Control Conference (CCC), 2014 33rd Chinese*. IEEE, 2014



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