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"Interdisciplinary Perspective of Basic and Engineering Science"
[IECIPBES-2023]

Date : 28th to 30th Oct 2023

Organized By
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INTERDISCIPLINARY PERSPECTIVE OF BASIC AND ENGINEERING SCIENCE (IECIPBES-2023)

(28, 29 & 30 October 2023)

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…. many other subjects are addressed in the conference theme but are not restricted to these.

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KEYNOTE SPEAKER

Sr.No	Name & Country of Keynote Speaker	Topics
1	Dr. Vaibhav Kathavate **(USA)**	Unraveling the role of intrinsic microstructural length scales on the corrosion and deformation behavior of materials: Harness the power of materials characterization techniques
2	Dr. Mohnish Mahamune **(India)**	Utilizing AI tools to solve the Challenges & Possibilities in Science & Engineering.
3	Dr. Megha Deshmukh **(Czech Republic)**	Introduction to Nanotechnology, Materials and Need of Characterization tools
4	Dr. Farsa Ram **(USA)**	Bio-Based Porous Functional Materials for Hydro voltaic Energy Harvesting
5	Dr. Shirish Deo **(India)**	Resent Development in self-Compacting Concrete & It's Characterizations
6	Dr. Hanuman Thorat **(Czech Republic)**	Higher Education Opportunities to Study Abroad

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Revolutionizing Canal Head Regulators: An Innovative, Secure, and Cost-Effective Approach

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ABSTRACT

The head regulator, positioned at the commencement of a canal branching off from a reservoir or main channel, is crucial for managing water flow. Vertical Slide gates, commonly employed in canal head regulators, are examined for their advantages and disadvantages. Slide gates are characterized by their simplicity and practicality, with a design that allows for vertical movement to control water flow. They are typically constructed of steel and are designed to fit securely into guides such as channels to minimize water leakage. These gates can be raised or lowered as needed to permit or block water entry into the canal. Proper maintenance is essential to ensure their reliability, involving inspections for wear, lubrication, and addressing any corrosion or damage. Achieving a watertight seal when the gate is closed can be challenging, leading to potential water leakage issues, especially in systems requiring precise water control. The paper highlights certain limitations of traditional slide gates, particularly their susceptibility to rust and corrosion due to constant exposure to water and the environment. These gates can deteriorate overtime, making them challenging to replace. Additionally, the ease of access to these gates in remote areas may invite theft and vandalism. To address these shortcomings, an innovative design is proposed, drawing inspiration from ancient gate designs, such as the one near Jalatunga Sagar in District Nanded. This paper explores the development of an innovative head regulator design for canal networks. The new design employs a novel approach by eliminating moving parts and direct contact between steel components and water. Instead of vertical slide gate, a wedge-shaped structure made of Ferro Cement technology is adopted to control the discharge through this head regulator. This an attempt to replicate the lost wisdom with new material and with innovative design. This will solve practical difficulties encountered in such structures. An uPVC pipe embedded with steel rod is used to lock the gate while not in use. This design ensures water remains in the canal unless the wedge is removed, making it a secure and tamper-resistant solution. The unique aspect of this innovative head regulator design is its hidden, underground structure, concealed from view and accessible only through a locked chamber. Unauthorized operation is prevented by a locking rod, enhancing security. This design is not only economical and leak-proof but also cost-effective in terms of maintenance and repair of the head regulator gates.

Keywords: Head Regulator, Canal Network, Security of gates, Efficiency of head regulator gates

I. INTRODUCTION

This document is a template. An electronic copy can be downloaded from the International Journal (IJRST) website. Canal head regulators are vital components in irrigation systems, for controlling the flow of water from a source into a network of canals. This paper provides an in-depth examination of canal head regulators, discussing their design principles, operational considerations, maintenance problems and solution over it. Understanding these crucial aspects is essential for optimizing water distribution in agricultural and industrial applications while ensuring the sustainability of water resources. Canal head regulators serve as the gateway between the water source and the distribution network, regulating water flow to meet the demands of agriculture, industry, and municipal users. Properly designed, operated, and maintained canal head regulators are indispensable for effective water resource management.

Function and Components of Head Regulator Gates

- A canal head regulator consists of several essential components, including a control structure, gates, and measurement devices. The primary function of this system is to regulate the flow of water from a source (e.g., a river or reservoir) into a canal network while measuring the volume of water being diverted. To achieve this, the following components are typically present:
- Control structure: The control structure, also known as the canal headworks, comprises a set of gates and associated machinery. The gates can be radial, sluice, or flap gates, depending on the specific application.
- Measurement devices: Flow measurement devices such as weirs or flumes are integrated into the regulator to monitor the quantity of water being diverted accurately.
- Control systems: Automation and control systems can be incorporated to optimize water distribution, reducing manual intervention and enhancing efficiency.

Operational Considerations:

- Flow Regulation
- Efficient flow regulation is crucial to ensure equitable water distribution and avoid wastage. Various factors must be considered:
- Seasonal variations: Flow rates may fluctuate seasonally, and the regulator should accommodate these changes.
- Demand management: The regulator must be capable of adjusting flow rates to meet varying demands from users downstream.

Constraints in using conventional Vertical gates:

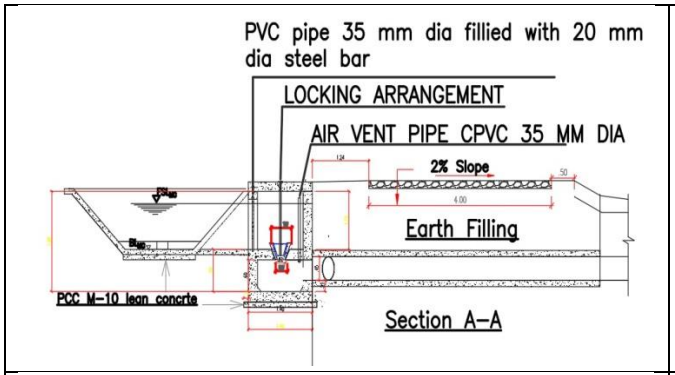
The current method of employing vertical lift steel gates is found to be inefficient and associated with certain drawbacks. When water flows through the canal, the head regulator remains in constant contact with water, leading to rusting. Rusting affects various components, including the steel plate, angle supporting the plate, side channel, and the gate lifting steam rod, as these parts are exposed to the elements and submerged in water during canal flow. Natural forces such as rain, sunlight, and air moisture contribute to the rusting process. In extensive command areas where these gates are installed to facilitate water flow into secondary channels, they often left without regular oiling and greasing and remain unpainted due to their remote location, making them susceptible to rust. Additionally, these steel gates are susceptible to theft due to the high market value of steel

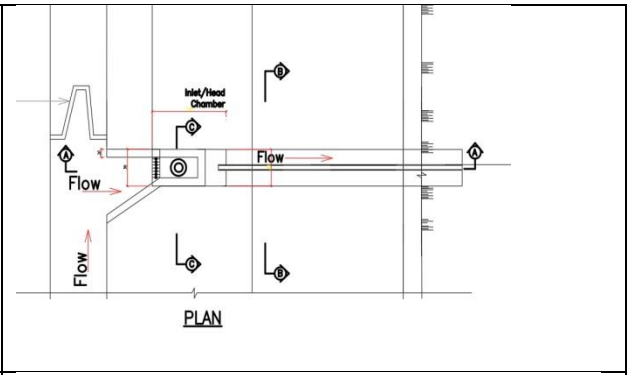
as scrap. Furthermore, these gates are not entirely leak-proof. The rubber seal used to prevent leakages, gets rupture after few years of use, and most of the time care is not taken to replace them in time with new one. This may be due to large number of gates and their remote locations. Water may leak to escape from it. Replacing rusted gates is also challenging job, as the side channel is embedded in concrete, expenses to take them out for repair is quite high. These head regulator gates are easily accessible in remote locations, making them vulnerable to damage and theft. The open system is an open invitation for theft. To address these shortcomings and introduce innovative gate designs, a new approach has been adopted based on ancient techniques used at Jalatunga Sagar near Kandhar, District Nanded, M.S. (India).

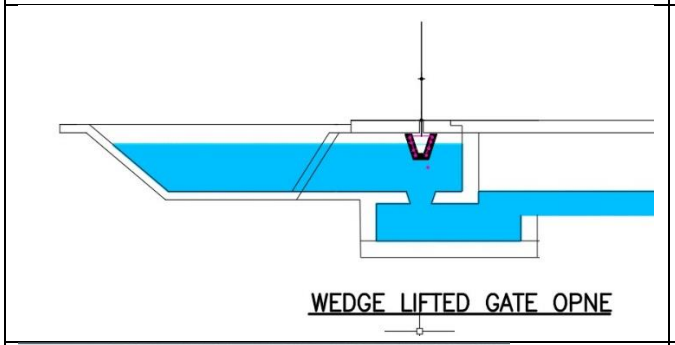
Innovative Wedge and Spigot vertical gate

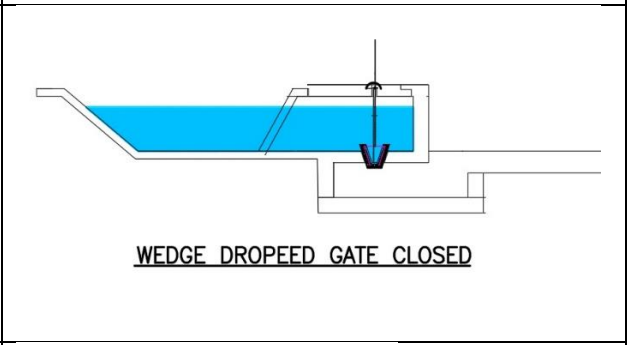
The authors have developed an innovative gate system described as the “Wedge and Spigot vertical gate." In this system, the gate for releasing water from the parent canal to the downstream canal is constructed using Ferro cement with nominal reinforcement, eliminating exposed steel components. These gates can be precisely precast in factory and transported for establishing at the site.

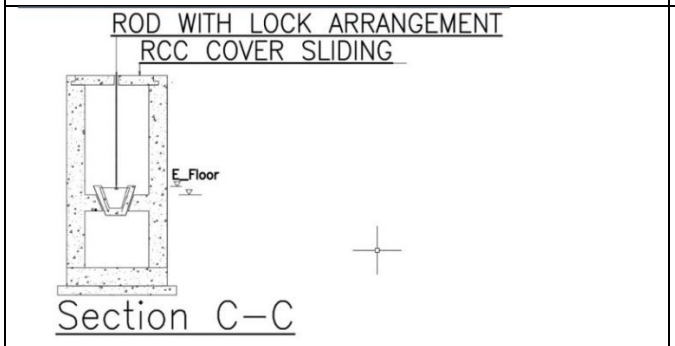
- Ferro Cement Construction: In this system, the wedge of gate is constructed using Ferro cement with nominal reinforcement. The absence of exposed steel components is a notable feature.
- Hand held Steel Rod with wholes at predefined locations: To facilitate the lifting of the gate, a hand held steel rod having hook at bottom and wholes at certain predefined manner on rod is fabricated. To keep certain controlled discharge through wedge this rod is provided with locking holes at predefined manner so that gate or wedge can be lifted depending upon discharge to be released. This mechanism is employed to raise and lower the gate. As this arrangement is very similar to hand held key rod used by a person who releases drinking water by opening of gate valve using rod. This rod is used only when gate to be operated. This rod is not fixed at site and can be removed and kept at safe place. Unless this rod with lifting hook is available the said wedge can not be lifted.
- uPVC Pipe Locking Rod with embedded Steel Rod: To further secure the system against tampering or unauthorized operation, a locking rod is suggested. This additional measure helps ensure the integrity of the wedge and lifting rod, preventing interference by unauthorised persons. To lock the head regulator a steel rod is embedded in a uPVC pipe is put in cavity of wedge. After opening a lock of flap this locking rod is lifted and kept aside. After finishing release of water this rod is again put in hole which make the wedge a fool proof. After putting this locking rod in wedge, a flap of hole is placed and this locking rod is also locked from top of slab b simple flap with lock and key.
- Bucket Shape Wedge: A wedge, shaped like a bucket, is prepared as a key component of the system. This wedge fits precisely into a Spigot hole that is made in a concrete block. The design ensures that the wedge block securely accommodates the wedge.
- Spigot Connection: The Spigot, where the wedge fits, is connected to a pipe outlet. This connection is responsible for controlling the flow of water from the parent canal to the downstream canal.
- Water Flow Control: When the wedge is removed by lifting it, it creates an opening, allowing water to enter the hole and be released into the downstream canal through the pipe outlet. This action effectively opens the flow.
- Flow Closure: To stop the flow of water completely, the wedge is lowered down into the hole, due its significantly high weight it effectively sealing the passage and closing the water flow.

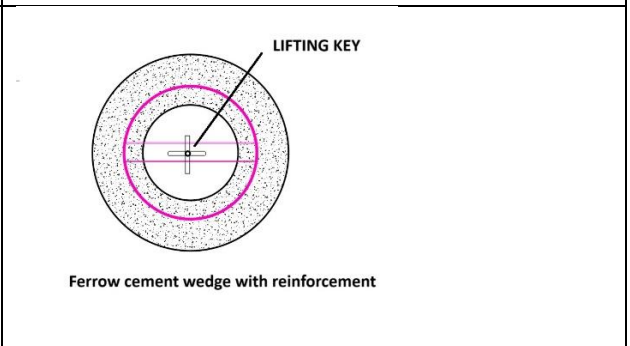

PVC pipe 35 mm dia fillied with 20 mm dia steel bar
LOCKING ARRANGEMENT
AIR VENT PIPE CPVC 35 MM DIA
2% Slope
Earth Filling
PCC M-10 lean concrte
Section A-A


Inlet/Head Chamber
Flow
Flow
Flow
PLAN


WEDGE LIFTED GATE OPNE

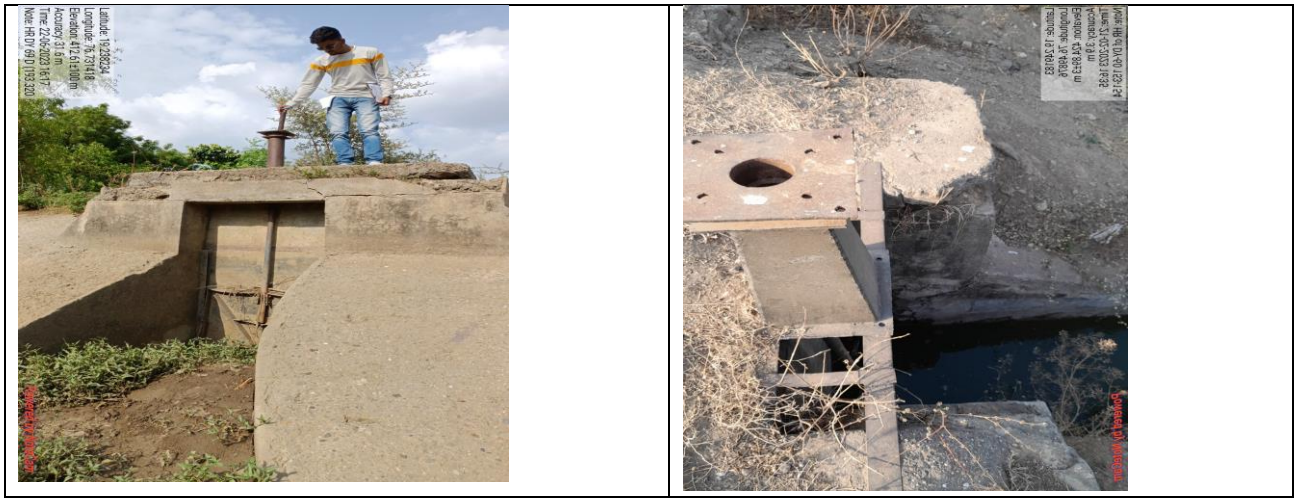

WEDGE DROPEED GATE CLOSED


ROD WITH LOCK ARRANGEMENT
RCC COVER SLIDING
E_Floor
Section C-C


LIFTING KEY
Ferrow cement wedge with reinforcement


Latitude: 19.443375
Longitude: 75.554378
Elevation: 452.34±3 m
Accuracy: 3.9 m
Time: 31-01-2023 10:49
Note: HR of DY - 10
Powered by NoteCam


Latitude: 19.168761
Longitude: 76.628204
Elevation: 363.07±37 m
Accuracy: 32.7 m
Time: 23-06-2023 15:03
Note: HR ON DY 65-A @ 170.940
Powered by NoteCam



Figures showing the gate with vertical lift steel plate.

Advantages of Wedge and Spigot Vertical lift gates:

- The author suggested the use of Wedge and Spigot Vertical lift gates for canal head regulators; it will offer several advantages in water resource management and distribution systems.
- Precise Flow Control: Vertical wedge lift gates provide accurate control over the flow of water. Operators can adjust the gate's position to precisely regulate the volume of water released into the distribution canals. This precise control ensures that water can be distributed according to demand.
- Durability: Wedge and Spigot Vertical lift gates are typically designed to be durable and long-lasting as happen in concrete sleepers used in Railways. They are capable of withstanding the wear and tear associated with continuous use and exposure to water.
- Customizable Flow: These gates allow for customizable flow rates, which mean that water can be released in various quantities depending on the specific needs of downstream users or the requirements of the irrigation system.
- Maintenance Simplicity: Maintenance and repairs of vertical lift gates are relatively simple. Regular Lubrication and painting not required. Wedge and Spigot can be replaced when damage occurs.
- Sturdiness: The weight of the wedge can make the gates sturdy and leak-proof. This reduces the likelihood of water leakage and operational issues.
- Pre casting of whole gate in parts: The parts can be precast precisely well cured in casing yard which ensure quality and accuracy.
- Versatility: Wedge and spigot Vertical lift gates can be used in a wide range of applications, from small-scale irrigation systems to large canal networks. Their adaptability makes them suitable for various water management projects.
- Water-Level Management: These gates are often employed to maintain specific water levels in canals, which is essential for ensuring a consistent and adequate water supply to downstream users.

II. CONCLUSION

It is concluded that the "Innovative Wedge and Spigot vertical gate" is a water control system that utilizes a Ferro cement gate with a wedge and Spigot mechanism, eliminating exposed steel components. The gate is operated by lifting and lowering the wedge, allowing for precise control of water flow from the parent canal to

the downstream canal, with the option of additional security provided by a locking rod. Wedge and Spigot vertical lift gates offer precise flow control, sediment management, improved water quality, and durability. Their versatility, simplicity of maintenance, and potential for reducing energy consumption make them valuable components in water resource management and distribution systems.

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An Analysis of Young Adult Characters in Nikita Singh's Fiction

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ABSTRACT

Nikita Singh has been writing many more novels to have common theme on young adult characters and their aspirations to explore the majorly the middle class. The different mentalities of young adults' found in her literature. She has written her literature Indian subcontinent; So the description found young generation its aspirations along with their young psyche. Though they different obstacles to achieve success. They have different and have complex relationship. Youngsters are also aspirants of better life as present they have and facing the many more problems to keep up the life. Break up and reunions are also found in her literature. Young age and problems they face in their practical life is vivid picture sketched by novelist. The purpose of this research paper is to find out the young adults characteristics and their problems; they face in her fiction. To examine the characteristics of young adults critically to understand relationship in her Literature. Young adults are facing themselves some problems to sustain life. It is shown through her literature.

Keywords: Young Adults; social media; Love and Romance; Break ups and Reunion

I. INTRODUCTION

Erik Erikson's psychosocial theory has had a significant impact on our understanding of human development, and the stage of young adulthood is a critical part of his framework. Erikson proposed that each stage of life is characterized by a specific psychosocial crisis that individuals must navigate to achieve healthy development. In the case of young adulthood, Erikson described the primary psychosocial conflict as "intimacy versus isolation." This stage typically occurs between the ages of 18 and 40, and it revolves around the challenge of forming deep, meaningful relationships with others while also establishing a clear sense of personal identity. During this stage, individuals are exploring their identities, seeking intimacy in relationships (both romantic and platonic), and trying to find their place in the broader social context. Successfully navigating this stage leads to the development of strong interpersonal connections, a stable sense of self, and a capacity for intimacy. In terms of health, young adulthood is often considered a peak period. Physically, individuals in this age range are generally at their prime in terms of strength, endurance, and overall health. However, it's also a time when lifestyle choices, such as diet, exercise, and stress management, can significantly impact long-term health. Overall, this stage is a crucial time for personal and social development, as individuals work to establish their identities, build relationships, and make choices that will shape their futures.

II. FRIENDSHIP AND RELATIONSHIP

The essence of how relationships between characters play a crucial role in developing themes and character depth in Nikita Singh's novel. Indeed, the interactions between characters can reveal various aspects of their personalities, motivations, and conflicts, adding layers of complexity to the story. Exploring relationships allows readers to witness the multifaceted nature of characters, showcasing both their strengths and weaknesses. This mirrors real-life dynamics, where individuals may reveal different facets of themselves depending on the context and the people they interact with. Understanding the similarities and differences between characters, as well as their feelings toward each other, contributes to a nuanced portrayal of their relationships. This complexity can elevate the storytelling experience, making the characters more relatable and engaging for readers. The positive or negative nature of relationships adds another dimension to the narrative. Positive relationships may contribute to the characters' growth, provide support, and enhance the overall theme of the story. On the other hand, negative relationships can introduce tension, conflict, and obstacles, driving the plot forward and creating opportunities for character development. Interpersonal communication and interaction with others are essential for character development. Through these relationships, characters can evolve, learn, and change, contributing to the overall architecture of the story. The interconnectedness of different segments of the novel, facilitated by relationships, helps create a cohesive and rich narrative. The mention of true friendship and its role in various types of novels, including romantic ones, highlights how relationships can serve as a central theme that resonates with readers. Friendship, love, and other interpersonal connections are powerful motifs that can profoundly impact the characters and the overall direction of the narrative. In summary, the exploration of relationships between characters is a fundamental aspect of fiction, contributing to the development of themes, character depth, and the overall richness of the storytelling experience.

III.LOVE AND ROMANCE

Love indeed encompasses a wide range of emotions, states, and attitudes, making it one of the most profound aspects of human existence. The distinction you draw between platonic and romantic love highlights the diversity of this emotion, which can manifest in various forms and intensities. The idea that love involves unselfish service to others is a poignant observation. Love, in its truest form, often entails putting the well-being of others above oneself. Acts of kindness, empathy, and understanding are powerful expressions of love that strengthen interpersonal connections and contribute to the overall fabric of meaningful relationships. The connection between love and literature is significant. Throughout history, writers have explored the intricacies of love, using it as a central theme to delve into the human condition. Love's ability to both nurture and challenge, to bring joy and heartbreak, makes it a rich and versatile subject for storytelling.Your distinction between love and romance is insightful. While love is a broad and encompassing emotion, romance is characterized by the thrill, excitement, and exhilaration that often accompany the experience of love. The analogy of exhilaration being a kin to the overflow of happiness, whether from riding an ocean wave, hearing a favorite song, or sharing laughter with friends, vividly conveys the intense and uplifting nature of these feelings. Nature of love, emphasizing its power to shape relationships, impart important lessons, and leave a

lasting impact on our lives. The recognition of both the joy and challenges inherent in love adds depth to our understanding of this universal and timeless aspect of the human experience.

IV. SOCIAL MEDIA

Love, one of the most intense human emotions, encompasses a variety of feelings, states, and attitudes, ranging from interpersonal affection to profound pleasure. Whether it's a platonic or romantic connection, a fleeting moment or a lifelong commitment, love has the capacity to foster meaningful relationships, break hearts, impart valuable lessons, and permanently alter lives. It's unsurprising that love stands as one of the most frequently explored themes in literature. Love involves selfless service to others, serving as evidence that one genuinely cares. Both love and romance, though distinct, can coexist within the same context. Love represents a deep-seated emotion felt by one entity towards another, often shared mutually. In contrast, romance is characterized by the sensations of thrill, excitement, and exhilaration. Exhilaration, exemplified by experiences like riding an ocean wave, hearing a beloved song, or sharing uncontrollable laughter with friends, represents a surge of happiness.

V. SOCIAL RELEVANCE OF YOUNG ADULTS

According to Erik Erikson's psychosocial life stages, one crucial phase is young adulthood, spanning from 18 to 40 years of age. In this stage, the primary conflicts revolve around intimacy and the capacity for loving relationships with others. Young adults engage in exploring relationships that may lead to commitments beyond familial bonds. Successfully navigating this stage can result in fulfilling relationships and a sense of commitment, safety, and care. Conversely, avoiding intimacy and fearing commitment may lead to feelings of isolation, loneliness, and depression. Nikita Singh, in alignment with Erikson's theory, addresses social issues prevalent among young adults in her works. These include themes like depression, betrayal in love, and contemporary social perspectives. For instance, in "Letters to My Ex," the narrative revolves around the breakup of Nidhi and her reunion with Abhay. "Love @ Facebook" explores modern social dynamics, incorporating symbols and short forms commonly used on social media.Singh's "Someone Likes You" tells a story of transformation from an unattractive appearance to a remarkable makeover. "The Reason is You" delves into the challenges of mental illness and depression in the relationship between Siddhant and Akirti. "After All This Time" portrays social issues faced by young adults, such as Lavanya dealing with being HIV positive and reconnecting with an old friend. "Accidentally in Love" narrates the love story of Chhavi and Tushar, while "The Promise" unfolds as a tragic love story that remains unfulfilled until the end.Nikita Singh extends her engagement with readers through various blogs, primarily focused on young adult themes and her literary works. These writings serve as a means to connect with a broader audience and delve into the social and emotional landscapes of the young adult experience.

VI. CONCLUSION

The exploration of middle-class orthodox thinking and recurring themes in literature, as discussed in the concluding sections, serves as a backdrop for delving into a variety of contemporary topics within the narrative. Love, betrayal, friendship, the impact of social media, and their repercussions on human life emerge as central themes. One noteworthy observation is the younger generation's pronounced addiction to social media,

shedding light on the evolving dynamics of interpersonal relationships in the digital age. The narrative also delves into the complexities of love triangles, portraying them as potential sources of strife in adult relationships, adding a layer of realism to the storytelling. The portrayal of the middle class as discontent with their jobs despite embodying values such as honesty, aspirations, hard work, and self-discipline speaks to the nuanced challenges and aspirations faced by individuals within this demographic. This discontent adds depth to the characters and reflects broader societal concerns. The exploration of betrayal and reunion within adult relationships underscores the intricate nature of human connections. The narrative seems to navigate through the emotional intricacies of these themes, offering readers a glimpse into the multifaceted aspects of personal relationships. A particularly relevant aspect touched upon is the impact of social media on mental health, hinting at the potential disturbances that may arise from excessive use, amplified by the ubiquity of the internet. This commentary on the intersection of technology and mental well-being provides a contemporary lens through which societal challenges are examined. The emergence of non-fictional literary trends, such as blog and article writing, is highlighted as a noteworthy development in literature. This reflects the evolving landscape of literary expression, with new forms gaining prominence in response to societal changes. It serves as a reflection of societal norms and challenges, providing readers with a nuanced understanding of the complexities inherent in human relationships and the impact of modern phenomena such as social media.

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Recent Advancement in Synthesis and Biological Activity of Acridine and Acridinediones Derivatives

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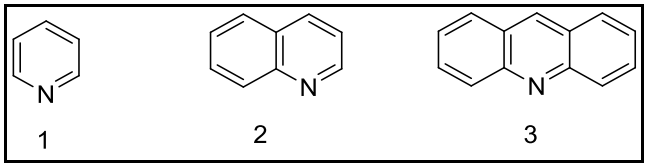
ABSTRACT

The research Community around the globe struggle with cancer or bacterial, parasitic, viral, tuberculosis, Alzheimer's, and other diseases. Therefore, many research groups seek new, more effective, more selective, and less toxic scaffolds. Acridine/acridone derivatives constitute a class of compounds with a broad spectrum of biological activity due to their molecular beauty. In this book's chapter, we glimpse biological activity and recent advancements in the development of new synthetic routes for the synthesis of acridine and acridinediones derivatives. We conclude here with biologicals spectrum and synthetics chemistry and acridine analogues.

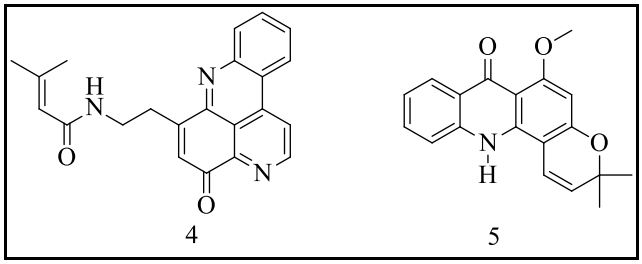
Keywords: Synthesis, Multicomponent Reaction, One Pot Synthesis, Biological Activity.

I. INTRODUCTION

Acridine **(3)** is an important class of heterocyclic compounds containing nitrogen in which the benzene ring is attached to the quinoline **(2)** ring. The structural moiety in which two benzene rings are attached to a pyridine ring **(1)**. The other names of Acridine are dibenzo[*b,e*] pyridine and 2,3-benzoquinoline. It has a similar structure to anthracene in which one center 'CH' group is replaced nitrogen atom. The first isolation of acridine was carried out by Carl Grabe and Heinrich Caro in 1870 from coal tar by dilute sulfuric acid. Acridines are weakly basic which is similar to that of pyridine having an excited state is pKa of 10.6 and ground state pKa of 5.1. The importance of heterocyclic systems that contain nitrogen is underlined by their key role in natural products. Acridines represent one of the most important subunits as their use in the form of building blocks for heterocyclic systems and have a strong influence in many fields.



Acridine derivatives are widely found in natural alkaloids. Acriflavine and acridine have an irritating odor. These crystallize in colorless to light yellow needles with a melting point of 110°C and boiling point of 346°C [1]. Cystedytins share architectural similarities with other recently discovered marine natural products incorporating highly condensed polycyclic heteroaromatic skeletons. First pyrido-acridine alkaloid Cystodytins A (**4**) was isolated from a marine tunicate and it is the first tetracyclic member which shows significant biological properties [2]. The extraction of Acronycine (**5**) alkaloid was carried out from the bark of the Australian plant *Acronychi*a Baueri Schott and shows antitumor activity [3] Aminoglycoside derivatives may provide a means to selectively target viral RNA sites, including the HIV-1 Rev response activity [4].

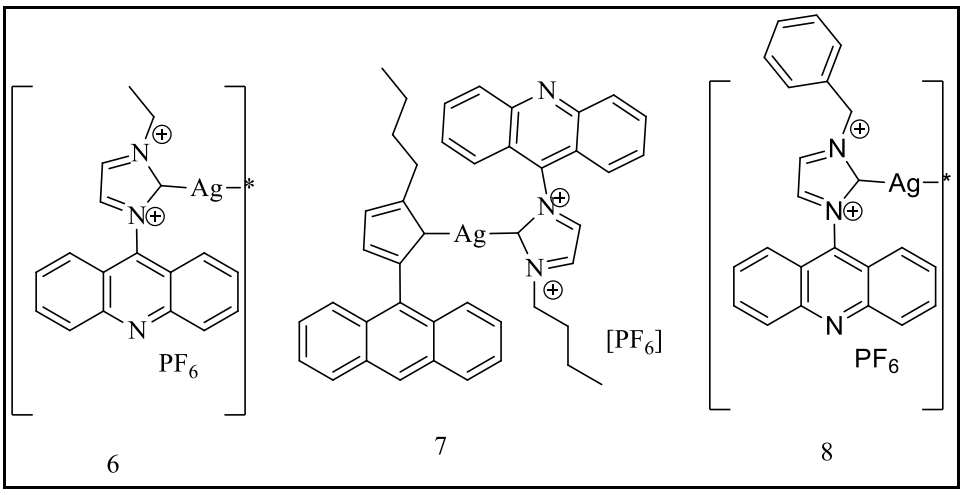


II. BIOLOGICAL SIGNIFICANCE

Acridine derivatives are an important class of heterocyclic compounds due to the application of these scaffolds in the field of pharmaceuticals such as antibacterial, antitumor, cytotoxic, HIV-1 rev response, G-quadruplex DNA telomere targeting, potential anti-tuberculosis, and inhibitory activity.

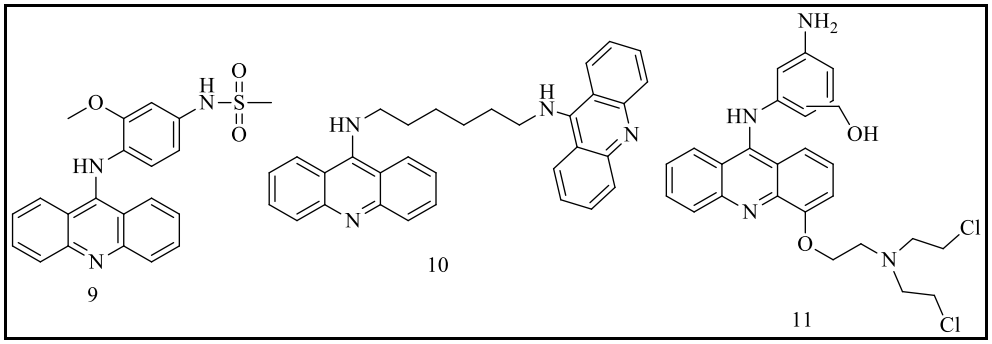
Antibacterial activity

The {Ag [1-acridinyl-3-butylimidazolydiene] 2 (PF_6) (CH_3CN)} [**6**], f{Ag[1-acridinyl-3-ethylimidazolydiene](PF6)}$_n$ [7] and {Ag [1-acridinyl-3-benzylimidazolydiene] (PF6)}$_n$ [**8**] showed an excellent antimicrobial properties against *A. Acinetobacter baumannii* and *P. aeruginosa.* The bacterial strains were inoculated to the surface of agar plates [5].



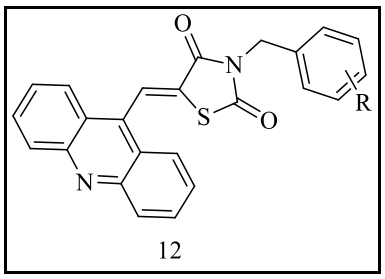
Antitumor Activity

2-Methyl-9-substituted Acridine shows antiproliferative properties and chemotherapeutics like Amsacrine (**9**). Bis-acridine derivatives (**10**) showed *in vitro* cytotoxic activity against *A-549* and *MCF-7* these two cancer cell lines with CTC_{50}. 9-Anilinoacridine derivatives (**11**) excellent antitumor activity in mice against the human breast carcinoma MX-1 xenograft [6-8].



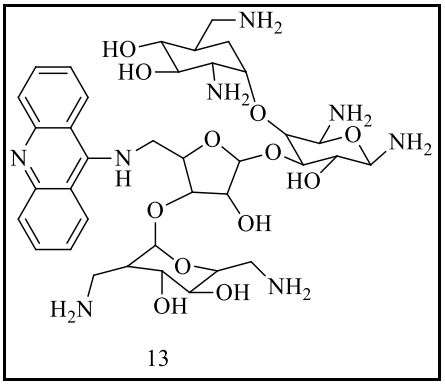
Cytotoxic Activity

The synthesis of novel hybrid 5-acridin-9-ylmethylene-3-benzyl-thiazolidine-2,4-diones derivatives of acridine-thiazolidines was performed by Michael addition reaction (**12**) and the derivatives were evaluated against tumor cell lines of different histotypes which showed potent cytotoxic activity this cytotoxic activity [9]



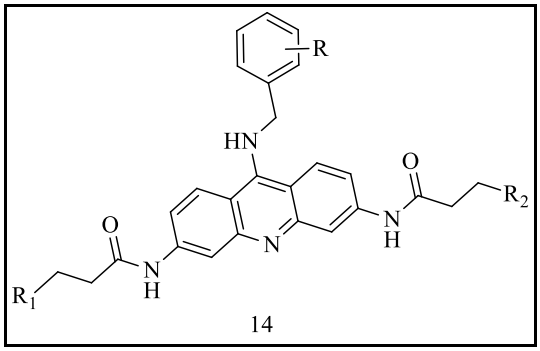
HIV-1 Rev Response Activity

Aminoglycoside derivatives (**13**) may provide a means to selectively target viral RNA sites, including the HIV-1 Rev response via aminoglycosides evaluated for their nucleic acid affinity [10].



G-quadruplex DNA telomere targeting

A series of benzylamino-substituted acridine derivatives (**14**) acts as G-quadruplex binding telomerase inhibitors. This derivative obtained by replacement of the previously reported aniline substituents by benzyl-amino groups enhances quadruplex interaction [11].



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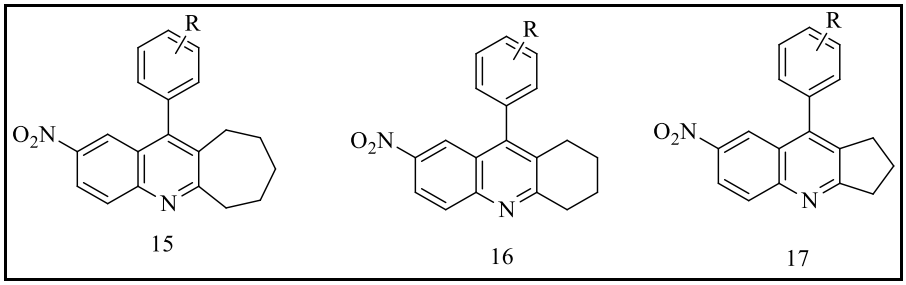
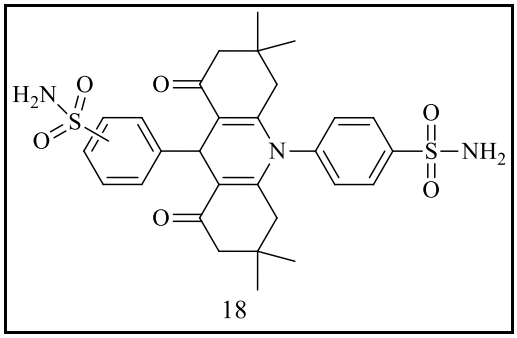
Potential anti-tuberculosis

The synthesis of novel acridine derivatives (**15-17**) is also studied and evaluated for growth inhibitory activity towards *Mycobacterium tuberculosis* H37Rv. These derivatives exhibited bactericidal activity at 50 mg/mL and it was not cytotoxic at low concentrations. These derivatives were synthesized via the Friedlander reaction [12].



Inhibitory Activity

The synthesis of a new acridine bis-sulfonamides scaffold by the multicomponent reaction was reported by G. C. Muscia and *et.al*. The synthesized acridine derivatives were investigated as the inhibitors of four human carbonic anhydrase isoforms. These derivatives also showed activity against the carbonic anhydrase I, II, IX and XII isoforms [13].



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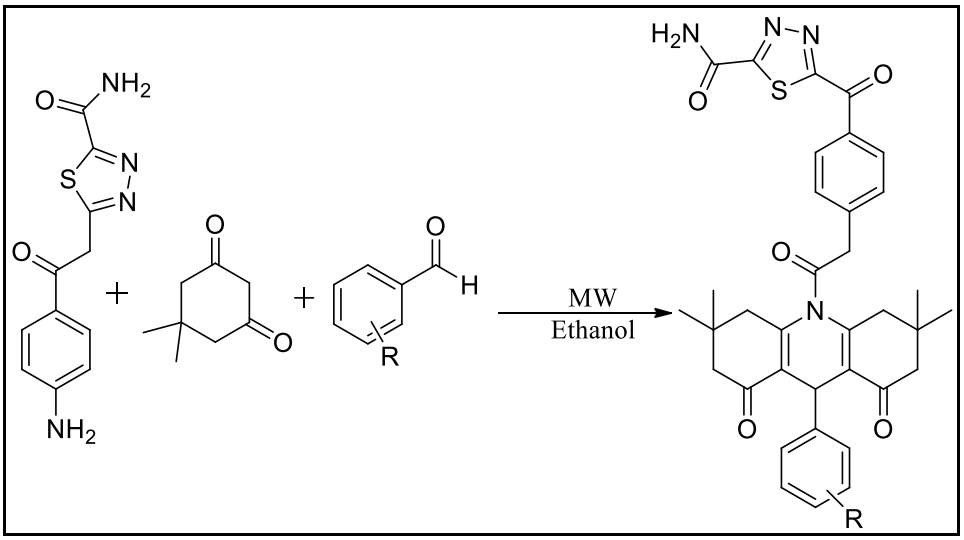
III.METHODS OF SYNTHESIS

Acridines have numerous applications in various fields. The synthesis of acridine derivatives receives wide importance in various fields such as medicinal chemistry, photochemistry, and organic synthesis. Several strategies for these compounds have been reported. The very simplest method for their synthesis involves one

pot, three-component condensation of cyclohexadione, aromatic, and anilines under different conditions using various catalysts. Some of the recent approaches for syntheses of acridine derivatives are given below.

Jie Zhang *et. al.* Approach:

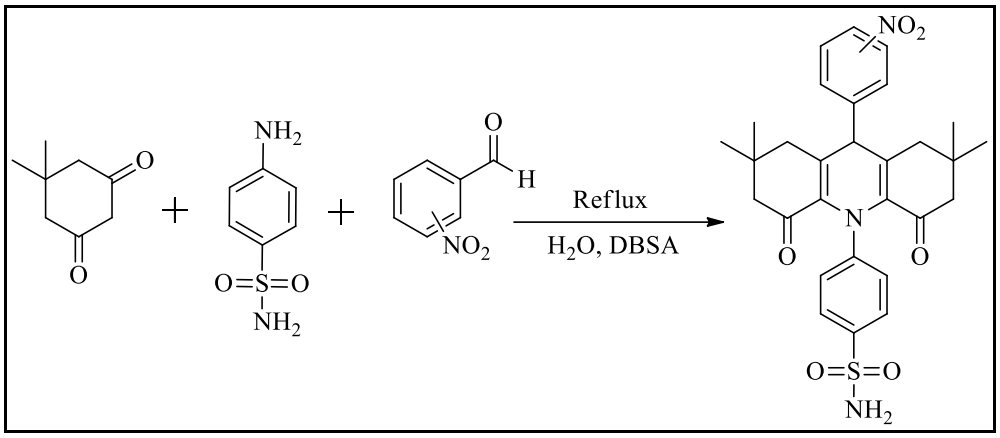
A mixture of 5,5-dimethylcyclohexane-1,3-dione, various aromatic benzaldehyde, and 4-amino-*N*-(5-sulfamoyl-1,3,4-thiadiazol-2-yl)benzamide in 5 mL ethanol was irradiated in microwave synthesis system and formation of the acetazolamide based hybrid acridine derivative was reported (**Scheme 1**) as the desire products [14].



Scheme 1

Ibrahim Esirden *et. al.* Approach:

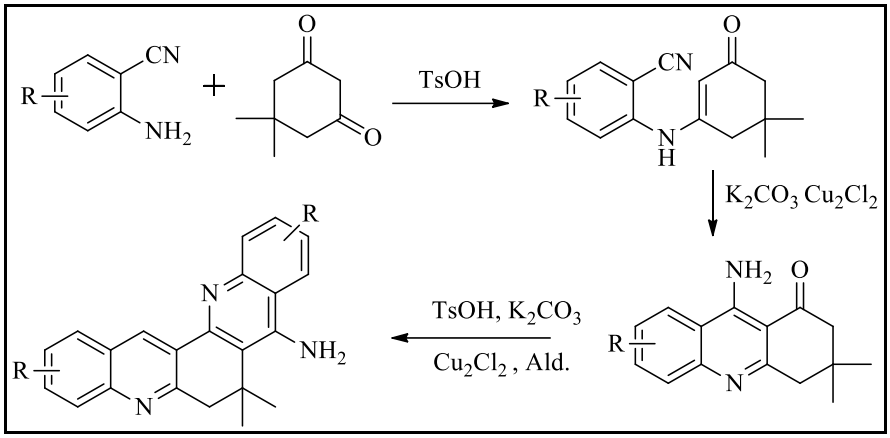
By using the multicomponent reaction system (MCR), nitro acridine sulfonamides (**Scheme 2**) were obtained from cyclic-1,3-diketones, 4-aminobenzene sulfonamide and aromatic aldehydes [15].



Scheme 2

Guang-Fan Han *et. al.* Approach:

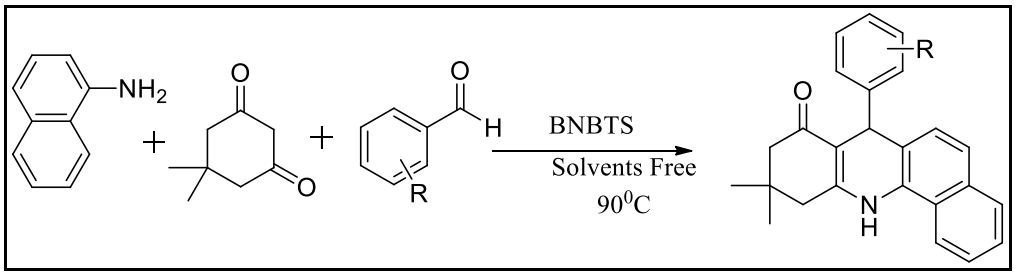
Novel 9-amino-3-substituted-1,2,3,4-acridin-1-one derivatives and 9,14-diamino-7-substituted-7,8-dihydroquinolino[2,3-*a*]acridine derivatives (**Scheme 3**) were synthesized by the condensation reaction of 5-substituted-1,3-cyclohexanedione with 2-aminobenzonitrile and substituted 2 aminobenzonitrile using p-toluenesulfonic acid, K_2CO_3, and Cu_2Cl_2 as catalysts[16].



Scheme 3

R. Ghorbani-Vaghei *et. al.* Approach:

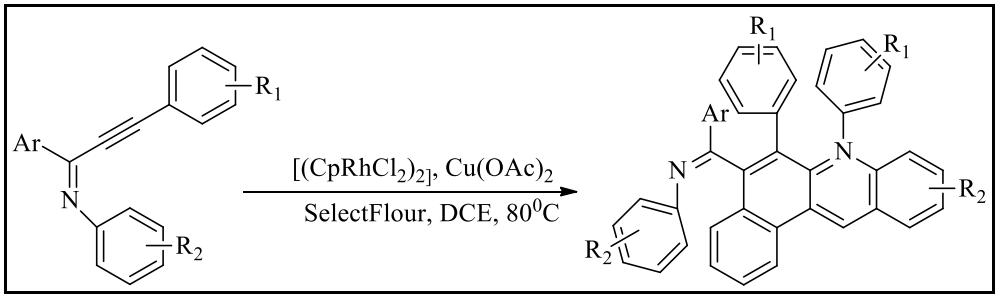
N,N'-dibromo-*N,N'*-1,2-ethanediyl *bis*(*p*-toluenesulfonamide) [BNBTS] was used as a reusable catalyst for the one-pot synthesis of benzo[*c*]acridines (**Scheme 4**) in good to high yields using three-component reaction from naphthalen-1-amine, aryl aldehydes and cyclic 1,3-dicarbonyl compounds under solvent-free conditions [17].



Scheme 4

Yingying Shan *et. al.* Approach:

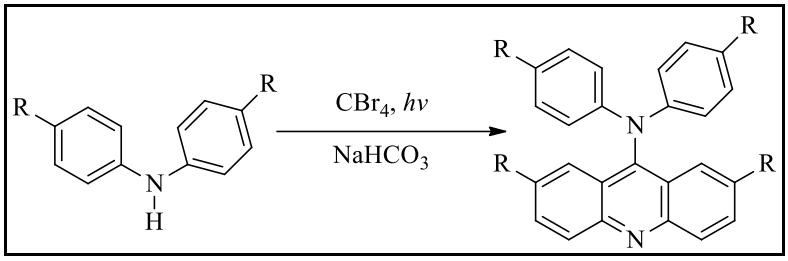
The pairs of molecules of alkynyl imine might produce a double molecular cyclization reaction to generate the functionalized acridine derivatives (**Scheme 5**) catalyzed Rh(III) by double molecular alkyne imine C-H activation [18].



Scheme 5

Viacheslav A. Sazhnikov *et. al.* Approach:

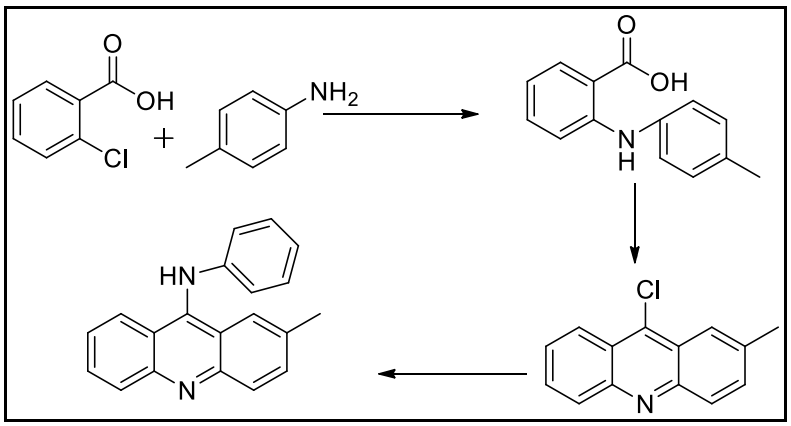
The synthesis of three 9-diarylamino-substituted (**Scheme 6**) acridines using diarylamine and carbon tetrabromide in hexane was carried in a Pyrex bulb and irradiated with sunlight for four weeks the purple precipitated [19].



Scheme 6

Rajesh Kumar *et. al.* Approach:

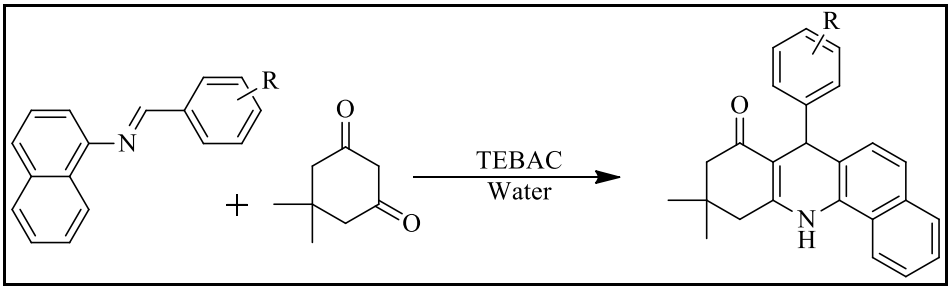
2-methyl-9 substituted acridines (**Scheme 7**) were synthesized by nucleophilic substitution of 2-methyl-9-chloroacridine with aromatic amines and 9-chloroacridine was synthesized from 2-chlorobenzoic acid and aromatic amines by nucleophilic substitution reaction [20].



Scheme 7

Gajanan B. Kasawar *et. al.* Approach

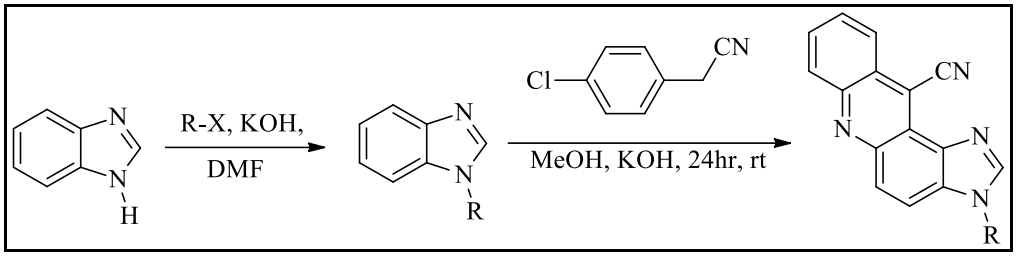
The synthesis of novel benzo[*c*]acridine derivatives (**Scheme 8**) via annulation of *N*-arylidenenaphthalen-1-amine and dimedone in the presence of triethylbenzylammonium chloride catalyst under aqueous medium [21].



Scheme 8

RobabehSahraei *et. al.* Approach:

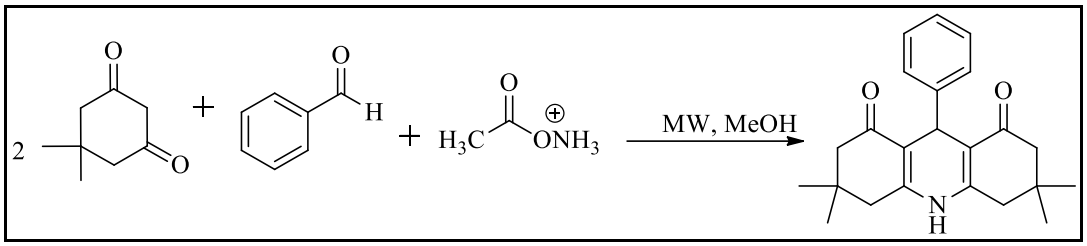
The synthesis of 3*H*-imidazo[4,5-*a*]acridine-11-carbonitriles (**Scheme 9**) by using 5-nitro-1*H*-imidazoles and 2-(4-chlorophenyl)acetonitrile at room temperature in DMF solvent. [22].



Scheme 9

Miyase Gozde Gunduz *et. al.* Approach:

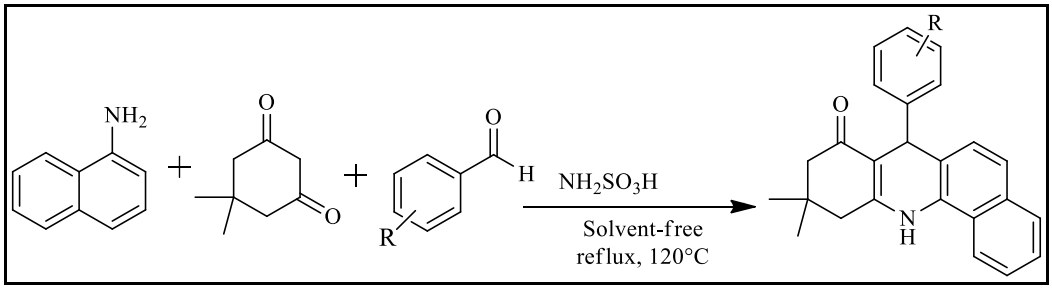
The synthesis of acridines (**Scheme 10**) by the condensation of 1,3-diketone, different aryl aldehydes and ammonium acetate in methanol under microwave-assisted conditions. The synthesized compounds showed interactions with the active site of the potassium channel blocker [23].



Scheme 10

Majid M. Heravi *et. al* Approach

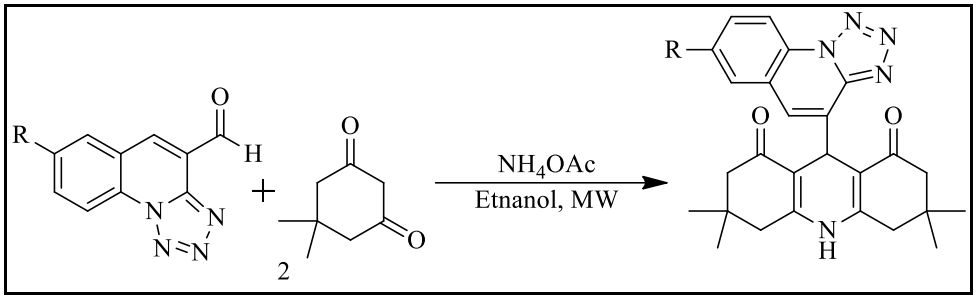
The synthesis of benzo[*c*]acridine derivatives (**Scheme 11**) via condensation of α-naphthylamine, dimedone and various aromatic aldehydes in the presence of a catalytic amount of sulfamic acid was reported under solvent reaction condition at 120°C. The key advantages of this reaction are excellent yield, simple experimental procedure, easy workup and use of reusable catalyst [24].



Scheme 11

Niraj K. Ladani *et. al.* Approach

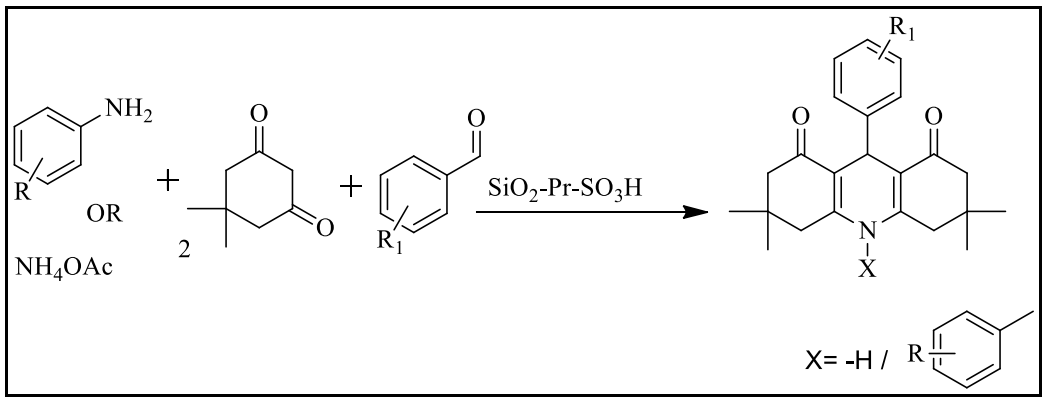
Microwave-assisted synthesis of acridine-1,8-diones derivatives (**Scheme 12**) via annulation of cyclohexane-1,3-dione, various tetrazolo[1,5-*a*]quinoline-4-carbaldehydes and ammonium acetate in ethanol. The synthesized derivatives were subjected to *in vitro* antimicrobial screening against *Escherichia coli*, *Bacillus subtilis* and *Streptococcus aureus* bacterial activity [25]



Scheme 12

Ghodsi Mohammadi Ziarani *et. al.* Approach

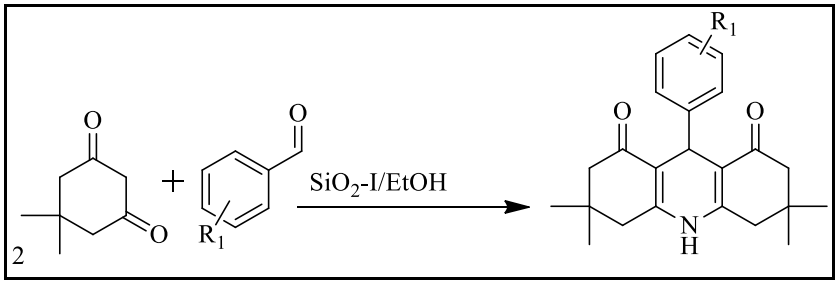
The synthesis of 1,8-dioxo-decahydroacridine derivatives (**Scheme 13**) via the reaction of different aryl anilines or ammonium acetate, various aldehyde and dimedone in the presence of sulfonic acid functionalized silica catalyst under solvent-free condition. The key features of this protocol are minimum reaction time, excellent yield simple workup procedure and experimental conditions [26]



Scheme 13

K. B. Ramesh *et. al.* Approach

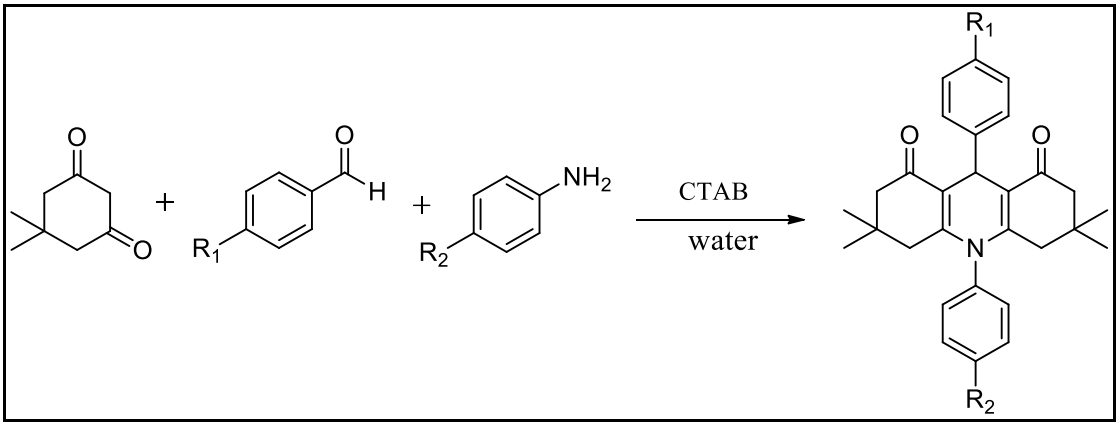
The synthesis of 9-aryl-hexahydroacridine-1,8-diones derivatives (**Scheme 14**) via condensation of ammonium acetate, various aromatic aldehydes and dimedone in the presence of heterogeneous catalyst silica-supported iodide (SiO_2-I) in ethanol solvent [27].



Scheme 14

Jing-Jing Xia *et. al.* Approach

One pot synthesis of *N*-substituted acridinediones derivatives (**Scheme 15**) via Hantzsch condensation of an aromatic aldehyde or formaldehyde, aromatic aniline and dimedone was studied in the aqueous solution of cetyltrimethylammonium bromide (CTAB). The key advantages of this methodology are green and eco-friendly approach, excellent yield and simple experimental procedure [28].



Scheme 15

IV. DISCUSSION

Sustainable organic chemical processes have to be developed by the developing field of green chemistry due to the growing environmental pollution and its severe effects on living systems. Thus, the importance of greener pathways in organic synthesis is the field that is always expanding to accomplish sustainability. The use of energy for heating and cooling is an important environmental issue for many chemical activities.

It is extremely important to create effective routes that make use of greener protocols to address such issues. Multicomponent Reactions (MCRs) are greatly diverse by one-pot synthetic processes. When synthesized sustainably, small molecules employed in the pharmaceutical and agrochemical sectors are constantly in high demand. These strategies frequently deal with the rising concern over environmental safety and hazard. The creation of such environmentally friendly techniques is the main focus in the field of sustainable and environmentally conscious chemistry since carrying out chemical reactions in a water-soluble catalyst is a green tool. . Therefore, many research groups seek new, more effective, more selective, and less toxic scaffolds. Moreover, acridine and acridone containing scaffold possess broad spectrum of cancer or bacterial, parasitic, viral, tuberculosis, Alzheimer's, and other diseases activity due to their molecular beauty.

Acradine and acridinediones synthesized by protocol like microwave assisted greener synthesis. Acradine and acridinediones derivatives synthesized by using various catalyst includes ethanol mediated synthesis, DBSA, TsOH, BNBTS, $Cu(OAc)_2$, $NaHCO_3$, TEBAC, DMF, KOH, SiO_2-Pr-SO_3H, SiO_2-I_2, and CTAB.

V. CONCLUSION

We discuss numerous synthesis methods to synthesize acridine and its analogs acridinediones in this book chapter. Efficacious, water-soluble, sustainable, and affordable catalysts, in addition to less dangerous catalysts and organic-based nanocatalysis, were employed in the reported synthesis of synthetic derivatives of acridinediones. A brief summary of this method contains a number of features, including a low minimum reaction temperature, short reaction periods, environmentally friendly solvents, a catalyst that is water soluble, and a straightforward workup procedure. Cancer, bacterial, parasitic, viral, tuberculosis, Alzheimer's disease, and other disorders are caused by acridine and its derivatives.

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Fusion of Brain Dominance and Ikigai Techniques for Identification of the Best Career Option

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ABSTRACT

Every person in the world, once in hers life, faces a challenges of the career choice. Her honesty about herself, hide by external factor that is others expectation about or her. This makes confusion in choice of hers best career. In literature, exploration of the brain dominance has proven that, as per brain dominance person strongly inclined to the skill, which is relevant to the declaration of the components by hers, brain dominance. And a Japanese technique "ikigai" used in literature for finding well beings of person. In this study, we fuse these two techniques and apply a machine learning algorithm to find the best career choice for a person.

Keywords: Brain Dominance, Ikigai, Machine Learning, Well Beings, Career choice, Skill development

I. INTRODUCTION

The success and well-being of an individual strongly depend on his systematic, timely, disciplined, and enjoyable working style in his career. To become successful, an individual should select the best career option that he can justify. The choice of the best career option poses several challenges. (Ahmad Najar, 2019).

1. Some of the people select a career only because they think they will get highly paid.
2. There is another trap in the glamour of the post.
3. Some others choose careers by force.

Everyone wants to select the best career. The choice of career is a difficult task. There are several factors that restrict one from selecting the best career option. Brain dominance helps to indicate the things that are biologically preferred by the person. The career chosen by him relative to the things produced by brain dominance has a positive impact on his career. (Hyma, 2015)

A. Research Problem:

In the process of selecting the best career option, it's necessary to explore innovative approaches that fuse psychological frameworks and cultural aspects to provide individuals with the best career recommendations. Brain dominance, which categorizes individuals into left-brained, right-brained, or balanced thinkers, and Ikigai, a Japanese concept representing the intersection of passion, vocation, profession, and mission, offer life purpose. Integrating these concepts and applying them to the generation of new features through the

correlation of brain dominance with Ikigai components and intersection methods on newly generated features can potentially revolutionize the career selection process.

B. Objective:

1. Brain dominance test conducted for the identification of which hemisphere that is left or right activation. Clearly indicate career inclination. Ikigai the Japanese technique tested for the integration of the Passion, Mission, Vocation, and Profession. Clearly indicate well-beings of the Individual.
2. Both the techniques provides features set, that must be tested for correlation, the most significant feature fused with the machine learning algorithm and fusion score indicate the best career option that make life happy and satisfactory.

II. LITERATURE REVIEW

A. Brain Dominance:

Brain dominance research has proved that there is a significant relationship between hemispheric preference and learning style; the learning style always inclines toward the particular skill set. Brain dominance is the tendency of an individual to process information through both hemispheres. Hemispheres are separated by different functionalities. Following are left and right brain hemisphere functionalities (Hyma, 2015)

In this paper, we discuss a technique for holding praying hands. In this technique, the candidate under assessment is said to do immediate holding of the praying hand comfortably, as shown in Figure 1. As a result, we will consider the upper side of the thumb. If it's the right hand, it means candidates have left-brain dominance, and if it's the left hand, then right-brain dominance.

Figure 1: Holding Praying Hands (iStock)

Right brain dominance indicates right hemisphere activation, and left brain dominance indicates hemisphere activation.

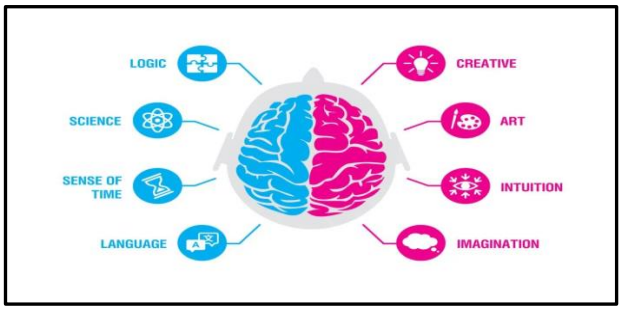

Figure 2: Brain Dominance Hemisphere (Left, Right) (Simply Psychology)

Due to the dominant brain, there are differences in learning styles and decision-making processes. There are also differences in the potential features of the individual and their inclination towards a particular task. The study provides an interesting framework for understanding human cognition.

B. Ikigai:

"Ikigai" is the Japanese technique for finding the well-being of an individual. Also, popular is the name “Reason of Being”. It provides an intersection of four pillar activities, such as what you love, what you are good at, what the world needs, and what you can be paid for. The intersection of these activities provides satisfaction in life and a reason for being. (ziesche, 2020).

Natasha Randall (2022) claims the first ever grounded research work in which robots in later life will handle sense of purpose and meaning in a preconized way.

Figure 3: Ikigai (Reason of Being) (Japangov)

In the execution, we have to ask some basic questions to the candidate under assessments. The questions are:

1. What you love
2. What the world needs
3. What you are good at
4. What you can pay for

Existing Career Guidance Methods:

Interest inventories demonstrate an assessment of a person's interest and match a potential job. As per the post-profile aptitude test conducted and the suggested career In the method of personality trait, as per trait, the career option is suggested. Educational counseling, the suitable career path, and guidance about it are given at the school, college, and university level. Job fairs and workshops where individuals can interact with employers and learn about various career options. (Ahmad Najar, 2019)

Limitation and Challenges of existing Methods:

The traditional method of choosing a career might ignore passion in the individual. It looks like it is leading toward financially lucrative but personally unfulfilling careers. Social and family expectations affect career choices. Passionate pursuits might be compromised due to uncertainty and a lack of job security, striving individuals toward safer options. Modern careers driven by technological advancement need continuous learning and skill adaptation. (Ahmad Najar, 2019)

III.MATERIALS AND METHODS

A. Data Collection:

Everyone faces problems with career choice. Data can be collected from any person, but for this study, we focused on graduate students because this period is the beginning of thoughts on career choice. Data collected by two experiments:

1. Data collection by the dominance test (left or right brain dominance)
2. Data collected by the Ikigai Component: Passion, Mission, Vocation, Profession Table 1 shows the data sample:

Table 1: Data: Ikigai

Passion	Mission	Vocation	Profession	Ikigai
Set(A)	Set(B)	Set(C)	Set(D)	Set(E)

Table 2: Brain Dominance(Left & Right)

Left Brain Dominance		Right Brain Dominance
1	Arithmetic	Sensory Input
2	Logical Thinking	Auditory & Visual
3	Organized	Artistic Ability
4	Systematic	Creativity
5	Attending Details	Focus on Pattern
6	Sign Language	Follow Intuitions
7	Pay attention to Internal World	Attention to external world

B. Data Analysis

From the brain dominance test, we collect left or right dominance, and from Ikigai, we collect four vectors: passion, mission, choice, and profession. This Ikigai component is calibrated with the potential features of brain dominance. Another layer of relative potential career options is generated by the relevance of brain dominance and Ikigai.

C. Integration of brain dominance and Ikigai:

Ikigai of an individual can be changed as the status of his skill set and licking. Ikigai performed the assessment by using the questionnaire method; hence, during the assessment, he should be clear, concise, and honest. Four questions:

Q1. What do you love? A probable answer could be music, dance, art, social work, or helping others.

Q2. What are you good at? A probable answer could be song, art, design, or sport (cricket).

Q3. What the World Needs: Actually, the world needs lots of things, but here you have to select those that you can fulfill, with a special focus on the emerging needs of the world. That will probably be environmental sustainability. Entertainment, plantations, technology, farming, and medical

Q4: What can you be paid for: singing show, volunteering, music or dance training, KG tutor?

As per the assessment of the above questionnaire, the passion of such an individual will be working in an advertising agency or starting design-related work. The mission will be social programs. Vocation will be any

online work or musical shows. The profession will be a training program in music and dance. Ikigai will be in the entertainment industry.

According to the questionnaire and application of Ikigai, we have passion, mission, vocation, and profession. And ultimately, Ikigai. After combining the results of Ikigai with the brain dominance results, the most appropriate career option is suggested. For example, if the candidate under assessment has left-brain dominance, then, as per Table 2, left-brain dominance shows a dominant dominance of logical thinking, arithmetic, organization, and systematics. After taking the brain dominance test now, it will change the reason for being and well-being to product engineering and product design.

IV. CONCLUSION

A. Individual Satisfaction and Fulfillment

Individual contentment and satisfaction are greatly impacted by career decisions. Jobs that are fulfilling and motivate people are those that are in line with their values, talents, and passions. Well-being is enhanced by careers that allow for advancement, social responsibility, and work-life balance. Mismatched jobs can impact one's life trajectory and general happiness by causing stress, frustration, and discontent.

The study reveals that career alignment with personal values and interests significantly impacts individuals' well-being and job satisfaction. Participants who pursued careers aligned with their brain dominance and ikigai experienced fulfilment, while those mismatched experienced frustration and dissatisfaction. This highlights the importance of personal values in career choices.

Career choice has great importance in society. This study explore the Intergration of brain dominance and ikigai will surely helpful in choice of best career option Integrating brain dominance and Ikigai into career selection is a transformative paradigm that can develop career pursuits. By understanding one's brain dominance, individuals can align their career choices with their innate abilities, leading to a sense of purpose and fulfillment. This holistic approach goes beyond traditional skills matching to job requirements, considering individuality, passions, and world needs. It fosters a workforce engaged, motivated, and passionate, leading to accelerate productivity, creativity, and innovation. It also promotes mental well-being by reducing job-related stress and dissatisfaction, alleviating healthcare burdens. By empowering individuals to discover their true callings, society can create a skilled and satisfied workforce, leading to a more harmonious world.

Artificial Intelligence, machine learning and deep learning are today's technology can be used for learning pattern on available data from the fusion of two methods brain dominance and ikigai. Numerous machines learning algorithm can be future for providing more accurate career predictions based on brain dominance and Ikigai.

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Women's Participation in Physical Activities and Sports Benefits

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ABSTRACT

The purpose of this study was to describe the "Women participation in physical activities and sports benefits". It was a descriptive study. In this study focused the women play the vital role in the field of physical education and sports. Women participation in various sports for physical and mental fitness as well as success to achievement awards. Participation women in physical activity and sports in physical health benefits of regular physical activity are well established. Regular participation in such activities is associated with a longer and better quality of life, reduced risks of a variety of diseases and many psychological and emotional benefits. Regular activity can have a positive effect upon girls' psychological well-being; indeed, some studies indicate that girls may respond more strongly than boys in terms of short-term benefits.

Key words: Women Participation in Physical Activity and Sports.

I. INTRODUCTION

There is an international consensus that participation in physical activities can offer a great deal to individuals, Communities and nations. The evidence suggests that from an early age, differences in gender-based attitudes towards and opportunities for sports and physical activities can have a vital influence on children's participation. This may, in turn, affect later involvement in physically active lifestyles, and the social and health benefits that may result for them.

This report offers a summary of research into girls' participation in sports and physical activities. It focuses upon the following themes:

- **Benefits of Sports and Physical Activities;**
- **Patterns of Girls' Participation in Sports and Physical Activities;**

To make the paper as useful as possible for readers from different backgrounds, and to keep the main paper of a manageable size, we have appended some additional information, including some suggestions for future research in the area of gender and physical activity, further reading, and details of relevant organizations.

II. BENEFITS OF SPORTS AND PHYSICAL ACTIVITIES

Physical Health:

The physical health benefits of regular physical activity are well-established. Regular participation in such activities is associated with a longer and better quality of life, reduced risks of a variety of diseases and many psychological and emotional benefits. There is also a large body of literature showing that inactivity is one of the most significant causes of death, disability and reduced quality of life in the developed world. Physical activity may influence the physical health of girls in two ways. First, it can affect the causes of disease during childhood and youth. Evidence suggests a positive relationship between physical activity & host of factors affecting girls' physical health, including diabetes, blood pressure and the ability to use fat for energy. Second, physical activity could reduce the risk of chronic diseases in later life. A number of 'adult' conditions, such as cancer, diabetes and coronary heart disease, have their origins in childhood, and can be aided, in part, by regular physical activity in the early years. Also, regular activity beginning in childhood helps to improve bone health, thus preventing osteoporosis, which predominantly affects females. Obesity deserves special mention. There seems to be a general trend towards increased childhood obesity in a large number of countries, and this increase seems to be particularly prevalent in girls from highly urbanized areas, some ethnic minorities and the disabled. Obesity in childhood is known to have significant impact on both physical and mental health, including hypertension and abnormal glucose tolerance. Physical activity can be an important feature of a weight control programme for girls, increasing calorific expenditure and promoting fat reduction. Indeed, recent systematic reviews on both the prevention and treatment of childhood obesity recommend strategies for increasing physical activity.

Mental Health:

In recent years, there has been evidence of disturbingly high rates of mental ill-health among adolescents and even younger children, ranging from the low-self-esteem, anxiety and depression to eating disorders, substance abuse and suicide. Adolescent girls are particularly vulnerable to anxiety and depressive disorders: by 15 years, girls are twice as likely as boys to have experienced a major depressive episode; girls are also significantly more likely than boys to have seriously considered suicide Research suggests two ways in which physical activities can contribute to mental health in girls. Firstly, there is fairly consistent evidence that regular activity can have a positive effect upon girls' psychological well-being; indeed, some studies indicate that girls may respond more strongly than boys in terms of short-term benefits.

Patterns of Girls' Participation in Sports and Physical Activities:

In addition to benefits for women and girls themselves, women's increased involvement can promote positive development in sport by providing alternative norms, values, attitudes, knowledge, capabilities and experiences. The contributions of women, particularly in leadership positions, can bring diversity and alternative approaches and expand the talent base in areas such as management, coaching and sport journalism. The participation of women and girls in sport challenges gender stereotypes and discrimination, & can therefore is a vehicle to promote gender equality and the empowerment of women and girls. In particular, women in sport leadership can shape attitudes towards women's capabilities as leaders and decision-makers, especially in traditional male domains. Women's involvement in sport can make a significant contribution to public life and community development.

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Automating Malaria Diagnosis: A Deep Learning Based Approach for Early Detection

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ABSTRACT

A person's life and health are of utmost importance. To ensure their safety and well-being against various diseases, I have developed an algorithm aimed at early detection of serious illnesses, such as malaria. Early detection is crucial, as the effects of malaria can worsen rapidly and pose a significant threat to human life. Malaria is caused by Plasmodium parasites, which are typically identified by trained microscopists through the examination of microscopic blood smear images. However, modern deep learning techniques can automate this analysis, reducing the reliance on skilled workers. In this article, we present a fully automated model for malaria diagnosis using Convolution Neural Networks (CNNs). Our approach involves three training procedures, including general training, distillation training, and auto encoder training. These techniques, which encompass knowledge distillation, data augmentation, Auto encoder, feature extraction by a CNN model, and classification by Support Vector Machine (SVM) or K-Nearest Neighbors (KNN), collectively optimize and enhance the accuracy of our model.

Keywords: Tiny Plasmodium parasites, blood smear, data augmentation, CNN, knowledge extraction, auto encoder, inference performance, floating point operations, and deep learning.

I. INTRODUCTION

Human life and health are the most important things in it. Therefore, utilizing current technology, I have developed an algorithm that will fully assist in diagnosing critical diseases like malaria in order to make it secure and defend against many types of infections. Early malaria detection will be beneficial since the disease's effects worsen rapidly and endanger human life significantly.

An imbalance or increase in the number of malaria parasites in the patient's blood serves as a marker for the infection's severity and causes malaria. Plasmodium spp. is a blood parasite that causes malaria. An estimated 3 million people die from it annually, and it affects between 200 and 300 million people annually. It is essential to diagnose and treat it [1, 2, 3]. Therefore, it is crucial that medication be started at the appropriate time in order to accurately and quickly identify disorders.

These days, Plasmodium spp. can be visually detected in blood samples and recognized effectively using a chemical procedure known as (Giemsa) staining [4].The staining procedure accentuates white blood cells

(WBC), artifacts, and Plasmodium spp. parasites while mildly coloring the RBCs. Giemsa stain RBCs pink, chromatin blue, and nuclei nuclei. Numerous field investigations have demonstrated that when carried out by non-experts, manual microscopy is an unreliable screening technique. In the bloodstream, malaria parasites take up residence in red blood cells. Segmenting RBCs from a blood picture and determining whether they are parasite-infected or normal is a crucial step in the malaria parasitemia count process. Images of thin blood vividly show the shape of the cells. Manually counting parasitemia requires expertise and is time-consuming.

II. LITERATURE REVIEW

Many techniques for identifying malarial parasites in a patient have been documented in the literature. These methods include polymerase chain reaction (PCR) [14–16], rapid diagnostic test (RDT) [11–13], microscopic diagnosis [5–10], and clinical diagnosis [3, 4]. In laboratory settings, conventional diagnostic techniques such as PCR and clinical diagnosis are carried out. The degree of human expertise at hand has a major impact on the accuracy and efficiency of these techniques [17]. In remote areas where malaria may be prevalent, there is insufficient availability of such expertise.Two of the most effective techniques for diagnosing malaria are RDT and microscopic diagnosis, which have a significant impact on malaria control in the modern era [13]. Because RDT can provide a diagnosis in as little as 15 minutes and doesn't require a microscope or a trained professional, it is an effective diagnostic tool [18].

But according to WHO [19] and others [20, 21], RDT has a few drawbacks, such as lack of sensitivity, incapacity to measure parasite density and distinguish between P. ovale, P. vivax, and P. malariae, more expensive than a light microscope, more vulnerable to heat damage, and moisture content. Due to their lack of these drawbacks, microscopic systems are thought to be efficient. for the detection of malaria parasites [13, 22], but this method necessitates the presence of a trained under a microscope [23].

Makkapati and Rao [27] investigated HSV color space segmentation. Red blood cells and parasites are divided into groups according to a method described in [27] that uses the HSV color space to identify the dominant hue range and determine the ideal saturation limit values. Techniques that require less computation than the current strategies areintroduced to eliminate artifacts. Images from are used to assess the scheme. Leishman-colored blood smears. It was discovered that 83% of the scheme was sensitive. As the approach uses HSV space and is dynamic in that pertinent thresholds are ascertained based on the statistics of the provided image instead of maintaining them constant for allpicture. Plans establish the ideal saturation levels for dividing RBCs and Strong chromatin dots that withstand variations in color. Using images of Giemsa-stained blood slides, Raviraja et al. [28] present a blood image processing method for identifying and categorizing malarial parasites in order to assess the parasitamia of the blood. A statistically based method is utilized to identify red blood cells contaminated with malarial parasites. Color, shape, and size information are used to automatically separate the parasites (trophozoites, schizonts, and gametocytes) from the remaining portion of an infected blood image. In order to reconstruct the image, the altered image is compared to infected images after scaling and shaping. To create a mathematical foundation, the returned images are statistically analyzed and compared. Additionally taken into account is an assessment of the parasite's nuclei's dimensions and form.

In this study, we used a publicly available malaria dataset to train multiple computationally efficient and accurate models for the detection of malaria parasites in single cells [24]. The main three contributions that we have made are listed in this paper:

- We discovered some samples were incorrectly labeled when conducting experiments on the malaria dataset.The corrected versions of these incorrectly labeled samples can be found in [25] for use in subsequent studies.
- In contrast to earlier research on malaria parasite detection, our trained models are not only is it extremely accurate (99.23%), but it also uses a lot less computational power.In comparison to earlier published work, only 4600 flops were used [26].
- The model was used for to gain a better understanding of its performance in low resource settings.

III.METHODS AND MATERIAL

Relevant work:

The objective of the project is to develop an image processing algorithm to automate the diagnosis of malaria on thin blood smears. The image classification system could positively identify malaria parasites present, So, to achieve this Problem to develop an Algorithm which serves as the preprocessing tool for the image analysis. A prototype consisting of existing software packages such as Mat lab is used for feature extraction and classifier implementation.

Because malaria is a potentially fatal illness, scientists from all over the world are deeply interested in researching it. The majority of malaria diagnoses in the past have been made in a laboratory environment, requiring a high degree of human expertise. This issue was first researched in order to address automatic systems, such as those that use machine learning techniques. The hand-crafted features in decision making were primarily taken into consideration by the techniques reported in this field. Principal Component Analysis (PCA) [31] and Support Vector Machines (SVM) [29, 30] were utilized for feature extraction, while morphological factors were the basis for classification. In contrast to the more recently researched deep learning based approaches, these types of models do not achieve as high of an accuracy.

Using a convolutional neural network (CNN), malaria pathogens can be automatically identified from microscopic images [32].

A collection of experiments was carried out using a malaria dataset that was made available to the public. The methods for gathering data and preprocessing it are covered in the subsections that follow. After conducting a series of experiments, we selected our best model, which is covered in the subsections on suggested model architecture, in terms of both performances and effectiveness. The subsections on training details cover experimental specifics and experimental configurations. The general training procedure, distillation training procedure, and autoencoder training procedure are the three training procedures that cover training of the models; specifics are given in the relevant subsections.

Methodology:

A malaria dataset that is accessible to the public was used to carry out a number of experiments.

In the subsections that follow, data collection and preprocessing methods are covered. We select our optimal model based on its performances and overall quality among the set of experiments.Consequently, efficacy is covered in the subsections on the suggested model architecture. Attempting the training details subsections cover specifics and experimental conditions. The models' trainingis covered under the general training procedure, distillation training, and three other training procedures as well as the autoencoder training procedure; specifics are given in the relevant subsections.

IV. IMPLEMENTED ALGORITHM AND ITS DETAILS

4.3.1. Goals of algorithm

The Algorithm Goals Specifies the view and direction as to how the project would be implemented & what are the steps to be followed during creating project.

- It gives the Idea of how the problems are resolved and segmented to solve it.
- Proper algorithm development at this stage can prevent a number of complications.

4.3.2. Neural Network

1. Start.
2. Capture images for creating database.
3. Convert RGB image into gray scale image.
4. Apply GLCM for Energy Feature Extraction. And also extract other features.
5. Analyze results obtained for images & create the database form same
6. Give the data base to Neural network (Input as T and Output as P).
7. Train the neural network accordingly
8. Simulate the network to obtain the result.
9. Drive the condition to declare the output
10. Display result in message dialog box.
11. To test algorithm for new image repeat step 8 to 10.
12. End

4.3.3. Support Vector Machine

1. Start.
2. Capture images for creating database.
3. Convert RGB image into gray scale image.
4. Apply GLCM for Energy Feature Extraction. And also extract other features.
5. Analyze results obtained for images & create the database form same Create the database in MxN matrix for input and for create 1xN matrix for output Sample
   Where
   M= Number of feature.
   N= Number of Samples for training.
6. Give the data base to SVM for training
7. Train the SVM accordingly with decided Kernel and functions
8. Classify the SVM output obtain that is result.
9. Drive the condition to declare the output
10. Display result in message dialog box.
11. To test algorithm for new image repeat step 8 to 10.
12. End.

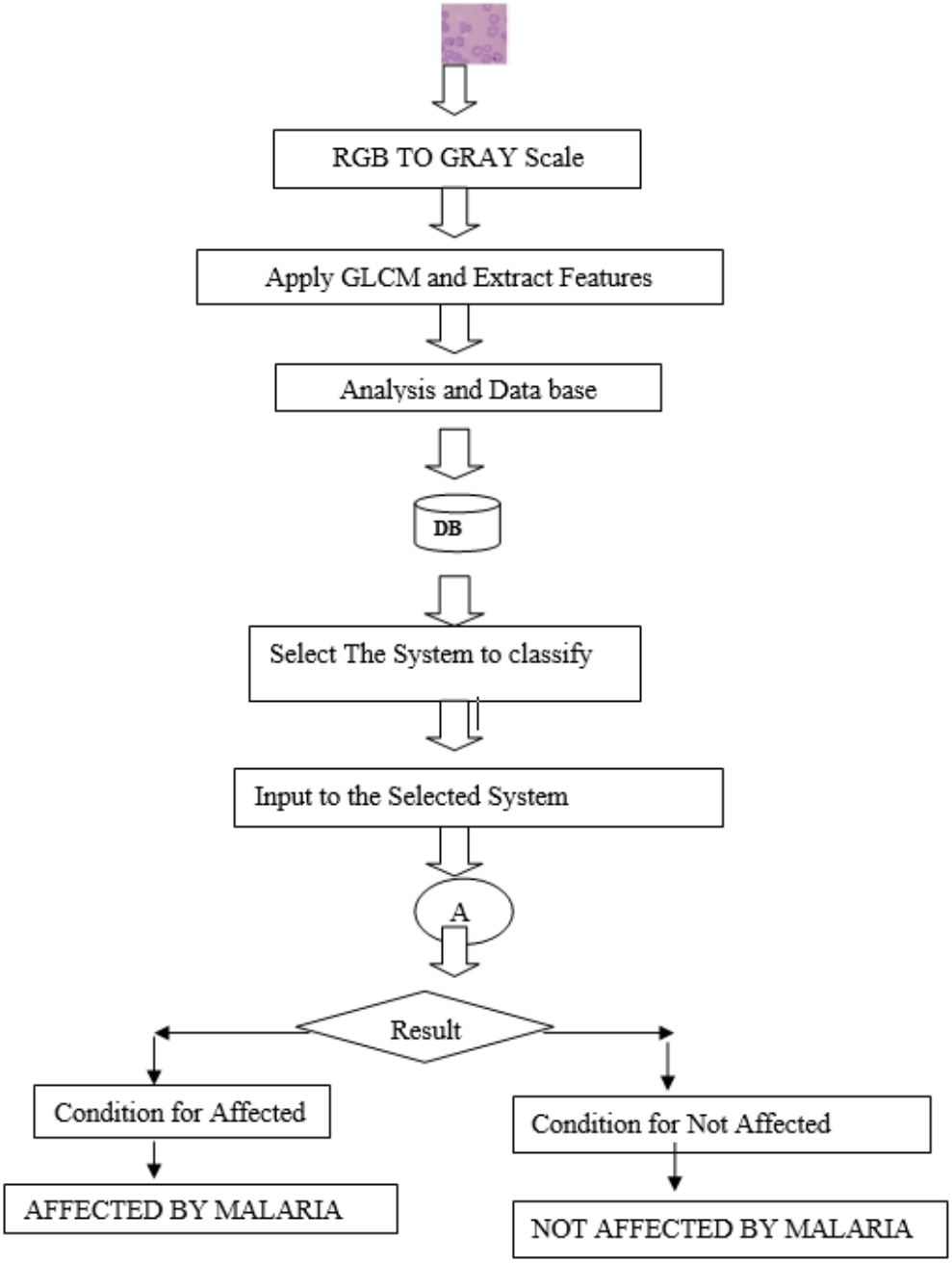

Fig A: Steps to implement the Algorithm

4.3.4. Data-Set:

The malaria dataset comprises 27,558 images of cells that are divided into two categories: parasitized and uninfected cells. Each type of cell in the dataset has an equal number of instances. 150 P. falciparum and 50 healthy patients provided data, which was captured at Chittagong Medical College Hospital in Bangladesh using a smartphone and a traditional light microscope [33].

Later, at the Mahidol-Oxford Tropical Medicine Research Unit, a skilled slide reader manually annotated the slides. In this data, parasitized samples indicate the presence of Plasmodium, while uninfected samples indicate the absence of Plasmodium but the possibility of other objects, such as impurities or staining artefacts.

Suspicious and incorrectly labeled data was set aside during annotation, reducing the total amount of data from 27,558 to 26,161. There are currently 13,132 pieces of parasitized data after 647 suspicious and incorrectly

labeled pieces were removed. Properly parasitized data is regarded as true in this article, while suspicious data is regarded as falsely parasitized. 750 suspicious photos were discovered for the uninfected malaria data, and these images were labeled as false uninfected. Once those data are removed, 13,029 pieces of true uninfected data remain.

4.3.5. Data Preprocessing:

In supervised learning, the data that is fed into the model determines its behavior and performance in full. As a result, preparation of the data is essential before conducting experiments.Taking into account that the model input was used to resize manually corrected images in this work, and rescaled the image patches to map the features in a range of 0 to 1, which resulted in obtaining quicker convergence. For training data preservation, data augmentation in accordance with Table 1 was also used.

Table 1.Augmentation table.

Augmentation Type	Parameters
Random Rotation	20 Degree
Random Zoom	0.05
Width Shift	(0.05, –0.05)
Height Shift	(0.05, –0.05)
Shear Intensity	0.05
Horizontal Flip	True

Model Architecture Suggestion In this article, an autoencoder-based architecture is proposed to fulfill the purpose of detecting malaria parasite from blood smear (exactly the similar kind of blood smear collected by [24]) displayed in Figure 3. One particular kind of artificial neural network called an autoencoder [34] compresses input data into a representation of lower-dimensional latent space, and then reconstruct the output from this as illustrated by Equations (1) and (2).

$Xi = Decoder(Encoder(Xi))$.....(1)

$L\theta = C\theta(Xi , Xi)$..... (2)

Here, the difference between the original and reconstructed image's i number is determined by the Mean Square Error (MSE) loss function C.

Dimensional reduction is the main goal of an autoencoder [60]. As a classifier, though, it is employed in this task, drawing inspiration from [35,36]. The two primary parts of an autoencoder are an encoder and a detector. The fully connected layer substitutes the decoder for the classification task that made it possible for Autoencoder to categorize the anticipated classes. We'll talk about the whole process in a section that follows.

Encoder: The encoder uses the least amount of distortion to compress the input into a latent space representation. When an encoder compresses a set of input images (Xn = x1, x2, x3,...,xn) that belong to a training set, Kn = k1, k2, k3,..., kn is the set of latent representations of Xn.

k1, k2, k3 . . . . . kn = Encoder(x1, x2, x3 . . . . . xn) .....(3)

Kn = Encoder (Xn) .....(4)

The purposed encoder consists of three convolutional layers, with a max-pooling layer positioned after each layer. Each layer's kernel size is defined as (3 × 3) with the same padding and 1-pixel stride in order to perform

the convolutional operation. The initial convolutional layer had a kernel number of 16, while the second and third layers had kernel numbers of 8 and 4, respectively. In order to add non-linearity to the neuron's output, the ReLU activation function—which is represented in Equation (5)— was applied in the hidden units of the encoder.

$S = \max(0, M)$ .....(5)

In this case, S represents the result of applying nonlinearity to matrix M.

The max-pooling layer (Equation 6) with a window size of 2 × 2 and strides of 1 is applied in order to sample down the features map.

$Z = \max h,wi,j=1(Mi,j)$ .....(6)

The output matrix Z is made up of the maximum value for every patch in the input matrix M.

Decoder: The decoder uses the latent representation to reconstruct the image Rn = r1, r2, r3,...,rn. Equations (7) and (8) reveal that Kn = k1, k2, k3,..., kn.

r1 ,r2 ,r3 . . . . . .rn = Decoder (k1 , k2 , k3 . . . . . kn) ..... (7)

Rn = Decoder (Kn) .....(8)

There are four deconvolutional layers and three upsampling layers in the decoder. For every Deconvolutional layer, the number of kernels defined was 4, 8, 16, and 3, and the kernel size was 3 × 3 with strides size 1 having the same padding. The opposite of a deconvolutional layer is Convolution layer and in contrast to it, rather than converting 3 × 3 features into one pixel, Map one pixel to a 3 × 3 features vector using deconvolutional layers. Utilizing the ReLU activation function,non-linearity will be introduced by the hidden units. A 2 × 2 window size upsampling was used to obtain the input image closer in order to reconstruct it using the latent representation.

To fulfill our needs, a flatten and two fully connected layers take the place of the decoder during testing the ability to identify.

3. Model Architecture Suggestions:

In this paper, an autoencoder-based architecture—illustrated in Figure 3—is proposed to fulfill the objective of detecting malaria parasite from blood smear (precisely the same type of blood smear collected by [24]). An example of an artificial neural network that compresses data is an autoencoder [59].then reconstruct the output by feeding the data into a lower-dimensional latent space representation.

Equations (1) and (2) display the representation.

Xi = Decoder(Encoder(Xi)) .....(1)

$L\theta = C\theta(Xi, Xi)$ .....(2)

Here, the difference between the original and reconstructed image's i number is determined by the Mean Square Error (MSE) loss function C.Dimensional reduction is an autoencoder's main goal [60]. But for this task, Inspired by [61,62], it serves as a classifier. The autoencoder consists of two primary parts: A decoder and an encoder. The fully connected layer takes the place of the decoder in the classification task which enabled the expected classes to be classified by Autoencoder. The entire procedure will be covered in the part that follows.

The encoder converts the input to a latent space representation by compressing it as much as possible deformation. The encoder compresses the Xn = x1, x2, x3,..., xn set of input images that belong to the training set. Kn is equal to k1, k2, k3,..., kn.

k1, k2, k3 . . . . . kn = Encoder(x1, x2, x3 . . . . . xn) ..... (3)

Kn = Encoder (Xn) .....(4)

V. RESULTS AND DISCUSSION

Results

The performance of classifier is defined by the feature used to train the classifier. The results for the experiment are given in table (2) and (3). For the malaria images database the result obtained are as follows.

Method	Neural Network	ANFIS	SVM
Accuracy	78.53%	89.63%	98.25%

Table2. Shows accuracy of algorithm for different methods of classification Description of Features and Parameters

The selection of features to be employed in a particular data classification problem is just as important as the classifier itself, as the features selected have an impact on the classifier's performance [5]. The distinguishing characteristics between healthy and diseased cells are determined and utilized in training. The chosen features are based on statistics and color.

Skewness.

- Kurtosis.
- Standard Deviations.
- Energy

Feature extraction makes use of the above parameters. Gray level and saturation histograms of the image's pixels are used as statistical features. The mean value, angular second momentum, skewness, standard deviation, and kurtosis are regarded as features [6] and computed using the aforementioned equations based on this analysis. Here is a description of the parameters.

SKEWNESS

The asymmetry of the data around the sample mean is measured by skewness. The data are more dispersed to the left of the mean than the right if the skewness is negative. Positive skewness indicates that the data are more widely distributed to the right. Any fully symmetric distribution, including the normal distribution, has zero skewness.

A distribution's skewness is described as

$$Skewness = \frac{1}{\sigma^2}\sum_{b=0}^{L-1}(b-\bar{b})^3$$

where E (t) is the anticipated value of the quantity L, b is the mean of x, and σ is the standard deviation of x.

KURTOSIS

Kurtosis quantifies a distribution's propensity to have outliers. The normal distribution has a kurtosis of 3. Distributions that exhibit higher levels of outlier occurrence than the normal distribution have kurtosses larger than 3, while distributions with lower levels of outlier occurrence have kurtosses lower than 3.A distribution's kurtosis is defined as

$$Kurtosis = \frac{1}{\sigma\ b^4}\sum_{b=0}^{L-1}(b-\bar{b})^4 P(b) - 3$$

STANDARD DEVIATIONS

When n is the sample size, the standard deviation normalizes by n-1. Given a population X consisting of independent, identically distributed samples, the result Y is the square root of an unbiased estimator of the variance of the population.

What is the standard deviation?

$$StndardDev\quad iation\ = \left[\sum_{b=0}^{l-1}\left(b-\overline{b}\right)\right]^{1/2}$$

ENERGY

The Gray Level Co-occurrence Matrix is used to calculate the energy (GLCM). The matrix is computed by the GLCM using the necessary resolution factor and our design. Next, it provides energy by squaring and adding the GLCM elements.

The total squared of the GLCM's elements is returned by energy. Spread = [0 1]. For a constant image, energy equals 1.

$$Energy\ = \sum_{b=0}^{L-1}[p(b)]^2$$

Other names for energy include angular second moment, uniformity, and uniformity of energy.

VI. DETAILS OF IMPLEMENTED ALGORITHM

The following are the parameters that were taken from the sample photos and found to work best with each classifier.

Images	Skewness	Kurtosis	Std	Energy
For not Affected images	-2.33158	11.41209	0.101356	0.418505
	-1.05379	2.785143	0.092253	0.461512
	0.25247	1.801433	0.138752	0.161675
	0.305202	2.082076	0.109513	0.213483
	-1.95057	6.828676	0.08351	0.573091
	-0.59863	3.248551	0.103029	0.224987
	-0.00851	1.455434	0.11191	0.304597
	-0.68088	2.489777	0.057329	0.424923
	-0.43092	2.2322	0.135943	0.112798
	-0.47869	2.074422	0.07067	0.45825
for Affected images	-0.77172	2.755637	0.14145	0.235728
	-0.98477	3.285878	0.240115	0.114415
	-0.47004	2.806247	0.183123	0.068736
	-1.09039	4.189564	0.182176	0.169848
	-0.06437	1.863338	0.25255	0.050478
	0.092649	2.062773	0.16621	0.175552
	-1.0474	3.092403	0.098995	0.553743
	-0.07078	2.322458	0.172404	0.128377
	-0.76714	3.145267	0.179682	0.090911
	-0.47861	2.593785	0.204835	0.045447
Min	-2.33158	1.455434	0.057329	0.045447
Max	0.305202	11.41209	0.25255	0.573091
Average	-0.63142	3.226358	0.14129	0.249353

Table 3: Images and their respective parameter values.

Type of images	No. of samples	No. of Correctly Identified images			%Accuracy		
		NN	ANFIS	SVM	NN	ANFIS	SVM
Affected	10	8	8	9	80	80	90
Not-Affected	10	7	9	10	77	90	100

Table 4 displays how accurate an algorithm's decisions were for various classification techniques.

Method	Time Required
Neural Network	6.58
ANFIS	4.329
Support Vector Machine	3.852

Table 5. Computational Time

VII. CONCLUSION

This paper discusses how image processing can be used to effectively analyze different parameters of a blood cell image, such as skewness, kurtosis, and standard deviation, while using GLCM as the energy source. Based on the experimental results, it can be concluded that the proposed approach is valuable and can significantly support accurate malaria disease identification with minimal computational effort.

When manually counting the number of RBC & WBC (the Giemsa process), mistakes can occur because the boundaries are not obvious or well-defined, which can cause us to make the wrong choice. Therefore, the developed algorithm is more useful than other techniques to solve this problem. Given that this system satisfies the requirements for real-time applications, we can readily obtain a functioning standalone version of it.

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Green Synthesis and Characterization of Iron-Based Nanoparticles for Environmental Applications

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ABSTRACT

Researchers have been able to create and synthesise nanosized materials with novel physicochemical properties in recent years, opening a wide range of potential uses in the biomedical area. Since nanotechnology is becoming increasingly applicable and influential in many other fields, there has been a significant increase in the usage of efficient and environmentally friendly synthetic techniques or procedures for the synthesis of iron-based nanomaterials. we examine the existing research on how to responsibly manufacture nanoparticles made of iron. When compared to more conventional approaches, plant-mediated synthesis stands out as an innovative and environmentally friendly way to create nanomaterials. This is because of the eco-friendliness and ease of its procedures. Compared to traditional techniques of synthesis, the produced nanoparticle is easier to make, more stable, and effective in a variety of application in different areas. This investigation, which focuses on the iron-based nanoparticles, provides information on the numerous sources employed thus far and the process by which the materials were developed for use in environmental applications.

Keyword: iron oxide nanoparticle; biomedical application; environmental; green methods.

I. INTRODUCTION

Nanotechnology is a rapidly expanding interdisciplinary field that will have far-reaching consequences across industries like medicine, ecology, and food production. Nanotechnology has been the focus of many studies aimed at reducing or eliminating pollution in aquaculture. Due to their extremely small size in nm and high surface-to-volume ratio, the physical and chemical properties of nanoparticles differ from those of other substances with the same chemical makeup. They are also used to get rid of pollutants, contaminants, and heavy metals [1-2]. Their nanoscale dimensions make them applicable in numerous fields, including mining,

mass production, healthcare, chemistry, ecology, power generation, and agriculture. While "bottom-up" procedures employ chemical reduction, electrochemical approaches, and no breakdown, "bottom-to-top" strategies involve the self-assembly of atoms to new nuclei, which grow into nanosized particles. Physical and chemical nanoparticle synthesis methods have significant limitations, including poor surface formation, limited production rate, high production cost, high energy needs, and the use of hazardous reducing agents. Enzymes and other biologically active molecules are used as reducing and capping agents in biological synthesis, which also reduces energy consumption and allows for large-scale production. Synthesis relied on the usage of microorganisms and plant materials. The requirement to keep cell cultures and work in an aseptic atmosphere are major hurdles for microbe-mediated synthesis[3-4]. Plants are the best mediators of synthesis, therefore. Remediating wastewater contaminated with heavy metal ions is best accomplished through adsorption using a variety of adsorbents. The magnetic property, catalytic activity for removing pollutants from water bodies, low cost, high surface area, high functionalization, high adsorption capacity for several contaminants in water and wastewater treatment, antimicrobial and antioxidant activities, and abundance make iron-based nanoparticles important among synthesized nanoparticles [5-6].

According to their characterization results, the iron-based nanoparticles comprised iron oxide and had spherical cores ranging in size from 30 to 80 nm [7]. The strong reactivity of these iron-based nanoparticles was further demonstrated by their capacity to extract transition metal solution. This approach is promising for remediating transition metal polluted water and creating green nanoparticles. Toxic organic pollution removal is just one example of the many potential scientific and technological uses for ecologically friendly iron oxide nanoparticle manufacturing, which the author believes has the potential to be an efficient, cost-effective, and practical technology in the future. Nanoparticles were typically round, square, or octagonal in size. This method has a low cost, can be easily replicated, and is good for the planet. Recent research has uncovered methods to synthesize iron-based nanoparticles for environmentally beneficial treatments and applications, going beyond traditional and obsolete technologies in the process. This involves limiting the use of damaging and depleting material inputs, increasing the efficiency of time, space, and energy, and more.

II. GREEN SYNTHESIS METHODOLOGY OF IRON OXIDE NANOPARTICLES

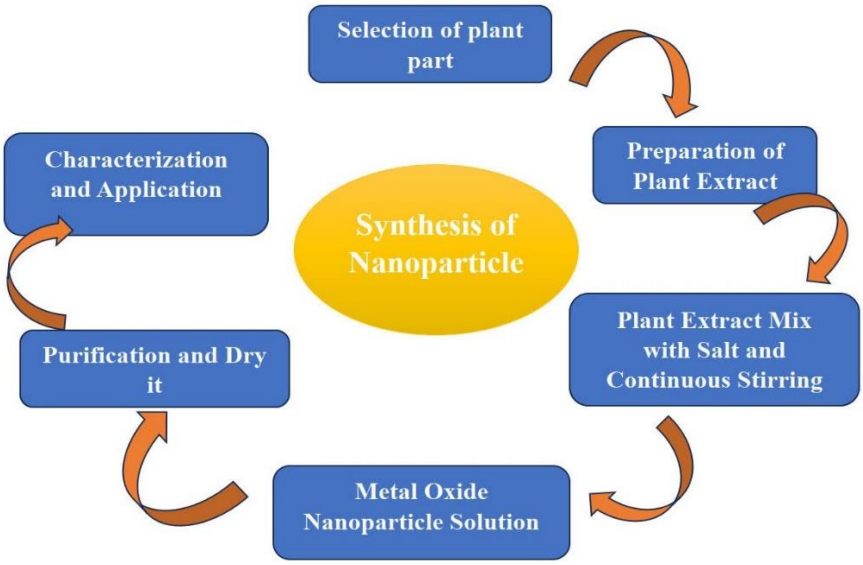

Fig.1. Synthesis of Iron Oxide nanoparticles

Figure 1 depicts the most prevalent methods for synthesis of iron oxide nanoparticle, efficient extraction of the bioactive components of plant materials, such as leaves, stems, or roots, is necessary to produce iron-based nanoparticles [8]. Polyphenols, saponins, organic acids, vitamins, polysaccharides, and other organic solvents like methanol and acetone are examples of these substances. They serve as capping and reducing agents in a reaction with a precursor, often an ferric chloride solution. Zero-valent ion nanoparticles are produced when Fe^{3+} is transformed to FeO. For instance, zero-valent iron was created using the polyphenols in dried green tea extract. Green tea leaves' polyphenols were extracted using a microwave to create nanoparticles with a size range of 10 to 30 nm. Bioactive substances called polyphenols are widely found in plant leaves. Ethanol was used to extract the green tea powder, which was subsequently cooled and filtered. Zero-valent iron nanoparticles were created by mixing an iron (III) chloride solution with a polyphenol-rich plant extract. An overview of plant-based methods for creating nanoparticles can be found in the following [9]. Since biomolecule, bacterial, and fungal nanoparticle synthesis need labor-intensive, high-maintenance cultures and continual sterile conditions, plant nanoparticle manufacture is preferred [8, 10].

III.CHARACTERIZATION OF IRON OXIDE NANOPARTICLES

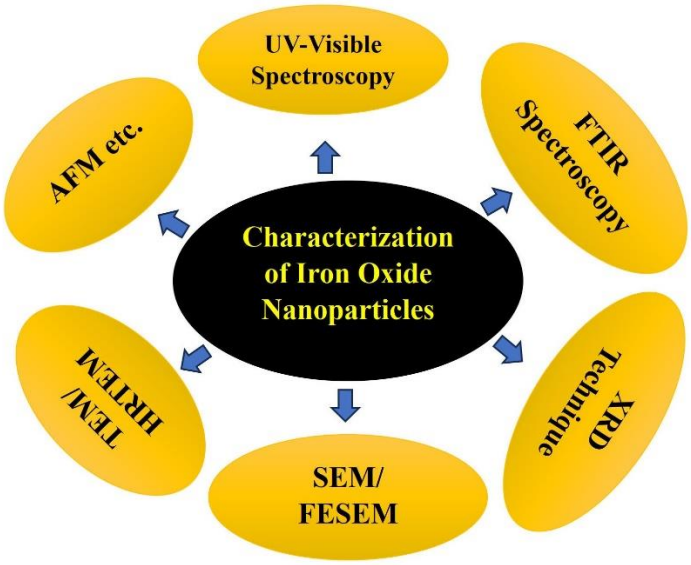

Fig.2.Characterization of Iron Oxide Nanoparticles

A variety of methodologies can be used to better understand the magnetic characteristics of iron oxide nanoparticles and examine their physiochemical properties [11]. This category includes spectroscopic, microscopic, and magneto metric approaches. Infrared spectroscopy (IR), X-ray photoelectron spectroscopy (XPS), Fourier transform infrared spectroscopy (FTIR), Electrophoresis, Zeta potential measurement, Thermal gravimetric analysis (TGA), Ultraviolet - visible spectroscopy (UV-VIS), and many other techniques are available [12].

Figure 2 depicts the most prevalent methods for analyzing nano-sized iron oxide particles. A wide range of spectroscopic approaches are used to examine the nano-sized iron oxide particles. The fundamental approach for probing any nanomaterial is XRD. X-ray diffraction was used to investigate the crystalline structure and size of nanoparticles. In order to determine the sizes of the nanoparticles, Scher-rer's equation [13-14] is applied to the main peaks of the XRD pattern. The huge peaks make predicting the size of nanocrystalline nanoparticles problematic. TEM/HRTEM can measure the size and shape of nanoparticles in suspension. Scanning electron

microscopy (SEM)/field emission scanning electron microscopy (FESEM) and atomic force microscopy (AFM) are used to investigate iron oxide nanoparticles. Based on the images we took; we can approximate the size (in terms of diameter). TEM investigation can provide an estimate of the electron phase shift, crystallinity, nanoparticle aggregation state, and lattice spacing. The AFM instrument is useful for determining surface roughness, step height, and the location of scattered particles. Structures and functional groups are identified using FTIR spectroscopy. Light with wave numbers ranging from 4000 to 660 cm^{-1} is absorbed by nanoparticle molecules. Thermogravimetry can be used to learn about the thermal stability of iron oxide nanoparticles. The chemical kinetics, molecular transport, and other effects of nanoparticle concentration are studied using visible and UV-light-based fluorescence correlation spectroscopy[15-16].

IV. APPLICATION OF IRON OXIDE NANOPARTICLES

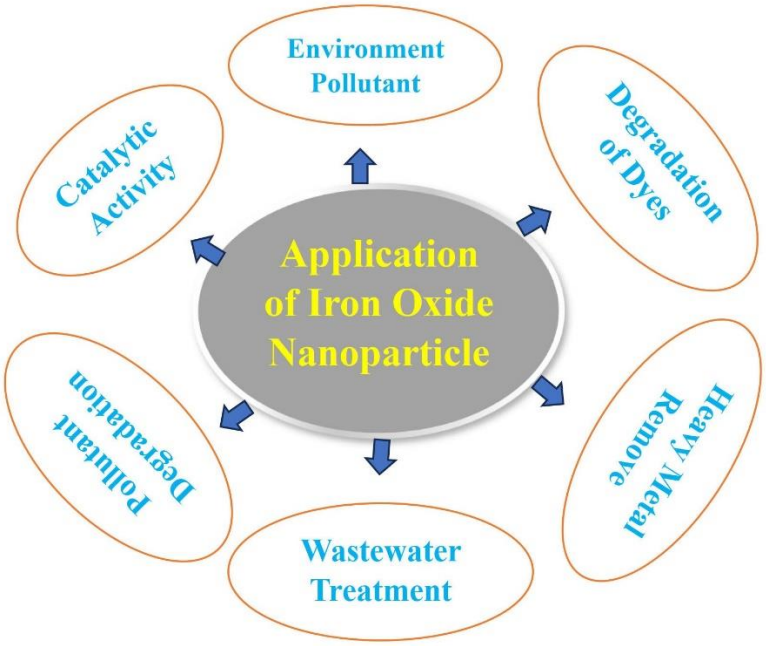

Fig.3. Application of Iron Oxide Nanoparticles

To synthesize nanoparticles in a way that is both effective and benign to the environment, it is recommended that green chemistry principles be adhered to. This means that the green synthesis process should use minimal amounts of heat and solvents to extract the active bio-component from low-energy sources such plants, microbes, biopolymers, and waste materials and many more application show in figure 3. Biomolecules, especially polyphenols, which are derived from plants and employed as reducing, capping, and stabilizing agents, have been dissolved in water in several investigations. Leaves, branches, roots, flowers, fruits, fruit peels, seeds, gums, and even rubbish have all been mined for these bioactive polyphenols[17-18]. Methyl orange, malachite green, and orange dye are only a few examples of the toxic compounds released into the environment during production. Among the heavy elements are arsenic and chromium. Many organic and inorganic substances should not be present in water because of their toxicity and cancer-causing qualities [19]. Recent research has shown that iron nanoparticles can be employed for environmental purification [20]. Iron-based nanoparticles are useful in environmental cleanup, especially for in situ methods, due to their adsorptive and reductive capabilities. They are cheap, harmless to humans and animals, and efficient at decomposing

many different types of organic and inorganic pollutants. In addition, their efficacy can be improved by combining them with other methods, such as chemical oxidation, bioremediation, and chemical oxidant activation [21]. Dyes have an affinity for a surface when applied to it due to the chemical structure they contain. Dyeing refers to the method by which colourants are permanently affixed to textiles and other materials used in the food, garment, and other industries. The iron nanoparticles used to bleach methyl orange and sterilize bacteria were synthesised using chlorophyte comosum leaf extract. Chloropytum comosum leaf extract water dispersion is used to treat the iron salt precursor as a reducing and stabilising agent. Methyl orange was used to test the efficiency of H_2O_2-catalyzed iron nanoparticles at removing dyes and degrading organic pollutants. Degradation of methyl orange is shown to be most effective after few hours [22]. Another study demonstrated that in the presence of an aqueous H_2O_2 solution, iron oxide nanoparticles synthesised using a green process were particularly effective at degrading methyl orange. The results showed that between 5-40 nm in diameter, the great majority of iron oxide nanoparticles are round. Green and sustainable, plant-mediated synthesis of iron oxide nanoparticles has many potential uses. One of these is as a heterogeneous Fenton-like catalyst for the degradation of azo dyes[23-24]. Results from experiments corroborate claims that magnetic graphene oxide laccase nanoparticles improve processing efficiency and provide novel enzyme applications in industry. Iron Oxide Nanoparticles were also synthesized spontaneously using extract from the piper beetle. The Piper beetle's phenolic compounds have been hypothesized to act as capping or reducing agents. The manufactured iron oxide nanoparticles significantly sped up the breakdown of MO and MG dyes [25]. Electron-hole pairs are produced during the photocatalytic degradation of dye due to irradiation, and these react with the surface of the nanoparticle to produce hydroxyl radicals. Toxic pigments can be broken down by these radicals due to their oxidizing capabilities. Nanoparticles act as photocatalysts when exposed to light of any wavelength, including visible and UV light. This exposure triggers a redox process that results in the creation of electron hole pairs via the release of electrons from the conduction band and protons from the valence band. Surface electron-hole interactions in a photo catalyst set off a cascade of redox events. At the same time, OH free radicals are created when H^+ is oxidized by water. The reduction process on the surface of nanoparticles as a photocatalyst begins with a reaction between electrons in the conduction band and oxygen, yielding intermediates such superoxide radical, per hydroxyl radical, H_2O2, and finally $\cdot OH$. Harmful pigments can be broken down with the help of this radical [26-27].

V. CONCLUSION

The rapidly developing field of "green synthesis" studies effective, eco-friendly ways to make nanoparticles. Using green reagents and more environmentally friendly manufacturing techniques, green synthesis aims to have less of an impact on the environment than standard synthesis methods. We examined the most recent studies on sustainable methods of creating nanoparticles for wastewater treatment in this post. Several instances of environmentally benign nanoparticles have been highlighted. One of the biggest challenges in the synthesis of nanoparticles for environmental cleanup is controlling particle size and morphology. It was demonstrated that variables related to green synthesis, like pH, temperature, and reaction time, might change these characteristics. It was shown by going over their efficacy and pollutant removal techniques that green nanoparticles might help with dye degradation and water pollution removal. Degradation processes, heavy metal adsorption, and pollutant degradation were all investigated in detail. Future research avenues that are worth pursuing include large-scale assembly, the possible effects of greener nanoparticles on plants,

improvements in the shape of green nanoparticles, and the regeneration of iron-based nanomaterials following adsorption.

VI. ACKNOWLEDGMENTS

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VII. CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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Polymer in Medicinal : A Review

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ABSTRACT

Polymers are macromolecules, versatile in structure, constitution and properties. They have wide range of applications in various fields such as biophysics, medicine, electronics, and other branches of science and technology. Among these polymers biomedical polymers are specially mentioned due to their less toxicity in vivo, easy to process and sterilized, better shelf life, light weight, and remarkable properties suited to the applications. The biomaterials are the materials that can be implanted in body of living to provide special prosthetic functions or used as diagnostic, surgical and therapeutic applications. This paper explores the various applications of polymers in the field of medicine. Polymer has become a boon to the society and has much application to the medicinal field and some of them are explore in the paper.

Keywords: - polymers; biomedical; toxicity; macromolecules.

I. INTRODUCTION

Among others, polymers represent the main and most promising type of biomaterials to be applied in biomedical area. Their widespread use in this field is due to the relative ease and the low cost with which they can be designed and prepared [literature survey]. Multiple biological, synthetic and hybrid polymers are used for multiple medical applications. A wide range of different polymers is available, and they have further the advantage to be tunable in physical, chemical and biological properties in a wide range to match the requirements of specific applications. This review gives a brief overview about the introduction and developments of polymers in medicine in general, addressing first stable polymers, then polymers with degradability as a first biological function, followed by various other functional and responsive polymers [1-2] Polymer play a major role in all aspects of biological processes. In fact, it is legitimate to proclaim that polymers are the molecular basis of life. The genetically inherited information required for the growth and health of living system [3]. A polymer is natural allies of medicine because living tissue is composed substantially of

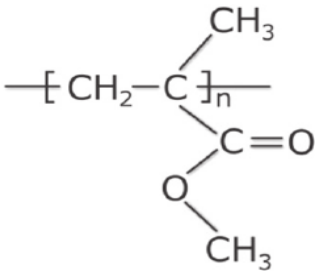
polymers [3]. The polymer biomaterial when comes in contact of blood and tissues should not cause any harm or destroy components of blood or tissues is the main aim of use of polymer inside the body.

II. POLYMERS

Polymers are long chain polymer. Polymers are of two types known as Natural Polymer and synthetic polymer. The Natural polymer are obtained from nature such as plants and animals such as, and the silk, rubber, cellulose, wool, amber, keratin, collagen, starch, DNA, and shellac. Synthetic polymer are the man made polymer made in laboratory such as nylon, polyethylene, polyester, Teflon, and epoxy. The Polymer has different use in various field. They are used in Industries, Domestic, Food Packaging, paints, Body care, Medicinal and drugs and now we can use in the Medicinal inside and outside the body. The polymers are Degradable and Non Degradable which can be use in.

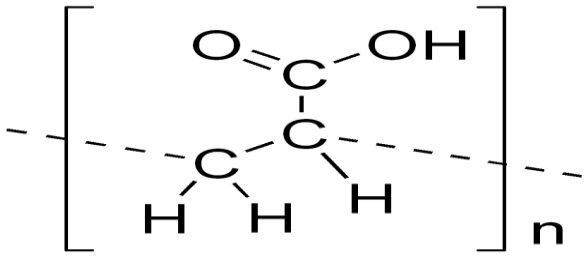
III.APPLICATION

3.1. PMMA Structure



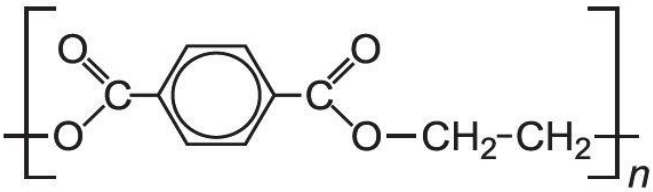
Dental materials are dominated by polymers to a an increasing extent. Impression materials are made of silicone and polysulfide elastomer that cure rapidly in the mouth and maintain their shape. Denture bases are made from polymer based on poly(methy methacrylate) (PMMA) that are crossed linked through a free radical process. Fillings that match the teeth appearance are composed of highly filled difunctional methacrylate that are used by exposer to blue light Polymers also play a central role in dental adhesive[3].

3.2. Polyacrylic acid (PAAc) Structure



Polyacrylic acid (PAAc) is used for bioadhesive drug delivery systems. Polymers are essential for controlled drug release in trandermal patches, microsphere, pumps, aerosols, ocular implants and contracentive implants. The mechanism of this drug release is of three different ways some is the diffusion –controlled way, in which drug is released by solution diffusion through a polymer. The second way is the erosion- controlled route, in which the drug release is activated by dissolution, disintegration or biodegradation of the polymer [4]

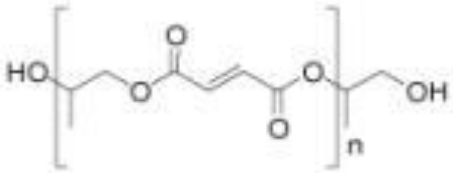
3.3. Polyester Structure



Biostable and biodegradable polyesters are used in biomedicine. Biostable polyesters containing aromatic groups are polycarbonates (PC), poly(ethylene terephthalate) (PET, dacron). They are used in form of membranes, filaments and meshes.[5] They are used for dialysis membranes are main representatives of this polymer class in biomedicine.[7]

3.4. POLYFUMARATES [Poly (propylene fumarate)]

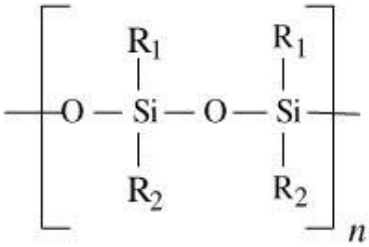
Structure



In recent years a significant amount of work has been performed on polyfumarates. The Poly(propylene fumarate) (PPF) is an important biodegradable and crosslinkable polymer. Also has covalent polymer network. For instance. Mikos and colleagues have investigated a partially saturated linear polyester based on poly(propylene fumarate) or PPF for use in filling skeletal defects [6]. The mechanical properties of this polymer have been reported to be similar to that of trabecular bone. Additionally, this unsaturated polymer can cure in vivo. There by facilitating the ability to fill skeletal defects of any shape or size with minimal surgical intervention.

3.5. Silicones Polymer

Structure

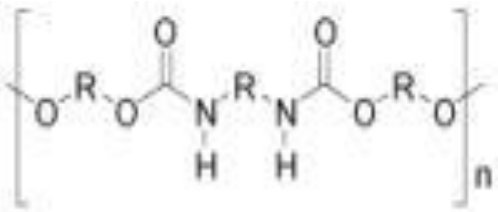


Silicone polymers, more properly called polysiloxanes, are inorganic-organic polymers with the chemical formula [R2SiO]n, where R is an organic group such as methyl, ethyl, or phenyl. By varying the –Si-O- chain lengths, side groups, and crosslinking, silicones can be synthesized with a wide variety of properties and compositions. They can be classified as fluids, elastomers, and resins. Polymers of moderate molecular weight are fluids, while high molecular weight, slightly cross-linked polymers are elastomeric. Silicones have a number of medical applications because of their biocompatibility and chemical inertness. The FDA has approved many medical silicone-based medical devices such as catheters, tubing, gastric bags, drains, and endoscopic windows. The gel form is used in bandages and dressings, breast implants, testicle implants, pectoral implants, contact lenses, and a variety of other medical uses.[Ortensia Ilaria Parisi, Manuela Curcio and

Francesco Puoci Polymer Chemistry and Synthetic Polymers] The development of polymeric heart valves casted light upon the impact of physiologic flow pattern on the durability of valve prostheses: any energy loss on the valve is destructive energy for the valve [9,10]. Also this polymer is also used in the cochlear implant . The Silicone polymer is used making Heart valves, blood filters, artificial heart, vascular tubing.

3.6. Polyurethanes

Structure



Polyurethanes are synthesized with multiple chemistries and properties. Polyester-, polyether-, and polycarbonate-based polyurethanes with aromatic or aliphatic components are in medical use, where aromatic formulations have the better biostability. Thermoplastic polyurethanes do not need plasticizers, but retain their elasticity by the mixture of hard and soft segments. The polycarbonate based polyurethanes have excellent stability against oxidation and biodegradation as PVC does, however, there are concerns about release of bisphenol A with estrogen-like activity. Polyether based polyurethanes, especially aliphatic formulations show rapid softening in the body, making them more comfortable for the patient [9]

IV. CONCLUSION

The polymer have various properties so it is use in the various field and one is the important field called medical field and without any disadvantage of the polymer on the body inside or even use outside one can live more life by the use of the polymer and one can see many more uses of the polymer. Also one can see many more polymer with the different use in medical field in the upcoming era.Middleton JC, Tipton AJ (2000) Synthetic biodegradable polymers as orthopedic devices. Biomaterials 21(23): 2335-2346.

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Image of Women in Eco Fiction and Science Fiction

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ABSTRACT

Science fiction as a literary genre has generally been regarded as a male realm since the stories were written by men, featured male heroes and were aimed at a male readership. There was the occasional woman writer taking up the task of writing a science fiction story, but that was not often enough. It was only in the late 1960s and early 1970s that women writers began to enter the genre in earnest and women protagonists began to populate the pages of the genre. This paper provides a brief overview of the treatment of gender in science fiction. It will present some of the most important images of women that the genre has offered over the years and also discuss the impact of the second wave of feminism. Gender and Environment in Science Fiction focuses on the variety of ways that gender and nature interacts in science fiction films and fictions, exploring questions of different realities and posing new ones. Science fiction has become an important medium of communication for new ideas and values concerning sex roles, and the influx of women into this previously male literary subculture is a change of significance for popular culture. Science fiction asks questions to propose other ways of living; it asks what if, and that question is the basis for alternative narratives of ourselves and the world we are a part of. What if humans could terraform planets? What if we could create human-nonhuman hybrids? What if artificial intelligence gains consciousness? What if we could realize kinship with other species through heightened empathy or traumatic experiences? What if we imagine a world without oil? The texts analyzed in this book ask these questions and others, exploring how humans and nonhumans are connected; how nonhuman biologies can offer diverse ways to think about human sex, gender, and sexual orientation; and how interpretive strategies can subvert the messages of older films and written texts.

Keywords: Gender, Feminism, Science Fiction

I. INTRODUCTION

Science fiction shows things not as they characteristically or habitually are but as they might be, and for this "might be" the author must offer a rational, serious, consistent explanation, one that does not (in Samuel Delany's phrase) offend against what is known to be known. Science fiction writers can't be experts in all disciplines, but they ought at least to be up to the level of the New York Times Sunday science page. If the author offers marvels and does not explain them, or if he explains them playfully and not seriously, or if the explanation offends against what the author knows to be true, you are dealing with fantasy and not science

fiction. The terms environmental fiction, green fiction, and nature-oriented fiction, might better be considered as categories of ecofiction which deals with environmental issues or the relation between humanity and the physical environment, that contrasts traditional and industrial cosmologies, or in which nature or the land has a prominent role. It is made up of many styles, primarily modernism, postmodernism, realism, and magical realism, and can be found in many genres, primarily mainstream, westerns, mystery, romance, and speculative fiction. Speculative fiction includes science fiction and fantasy, sometimes mixed with realism. Science fiction has popularly been conceived as male territory. From its beginnings in the stories published in the pulp magazines of the early to mid-twentieth century to the emergence of feminist science fiction in the 1960s and 1970s,-the genre featured boys' adventure stories.

A survey of the genre from its earliest stories and novels demonstrates that women have almost always been 'invisible' as writers, characters, and readers of science fiction or SF - as it is more popularly known. That this is true in all forms of literature, whether mainstream or popular, as well as other manifestations of culture, has been recognized by critics and scholars. In her book Man-Made World or Our Andocentric Culture, Charlotte Perkins Gilman points to this fact. She argues that fiction "has not given any true picture of woman's life, very little of human life, and a disproportionate section of man's life" (102). For a long time, science fiction, too, excluded women from the overall picture or relegated them to the sidelines. It was only after the Women's Movement of the late 1960s and 1970s that things began to change. This paper traces the development in the roles that women have played as characters, writers, and readers of science fiction over the years.

II. WOMEN AS CHARACTERS IN BOTH ECOFICTION AND SCIENCE FICTION

One of the major concerns that the Women's Movement addressed was the representation of women in popular culture. Betty Friedan's The Feminine Mystique (1963) was one of the earliest and most important works in this area. Many other critics and scholars soon began to focus on how the images of women found in popular culture are, in fact, men's images of women, and not women's images of themselves. In her article 'The Image of Women in Science Fiction' published in 1971, Joanna Russ, another popular SF writer, and feminist scholar, writes that "there are plenty of images of women in science fiction. There are hardly any women". Russ recognized that the images of women in science fiction reflect women as seen by men. Though most writers were concerned with showing a two-sexed world, no one was interested in working out the possibilities of a truly equal society. Much before Russ's observation, Kingsley Amis had written that through science fiction's most important use was to dramatize "social inquiry" and also provide "a fictional mode in which cultural tendencies can be isolated and judged", there was a strange lack of experimentation around sex and that while all else may vary, male/female relationships stay the same. He explains that "though it may go against the grain to admit it, science fiction writers are evidently satisfied with the sexual status quo".

This lack of concern for the imbalance in the representation of the sexes is evident in most of the SF writers and critics. Therefore, it follows that early SF had very few examples of women characters, leave alone woman protagonists. When women did feature in these stories, they were invariably portrayed as either "squeaking dolls subjected to instant rape by monsters – or old-maid scientists desexed by hypertrophy of the intellectual organs – or, at best, loyal little wives or mistresses of accomplished heroes". Most often, these female characters were "quite brainless" with their only function being to say "Oh? and Ooh! To the clever and resourceful hero" (LeGuin, 97-98).

One of the earliest examples of SF's masculinist orientation is Lester del Ray's 'Helen O' Loy' (1938). The short story narrates the tale of a robot whose name is derived from a combination of Helen of Troy and Helen made of alloy. She is a perfect housewife- learns about romance from the television soap operas, cooks, cleans, looks after her husband-inventor. The story, according to Veronica Hollinger participates in Western culture's long-standing marginalization of women … assumes that the social roles played by women and men as women and men are historical, that they will remain largely unchanged even in the distant future.

Helen Merrick identifies two major traditions in early SF: the depiction of the 'alien' as the 'Other' and the depiction of societies in which traditional societies are overturned and where 'women rule'. In the former, "the 'alien' could signify everything that was 'other' to the dominant audience of middle-class, young white Western males – including women, people of color, other nationalities, classes and sexualities" (243). Similarly, in 'Woman Dominant' stories, or as Joanna Russ terms it 'Battle of the Sexes' Stories, women is portrayed as threats to the gendered order. In Thomas Gardner's 'The Last Woman' (1932), an all-male 'Science Civilization' is left with only one woman and even she is ultimately executed. Both these traditions were harmful to women and their search for the depiction of positive and empowering images of women in science fiction.

III. WOMEN AS WRITER IN SCIENCE FICTION

Kathryn Weibl draws a connection between the type of images presented and whether they are created by men or women, in her 1977 book Mirror, Mirror: Images of women reflected in popular culture: When this premise is explored in the context of the present paper, it is found that pre-feminist science fiction has only a few women writers who were actively writing stories and novels. Sarah Lefanu observes in her book Feminism and Science Fiction (1988), what was lacking in early twentieth- and mid-twentieth century SF was "women-identified women as writers and readers". During the 1930s and 1940s, a few women writers like C. L. Moore and Leigh Brackett assumed a male voice and non-gender specific names. This was done in order to avoid prejudice on the part of editors and readers. As Jacqueline Pearson observes, while male writers of science fiction often produce traditional views of gender, even while apparently questioning "natural" social arrangements, female writers show their usual chameleon ability to "accommodate themselves to traditional androcentric models, and yet simultaneously to subvert these modes from within. The space adventure, science fiction by C. L. Moore and Leigh Brackett did not do much to challenge the 'space opera' conventions of much of the 1930s and 1940s; in which the protagonist may be a woman, but the politics of gender do not change.

Referring to C.L. Moore, as the most interesting of early female chameleons, Pearson notes how even though Moore made use of a male-identified narrative voice, her stories reveal peculiarly female preoccupations as well as a sharp awareness of what was going on in the real world. Shambleau, one of Moore's most important stories, has her regular hero, Northwest Smith, save a 'berry-brown girl …sweet and submissive and demure' from a mob. However, as the story unravels, she turns out to be Medusa, and the 'natural' balance between the sexes is reversed. Through the depiction of the Shambleau in a phallic role, Moore lets her usurp the dominant role and as a contrast, it is Northwest Smith who is shown in a submissive role. The tale ends with the destruction of the Shambleau, and the triumph of the no-longer tough male hero, who has to take the help of other men to defeat the 'alien'. The story is significant as it is a powerful depiction of female sexuality that diminishes the hero's masculinity and reduces him to submissiveness. It was not until the advent of feminist writers that this tradition was challenged and women began to be portrayed with positive characteristics.

IV. WOMEN AS READERS OF SCIENCE FICTION

Judith Fetterley's groundbreaking analysis of certain American fictional works by male writers, The Resisting Reader: A Feminist Approach to American Fiction (1978), takes a hard look at their intent, content, and impact on women readers. According to her, "literature is political" and it has impalpable designs on the female reader. This is because, the male is considered as the Universal, while the female is incidental or secondary.

This predominantly male bias is found not only in mainstream literature but also in all the genres of popular literature, whether American or not. Science fiction was no exception to this bias. That there have always been women readers of science fiction has been pointed out by the feminist critic Susan Wood in her article 'Women and Science Fiction'. However, she observes, these women readers also had to become one of the "boys" and read as "boys/men" and not as women. Adam Roberts points out that "from the dawn of SF … through to the end of the 1950s, the female audience for SF was small, and those women who were interested in reading it did so with a sense of themselves as alienated or at least sidelined spectators" .

According to Sarah Lefanu, SF reflected "masculine concerns" until the 1960s and 1970s as the stories and novels were written before the feminist intervention was based around the central theme of space exploration and the development of technology, and access to these areas was effectively denied to women in the real world. Traditionally, SF has been considered a predominantly masculine field which, "through its focus on science and technology, 'naturally' excludes women and by implication, considerations of gender.

In her scrupulously researched work The Battle of the Sexes in Science Fiction (2002), Justine Larbalestier argues that women were definitely present in the genre as readers, writers, and fans. However, the widespread conviction that there was almost no significant participation by women in SF before the 1970s is due to the marginalization of women in the SF community as a whole since marginality leads to invisibility. Though women were very active in SF fandom, their presence was not acknowledged very often. Jeanne Gomoll, in her 'An Open Letter to Joanna Russ' published in Aurora, winter 1986, refers to how her own experiences of SF fandom have been written out of history (Qtd. In Lefanu 6). Sarah Lefanu also agrees that women's past activities are being denied or ignored.

V. THE WINDS OF CHANGE

The 1950s saw a gradual change emerging in SF, as the genre began to engage with social-cultural concerns. Helen Merrick calls this change "a more engaged awareness of contemporary issues around sex, gender roles, race and ecology". A number of writers tried to resolve the 'Battle of the Sexes' through some form of equality. Examples are Philip Wylie's The Disappearance (1951), Frederik Pohl and Cyril Kornbluth's Search the Sky (1954), John Wyndham's 'Consider her Ways', (1956) and Robert Silverberg's 'Woman's World' (1957). Similarly, female characters began to be depicted as being capable of carrying out 'men's work'. Isaac Asimov's Robot series portrayed Dr. Susan Calvin, as a 'female man', while Robert Heinlein portrayed independent, intelligent and competent female characters in his novels like Tunnel in the Sky (1955) and Have Spacesuit Will Travel (1958).

VI. THE ECOFICTION AND SCIENCE FICTION

The term 'ecofeminism' can be used to describe a political, cultural, or economic movement that is aimed at establishing equal rights and legal protection for women. Feminism involves political, cultural and sociological theories, as well as philosophies concerned with issues of gender difference. It is also a movement that campaigns for women's rights and interests. In the 1840s, the women's rights movements, called the 'First Wave of Feminism,' had started to emerge in the United States and Britain with the emergence of women's suffrage movements. However, even before the emergence of organized suffrage movements, women and men had been writing about the inequalities and injustices in women's social condition and campaigning to change it. Mary Wollstonecraft's A Vindication of the Rights of Women (1792), John Stuart Mill's The Subjection of Woman (1869) and Friedrich Engels's The Origin of the Family (1884) were some of the most important works which influenced the movement.

In the twentieth century, the 'women's movement' of the 1960s, also called Second-wave feminism, and sometimes 'women's liberation,' was a "renewal of an old tradition and thought already possessing its classic books which had diagnosed the problem of women's inequality in society, and (in some cases) proposed solutions" (Barry 121). In addition to the books mentioned earlier, others like Olive Schreiner's Women and Labor (1911), Virginia Woolf's A Room of One's Own (1929) and Simone de Beauvoir's The Second Sex (1949) were also influential in shaping the movement. The central focus of the second wave was on total gender equality - women as a group having the same social, political, legal, and economic rights that men have. Writers like Simone de Beauvoir and Elaine Showalter established the groundwork for the dissemination of feminist theories dovetailed with the American Civil Rights movement. One of the major theoretical projects of the second wave of feminism is the investigation of gender and sexuality as social constructs, thus posing a challenge to notions of a natural law regulating feminine behavior and an innate female that describes and circumscribes woman.

VII. SCIENCE FICTION AND ECOFEMINISM

The genre of science fiction when used for feminist purposes opens up a whole range of possibilities to interrogate gender as a social and cultural construct. The stock conventions of SF like – time travel, alternat e worlds, entropy, relativism, etc., – can be used metaphorically and metonymically as powerful ways of exploring the construction of "woman". Pamela Sargent writes that the best fantastic literature and the most profound feminism have this in common: "they are subversive, continuously challenging the accepted wisdom of the tribe whilst seeking change and a new way of understanding and viewing the world.

According to Sharon Ben-Tov, science fiction "has given women writers the freedom to discover new stories and has gained an enthusiastic readership, not only among regular fans, but also among people attracted to the genre because it depicts women in innovative ways" (136). She elaborates that the science fiction world was one in which: The 1960s and 1970s, with its 'second-wave feminism', changed the SF genre and brought more women into active participation as readers and writers. Sarah Lefanu claims that because of the feminist intervention, women writers have been able to "draw on the possibilities opened up by an important strand within science fiction that is in opposition to the dominant ideology, that, rather than celebrating imperialistic and militaristic glory, is subversive, satirical, iconoclastic.

VIII. ECO FEMINIST AND SCIENCE FICTION FEMINIST

The SF written by women during the late 1960s and 1970s shows very clearly how a political vision can become an integral part of the imagination; how important, in other words, politics is to art. They also show the energy of ideas coming out of the women's liberation movement of this period and how immediate was their influence on writing. These women and many others were reading books like Shulamite Firestone's The Dialectic of Sex and Robin Morgan's Sisterhood is Powerful and participating in consciousness-raising sessions with other women. As their own awareness matured, their perceptions began to change and this change is evident in their writing, that is, in the fictional worlds created by them. According to Sarah Lefanu, "Feminism questions a given order in political terms, while science fiction questions it in imaginative terms" (100). The stories and novels of some of the major women science fiction writers like James Tiptree Jr. or Alice Sheldon, Ursula K. LeGuin, Suzy McKee Charnas and Joanna Russ, express, in different ways, "the conjuncture of politics and imagination" (Lefanu 101). The books by these writers are fired by a political vision coming from the heart of the women's liberation movement, one that is transformed by the power of their imagination into a rich and complex fiction. Most importantly, the vision is not presented to the reader to be passively consumed. They explore the possibilities, but offer no solutions. As Helen Merrick points out: The 1970s mark a high point in SF's engagement with gender, with the publication of a significant group of texts …these self-consciously feminist works consistently challenge and disrupt the perceived 'naturalness' of gender and locate the operation and proliferation of the more harmful effects of the gendered order deep within the political and cultural institutions of contemporary society (247-8).

Some of the most important works of this period, which treat the question of gender are Ursula K. LeGuin's The Left Hand of Darkness(1969), James Tiptree Jr.'s'The Women Men Don't See'(1973), 'Houston, Houston, Do You Read?'(1976), Suzy McKee Charnas's Motherlines (1978), Joanna Russ's The Female Man (1977), Marge Piercy'sWoman on the Edge of Time (1976), etc. While all these novels deal with gender, the approaches to this problem are different. However, what is similar is the notion that gender is socially produced, thus challenging taken-for-granted structures which reinforce gender binaries. Most importantly, these stories present extended families or communal life as alternatives to the nuclear family and parenting is shared amongst numerous 'mothers' who may be female or male (Merrick 248).

IX. CONCLUSIONS

The importance of cultural productions like the arts and literature in bringing about a change in consciousness and culture, cannot be stressed enough (Stimpson, 120) and it is in this area that some of the most important works of science fiction by feminist writers have played a very significant role. Their stories and novels take basic feminist issues like gender /sex roles, reproduction, motherhood, etc., and explore societies which are structured without sexual or gender hierarchies. These works question social gender constructs of what women "are" and postulate what women should be, thereby putting power into women's hands. They challenge the very issue of power, what Fetterley refers to as "the issue in the politics of literature". The changes brought about by feminism have encouraged more and more women writers to enter the field, and now, the contemporary scenario in SF offers challenging and invigorating possibilities for women who can find themselves as protagonists, writers, and readers.

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From Drought to Abundance: The Shirpur Pattern's Impact on Water Management

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ABSTRACT

Water scarcity is a pressing issue in many parts of India, particularly in regions like Maharashtra's Khandesh, Marathwada, and Vidharbha, where irregular and uneven monsoons contribute to water shortages. Climate change has further exacerbated the problem, leading to a cycle of drought and flood in some areas. The Deccan Plateau's geological characteristics, including layers of black soil, sand, silt, and gravel, play a crucial role in water storage. The traditional watershed management approaches have struggled to control floods and adequately conserve water resources. Water harvesting by Shirpur pattern technique has proven successful to resolve above problems. This paper explores the innovative "Shirpur Pattern" of watershed management developed and executed in Shirpur taluka of Dhule District of, Maharashtra State, India, which addresses these challenges. This paper also presents the principles, advantages, and ground results of the Shirpur Pattern, showcasing its potential to transform water management practices in water-scarce regions, contribute to sustainable agriculture, and enhance water resource resilience in the face of climate change. This paper highlights the successful way achieved to convert a water scare area in to water abidance area by use of innovative and effective water harvesting technique named as Shirpur pattern.

Keywords: Water scarcity, Shirpur Pattern, Watershed management. Climate change

I. INTRODUCTION

Water is basis for all activities of everyone's life, not only human, plants and animal but human ecosystem as whole. Scarcity of water compels human to extract more and more from underground, which temporarily solves the problem but not for long. Hence it is need of time to conserve maximum surface water and its underground sources. Water scarcity is a recurring issue in parts of Maharashtra, including Khandesh, Marathwada, western Maharashtra, and eastern Vidharbha, due to irregular and insufficient monsoon rains. Some areas, like Marathwada, even face water shortages in winter. This situation is exacerbated by climate change, leading to drought-flood cycles in certain regions. India's annual rainfall of 1170 mm is unevenly distributed, with the Deccan plateau in central and northern Maharashtra receiving only about 700 mm. People in these areas heavily rely on groundwater for agriculture and daily needs, causing a decline in underground water reserves.

Natural Ground water recharge: soft and hard layers get repeated several times in Deccan plateau of India. In these layers black soil layer act as barrier for water percolation and hence it minimizes rate of recharge of underground water sources. Sand layer and silt is most important layer which has huge capacity to hold water in it. Sand holds about 30% of water to its volume means 1cu.m sand holds about 300 litters of water. This water contributes to underground water and water to wells and bore wells in farms. Also like sand silt has capacity to hold 2.5 % of water in it means 1cu.m silt holds about 25 litters of water. If we have such natural storage available.

Conventional Methods of Water Shed Development: Conventional watershed has natural streams with natural width and depth. Also this channel has driven alluvium at base which is very fine and does not allow speedy infiltration. Because of having less width traditional watershed channels hold less quantity of water. Also because of having less natural depth it percolate less water to underground resources, as percolation barriers from channels have not been removed while constructing check dam. Also in such traditional watersheds, water gets stagnated for a long time and evaporated most of its part as vapour. More is stagnation time due to percolation barriers like alluvium, black soil layers, yellow soil layers etc. less is percolation and more evaporation.

Improvement in Ground water recharges a way forward: A Systematic way we can develop small watershed projects like Shirpur Pattern to mitigate water scarcity at domestic level itself. It will make a village self-dependent for irrigation and there will be no need to depend on medium and Macro irrigation projects. Shri. Amrishbhai Patel from Shirpur (Dist. Dhule, Maharashtra) developed a new concept of watershed management which is potent medicine for drought and floods both. The Shirpur Pattern focuses on maximizing surface water and underground sources conservation. It acknowledges the changing rainfall patterns, emphasizing the need for efficient water retention during short, intense rainfall events. By leveraging the natural capacity of these layers to hold water, the Shirpur Pattern proposes the construction of wide and deep watershed channels, increasing their capacity to store and infiltrate water. The details of the techniques are given below.

Shirpur Pattern: The Shirpur Pattern is founded on real geological experiments in soil and represents a technology that is both straightforward and proudly of Indian origin, requiring minimal engineering expertise and simple equipment like pickaxes and dumpers. This project offers exceptional cost-effectiveness when compared to its advantages. Its primary goal is to ensure sustainable irrigation in regions susceptible to drought. The Shirpur Pattern empowers farmers to achieve three annual crop cycles. Additionally, it ensures round-the-clock water availability for industries, agriculture, and the well-being of people in rural, urban, and hilly areas of the Saatpuda region.

Key components of the Shirpur Pattern: It include widening and deepening channels, removing percolation barriers, and strategically placing check dams to enhance percolation and lateral water movement. This approach accumulates more water, increases infiltration, and mitigates both flood and drought risks.

In Shirpur Pattern, watershed channels are considered most important thing for conservation. In this watershed pattern width and depth of channels made 3 to 4 times more than natural measurement. It focused on deepening the flow up to 15 to 20 mt. and widening up to 30 mt. That increases volume of channels to accumulate more water. Also due to increase in depth, at least one soft layer opens which helps in lateral and downward entry of water easily through sand and silt layers. Also percolation barriers get reduced as water doesn't come across such barriers like Black material. It also increases hydrological pressure at bottom surface in tank area. That results in increase in rate of downward movement of water. As speed of percolating water is

more hence a negligible part of water gets evaporated in such watershed area that in real sense increases underground water resources.

At appropriate distance series of check dams are constructed for percolation and lateral movement of stored water. Channels provided with chain of check dams which hold water in watershed/captive area itself and reaches underground sources of local area and make available water to localities' in summer as recharge in their wells. In deficient rainfall such watersheds accumulate maximum water and increase recharge efficiency. Also in flood condition it accumulates more water in upstream captive area itself as its volume is more than natural watershed that reduces water flow in main river course and minimizes flood conditions at downstream and river bank area. Hence Shirpur Pattern is beneficial for both flood and drought.

Advantage of Shirpur pattern:

It accumulates more water than traditional watershed structures.
It increases infiltration and percolation and effectively recharges underground water resources.
It reduces risk of both floods and droughts.
It is a kind of watershed decentralization.
It increases water availability 2-3 times more to watershed area.
It overcomes from evaporation, stagnation and overflow like problems.
It minimizes soil erosion.

Impact of Shirpur Pattern: It has been successfully implemented in several villages in Dhule District, Maharashtra, significantly improving irrigation availability and reducing water wastage through micro-irrigation systems. Additionally, during a severe drought in 2012, the Shirpur Pattern, along with government support, effectively resolved water scarcity issues in Jalna District by constructing check dams and recharging underground water sources, demonstrating its potential as a revolutionary concept for watershed management.

Benefits observed: This project is undergoing in many villages of Shirpur Tahsil in Dhule District of Maharashtra. Several villages adopted this pattern successfully. In many villages where only 25-30% of land was under irrigation which became 80-85 % after adoption of this pattern. The farmers were also advised to use micro irrigation systems to minimize water wastage and thereby use conserved water efficiently.

In 2012, many district faced drought in Maharashtra even worse than 1972 drought. In Jalna district the situation was worst. This is the district which has been facing drought conditions since many years continuously. The city people took it as challenge and by raising proper fund they not only solved drinking water problem and domestic use of it but also for irrigation to farms. Chief Minister and deputy chief minister gave green signal for his proposal. Under his guidance government built many check dams according to Shirpur pattern. In subsequent year with average rainfall all dams overflow with water and much of underground got recharged as farmers found their wells with high water level in summer.

The challenge of providing a sustainable drinking water supply has been permanently resolved. There has also been a significant reduction in energy consumption. In the basalt region, where the water table had dropped by 150 meters, it has rebounded by an impressive 140 meters. Similarly, in the alluvial areas, where the water table had sunk by 150 meters, it has now recovered by 110 meters, reaching a current depth of about 40 meters. As a result, water flows consistently in streams throughout the year, enabling farmers to cultivate three crops annually. Furthermore, the average per capita income has surged by one lakh per hectare.

II. CONCLUSION

Water is the foundation of all life, essential for humans, plants, animals, and the entire ecosystem. The recurring water scarcity issues in parts of Maharashtra, exacerbated by climate change, demands immediate attention. The reliance on groundwater extraction offers only temporary relief, and long-term solutions are essential.

The Shirpur Pattern, a novel approach to watershed management, addresses these challenges by maximizing surface water and underground source conservation. This pattern includes widening and deepening channels, removing percolation barriers, and strategically placing check dams to enhance percolation and lateral water movement. It has proven highly effective in increasing water availability, reducing the risk of both floods and droughts, and improving overall water management.

Successful implementation in Dhule District and Jalna District has shown its potential as a revolutionary concept, significantly improving irrigation availability and resolving water scarcity issues. The Shirpur Pattern has not only solved drinking water problems but also enhanced agricultural productivity, reduce energy consumption, and improved the socio-economic conditions of the region. This innovative approach offers a promising path toward sustainable water management in water-scarce regions.

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Advance Brain Tumor Detection in MRI : A Novel Segmentation Method with HSO

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ABSTRACT

In medical image processing related to the brain tumor Magnetic resonance (MR) images plays important role to detect the tumor but specific brain image segmentation is a not easy and it is one of the time taken process. An automatic process needed to detect the tumor in brain. Recently many researchers are working on the brain tumor segmentation methods but still some improvement is needed. In this paper work is improved for the adaptive local fitting method for efficient segmentation of the brain tumor. In Medical image processing one of the parameter which affects the accuracy is inhomogeneity. In proposed work HSO method is used for minimizing the energy function. For this weighted sum of the neighboring pixels is considered based on their comparative reputation. To MR images are used to find the brain tumor. Our method is compared with the other previous methods and it is found that our proposed work gives better results. Results are compared based on performance confusion matrix parameters. Brain tumors are a pressing medical concern, requiring accurate and timely diagnosis for effective treatment. This research paper explores the application of artificial intelligence (AI) as a transformative tool for the detection of brain tumors. Leveraging machine learning techniques and advanced image analysis, our study demonstrates the capacity of AI to significantly improve the accuracy and efficiency of brain tumor diagnosis from medical imaging, particularly magnetic resonance imaging (MRI).

We begin by assembling a diverse dataset of brain MRI scans, comprising both tumor and non-tumor cases. The collected data is meticulously preprocessed to enhance image quality and ensure uniformity. Subsequently, a machine learning model is trained on this dataset, enabling it to discern subtle patterns and features indicative of brain tumors. The model is rigorously fine-tuned and validated, achieving remarkable performance in terms of sensitivity, specificity, and overall accuracy.

The findings of this research underscore the transformative potential of AI in the realm of brain tumor detection. By harnessing the computational power of AI, we not only enhance the precision of diagnoses but also facilitate quicker decision-making for clinicians. The interpretability of AI-aided detection is carefully addressed, making this technology a valuable asset in the clinical setting.

As the field of AI in healthcare continues to advance, this research underscores its pivotal role in the early detection and management of brain tumors. The integration of AI into medical imaging presents a promising avenue for improving patient care and outcomes, offering a glimpse into a future where technology and human expertise collaborate seamlessly to address critical medical challenges.

Many times, in our city we see that the garbage bins or dustbins placed at public places are overloaded. It creates unhygienic conditions for people as well as ugliness to that place leaving bad smell.

Keywords: Radiomics, Tumor Segmentation, Neuroimaging, Healthcare AI, Diagnostic Imaging, Medical, Data Analysis, Radiology, Neuro-oncology.

I. INTRODUCTION

In Medical image processing field segmentation of Magnetic resonance (MR) images for brain tumor detection is useful; many researchers are working on this area. Early detection of the tumor is becoming easy and because of that death rate is reducing. In case of automatic medical diagnosis system MRI images provide good results as compare to the computed tomography. Contingent upon their underlying starting point, cerebrum tumors can be considered as either essential brain tumors or metastatic cerebrum tumors. In essential ones, the inception of the cells are cerebrum tissue cells, wherein metastatic cells become carcinogenic at some other piece of the body and spread into the brain. They are sorted as primary or secondary. An essential cerebrum tumor begins in your mind. Numerous essential cerebrum tumors are considered. Secondary brain tumor, otherwise called a metastatic cerebrum tumor. This research paper explores the application of AI in the detection of brain tumors, acknowledging the advancements made in image analysis, feature extraction, and machine learning models. By harnessing the computational power of AI, we aim to significantly improve the sensitivity and specificity of brain tumor detection, facilitating early diagnosis and treatment initiation.

Throughout this paper, we delve into the methodologies, technologies, and challenges associated with AI-based brain tumor detection. We examine the critical role of medical imaging, particularly MRI, as a primary data source for this endeavour. Furthermore, we discuss the implications of AI in clinical practice, emphasizing the complementary nature of AI and human expertise in healthcare decision-making.

As the field of AI-driven healthcare matures, it is imperative to comprehend the potential and limitations of AI in brain tumor detection. This research aims to contribute to the ongoing dialogue surrounding the integration of AI in healthcare, illustrating how it can enhance the accuracy, efficiency, and accessibility of brain tumor diagnosis, ultimately benefiting patients and healthcare providers alike. Brain tumors pose a significant challenge to the medical community, demanding swift and accurate diagnosis to enhance treatment outcomes and patient survival.

The early and precise detection of brain tumors is crucial, as it enables timely intervention and personalized therapy, minimizing the potential for disease progression and improving patient quality of life. In this context, the convergence of medical imaging and artificial intelligence (AI) has emerged as a transformative force, promising to revolutionize the landscape of brain tumor diagnosis.

Brain tumor detection has traditionally relied on the expertise of radiologists interpreting medical imaging, primarily magnetic resonance imaging (MRI) scans. While human expertise remains invaluable, the growing complexity and volume of medical data necessitate innovative solutions to enhance the efficiency and accuracy of the diagnostic process. It is within this paradigm shift that AI-driven technologies have found their place.

Artificial intelligence, particularly machine learning and deep learning techniques, offers a remarkable capacity to analyse vast datasets with exceptional precision, learning intricate patterns and subtleties that might elude the human eye. When applied to medical imaging, AI has demonstrated the potential to revolutionize the field of radiology by automating routine tasks, reducing subjectivity, and improving diagnostic accuracy.

II. METHODS AND MATERIAL

Data Collection: A diverse and comprehensive dataset of brain MRI scans was obtained for this study. The dataset consists of T1-weighted, T2-weighted, and FLAIR (Fluid-Attenuated Inversion Recovery) MRI images. The dataset includes cases of brain tumours of various types, locations, and stages, as well as normal brain images for comparison. Data were collected from multiple medical centres and institutions to ensure a broad representation of brain tumour cases.

Data Pre-processing: The collected MRI images underwent rigorous pre-processing to standardize and enhance their quality for analysis.

Pre-processing steps included:

Normalization: Intensity normalization to ensure uniform brightness and contrast across all images.

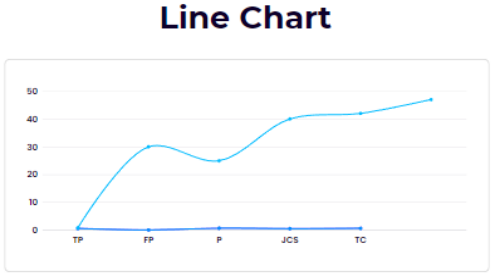
Resampling: Resampling to a common resolution to ensure uniformity in image dimensions.

Noise Reduction: Application of noise reduction techniques to improve image clarity.

Skull Stripping: Removal of non-brain tissue and skull from the MRI scans to focus the analysis on the brain region.

Feature Extraction: To enable the AI model to capture relevant information, advanced feature extraction methods were applied. Notably, we explored high spatial order (HSO) features, which consider intricate spatial relationships within the images. These HSO features, derived from texture analysis and radiomics, were utilized to represent the subtle patterns associated with brain tumors.

Harmony search (HS) is a music-inspired algorithm developed by Zong Woo Geem et al. in 2001. It is not swarm intelligence-based, but it is a metaheuristic algorithm. The first rule corresponds to selection or elitism, and the second and third rules are mutation.



Mutation can be local and global in HS. For example, pitch adjustment (the second rule) uses the following equation:

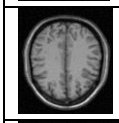
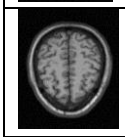
$$x_{\text{new}} = x_{\text{old}} + b_w \varepsilon,$$

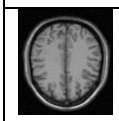
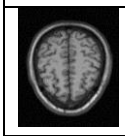
Where bw is the bandwidth of the pitch adjustment, whereas E is a random number. This is a local random walk, and the distance of the random walk is controlled by the bandwidth. This part can be considered a local mutation action with an equivalent mutation rate of 0.1 to 0.3.

The third rule is essentially mutation on a larger scale, which is essentially equivalent to random walks. The selection is controlled by the probability of choosing a harmony from harmony memory. Similar to genetic algorithms, this choice of harmonies from the population is high, with a typical value of 0.9, which enables the system to converge in a subspace. However, this may be at the expense of reduced probability of finding the global optimality in some highly nonlinear problems.

III.RESULTS AND DISCUSSION

Results are performed considering 50 MR images. In brain tumor detection MR images are used. To describe the performance of the proposed work confusion matrix is used here artificial neural network is used for the classification. The confusion matrix will describe the possible outcome in terms of predicted output. The outcome can be True Negative (TN), True Positive (TP), False Negative (FN) and False Positive (FP).

IMAGES	TP	FP	P	JCS	TC
	0.7525	0.1692	0.8164	0.6436	0.7831
	0.9103	0.2140	0.8096	0.7498	0.8570
	0.8933	1.1410	0.4391	0.4672	0.5888

IMAGES	TP	FP	P	JCS	TC
	0.7078	0.1463	0.8287	0.6174	0.7635
	0.7907	0.3100	0.7184	0.6036	0.7528
	0.9103	1.2140	0.8096	0.7498	0.8570

In this system we can consider following factors

TP = correct positive prediction

TN= correct negative prediction

FP= incorrect positive prediction

FN= incorrect negative prediction

TP Rate: It is calculated as the number of correct positive predictions divided by the total number of positives. It is also called as Sensitivity or Recall.

TP Rate = TP / (TP + FN)

FP Rate: False positive rate (FPR) is calculated as the number of incorrect positive predictions divided by the total number of negatives.
FP Rate = FP / TN + FP

IV. CONCLUSION

The overall results show that there needs some improvement in the accurate tumor detection. In our proposed method level set is used to minimize the energy function. While minimizing the energy function weighted sum of the neighboring pixels is taken into consideration. Based on the edge features the comparative prominence contiguous region is considered. In this HSO method is applied. Our proposed method is compared with the previous techniques, results shows that proposed work is giving better results in terms of accuracy. Future work will be evaluated considering large database.
In medical image processing accurate segmentation of masses is one of the important task. In brain tumor detection MR images are used. In our proposed method brain tumor segmentation is done considering the inhomogeneity parameter.

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Uncovering Falsehoods - Fake News Detection on Facebook

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ABSTRACT

The advent of the WWW along with the rapid adoption of social media platforms (such as Facebook, Twitter and Instagram), paved the way for a distribution of knowledge unprecedented in human history. However, certain companies use such platforms, sometimes to make money and sometimes to promote biased views, change mindsets, and spread satire or mockery. This phenomenon is known as fake news.

Because the spread of fake news can have serious consequences, including election rigging and growing political divisions, it is crucial to develop methods to detect fake news content. A computerized grading system is used to classify a wide range of things. The fake news is a term used to describe this circumstance. Given the serious consequences of fake news, such as influencing elections and widening political divisions, it is imperative to develop methods to detect fake news content. It is difficult to automate the classification of a text article as misinformation or disinformation.

We recommend using the machine learning automatic classification approach specified in this research work. Our research looks at various text properties such as word count, term frequency, and inverse document frequency, which can be used to differentiate between fake and genuine content. We train a Passive Aggressive Classifier and evaluate its performance against these properties using real-world datasets. The datasets are used partly to train and partly to test the classifiers. It is possible to determine whether the message is false by testing the various characteristics of the records in the classifier.

Keywords: Fake news, Natural language processing, Machine learning, Tfidf Vectorizer, Passive Aggressive Classifier, Confusion Matrix, Accuracy Score

I. INTRODUCTION

Fake news, a type of yellow journalism, summarizes news that may be false and is usually spread through social media and other online media. This is often done to promote or impose certain ideas and is often achieved with political agendas. Such messages can contain false and/or exaggerated claims and end up being viralized by algorithms and users can end up in a filter bubble.

Misleading or unreliable information is extensively disseminated through popular social media platforms (such as Facebook, Twitter and Instagram) [2]. The issue of fake news has become increasingly prevalent on social networks, with the potential to spread misinformation and cause harm. Fake news can be defined as intentionally false information presented as if it were true, often created with the intention of deceiving or

manipulating individuals [7]. Examples of fake news include fabricated stories, manipulated images, and misleading headlines.

The distribution of counterfeit data on social networks has a negative impact on individuals and can have serious consequences in communities [1], such as influencing political elections, inciting violence, and damaging reputations [8]. Therefore, it is crucial to detect and combat fake news on social networks to prevent the spread of misinformation and protect individuals from harm.

II. LITERATURE REVIEW

Detecting and combatting fake news on social networks is essential to ensure the accuracy and reliability of information being shared. Machine learning methods have been used to detect fake news with high accuracy rates [9]. For instance, support vector machines (SVM) have been used to automatically identify symbols and patterns in text, while decision trees have been used to classify news articles as either real or fake [10]. Additionally, some researchers have proposed the use of user-generated content, such as comments and reactions, to detect fake news [11]. These techniques can help identify and flag potential instances of fake news, allowing for further investigation and fact-checking.

One of the techniques used for detecting fake news on social networks is content-based analysis. This approach involves analyzing the content of news articles to assess their trustworthiness. Various deep learning models and frameworks have been developed for content-based fake news detection, such as those highlighted in a paper by Hangloo et al. in 2022 [12]. Additionally, sentiment analysis of news content and emotion analysis of users' comments have been used to extract features for fake news detection, as proposed in a study by Hamed et al. in 2023 [11]. These content-based approaches have shown promising results in detecting fake news on social networks.

Network-based analysis is another technique used for detecting fake news on social networks. This approach involves analyzing the spread of news on social networks and identifying patterns that may indicate the presence of fake news. For instance, Zhou et al. proposed a pattern-driven fake news detection approach that focuses on studying the patterns of fake news spread, spreaders of the news, and relationships between users [13]. Convolutional neural networks and support vector machines have also been used for abstracted views of fake news spread [14]. Crowdsourcing has been used to detect fake news in online social networks, as highlighted in a study by Raza et al. in 2022 [15]. These network-based approaches have shown promising results in detecting fake news on social networks.

Hybrid approaches that combine content and network analysis have also been proposed for fake news detection on social networks. For instance, Nasir et al. proposed a hybrid deep learning model that combines convolutional and recurrent neural networks for fake news classification [16]. A study by Ali et al. proposed an EGSLA algorithm that combines content-based and user-based features for fake news detection [17]. A hybrid model comprising a recurrent neural network and support vector machine was incorporated to detect real and fake news, as proposed in a study by Zhou et al. in 2022 [18]. These hybrid approaches have shown improved performance in detecting fake news on social networks compared to individual content-based or network-based approaches.

Simple classification methods are not specialized for fake news detection, and the lack of an efficient way to differentiate between fake and non-fake news is a big challenge in this area [4]. Automated detection of fake news is needed on social media, and machine learning algorithms like the Passive Aggressive Classifier are used

to identify fake news [2][1][3]. In addition, editors and journalists need new tools to verify content that originated from social media [2]. Detection of fake news is important because it has been spread out in more important volume and has formed ever more fraud [5].

Computational systems like Count Vectorizer, Tfidf Vectorizer, and Model for the recognition of fake information in community datasets are used to find out fake news [5]. Bag of words model and Tfidf vectorization model are two feature selection approaches used for fake news detection [3]. Logistic Regression Classifier, Naive Bayes Classifier, Random Forest Classifier, and Passive Aggressive Classifier can be used for classification purposes in fake news detection [3].

III.PROPOSED SOLUTION APPROACH

Due to the complicated nature of fake news, identifying the news category becomes a difficult task. It is obvious that the designed technique must contain some perspectives to handle the problem. Therefore, the designed model is a combination of several classifiers and vectorizers.

A. The fake news Dataset

The required dataset was referred from the Facebook dataset [19][3]. The size of the data set was 6383*4. That means there were 6383 rows along with 4 columns. The first column referred to the news, the second and third columns were the title and body, and the fourth column had labels that indicate whether the news is real or fake.

B. Text Preprocessing or Data Cleaning

The performance of a text classification model depends heavily on the words in a corpus and the features constructed from those words. Common words, also called stop words, increase the dimensionality of functions. Since social networks contain very unstructured data, their processing is very important before performing any operations on the data. For this purpose, a basic pre-processing was carried out. This step included data cleaning.

Cleaning the data set becomes an important task to highlight the important attributes that we will require for the machine learning system. Cleaning (or preprocessing) the data typically consists of several steps, like Removal of Punctuation to eliminate all special characters, Tokenization to provide unstructured text a structure, and Removal of stop words since they don't provide us with much information about our data.

C. Dataset Feature Extraction using Tfidf Vectorizer

Text data can be used to generate many functions such as word count, frequency of big words, frequency of unique words, etc. Feature extraction helps to reduce unnecessary data in a data collection. The proposed system is based on the Tfidf Vectorizer, which converts a collection of raw data documents in a TF-IDF Feature Matrix. First and foremost, we took the input in the form of a data set and then the data set is handled using the model we built.

Term Frequency is calculated as:

$$TF = \frac{Number\ of\ repetition\ of\ words\ in\ a\ sentence}{Noumber\ of\ words\ in\ a\ sentence} \quad (1)$$

Inverse document frequency is calculated as:

$$IDF = Log * \frac{Number\ of\ sentences}{Number\ of\ sentences\ containing\ words} \quad (2)$$

TF-IDF is given as:

$$TFIDF = TF * IDF \quad (3)$$

D. Classification using Passive Aggressive Classifier

The Passive Aggressive Classifier is a machine learning algorithm that has been implemented to identify fake news on Facebook. The algorithm performs by reacting passively to accurate classifications and aggressively to any misclassifications.

Step 1. Import necessary libraries

Step 2. Read the data into a Data Frame, and get the shape of the data and the first few records

Step 3. Check if there is any null value (drop null rows)

Step 4. Get the labels from the Data Frame

Step 5. Split the dataset into training and testing sets

Step 6. Initialize a Tfidf Vectorizer with stop words and a maximum document frequency of 0.7 (discard terms with a higher document frequency)

Step 7. Fit and transform the vectorizer on the train set, and transform the vectorizer on the test set

Step 8. Initialize a Passive Aggressive Classifier

Step 9. Predict the test set from the Tfidf Vectorizer and calculate the accuracy with accuracy score from sklearn metrics

Algorithm 1: Proposed Model

IV. RESULTS AND PERFORMANCE EVALUATION

We have investigated the effectiveness of Passive Aggressive Classifier by applying it on real-world dataset. This algorithm has been tested against a Facebook news dataset and has been found to work well with high accuracy.

The confusion matrix is used to compare the performance of the proposed model. We got an accuracy of 97.18% with this model.

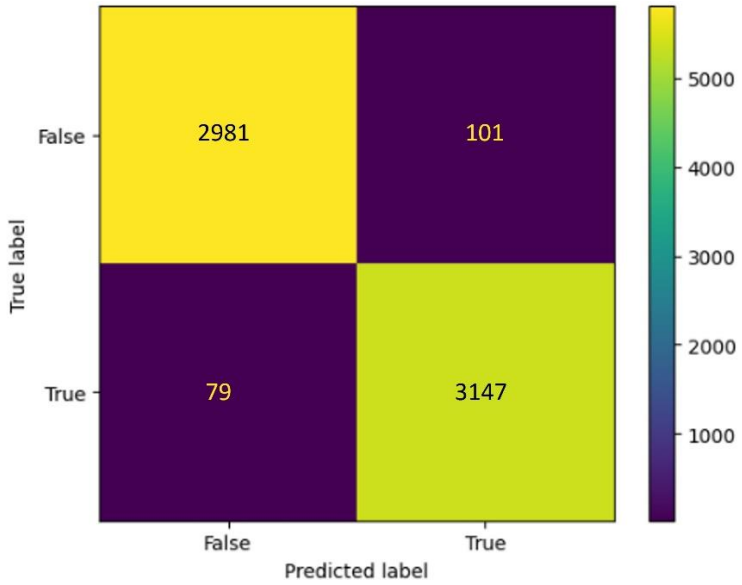

Figure 2: Confusion matrix with the number of false and true negatives and positives

So, with this model, we have 3147 true positives, 2981 true negatives, 101 false positives, and 79 false negatives.

V. CONCLUSION

To sum up, the problem of fake news on social media platforms is a complex and pressing problem that requires multi-faceted solutions and the use of advanced technologies to address it. Using advanced detection methods such as machine learning algorithms can help identify instances of fake news and prevent its spread. However, it is also essential that people consume information critically and check sources before sharing information on social networks.

The Passive Aggressive Classifier provides 97.18% accuracy in identifying fake news, which works well with Tfidf on a large volume of data, can be evidenced by the F1 score.

On the other hand, by working together to identify and combat fake news, we can ensure the accuracy and reliability of the information on social media and prevent the spread of harmful misinformation.

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The Role of Blockchain Technology in Enhancing Sustainability in Supply Chains

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ABSTRACT

Blockchain technology has rapidly expanded over the past decade, with potential applications in supply chain management. Despite its potential, there is a lack of comprehensive understanding beyond cryptocurrencies. Few business professionals have a thorough understanding of blockchain technology and its potential benefits. This article aims to provide a comprehensive analysis of the uses and advantages of blockchain technology in supply chain management, helping scholars and industry professionals understand its potential across various supply chain domains. A "closed-loop" value chain perspective is used to examine the advantages at every essential stage of the supply chain, from sourcing to customer and reverse logistics. Qualitative research is used to perform qualitative research, and a theoretical framework for blockchain-enhanced supply chain performance is developed. The study concludes by addressing the main disadvantages and obstacles to its adoption to help managers assess the true net benefits of blockchain technology.

Keywords: Traceability, Visibility, Environmental Impact, Ethical Sourcing, Economic Efficiency

I. INTRODUCTION

This study explores the concept of greater source provenance visibility in the manufacturing industry, focusing on three main constructs: supply chain sustainability, supply chain visibility, and blockchain technology. Supply chain sustainability involves a holistic approach that considers social and economic factors throughout the value chain of a finished product. It takes an integrated approach to ensure reliable management of inbound and outbound processes, as well as logistics within a supply chain. Technological advancements have enhanced communication and visibility across supply chains, improving areas of supply and demand synchronization. Visibility enhances collaboration and trust in relationships with partners, enabling the development of strong relationships with partners and stakeholders. However, traditional mechanisms and technological approaches like RFID, serialisation, bar codes, and e-pedigree have limitations in interoperability, privacy, scalability, and security in preventing sabotage in supply chains.

Blockchain technology (BCT) has substantial potential, having been highly successful in the financial domain, such as with bitcoin. It has attracted interest from various application arenas, such as mining and metal industries, due to its promise of reducing the need for intermediaries or trusted partners to verify, audit, or certify supply chain information. Security, transparency, and traceability are the primary characteristics and capabilities of BCT that would benefit supply chain visibility. Despite its success in the financial sector, there have been few research efforts to investigate its utilisation in other sectors. These studies have mostly focused on specific supply chains, especially from an industry perspective, without considering the effects on the network, which are typical in the contemporary business environment.

This research bridges the gap in the supply chain literature by comprehensively seeking to investigate the potential of BCT in addressing provenance issues related to raw materials, components, and finished goods throughout the value chain. The research aims to answer the following questions:

1. How much study has been done on the application of blockchain technology to supply chain sustainability?
2. What are the advantages of blockchain technology for supply chain visibility that are now understood?
3. What difficulties is blockchain technology now facing with supply chain provenance?

The study uses a content analysis method to evaluate texts related to supply chain sustainability, supply chain visibility, traceability, tracking, and blockchain technology.

II. LITERATURE REVIEW

The supply chain visibility, supply chain sustainability, and the BCT context are the three main research components for this study that are reviewed in this section.

2.1. Supply Chain Visibility

Supply chain visibility (SCV) is a crucial aspect of supply chain management (SCM), encompassing the tracking of parts, components, and finished products from upstream partners to final consumers. It involves access and transparency to accurate and timely information within the supply chain network, facilitating informed decisions. Traditional supply chains often lack traceability and transparency, leading to inefficiency, delays, errors, and increased costs. SCV refers to the extent to which actors within a supply chain have access to or share information they consider key or useful to their operations and of mutual benefit.

There is no consensus on the exact definition of SCV, but it is convergent around sustainability. Without an appropriate level of visibility, a sustainable supply chain will find meeting its sustainability objectives challenging. Information technology remains the primary enabler in contemporary SCM management, with enterprise applications and cloud-enabled technologies improving multiple areas of SCV utilization. However, these centralized systems also present limitations in terms of scope of visibility.

2.2. Supply Chain Sustainability

Sustainability standards in the global supply chain have become controversial due to the lack of a unified model to measure sustainability within a diverse global economic network. With over 93% of the world's 250 largest firms reporting on sustainability, the challenge of defining and acquiring sustainability-related data in the global supply chain is growing. To ensure a sustainable supply chain, proper identification of measurable attributes is crucial, which may differ from one supply chain to the next. These attributes need to be categorized based on the principal dimensions of sustainability: economic, environmental, and social.

Figure 1: Supplier engagement formats

The triple-bottom-line (TBL) principle suggests that a sustainable organization goes beyond traditional and financial bottom-lines, considering social, environmental, and economic dimensions. A comprehensive definition of sustainable supply chain management (SSCM) is essential, as it involves the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems to efficiently manage material, information, and capital flows associated with procurement, production, and distribution of products or services. SSCM and SCS complement each other, allowing for the incorporation of Supply Chain Value (SCV) to establish an integrative pathway towards sustainable supply chain visibility. An integrated approach is critical to building a conceptual platform that can examine the effectiveness of blockchain technology in a supply chain context.

2.3. What is the Blockchain?

Blockchain is a disruptive, emerging technology. Blockchain technology offers several potential applications for a wide range of businesses, despite the media's recent heavy emphasis on its usage for cryptocurrency. Blockchain technology stores digital data in a distributed, decentralised database or ledger. Blockchain technology's primary advantage is its ability to ensure data confidentiality and integrity, which builds confidence without the involvement of a third party. Data is kept in

chronological blocks, which are collections of data groups connected to additional blocks when they are complete. This creates what is referred to as the blockchain a chain of data. Digital information may be shared and recorded via the blockchain, but it cannot be changed. This generates an irreversible ledger that cannot be altered or removed, making it forever accessible. Because of this, distributed ledger technology is another term for blockchain technology.

2.4. Blockchain Technology

Blockchain technology (BCT) has the potential to resolve trust issues within supply chain networks due to its decentralized operational approach. Unlike centralized approaches like RFID, serialization, bar codes, and e-pedigree, BCT's decentralized operation allows for data sharing on a peer-to-peer network without a central authority. This approach is particularly beneficial in the financial domain, where trust remains a primary objective. Blockchain can be decentralized, giving equal rights to all users, or centralized, providing specific users with special rights. This allows for three sub-categories of networks: public, private, and federated blockchains. Public blockchains allow anonymous transactions without permission, while private and federated blockchains are permissioned.

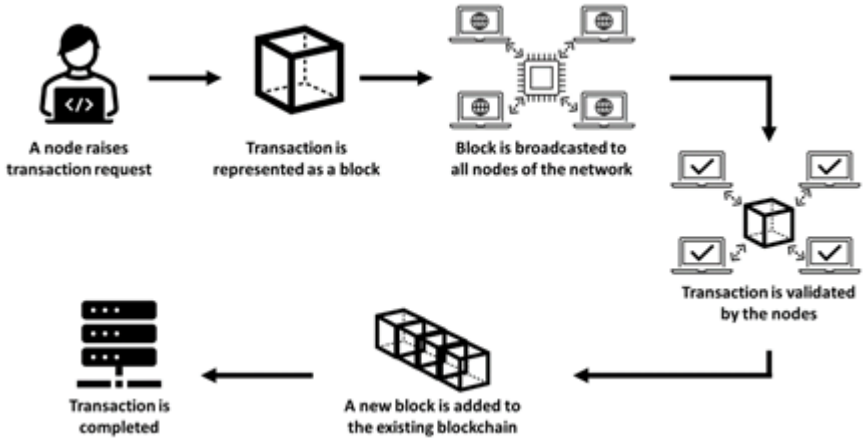

Figure 2: Transaction flow in a blockchain network

The potential of BCT extends beyond its decentralized orientation, with features such as distributed ledgers, immutability, consensus, and smart contracts. Recent advancements such as the internet of things (IoT) and artificial intelligence (AI) have been used to complement BCT for supply chain management. Combining blockchain technology with IoT and smart contracts provides a seamless supply chain automation environment, achieving cryptographic verifiability and significant cost and time savings. Blockchain technology is a digital ledger that is safe and decentralised, recording transactions across several computers. It provides a number of aspects relevant to sustainability, such as:

A. Decentralization

Decentralization is the dispersion of functions, control, and information across a network or system, rather than being centralized in a single organization. It is a crucial aspect of blockchain technology, where data and control are distributed across multiple nodes or computers, each maintaining a copy of

the blockchain ledger. Decentralization enhances transparency, security, and dependability in governance, finance, and supply chain management, promoting peer-to-peer transactions with trust.

B. Immutability

Immutability is the property that data on a blockchain cannot be altered once recorded, making it permanent. It is crucial for applications like financial transactions, supply chain management, and healthcare, as it ensures reliability, validity, and resistance to fraud and manipulation. The complexity of cryptographic methods and consensus procedures ensures data security and integrity, fostering transparency and trust in blockchain technology.

C. Transparency

Transparency in the supply chain involves providing open access to detailed information about all activities, including transaction histories and product provenances, to all participants. This transparency promotes sustainability by allowing customers to make informed decisions, verifying product authenticity, and ensuring ethical practices. It encourages fair trade, builds trust, and reduces fraud, fostering an environmentally and socially conscious supply chain ecosystem.

D. Traceability

Traceability is the process of documenting the movement and history of products, goods, or components throughout their lifecycle within a supply chain. This involves meticulous documentation of data during manufacturing, distribution, and consumption phases. Traceability enhances transparency, quality assurance, and accountability, enabling compliance with regulatory requirements, quick responses to issues like recalls or quality issues, and verifying product authenticity and safety. It is crucial for contemporary supply chain management as it promotes trust, moral sourcing, and sustainability.

In conclusion, BCT offers a promising solution to trust issues within supply chain networks, but its adoption remains conceptual and lacks empirical evidence. By combining BCT with IoT and AI, the potential of BCT for supply chain management is further expanded, ensuring transparency and cost savings.

III.METHODOLOGY

Using systematic literature analysis techniques, this study investigates the literature on the blockchain-based supply chain with a sustainability idea. By looking closely at the specific contents, this strategy can lessen any potential biases. To put it simply, we carried out two steps: first, we gathered articles by searching for a list of particular keywords; second, we looked at the trends in these articles. Since supply chain management has only recently begun to incorporate blockchain technology, we only looked at literature published after that year. Using the Google Scholar database, we initially conducted keyword searches to gather the most pertinent studies. "Blockchain," "supply

chain management," "blockchain-based supply chain," "sustainable supply chain," "sustainability," and "blockchain sustainable supply chains" were among the final list of top keywords. "Supply chain management" and "blockchain technology" are the most popular keywords. Three terms are shared by the two most mentioned articles: "blockchain technology," "supply," and management of the supply chain" and "sustainability". Through case studies or literature reviews of technology-based supply chains with sustainability, prior research has examined how the blockchain-based supply chain affects sustainability. Saberi et al. look into how supply chains might use blockchain technology to promote sustainability. Furthermore, the three pillars of sustainability in the blockchain supply chain have been covered in a number of articles. Enhancing environmental sustainability was the first topic covered. Additionally, a number of studies examine concerns related to social and economic sustainability, or governance. The next part contains comprehensive explanations of the possible indicators of the three sustainability pillars using blockchain-based supply chains in the literature study.

IV. RESEARCH ON THE INTERFACE OF BLOCKCHAIN AND SUSTAINABLE SUPPLY CHAIN MANAGEMENT

Blockchain assists businesses in cutting their carbon emissions, which contributes to environmental sustainability. Because all members are fully aware of the financial benefits of having a well-reputed organisation, it establishes a reputation-based system that incentivizes participants to discover the long-term solution to emissions. Blockchain technology can assist in the identification of all fake goods. By keeping track of the items, you may cut down on rework, which lowers the need for resources and lowers petrol emissions. Green items will be preferred by environmentally conscious consumers if the production process is made more environmentally friendly. Imposing a carbon tax is one way to achieve environmental sustainability because when a product gets more popular and its carbon footprint increases, consumers will choose the cheaper version of the same product. Blockchain technology has the potential to lessen the carbon footprint left by items as they travel to final consumers. The most recent version of the supply chain environmental analysis tool (SCEnAT), which is connected with blockchain, artificial intelligence, and the Internet of Things (IoT), suggests a framework for assessing the carbon emissions of all parties involved in supply chains. IBM is creating blockchain-based green assets that will assist companies in tracking, measuring, and lowering their carbon emissions. The primary research framework is depicted in "Figure 2." Consensus amongst partners, immutability, cybersecurity, distributed ledger decentralisation, and smart contracts are some of the characteristics of blockchain technology. The supply chain's responsiveness, openness, traceability, and confidence will all increase thanks to this fantastic information exchange technology. Carbon emissions may be intelligently monitored and controlled to increase environmental sustainability. In a similar vein, carbon taxing policies may be enforced and routinely reviewed using smart contracts. The supply chain's responsiveness and product tracability will win over clients' trust. All of these blockchain's features will be helpful in tracking and managing the humanitarian supply

chain's overall operations, and the companies that are a part of it will grow more socially conscious. Three categories comprise the total number of articles in this research piece.

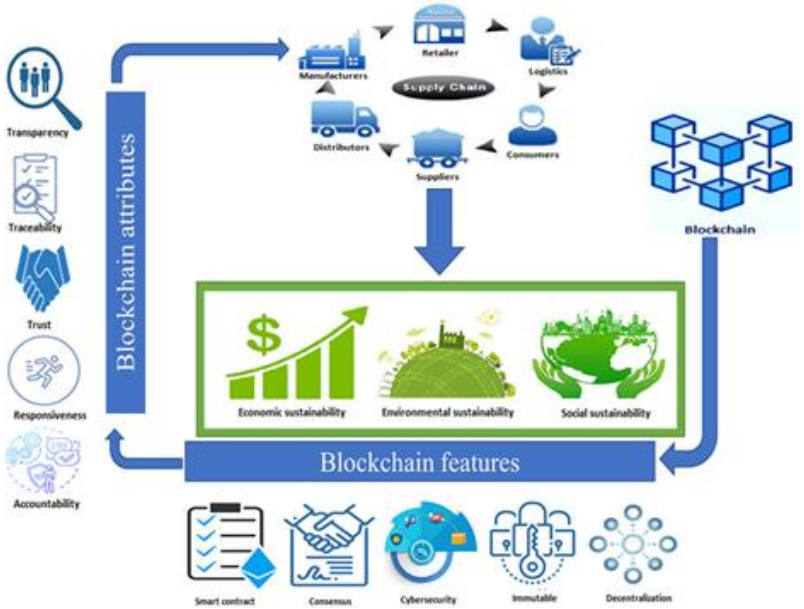

Figure 3: Conceptual framework of transformation of the supply chain to attain triple bottom line through blockchain.

V. ECONOMIC SUSTAINABILITY IN THE SUPPLY CHAIN

The food supply chain is one area where digitalization is changing the supply chain, as consumers are becoming more conscious of items that are socially and environmentally responsible. Consequently, safety, sustainability, and traceability have emerged as the main concerns. Blockchain technology is thought to be the main instrument in industry 4.0 and is recognised as a disruptive and inventive technology. Traceability, privacy, immutability, decentralisation, and consensus mechanisms are some of the blockchain's many properties. Agility, resilience, reactivity, and sustainability are the results of the blockchain.

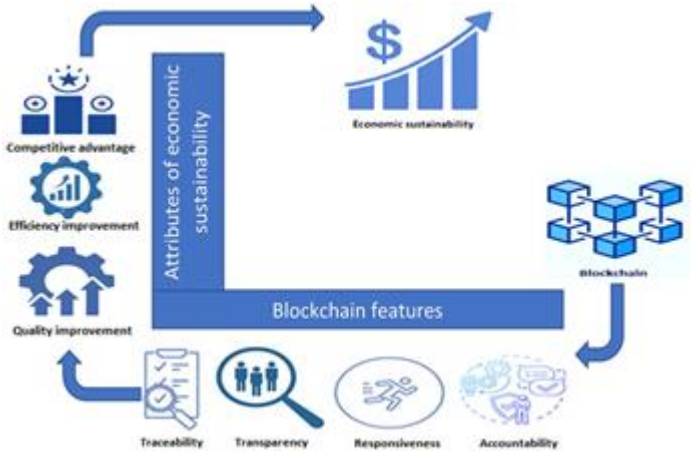

Figure 4: Conceptual framework of economic sustainability of the supply chain through blockchain.

"Figure 3" depicts the conceptual framework for the supply chain's economic sustainability utilising blockchain. As was covered in earlier parts, the primary characteristics of blockchain are its

accountability, responsive supply chain, efficient traceability, and transparency. The quality of goods or services will increase if supply chain procedures include these elements. Additionally, it will increase process effectiveness, giving it a competitive edge.

VI. RESULT

The percentage of projects using various blockchains according to the year of establishment is displayed in Figure 3. The two most widely used blockchains are Hyperledger, which is used in 21% of projects, and Ethereum, which is used in 23% of projects. Just 13% of projects don't care about blockchains. 5. Of the projects in the TBC category, 23 percent do not reveal which blockchain they are using. These projects either are not yet operational and do not want to reveal the kind of blockchain solution they use, or they are currently testing or choosing which blockchains to employ (and in other cases, these projects have ceased to exist). 7. Additionally, we see that in 2015, 2016, and 2017, Ethereum-based projects were more common than Hyperledger-based projects; however, this is not the case for projects built in 2018 or 2019 or even 2020. With 40% of all Ethereum-based projects developed this year, the majority of Ethereum initiatives came from projects started in 2017. This is around two years after Ethereum was released in July 2015 (Etheruem, 2020), suggesting a delay in the development of products that make use of this blockchain (as it is at the moment).

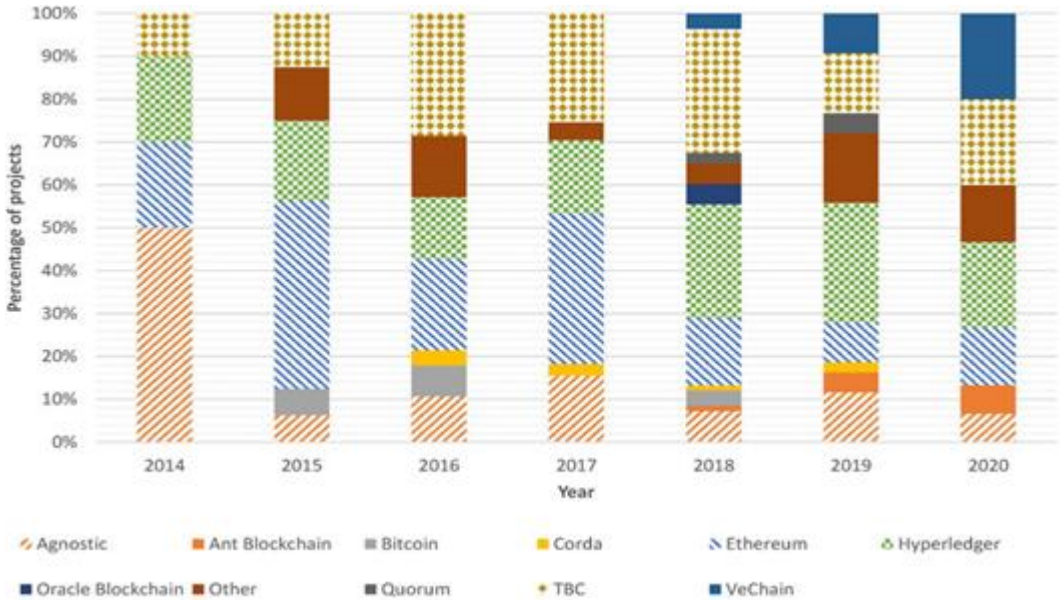

Figure 5: An Analysis of Blockchain Adoption in Supply Chains Between 2010 and 2020

Blockchains: Those that were recognisable in at least 1% of the data were classified as significant blockchains; those that weren't were labelled as ther. Numerous projects have their blockchains classified as TBC because they were not published. The blockchain from which the codebase originated was used to categorise projects when the blockchain was using an existing codebase and was not entirely separate from it. The agnostic category consists of solutions that are not dependent

on any specific blockchain. The blockchain categories that were applied were: Ant Blockchain, Bitcoin, Corda, Ethereum, Hyperledger, Oracle Blockchain, Quorum, VeChain, Agnostic, TBC.

VII. CONCLUSION

The report emphasises how blockchain technology has the ability to change supply chain management in ways that go beyond virtual currency. It highlights the benefits of blockchain technology at all supply chain stages, including sourcing, customer service, and reverse logistics. Researchers from the industry and academics provide insights for the study using qualitative research methodologies. A theoretical framework is created to show how supply chain performance is improved by blockchain. The conclusion offers a fair analysis of the primary drawbacks and challenges associated with supply chains implementing blockchain technology. Adopting blockchain technology in supply chain management has several positive effects, such as less fraud, better transparency, and improved partner trust. This gives managers a fair-minded viewpoint when evaluating the real-world difficulties posed by blockchain technology.

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[9]. Figure2: https://encrypted-tbn2.gstatic.com/images?q=tbn:ANd9GcTgAKbC45vn52Vs5ZWRFsRqoGnuJl69sc4Z6UzG-4NxA2ZJYOjQ

[10]. Figure5: https://encrypted-tbn3.gstatic.com/images?q=tbn:ANd9GcSjVAjsJHKbNiNxfiBau7ud0IMbf8V2NDF6MuT0NLrPBQgoCbxT

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Authenticating Encrypted Secure Message

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ABSTRACT

This research paper's goal was to increase data security by method of two levels of security namely multimedia authentication and encryption to suggest a key-dependent function that extracts identical bits or numbers from both plain text and encrypted images. Two levels of security like encryption and hashing can be incorporated in one system to prove the authenticity of the data without actually revealing the information. A sequence of many finite data points is expressed by A Discrete Cosine Transform as a sum of cosine functions oscillating at different frequencies. Watermark is also used as recognizable image or pattern that appears as various shades of lightness/darkness when viewed by transmitted light (or when viewed by reflected light, atop a dark background), caused by thickness or density variations. An algorithm or subroutine that maps large data sets of variable length, called keys, to smaller data sets of a fixed length is known as a Hash Function. Image encryption by computing 16x16 block DCT is the first step before encryption of each block. Chaos encryption based on Cat map has been employed. The Hash value of the original image and its corresponding encrypted version is calculated and are of same values as expected. Now, Decryption is done on encrypted image. The image comparison for an input image and decrypted image is also done and the observations are PSNR value is + Inf dB. A lower value for MSE means lesser error logically and a higher value of PSNR means it ranges between infinity for identical images, hence no loss in the images. Finally, Image comparison done for an input image and an output image with the help of histogram. And the result obtained as expected.

I. INTRODUCTION

It has become very important to secure digital images and videos with the unparalleled growth of the internet and the multimedia technology present everywhere more than ever. Multimedia data such as images, videos or audios can be easily copied by unauthorized users. They have become vulnerable to illicit signal processing operations. The security mechanisms which are employed to protect the multimedia data from unauthorized operations are Multimedia encryption to prevent eavesdropping, watermarking for copyright protection and tracking and parametric multimedia hashing for content authentication. In information technology era, images play important role in representing information. Images can be transmitted through public channel such as

internet and also stored in the storage devices. Storage or transmission of images through transmission channels in the form of plain-images have has risks.

Multimedia authentication is a relatively new research area which aims at ensuring that the particular data were sent by the authorized user and have not subsequently been altered or substituted. Message validation schemes such as watermarking and hashing have provided solutions for copyright protection and content authentication. Message authentication verifies the integrity of a message and that the purported identity of the sender is valid. Technology is continuously expanding and as it is there are more and more techniques discovered that attempt to improve already existing works. An interesting field to expand upon is that of encryption. After that the specific parts of the encryption method will be analyzed and discussed. Applying hashing it changes the positions of the pixel values of the original image. The result after a shuffled image that contains all of the same pixel values of the original image. The plain-images are vulnerable to access or interception by unauthorized parties. Therefore, the confidentiality of plain-images need to be protected from unauthorized access. Solution to this problem is to encrypt them so that the images cannot be recognized anymore. Image encryption has been used extensively as a technique to maintain information security.

1.1 PROBLEM STATEMENT

The problem of authentication of encrypted data in our contribution is twofold formulation of this new problem of authenticating encrypted data and second is development of a simple hashing algorithm applicable to encrypted images. Formulates the problem of authenticating encrypted data, the invariant watermark and invariant hashes and discusses about the zero-knowledge authentication.

Suppose if we have some information and without revealing the information, I want to prove to you that I have it. The way I do it should not in any way leak information about my actual data. Here comes the problem of authentication of encrypted data. This is termed as zero knowledge proof. Message authentication assures that data received are exactly as sent by and that the purported identity of the sender is valid. So, we have to look for a watermarking-encryption dual in which the watermark remains invariant to the encryption process.

1.2 AIM OF THE RESEARCH WORK

Our aim is to propose a key-dependent function that returns the same bits or numbers from images and their encrypted versions. By incorporating encryption and hashing in one system, we can have two levels of security and we can prove the authenticity of the data without actually revealing the information.

1.3 OBJECTIVE

The main objective of our project work is multimedia encryption that aims at rendering the information unintelligible under the influence of a key. Encryption aims at removing the redundancy and the correlation of the data by scrambling it. In order to protect data privacy, images and videos need to be encrypted before being transmitted to the destination. Because the multimedia data such as videos form large streams of data, partial encryption that encrypts only some significant parts of the data is employed. Multimedia has some special requirements like perceptual security, efficiency, cryptographic security, format compliance and signal processing in the encrypted domain.

1.4 EXISTING SYSTEM:

Our existing system described in order to boost the data security, we focuses on the marriage of the two levels of security. Multimedia encryption and multimedia authentication schemes serve two different purposes but they can be merged together in one system to protect confidentiality and to check the authenticity of the data. It is indeed a very challenging problem but if we can integrate the two functionalities simultaneously, it will revolutionize the area of multimedia distribution. A commutative watermarking and encryption has been proposed that embeds watermark into the encrypted media directly, which avoids the decryption watermarking-encryption triples. The encryption and watermarking operations are done on the same data part. Commutative watermarking and encryption scheme is proposed for media data protection. In the scheme, the partial encryption algorithm is adopted to encrypt the significant part of media data, while some other part is watermarked. It has been reported that commutative schemes based on partitioning the data are vulnerable to replacement attacks. Since one data part is not encrypted, it leads to leakage of information and it is vulnerable to watermark attacks.

1.5 PROPOSED SYSTEM

We propose to integrate the two in a framework where the parameterized hash value of an encrypted image is designed to be the same as the hash value of the parent unencrypted original image. In watermarking detection algorithm has been proposed which is able to detect the watermark irrespective of whether it is embedded in the plaintext and then the watermarked data is encrypted or first the plaintext is encrypted and then the encrypted data is watermarked. Watermark is detected without the knowledge of the decrypting key. But, the encryption that they have used permutes only the first 25 DCT coefficients. This is a weak encryption and the encrypted image leaks some information about the original image.

Most common variant of discrete cosine transform is the type-II DCT, which is often called simply "the DCT"; its inverse, the type-III DCT, is correspondingly often called simply "the inverse DCT" or "the IDCT". Two related transforms are the Discrete Sine Transforms (DST), which is equivalent to a DFT of real and odd functions, and the Modified Discrete Cosine Transforms (MDCT), which is based on a DCT of overlapping data.

1.6 Technical Specification

The technical specification for the system development are as follows

Operating system : - Windows XP service pack 2

System Configuration: -

- RAM : - 2 GB
- HDD : - 360 GB
- Processor : - Intel Core2Duo, 2.8 GHz

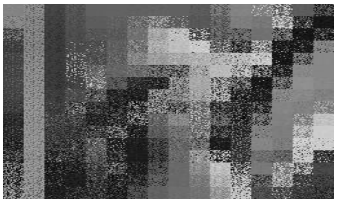
Software Required : - MATLAB (R2009a).

Image formats supported

- TIFF
- JPEG
- GIF
- BMP
- PNG
- XWD

Output Format : - JPEG

(a) Original Leena Image



b) Encrypted Leena image

Fig 1.71: (a) Original image and (b) Encrypted image. The image represents original image and its encrypted image.

Table 1.72 Comparison Secure message authentication and Joint Asymmetric Watermarking based on lena image.

Feature	PSNR (A Joint asymmetric watermarking)	PSNR Secure Message Authentication)
Original	-	-
Encryption	+59.53 dB	+63.47 dB
Decryption	+ 36.071 dB	+ Inf dB

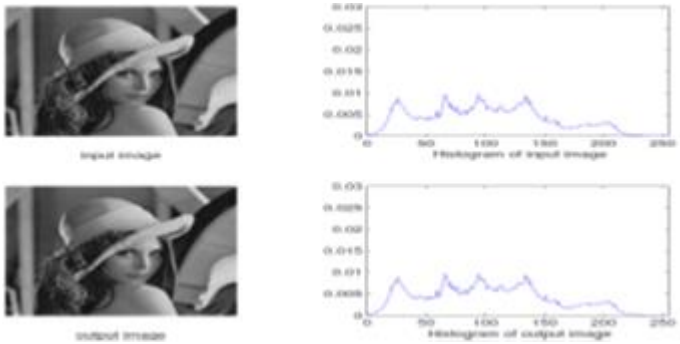


Fig 1.73: Comparing input & output Leena image with the help of histogram.

Table 1.73 Detection Performance for Leena image

feature	PSNR
Original	-
Encryption	+63.47 dB
Decryption	+ Inf dB

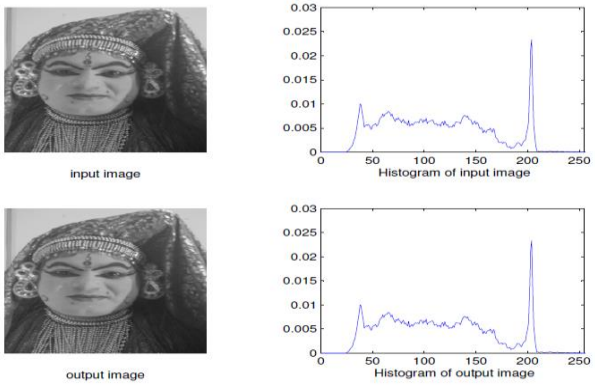


Fig 1.74: Comparing input & output image of Yakshagana with the help of histogram.

Table 1.74 Detection Performance for Yakshagana image

Feature	PSNR
Original	-
Encryption	+66.13 dB
Decryption	+ Inf dB

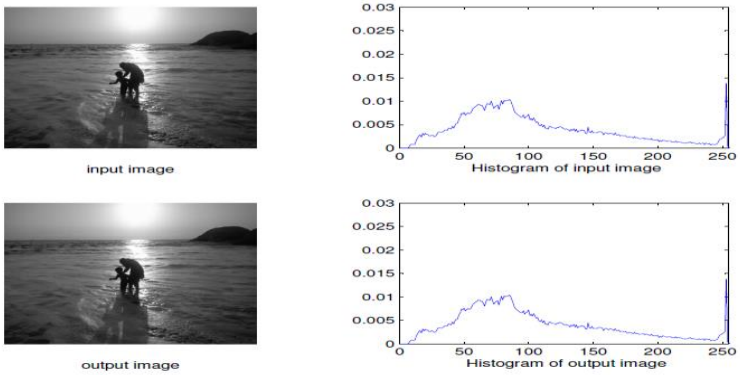


Fig 1.75: Comparing input & output image of beach with the help of histogram.

Table 1.75 Detection Performance for beach image

feature	PSNR
Original	-
Encryption	+67.48dB
Decryption	+ Inf dB

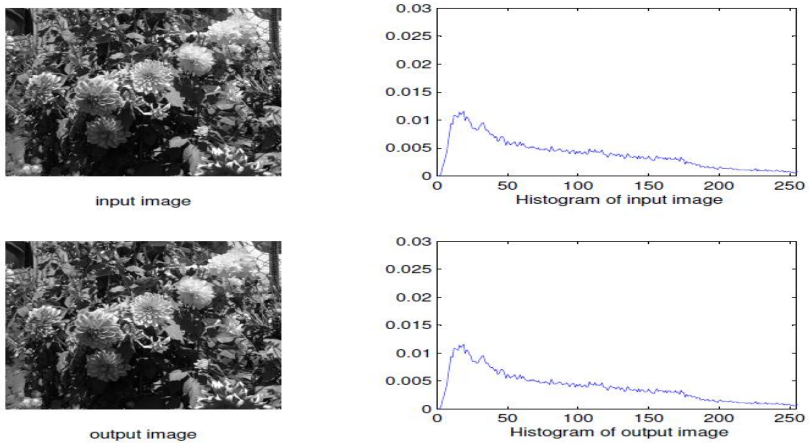


Fig 1.76: Comparing input & output image of flowers with the help of histogram.

Table 1.76 Detection Performance for flowers image

feature	PSNR
Original	-
Encryption	+66.13 dB
Decryption	+ Inf dB

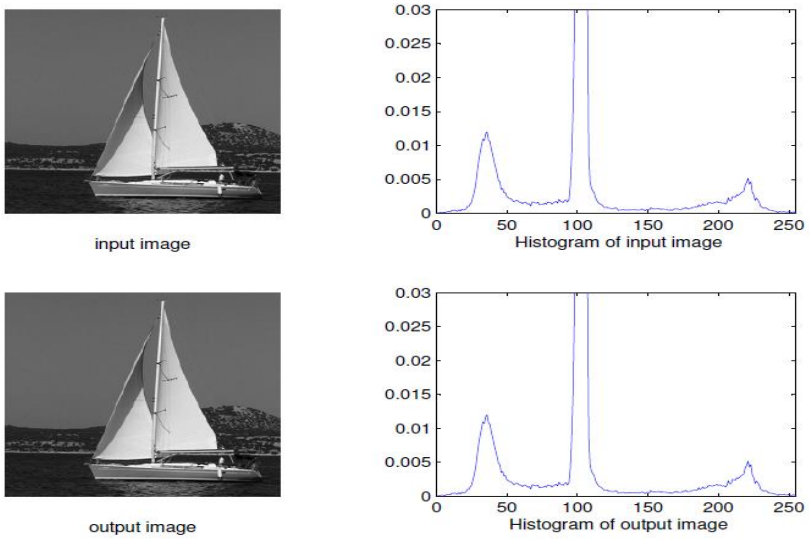


Fig 1.77: Comparing input & output image of boat with the help histogram.

Table 1.77 Detection Performance for boat image

feature	PSNR
Original	-
Encryption	+65.01dB
Decryption	+ Inf dB

1.7 SNAPSHOTS OF SECURE MESSAGE AUTHENTICATION

Fig 1.81: Screen shot main_window, of the project where three buttons to perform Encryption, Decrypt and Exit.

II. CONCLUSION

We proposed combine framework where the parameterized hash value of an encrypted image is designed to be the similar as the hash value of the parent unencrypted original image. By allowing a portion of the statistical signature in the original image to surface despite the encryption operation, it becomes possible to validate the authenticity of the encrypted image without tapping into its contents. By constraining the encryption process to be a block DCT permutation cipher, we have observed that the mean and variances of the blocks remain the

same even after encryption. Formulates the problem of authenticating encrypted data, and discussed about the invariant watermark, invariant hashes and the zero-knowledge authentication.

We also present the chaos based encryption that employed on the data points to scramble the information. We then recommend and analyze the novel method for calculating the hash used these two features to construct the hash value. This simple choice of features also depicts a significant variability across a variety of images. The prime intention of the project work will be to formulate the problem of authenticating encrypted information and design of a non-complicated and light weight hashing algorithmic rule applicable to encrypted images. By allowing a segment of the statistical signature in the original image to surface despite the encryption function, it becomes potential to validate the authenticity of the encrypted image without tapping into its contents.

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The Role of Literature for Inculcation of Ethics into Students

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ABSTRACT

The present research paper aims to analyse the different methods applied for enlightening ethics by English lecturers of class BA, B.com & B.sc first-year Compulsory English textbook. Apart from this, the college curriculum includes cultural activities on national and international events to maintain ethical equilibrium. **Methodology:** BA, B.com & B.sc first-year compulsory English textbook was reviewed and analyzed extensively to comprehend values in UG students. Furthermore, the Qualitative method was used in the study to interview 30 Assistant professors of senior colleges aided and private colleges to know their teaching strategies and activities organized by the school at the national as well as international levels to impart ethics. **Findings:** The findings of the study discovered that some of the strategies adopted by the Syllabus are unable to inculcate ethics in students at the UG level because of their improper inclusion of objectives in compulsory English textbooks which makes most of the ethics irrelevant for UG students. Questionnaires for Lecturers manifest that the incapability of syllabi abuse as a consequence of college workload hinders organising activities inside and outside the college. Moreover, the syllabus's shortcomings in providing single ethics education lecturers to every particular level are also one of the difficulties in the inculcation of ethics.

Keywords: Ethics in compulsory English textbook, the role of English literature, ethics.

I. INTRODUCTION

Present research paper through a focus on 'The Role of Ethics for the inculcation of Ethics into students' with diverse outlooks and conclude it in their perspective. Literature is the mirror of society, it shows the real picture of mankind. However, the Present research paper shows a correlation between students, lecturers and literature. As such any nation does progress beyond the Earth planet, it goes to the moon and Mars. But, one should not forget human ethics, because machines can change the speed of any work and reaction, but they cannot inculcate ethics into students. Therefore, if it forgets, to make aware of ethics into students. It must be a clear decline of one nation. In that process, curriculum plays a vital role in inculcation ethics into students. If the curriculum is framed faulty without including ethics that can be a serious mistake. Whenever one thinks about a good nation with good human ethics, it could be the effect of human values implementation in the nation's manifesto and curriculum for students. Because youth have great energy to change the situation as well as make the nation proud. India has a great scenario of culture, from ancient times Indian culture is considered unique and full of ethics with education systems. As such, Gurukul, and Ashrams, were a real attraction to

education. Therefore, Indian education was the centre of spirituality, morals, and ethics. In Gurukul and Ashramas, Gurus were taught the shiyas to live with social values. It must be stated that Gurukul education aims to inculcation ethics into students.

Hill, 2004, provides a slightly different emphasis.' Values are the priorities individuals and societies attach to certain beliefs, experiences, and objects, in decline how they shall live and what they shall treasure.'

Ravindranath Tagor 1910, 'Where the mind is without fear and head is held high, where knowledge is free, where the world has not been broken up into fragments by narrow domestic walls.'

Oscar Wilde, 1895, 'Literature always anticipates life. It does not copy it but moulds it to its purpose. The nineteenth century, as we know it, is largely an invention of Balzac."

Johan Wolfgang Von Goethe, 'The decline of literature indicates the decline of a nation'

E.M. Forster, 'What is wonderful about great literature is that it transforms the man who reads it towards the condition of the man who wrote'

Hall, 1994, 'states that when schools or colleges and teachers become aware and clear about their values, they are then able to understand and convert those values into a clear belief system about the nature of education.'

II. METHODOLOGY

The present research paper has evaluated the Compulsory English textbook of UG. A semi-structured interview was also taken by the lecturers. The present researcher has divided the questionnaire into three parts in which 05 questions were objective, 05 questions were subjective and 05 questions were on yes, no type.

III.THE PROBLEM OF STATEMENTS

In the present scenario, human values are on the curve of decline, due to improper composition of the curriculum. So one, cannot compare past value education with present modern education, it's a a painful affair. So, with time, there have been all types of decline. There's so much destruction of ethics on a big scale at all levels and in all fields is a serious matter. So, it requires careful consideration of all aspects of life, the changes that have happened which have affected not only the lifestyle of human beings over the years.

Ethics means something invaluable, has a price and is worthwhile. In other words, Ethics changes human behaviour and action or teaches what is true. And what are falls? What is right? And what is wrong?

IV. ROLE OF LITERATURE FOR INCULCATION ETHICS

Literature is a mirror of society, it plays a very important role in transforming ethics into students as literature introduces awareness about the day today's life activities through dramas, stories and poems. It teaches human values such as. Life skills inculcation of real-life situations and values to cope with conflicts. Literature for emancipation, empowerment of deprived, marginalized people. Literature to demolish communal harmony and eradicate differences based on caste, colour, racism language etc. Literature for maintaining peace, fraternity, equality, and liberty in the world. Literature for saving from war and conflicts. Literature for social change gender equality and gender neutrality. Therefore, implementing all these ethics curricula is the central point of change. Its responsibility is to inspire students in overall community empowerment.

V. CONCLUSION

The present research paper shows that literature plays very essential role in inculcation ethics into students. So, the inculcation of values substantially depends on the vision, inspiration values and composition of the curriculum. Education is one of the best tools to change behaviour in students. It can be negative or positive. Literature helps to develop moral-ethical issues are developing. Self-discipline expression of feelings and ideas, optimistic view towards life hope to keep patience, sensitivity, appreciation of cultural diversity etc. Therefore, literature is an integrated part of human life it teaches integrity, fraternity, and equality with spiritual values.

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Water Supply and Engineering Marvels at Daulatabad : Unveiling Historical Secrets

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ABSTRACT

Daulatabad, formerly known as Devagiri, is a historic town located 15 km northwest of Aurangabad in Marathwada. Positioned on the ancient Pratishthan path and the modern Aurangabad-Dhulia State highway, it boasts a medieval hill-cum-land fort, the most significant of all Indian forts. Historical sketches of Devagiri reveal that Bhillama, the 13th-century king of the Yadava family, founded the city. This fort played a vital role in shaping medieval Maharashtra's culture and saw the rule of various dynasties from the Yadavas to the Marathas, making it an Islamic stronghold for centuries. It served as the capital of Maharashtra during the Yadava period and was later elevated to an imperial capital by Muhammad Tughlaq. However, its status dwindled under Ahmednagar rule. In the context of town planning and water supply systems in India, water supply has been a significant aspect throughout history. Early Hindu towns were often located near rivers, lakes, or artificial reservoirs, making water readily available. However, Devagiri being located at high-altitude due to war fear and the preference for naturally protected sites for empire capital, water supply became a challenge as there were no water sources in the vicinity. Exploring the historical water supply schemes at Daulatabad, historians and travellers remained silent due to the secrecy surrounding the water sources. However, a research study taken up by Department of History and Archeology, Marathwada University (Dr. BAMU), Government Engineering College Aurangabad and Deccan College Pune under the guidance of Professor Dr. Ramchandra Morwanchikar uncovered the presence of different water supply schemes over time, In this paper highlighted the astonishing engineering techniques of sustainable rain water harvesting and water supply systems established in the vicinity of Devagiri Fort by the rulers in different periods.

Keywords: Daulatabad, Devagiri, Water Supply Systems, Historical Engineering Techniques, Rainwater Harvesting.

I. INTRODUCTION

Water is super important for life. Rain is where we get most of our water, especially in India. In India, they depend a lot on the rain from the monsoon season. The number of rainy days can be different in various parts of the country, from 10 to 40 days each year. It's crucial to save water when it rains so that there's enough when it doesn't rain.

A long time ago, people in India figured out smart ways to save and manage water. They did this because more people were living there, and they needed water. But sadly, a lot of their ideas and knowledge have been forgotten. Old water structures and writings about water are in danger of disappearing forever. We need to make sure we don't lose this important part of our history.

Figure 1 : Devagiri/ Daulatabad Fort

Source: https://www.google.com/maps/@19.9442847,75.2197334,2799m/data=!3m1!1e3?entry=ttu

One cool example of how they managed water is at the Daulatabad fort in India (Fig 1). This paper talks about how they made sure there was enough water for the fort. We'll also see if their ideas can help us with water today when we sometimes don't have enough.

Unveiling Historical Secrets

A long time ago, a king from Yadava, named Bhillama built the Daulatabad fort in 1187 A.D. It's a big, important fort in India, not far from Aurangabad City in the Maharashtra state. The fort sits on a tall, steep hill, which makes it hard for enemies to attack. Bhillama made it even stronger by adding more defences. Many important dynasties ruled from this fort over the years, and that's why it's so famous. Here are some of the dynasties.

The Yadava [1187-1294 A.D.]

The Khilaji [1295-1320 A.D.] The Tughlaq [1320-1343 A.D.] The Bahamanis [1350-1484 A.D.] The Nizam [1490-1635 A.D.]

The Mughal [1635-1724 A.D.]

The Nizam of Hyderabad [1724-1948 A.D.

During the prime meship of Malik Ambar, that Daulatabad was made the capital of the remnants of the Nizamshahi kingdom of Ahmednagar and as reinforced by adding some bastions and fortification walls so as to bear the destructive attacks of the Mughals 1607-1627 AD.). Despite this arrangement Malik Ambar was forced to surrender the city of Daulatabad to the Mughals (1607-1627 AD). During the succeeding era of struggle for supremacy over Deccan (1681 to 1707 A.D.) the fort of Daulatabad was converted in to an Imperial prison where state prisoners like Tana-shah, the deposed king of Golkonda, Yesubai, the unfortunate wife of Chhatrapati Sambhaji etc. were imprisoned. It is the irony of history that the impregnable stronghold designed for imperial capital was destined to be a state prison, where thousands of prisoners died unsung, unheard and

unwept. As a result, we find a large number of tombs and Durgahs in and outside the city of Daulatabad. From 1724 to 1948 AD. It was under the possession of the Nizam of Hyderabad. Though the Peshwas tried to control this region for some time they were not at all interested in its possession 16 During the last phase of the police action (Sept. 1948) the local Razakars tried to defend it against the Indian army, but they were ousted from Daulatabad. Since then it is a deserted and neglected village in the district of Aurangabad.

In the old days, there was a city called Devagiri. It was then renamed as Daulatabad. It was made up of two parts, Kataka and Devagiri. This city was very important because it was a rich trading centre and the centre of politics and the military in the south-central area. For a long time, it was the main city in the central-southern area, and for a short time, it was the main city for the whole empire. Daulatabad was under the Islamic rule for more than six centuries (i.e. from 1320 to 1948 A.D.). During these centuries it was subjected to various changes at sometimes even of a radical-nature. During this long Islamic hiatus it witnessed the era of grandeur along with the era of frustration. Once it was a booming metropolitan centre full with public and private structures, mosques, hammams, gardens, since there were many people living there, they needed a lot of water. Surprisingly, the Yadava dynasty found good ways to manage their water supply by collecting rainwater and using it efficiently, Dr. Morwanchikar (1998).

Fig 2 : Fortification walls dividing the fort area

The area is subdivided in to four parts by construction of encircling fortification walls named as Outer side Amberkot, Double wall Mahakot, Kalakot and Moat . Area in between Ambarkot and mahakot (Residential area for General Public), in between Mahakot and Kalakot (residential area for people belonging to higher social strata), Area in between Kalakot and Moat was reserves for royal residence onlly, and Moat and Hill top was used as Emergency resort.

Dr Morwanchikar, the and then Professor and Head of Department of History and Ancient Indian Culture of Marathwada University, along with a team of scholars from Deccan College Pune had done thorough scientific explorations and excavations and unveil the various aspects of the fort. The departments of Centre and State Archaeology and Department of Civil, Government College of Engineering, Aurangabad had also participated in this task. The author has worked on the water supply schemes of the different phases of the medieval townships of Devagiri and Daulatabad. It is very promising and interesting to know our ancestors wisdom of water harvesting techniques and water wisdom to resolve the water supply problems.

Urban Planning and Water Supply in India:

The history of town planning in India can be traced back to the early stages of urbanization in the region. Archaeological evidence from excavated towns reveals that water supply has consistently played a significant role in urban planning throughout different eras. In the context of Hindu town planning and water supply, many ancient and medieval towns were strategically located near rivers, lakes, or artificial tanks and reservoirs, ensuring a readily available water source. This proximity to water resources eased their water supply needs.

However, as history progressed, factors such as civil conflicts and evolving warfare strategies led to a shift in the selection of capital cities and political headquarters. The new choices often favoured naturally protected sites, which could include dense forests, hilly terrain, deserts, barren lands, or isolated hillocks like Chittod or Daulatabad. While these natural settings offered superior defence advantages, they also gave rise to a pressing issue: the challenge of sourcing water at relatively high altitudes.

This transition to elevated locations presented a complex problem of ensuring a sustainable water supply. The question arose: how could water be efficiently transported to these elevated sites to meet the growing demands of the population and the urban infrastructure?

- **The Smart Ways of Water Management:**

They Managed Water very wisely. The rain comes and goes, and it's not the same everywhere. In Daulatabad fort, they used different methods to make sure there was enough water for the people and their fields. Even though there were no big rivers or lakes nearby, they made sure the people had water. Rainwater was the main source of water, and they used it so well that the city became very successful, almost like a golden age. Many rulers wanted to rule this prosperous area (Bhalage et al, 2007).

- **Water Supply in the Yadava Period:** During the Yadava period, they mostly used rock-cut cisterns, open-dug wells, and tanks for water. About 50,000 people lived there at that time.
- **Water on the Hill Top:** The Yadavas, who built the fort and city, depended on rainwater. They made two small rock cut cisterns on the hill's top, close to the fort, to collect rainwater. These cisterns could provide water for about 200 people each year.
- **Dug Wells :** There were about 100 wells in the suburbs, including step wells.
- **Reservoirs:** Researchers found four big tanks at different heights that the Yadava rulers built. These tanks are still there, and during the time when the Muslim rulers were in charge, they were named Parion-Ka-Talab, Hauz-A-Qutlaq, and Ab-Pash-Darra (Bhalage et al, 2007).
- **Water Supply in the Khalaji Time:** The Khalajis didn't change the water supply methods that were already there, and their rule didn't last very long.
- **Water Supply in the Bahamani Occupation:** For about one and half century, Daulatabad was under the possession of the Bahamani dynasty. For the purpose of water supply some wells within and outside the fort were made deep. The earlier water supply system was renovated.

- **Water Supply and Nizamshahi of Ahmednagar:** During the successive Nizamshahi (Ahmednagar) occupation of Daulatabad, it was once again elevated to the position of a State capital. Its importance as a centre of political activities, trade and commerce reached the culmination. This was resulted into abnormal increase in population. This increase in population called for a revision of the existing water supply schemes. It was Malik Ambar who constructed the huge and magnificent palace complex at the top of the hill. He excavated ditch around the circuit of the hill and isolated the central hill from the rest of the area. He continued excavation deep under the ground level and provided an artificial moat (60 x 30') around the whole circuit. it is proved beyond doubt that Malik Ambar was a born hydraulic genius. He devised a meticulous scheme and executed it with full confidence. The salient features of this scheme are discussed below.

For harvesting rain water he selected the opposite northern valley as a catchment area. To collect the rain water coming from the top, a ditch and small masonry diversion bund was constructed at the foot and along the altitude of the hill (see figure 2). The dimensions of the bund were 750 mm x 450 mm x 2000 meters. This served the purpose of diversion of the rain water coming from the top of the mountain. The rain water thus diverted accumulated at the lower end of the diversion bund where a receiving cum- filtration chamber was provided. The level difference between the receiving chamber and the discharging chamber (near the moat) was considerably high (i.c. about 10 m). Hence by means of simple gravitational force he was successful in conveying water towards the royal residence. The receiving chamber incorporated two filtering chambers of different dimensions. They are one below the other. The upper chamber was constructed in brick and lime mortar while the lower one was in dressed stones. The lower chamber had connected with two lines of conduits, one of terracotta of 20 centimeter diameter and another of stone of 40 centimeter diameter. These conduits were cased in lime mortar, brick bats and pebbles. After traversing a distance of nearly one kilometer these conduits end in a receiving tower which is at a low level from that of the above discussed filtering chambers. The RL at the receiving chamber on the hill was 514. 82 m and the RL at the outlet (Receiving Tower) is 503. 57 m and this head difference in relative levels were sufficient to carry water by gravity towards the moat. In the history of hydraulic engineering, the difference of the levels, discharge and diameters of the pipes laid were worked out without any engineering or mechanical contrivances. From the receiving tower an open channel was excavated which carried water into the moat, where it was stored in the moat section mentioned mention below.

While cutting the moat below the surface level a section (of 20 x 10 x 200 = 4000 m^3) was separated by means of two diaphragms. A hole at specific height was provided, in each diaphragm and the excess waterpassed through these two holes were stored in the remaining area of the most. This excess water was furthers carried to the palace complex of the Rang-Mahal.

Lifting Arrangements: At two convenient places in the moat (just below the Nizamshahi palace and at the end of Kala-Kota) provision was made to lift water by means of bullocks. From these two points conduits were provided to supply water to the desired palace complex. This scheme was devised only for the water supply for the Royal-complexes. Hence to meet the increasing need of water-supply he implemented Second Line of Water Supply.

Second Line of Water Supply: To provide water to the sector between the Kalakota and Mahakota a new scheme of water supply was introduced. For that, three storage weirs were constructed in the valley towards north. A channel was provided at the bottom of the upper most reservoir ie. Hauz-EQutlaq. From this reservoir water was conveyed by gravity, through conduit up to the fort area between the Kalakota and Mahakota.

Third Line of Water Supply: At the end of the second weir an earthen bund which supported the overhead conduit, was provided. The second conduit collected water coming from top of the hill and stored in chamber constructed at the convenient point. This conduit ended in an open-channel which carried the above run off towards the. This open channel runs all along the North Western boundary of the third weir Le Aba-Pasha Dara. The channel ended in a conduit which took water into the fort. The conduits coming from the upper and Number of pressure relief towers were fixed on these lines from where water supply was branched off in desired directions. At a tower near Chand Minar there are seven distributaries which carried water to seven different palaces.

Fourth Line of Water Supply:

To provide water to the general habitation a separate scheme was executed. This was based on an open channel which originated from the bottom of the above reservoir. The channel entered the fort through Ellora-Gate. Through number of branching towers water was carried to number of sectors of general habitat.

II. RESULTS AND DISCUSSION

Water management has played a crucial role in the history of Daulatabad, ensuring the survival and prosperity of the city through various dynasties and periods. The strategies employed for water supply in different eras are indicative of the resourcefulness and engineering skills of the rulers of the time. In this discussion, we will examine the methods used for water management in different historical periods, including the Yadava, Khalaji, Bahamani, and Nizamshahi periods.

Yadava Period: During the Yadava period, the city of Daulatabad primarily relied on rainwater for its water supply. The Yadavas ingeniously constructed rock-cut cisterns on the hill's top, near the fort, to collect rainwater. These cisterns were capable of providing water for about 200 people annually. Additionally, there were about 100 wells in the suburbs, including step wells, ensuring a decentralized and diversified water supply system. Researchers have also identified four large tanks built by the Yadava rulers at different heights. This approach, focusing on rainwater harvesting and multiple water sources, contributed to the city's resilience and prosperity during this period

Khalaji Period: The Khalajis did not introduce significant changes to the existing water supply methods, indicating the continued viability of the systems established by the Yadavas. However, their rule in Daulatabad was relatively short-lived.

Bahamani Occupation: Under the Bahamani dynasty, Daulatabad witnessed some renovations in the water supply system. Wells both within and outside the fort were deepened, likely to meet the growing demands of the population. The water supply system from the Yadava period was maintained and upgraded, suggesting the ongoing importance of these systems in sustaining the city.

Nizamshahi of Ahmednagar: During the Nizamshahi occupation, Daulatabad experienced a resurgence in its political and economic significance, leading to a significant population increase. This growth necessitated a reevaluation and enhancement of the existing water supply infrastructure. Malik Ambar, a prominent figure of the time, demonstrated remarkable hydraulic engineering skills. He implemented a comprehensive scheme to manage rainwater, emphasizing the collection and distribution of rainwater for various purposes.

As far as the habitation within the fort is concerned there were five settlements (a) a citadel at the top of the hill, (b) in the sector within the Kalakota, (c) in the sector behind Chand Minar, (d) in the sector opposite Chand Minar € the area of Rang Mahal, (f) in the sector within Ambar-kot

To meet the scarcity of water various schemes of water supply are implemented during the different phases of its occupation. Stone and earthen conduits, filtration chambers, pressure relief towers and distributaries are the Characteristic features of the supply system. The water is conveyed by means of gravity. The comprehensive water management strategies implemented during the Nizamshahi period, particularly the ingenious rainwater harvesting techniques and the multi-tiered distribution system, reflect the city's continued growth and prosperity.

In summary, the history of water management in Daulatabad is a testament to the innovative and adaptive approaches employed by different dynasties to secure water resources. The utilization of rainwater, construction of cisterns, wells, tanks, and the ingenuity of engineers like Malik Ambar were pivotal in sustaining the city's success throughout its history. The ability to adapt and improve upon existing systems played a crucial role in Daulatabad's resilience and growth as a prominent historical city.

III.CONCLUSION

In conclusion, the exploration of water supply schemes in historical Daulatabad unveils a fascinating narrative of innovation, adaptability, and engineering prowess across the ages. Water, the lifeblood of any settlement, held a paramount role in the growth and sustenance of urban centers in ancient India. The transition from towns located near natural water sources to hilltop fortresses posed a unique challenge: how to ensure a consistent water supply to these elevated and strategically fortified locations.

Each ruling dynasty that presided over Daulatabad brought its own solutions to this perennial problem. The Yadavas, who first established the town, relied on wells, rock-cut cisterns, and tanks. The Bahamanis deepened wells during their rule, recognizing the necessity of a stable water source. However, it was under the reign of Malik- Ambar, during the Nizamshahi of Ahmednagar, that the most remarkable and pioneering solution was conceived.

Malik-Ambar's ingenious water supply scheme harnessed the power of rainwater, leveraging the natural topography of Daulatabad. He identified the northern valley as the catchment area, skillfully collecting rainwater in rock-cut cisterns and channeling it through a complex system of conduits and channels. This system, using the force of gravity, efficiently transported water to different sectors of the town, meeting the needs of both the royal complexes and the general populace. Malik-Ambar's achievement is a testament to his hydraulic genius and his ability to address a seemingly insurmountable water supply challenge.

The study of these water supply schemes underscores the dynamic relationship between water supply, town planning, and the defense of ancient urban centers. It reveals the adaptability of human ingenuity in the face of changing circumstances and technological limitations. From the early Hindu towns to the hilltop fortresses, the continuous evolution of water supply systems reflects the resilience of human civilization and the ability to overcome challenges posed by geography and warfare.

As we delve into the rich tapestry of history, the water supply schemes of Daulatabad provide a poignant reminder of the critical importance of water resources in shaping the course of civilization. This study not only sheds light on the engineering feats of the past but also serves as an inspiration for the sustainable management of water resources in the present and future.

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Natural Language Processing

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ABSTRACT

manages human and programmed conversation. NLP is the investigation of mathematical and mathematical representation of various parts of language and the development of a broad range of frameworks. The common language education indicates its attraction through a wide range of uses. NLP was formerly used for handling static information. NLP is at present working admirably with databases, vocabulary data bases, and pattern rearrangement. These include structures of communication that combine conversation and normal speech. The NLP plays a role in software engineering since many aspects of the profession are linked with grammatical qualities of information. NLP plays a role in software engineering because a lot of the field are linked with phonetic elements of language. The NLP is a study and an application zone that examines how computers are used for understanding and control. To do accommodating things, use typical text or speech. There are variously innovations that incorporate areas of study, such as machine learning is, global and natural language text interpretation, encoding, and representation cross-language data recovery (CLIR), discourse acceptance, and automated AI and master frameworks.

Keywords: - Framework, Phonetic elements, Machine learning Framework, Language Processing, NLP, TF, TWF.

I. INTRODUCTION

The natural language processing (NLP) system typically depends on the series method. It follows the technique of having readers read a text out in sequential order, that is, a single phrase at a time or one word at a time. This was historically how grammar ideas were developed as well as how computer scientists used them. NLP creates demand in the information age thanks to a wide range of applications. The development of the NLP as a field of study started in 1950 with a goal of educating non-programmers about the significance of computer systems understanding. By improving the NLP, subject matter experts are able to receive a clear search response. NLP is used to communicate customers' feelings, knowledge, and responses to other individuals and their surroundings. In early childhood, natural language (NL) is usually taught by individuals in close proximity to the learner. Humans are still not advanced enough for computers to fully comprehend these languages in their raw forms. The collection of techniques used to attempt to accomplish this goal is called NL production. Because of its broad applicability across various disciplines, NLP is a deep and diverse field [3]. Natural language processing is

a group of techniques that eliminates explanations and grammatical structures from inputs to provide a useful job. As a result, outputs are generated by NL generation according to target language rules and the task at hand. Because natural language processing (NLP) provides a path towards increased interaction and productivity, it is employed in instructional systems, duplicate identification, information-based command, and data collecting interface fields. Recent years have seen an increase in the amount of NLP research being conducted. The programmed method of word analysis known as "NL processing" is a rapidly developing area of research and development. The main techniques to definition and implementation in natural language processing are distinguished in the literature.

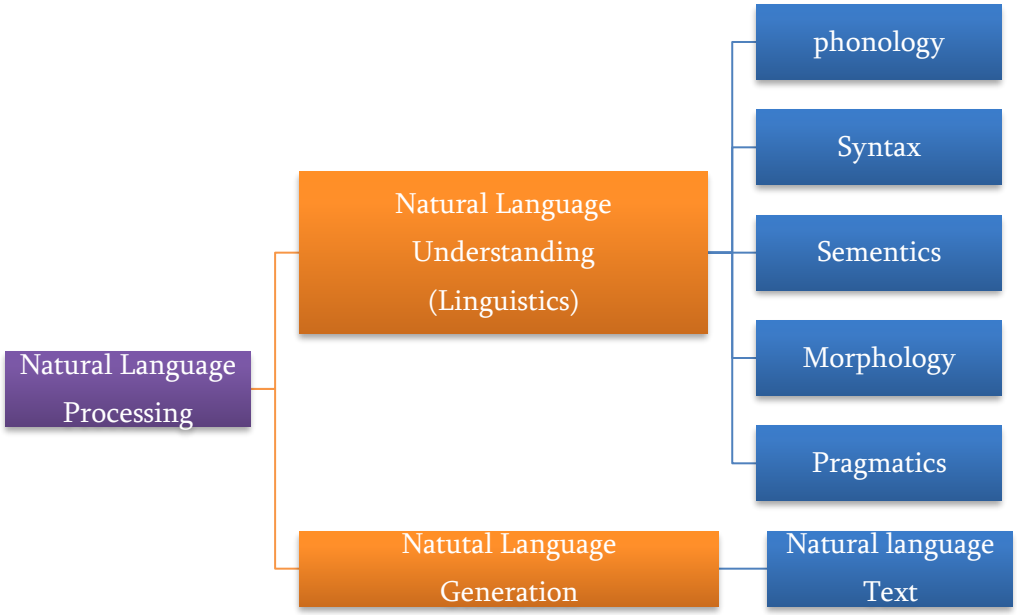


Figure 1. Broad classification of NLP

The goal of Natural Language Processing is to accommodate one or more algorithm or system specialties. The NLP assessment metric on an algorithmic system enables the integration of language understanding and language generation. It is even employed in detection of multilingual events Rinpoche et al developed a novel modular system for cross lingual event extraction from English, Dutch, and Italian texts by employing various pipelines. The system includes a modular set of the most prominent multilingual Natural Tools for Natural Language Processing (NLP). Modules for basic NLP processing are integrated into the pipelines well as more complex tasks like cross-lingual named entity linking and semantic role Labelling and normalisation of time. As a result, the cross-lingual framework enables the interpretation of events, participants, locations, and time, as well as their relationships. The output of these individual pipelines is meant to be used as input to a system. Obtains knowledge graphs based on events. All modules function similarly to UNIX pipes in that they all take standard input, some annotation, and standard output, which is then the input Pipelines are built as a data-centric architecture for the next module so that modules can be added adapted and replaced. Furthermore, modular architecture enables various configurations as well as for dynamic distribution. The majority of work in Natural Language Processing is done by computer scientists, but other professionals such as linguists, psychologists, and philosophers have also expressed interest. One of the most perplexing aspects of NLP is that it adds to knowledge of human language. Natural Language Processing is associated with various fields. Theories and techniques for dealing with the problem of communicating through natural language in relation to the computers. Researchers have proposed methods to remove ambiguity, such as preserving ambiguity

(Shembo 1997; Emelia & Doran 1998; Knight & Languidly 2000). Their goals are very similar to those of finally; they cover a wide range of ambiguities and include an implicit statistical component in their method.

II. METHODS AND MATERIAL

NLP models find relationships between the constituent parts of language, such as letters, words, and sentences in a text dataset. For data pre-processing, feature extraction, and modelling, NLP architectures employ a variety of methods.

Natural language processing uses two primary techniques: syntax and semantic analysis.

The method in which words are arranged in a phrase for proper grammatical sense is known as syntax. NLP analyses a language's meaning using its syntax that complies with grammatical norms. Techniques for syntax include:

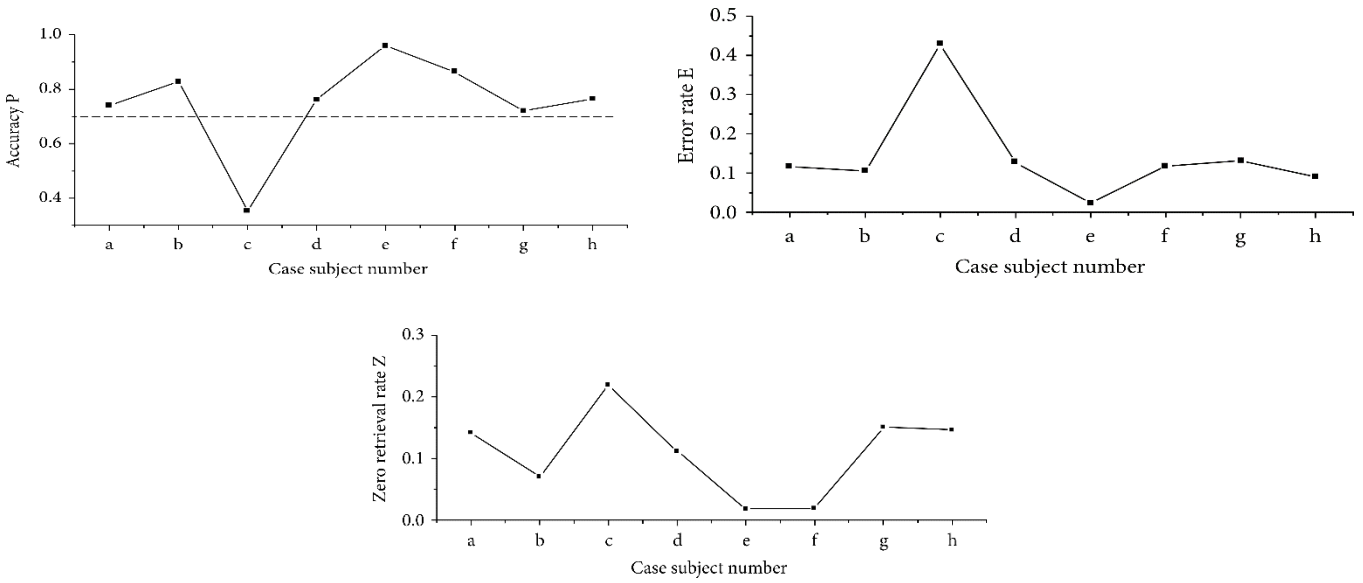
- Splitting: This is a sentence's grammatical analysis. Example: The sentence "The dog barked" is supplied to a natural language processing system. Parsing means splitting this sentence into its component components of speech, such as dog (noun) and barked (verb). For more difficult downstream processing jobs, this is helpful. fragmentation of words. This is the process of extracting word formations from a text string. Example: A handwritten document is scanned and entered into a computer.
- Disambiguation of words: This method derives the meaning of a word from its context. Example: Consider the following phrase: "The pig is in the pen." Pen has several possible meanings. This approach allows an algorithm to grasp that the term "pen" refers to a fenced-in region, not a writing implement.
- Recognized named entities: This defines which words can be classified into categories. For example, using this strategy, an algorithm may evaluate a news story and detect all mentions of a specific firm or product. It would be able to distinguish between visually similar entities using the semantics of the text. In the line "Daniel McDonald's son went to McDonald's and ordered a Happy Meal," for example, the algorithm may distinguish the two instances of "McDonald's" as two unique entities -- one a restaurant and one a person.
- Language generation via natural means: A database is used to determine the semantics of words and generate new text. For instance, an algorithm may automatically generate a summary of findings from a business intelligence platform by mapping specific terms and phrases to data elements in the BI platform. Another example would be generating news stories or tweets automatically based on a specific body of text used for training.
- Data pre-processing: Before a model can process text for a specific task, the text must often be pre-processed in order to improve model performance or to convert words and characters into a format that the model can understand. Data-centric AI is a growing movement that emphasises data preparation. Various techniques for data pre-processing may be used
- Stemming and lemmatization: Stemming is an informal process of converting words to their base forms using heuristic rules. For example, "university," "universities," and "universities" could all be mapped to the base universe. (One limitation of this approach is that "universe" may also be mapped to universe, despite the fact that universe and university do not have a close semantic relationship.) Lemmatization is a more formal method of locating roots that involves analysing a word's morphology using vocabulary from a dictionary. Libraries such as spacey and NLTK provide stemming and lemmatization.

- Sentence segmentation: is the process of dividing a large piece of text into linguistically meaningful sentence units. This is obvious in languages such as English, where the end of a sentence is indicated by a period, but it is far from trivial. A period can be used to both mark an abbreviation and to end a sentence; in this case, the period should be part of the abbreviation token. The process becomes even more complicated in languages that lack a delimiter that marks the end of a sentence, such as ancient Chinese. Stop word removal attempts to remove the most frequently occurring words that add little information to the text. For instance, "the," "a," "an," and so forth. Tokenization is the process of separating text into individual words and word fragments. The end result is typically a word index and tokenized text, with words represented as numerical tokens for use in various deep learning methods. Language models can be made more efficient by instructing them to ignore unimportant tokens.
- Feature extraction: Most traditional machine-learning techniques work on features, which are generally numbers that describe a document in relation to the corpus that contains it, and are generated by Bag-of-Words, TF-IDF, or generic feature engineering techniques such as document length, word polarity, and metadata (for example, if the text has associated tags or scores). Word2Vec, Glove, and learning the features of a neural network during training are more recent techniques.
- Bag-of-Words: The number of times each word or n-gram (combination of n words) appears in a document is counted by Bag-of-Words. For example, in the example below, the Bag-of-Words model generates a numerical representation of the dataset based on the number of occurrences of each word in the word index in the document. TF-IDF: In Bag-of-Words, we count the number of times each word or n-gram appears in a document. TF-IDF, on the other hand, weights each word based on its importance. We consider two factors when determining the significance of a word:
- Frequency of occurrence: What is the significance of the word in the document?
- TF (word in a document) = the number of occurrences of that word in the document divided by the number of words in the document.
- Inverse Document Frequency: How important is the term in the corpus as a whole?
- IDF (word in a corpus) =log (number of documents in the corpus/number of documents containing the word). We if it is common across the corpus. A term's TF-IDF score is the product of TF and IDF.

III.RESULT AND DISCUSSION

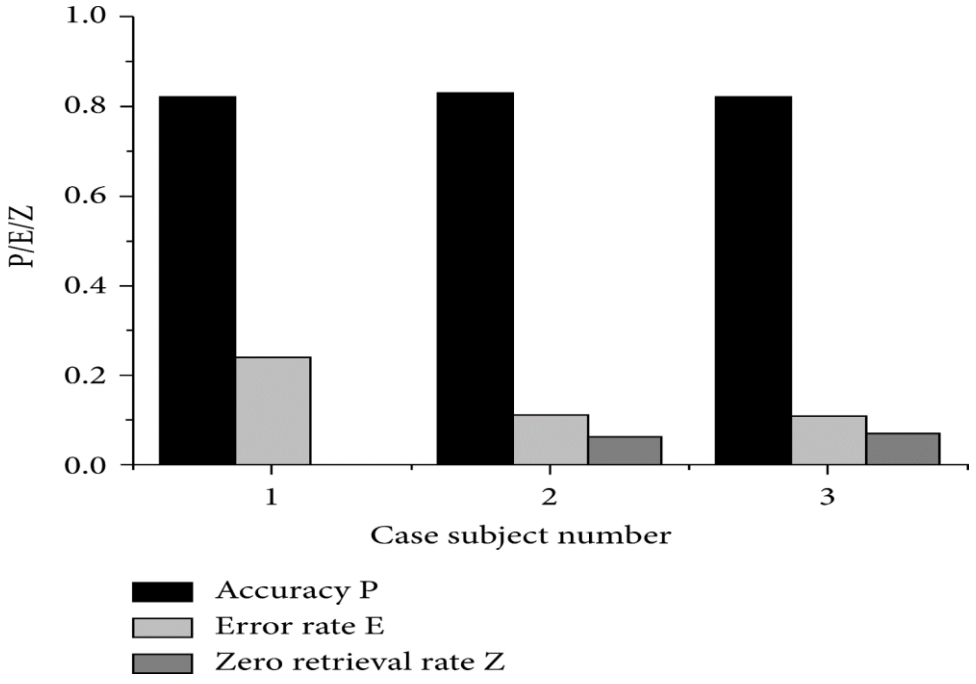
3.1. Performance Analysis of Real Single-Subject Case Retrieval

A single topic implies that each situation has a matching legal clause that is binding on it. Seven examples were chosen for this investigation, involving assault, theft, and interference with law enforcement. Table 2 and Figure 4 illustrate the statistics. Table 2 shows that the search algorithm for this investigation understands legal phrases and the total number of instances relating to each topic. Figure 4 depicts more facts about its correct rate, mistake rate, and accuracy rate. Except for the case of "interference of law enforcement," the proper detection rate of other cases is determined to be less than 70%. The reason for this is that such descriptions encompass a wide range of prohibited acts, resulting in a reduced rate of correct detection. As a result, this study's retrieval system can reach more than 70% of the retrieval ability of a single subject case.



3.2. Performance Analysis of Real Multiple-Subject Case Retrieval

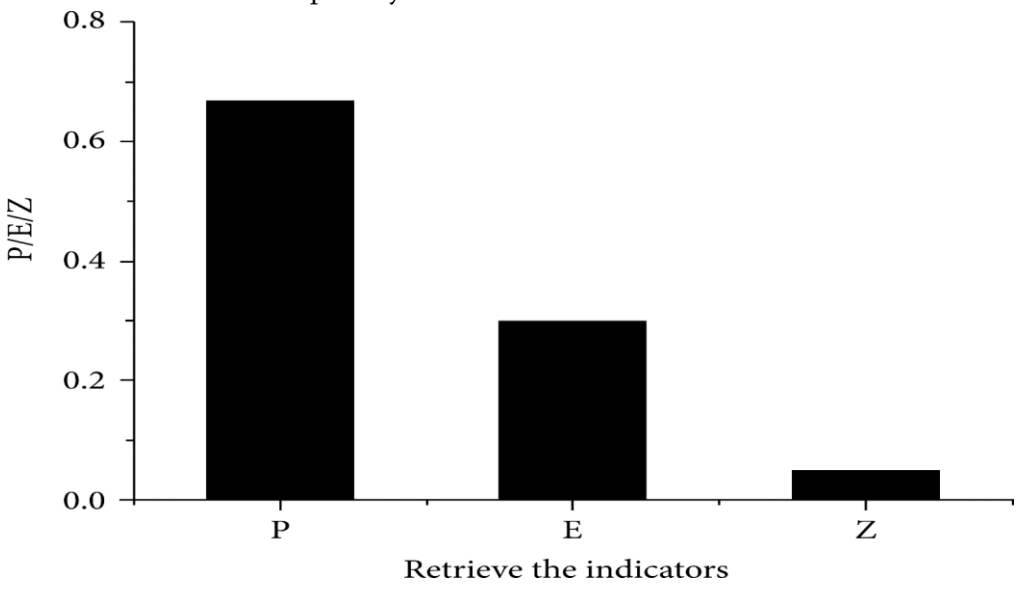
Multiple topics suggest that each case is bound by multiple legal provisions. Three scenarios are chosen for this study: violence and theft, theft and gambling, and drug taking and assault. Table 3 and Figure 5 illustrate the statistics. The above experimental results show that the multitopic case has a significant rise in the right detection rate in this study's legal retrieval system, both of which are greater than 75%. The reason for this could be because more information is recognized after including numerous subjects, resulting in a lower zero retrieval rate and a higher right detection rate. As a result, the retrieval mechanism of this study is more than 75% effective.



3.3. Online Case Testing and Analysis

The peculiarities of online situations are more sophisticated, and the record may be comments on design terms either orally or manually. 174 examples are received from the network during the testing phase. Figure 6 depicts the search results produced by the test. The accurate rate is approximately 65%, the mistake rate is up

to 30%, and the zero-retrieval rate is 4.7%. As a result, the retrieval system used in this study can attain more than 65% of the online case retrieval capability.



IV. CONCLUSION

As compared to different computer approaches, the natural language processing is a relatively modern area of research and implementation. There have been many areas of advances to date indicating that natural language processing or handling based data approach innovation will seek after to be a significant felid of data system development and exploration now and far into what's to come the skilful phase transforms natural language methods applied to voice recognition technology, particularly in the combination of text-to-speech and automatic voice recognition. The NLP relevance in the processing of the text inputs is reflected back. The wave transformation modules' original speech pronouncement is most likely to the output of the prior text processing modules. Natural language processing methods and the most useful NLP equipment kits for badges and Chinese word selection this paper has examined.

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TGA- DTA Study of PVA based Solid Polymer Complexes

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ABSTRACT

In the present work PVA: AA Polymer complexes were prepared by solution cast technique to study the thermal behavior of Polymer thin films at various temperatures. The glass transition temperature Tg was determined from both DSC and DTA suggest that polymer complex under study retains water upto it's melting temperature Tm. Further Tg and Tm values of different samples were compared which also confirms that Tg decreases with addition of ammonium salts in PVA.

Keywords: DTA, TGA, Polymer Complexes

I. INTRODUCTION

Designing of technically suitable devices with desired specifications, in general, requires reproducible materials in terms of physical and electrochemical properties. This is possible only if a structure-property relationship get well substantiated with experimental data. Most of the physical and electrochemical properties are governed by phase and form of materials along with their morphology. [1]On the other hand, thermal properties provide guidelines for operating conditions of devices. The thermal analysis is made up of various techniques for studying the thermal behavior of materials. Structure and chemical composition of material may undergo changes (melting, oxidation, decomposition, reaction transition, etc.) when it is subjected to thermal heating or cooling process.[2]

The study of effect of heat on the materials, obviously, is a long history for man's earliest attempt at producing pottery, extracting metals and making glasses through the philosophical discussion. Thermal analyses are the group of techniques in which the property of the sample is monitored against time or temperature while the temperature of the sample, in a specified atmosphere, is programmed. The programme may be involving cooling or heating at a fixed rate of temperature change, or holding the temperature constant, or any sequence of these. The thermal analysts designated all noticeable changed part of the curve on the diagram/graph as called thermal effects. These thermal effects are caused either by physical or chemical changes. The thermal analysis is widely used in research, analytical and quality control laboratories to study diversity of problems. [3]

In the present work, Differential scanning calorimetry (DSC) and thermo gravimetric analysis/differential thermal analysis (TGA/DTA) is used to obtain information on the thermo-chemical properties such as, glass

transition and melting temperatures, dehydration, dissociation, decomposition, phase transformation, purity, etc. po polymer complexes.

II. MATERIALS AND METHOD

Poly(vinyl alcohol) (PVA), with a degree of hydrolysis more than 99% and average molecular weight of 146000, was procured from Aldrich, USA with dopant ammonium Salts (AA,AS,AMTH.ADP,AN with 80PVA:20AX polymer complexes where (AX=AS, ADP, AMTH, AA and AN) PVA is a potential material having high dielectric strength, good charge storage capacity and dopant dependent electrical and optical properties. It has carbon chain backbone with hydroxyl groups attached to methane carbons/these OH groups can be a source of hydrogen bonding and hence assist the formation of polymer complexes [4]. Polyvinyl alcohol which is a semi crystalline and biodegradable polymer has very important applications due to the role of OH group and hydrogen bonds[5].

In the present study the solution cast technique was used to prepare poly(vinyl alcohol) based polymer complexes owing to its simple procedure and inexpensive.

Preparation of PVA:AA complexes

The aqueous solutions with desired mole ratios of PVA:AA as (95:5), (94:6), (90:10) (87.5:12.5), (85:15), (80:20), (75:25) and (72.5:27.5) were prepared by dissolving PVA and AA separately in deionized water and then mixing them together. Later, each aqueous solution batch was thoroughly stirred for 8–10 h at 60–70 °C using magnetic stirrer so as to obtain the homogeneous single-phase solution. The homogenous viscous solution thus obtained was then casted on the glass, the Teflon-plate and in the petri dish. The casted solution was left for a week in a desiccator covered with perforated aluminium foil to evaporate water slowly at room temperature. The smooth and uniform films transparent to visible light were obtained. These solid polymer complexes were characterized using DSC, DTA/TGA technique to investigate thermal properties of the prepared samples.

III.RESULTS AND DISCUSSION

1 DSC and TGA/DTA

The typical DTA and TGA curves for 25 mole% AA (ammonium acetate) doped PVA, the highest conducting one amongst all the samples in this series are depicted in Figs.1.1 and 1.2, respectively. The two distinct endothermic peaks, the onset of first at about 209 ºC and that of second at 233ºC are distinct in Fig. 1.1. The TGA curve shown in Fig.1.2 reveals the negligible weight loss up to about 100 ºC. Further, the rate of weight loss slightly increases thereafter till 200 ºC. Furthermore, a sudden/drastic increase in the weight loss at about 233 ºC is discernable. Since there is no significant change in weight till 233 ºC (Fig.1.2), the small exothermic hump in DTA curve at around 178 ºC (Fig.1.1), just before the first endothermic peak, is attributed to the glass transition (Tg). And endothermic peak with onset at around 209 ºC observed in DTA curve (Fig.1.1) is assigned to the melting of polymer complex. The prominent endothermic peak at 233 ºC where onset of drastic weight loss (Fig.1.2) observed that coincides with the prominent endothermic peak in DTA thermo gram (Fig.1.1) is attributed to the boiling/evaporation of water (T_b).

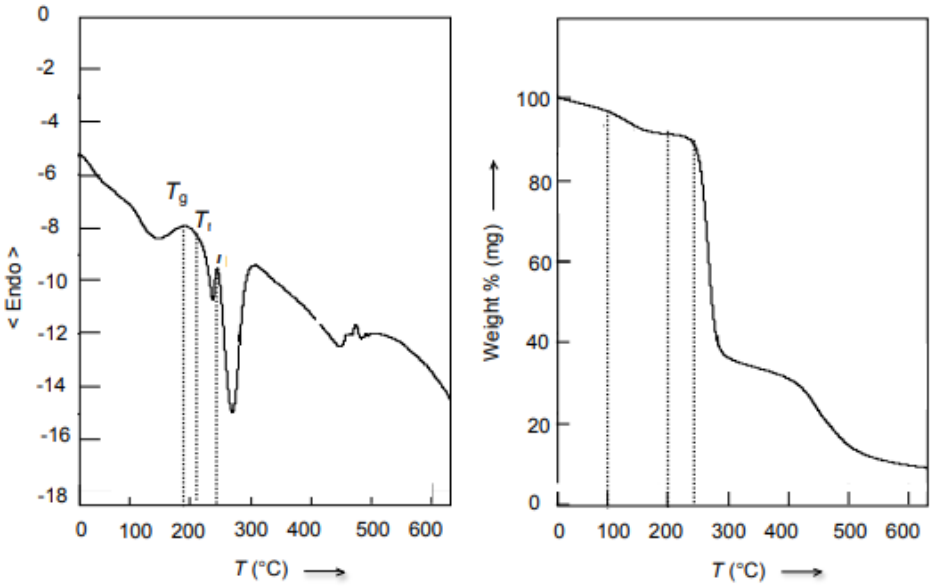

Fig.1.1 DTA curve for 25 mole% AA doped PVA Fig.1.2 TGA curve for 25 mole% AA doped PVA.

A typical DSC curve is depicted in Fig.1.3. The onset temperature of endothermic peak appeared in DSC curve is taken as a glass transition temperatures (Tg); and found 179 ºC. The T_g determined from both the DSC (Fig.1.3) and the DTA (Fig.1.1) results are in close
agreement. These results suggest that the polymer complex under study retains water up to its melting temperature T_m. The water retention up to about 233 ºC would allow the proton conduction without any much change in these polymers, which is an advantage from fuel cell viewpoint. In other words, the polymer complex under consideration may be useful in FC operated at up to 212 ºC. [6-11]

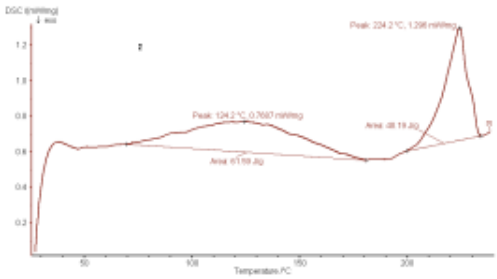

Fig. 1.3 DSC curve for 25 mol% AA doped PVA

The values of T_g and T_m obtained from DTA and DSC of all samples belongs to PVA:AA complex system under study are compared in Table 2.1. As seen the Tg of polymer complexes decreases with an increase in AA concentration. The vales of Tg of complexes under study are, in general, lower than that of the reported one, however [13, 14]. The difference in molecular weight and degree of hydrolysis of PVA of present materials results in the difference in the values of Tg and Tm and so different than the reported vales. Similarly, the decrease in the value of T_g with increased salt concentration in PVA has also been reported [13]. The plasticization of PVA polymer due to addition of AA salt weakens the dipole-dipole moment of PVA chains thereby decrease in T_g as well as T_m.[12-15]

Samples PVA:AA	DSC T_g (°C)	DSC T_m (°C)	DTA T_g (°C)	DTA T_m (°C)
100:00	190	231	192	230
95:5	187	227	185	225
94:6	187	217	185	210
90:10	185	225	183	223
87.5:12.5	185	212	183	190
85:15	183	224	182	222
80:20	182	215	181	220
75:25	179	227	178	223
72.5:27.5	175	212	172	220

Table 2.1: A comparison of T_g and T_m obtained from DTA and DSC measurements for (100-x) PVA:(x)AA (x = 5, 6, 10, 12.5, 15, 20, 25 and 27.5) complexes

A comparison of T_g and T_m values obtained from DTA and DSC of all samples of the series 80PVA:20AX (AX = AS, ADP, AMTH, AA and AN) is given in Table 2.2. Evidently, both the Tg and the Tm obtained from the DSC and DTA curves are closely matching with each other. In this case also, Tg decreases with an addition of ammonium salts in PVA. These results suggest that the 20 mol% ammonium salt added PVA polymer complexes also retain the water up to their melting temperatures.

IV. CONCLUSION

Poly(vinyl alcohol) based polymer complexes added with ammonium salts with different wt% were prepared by solution cast technique. The glass transition temperature T_g was determined from both DSC and DTA suggest that polymer complex under study retains water upto it's melting temperature T_m. Further T_g and T_m values of different samples were compared which also confirms that T_g decreases with addition of ammonium salts in PVA. The water retention up to about 233 ^oC would allow the proton conduction without any much change in these polymers, which is an advantage from fuel cell viewpoint. In other words, the polymer complex under consideration may be useful in FC operated at up to 212 ^oC.

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Application of Artificial Intelligence in Civil Engineering

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ABSTRACT

Artificial Intelligence (AI) is the branch of computer science which can be effectively used in civil engineering work to optimize the efficiency in Civil Engineering Industry. Traditional methods in civil engineering required large amount of calculations for modeling and analysis, which can be effectively solved with the help of AI. This study gives overview on the application of AI and its methods in different stages in civil engineering projects. Recently developed and developing methods for the application of artificial intelligence in civil engineering such as neural network, fuzzy system, reasoning, classification, fire-fly algorithm, knowledge based engineering and simulated engineering are discussed in this study. The main role of AI in civil engineering is to automate the repetitive task such as project scheduling, cost estimation, resource management to improve the quality and efficiency in civil engineering projects. AI has the potential to make a drastic change in civil engineering industry.

Keywords: Artificial Intelligence, neural network, fuzzy system

I. INTRODUCTION

Civil engineering is the field which contributes projects which are directly benefited by society, fulfils their basic needs. Every project in civil engineering is unique in nature as the finished product is different in every project. As compared to other industries like automobile industry, IT industry, manufacturing industry, the construction industry has negligible non-repetitive activities, due to which the industry faces the more complex problems. Contribution of manpower is very high in construction industry. The quality of product mostly depends upon the skill and experience of an employee. Lower accuracy, lower quality of the product, delay in delivery of the project are some of the complex problems which are occurred in every project in the field of construction industry. To overcome these problems, a sustainable solution required and artificial intelligence (AI) has the potential to develop systematic approach for the complex problems in every specialized area of civil engineering. AI has the potential to mitigate the risk involved, improve the productivity, automate the process and operations, overcome the risk involved in supply chain management in construction industry.

Artificial Intelligence (AI) is the branch of science which includes research, design and application of intelligent computer. AI was developed on the basis of interaction between several interdisciplinary such as

computer science, information theory, cybernetics, linguistics, psychology and neurophysiology. The field AI aims to learn how to simulate and implement the some of the intelligent functions of human brain, so to make relevant theories and the technology. AI is widely accepted as a technology that offers an alternative way to solve complex and obscure problem. It is also used in the various fields for modeling, optimization, identification, prediction and control of complex problems.

Artificial Intelligence proves as best solution for the development of structural technologies, automatic data analysis, and analysis of data for monitoring, health protection, planning, and risk evaluation, decision-making, and project control. AI plays important role on the site to improve the quality, efficiency and safety in the construction industry. This paper aims to provide overall view on the role of artificial intelligence in civil engineering and construction industry.

II. ARTIFICIAL INTELLIGENCE

2.1 Introduction

Artificial Intelligence is specially the smart computer programs or algorithms, which are used to solve complex problems and reasoning, which are generally done by human brains. AI uses programs or algorithms to store and analyze the big and unstructured data. AI system can collect and store the large amount of data for the engineers which further can be used for the project planning, design and at controlling phase. Mainly research of AI aims to involve knowledge representation, learning, automated planning, perception, robotics, reasoning, natural language processing, and general intelligence.

Generally, there are two types of machine intelligence which are hard computing methods and soft computing methods. Hard computing is the method which is based on the binary logic, numerical analysis and crisp systems. Exactly stated analytical model is required to produce precise solution in hard computing method. While soft computing is completely different approach, it can deal with indeterminate and complex data, which includes stochastic information, and allows parallel computations. Soft computing approach includes methods which are able to develop their own programs and generate approximate answers.

2.2Soft Computing Methods

Soft computing is also known as computational intelligence. It is the use of approximate calculations to provide accurate but usable solutions to complex computational problems. This system provides solution for the problems that may either unsolvable or too time-consuming to solve. Human mind is key reference behind the soft computing approach. The main components of this soft computing method are fuzzy logic, artificial neural networks, and genetic algorithm.

Table: Soft Computing Methods

Self Computing Methods				
Sr. No.	Main Method	Sub Methods		
1	Fuzzy Computing	Fuzzy Set	Fuzzy Logic	Fuzzy Theory
2	Neural Network	Artificial Neural Network	Back Propagation Neural Network	Feed Forward Neural Network
3	Evolutionary Computing	Genetic Algorithm	Evolutionary Algorithm	Different Evolutions
4	Machine Learning	Semi-supervised Learning	Un-supervised Learning	Supervised Learning
5	Swarm Intelligence	Ant Colony Optimization	Particle Swarm Optimization	Firefly Algorithm
6	Additional Methods	Wisdom System	Chaos Theory	Belief Theory

III.ARTIFICIAL INTELLIGENCE IN CIVIL ENGINEERING

In various fields of civil engineering AI is applicable to get a comprehensive solution. AI involves in the development of empirical evidence based mathematical models which are used in the fields of building materials and structural mechanics. Various studies show that the techniques in Artificial Intelligence like Fuzzy Logic, Artificial Neural Network, Genetic Algorithm, Fuzzy Genetic provides feasible solutions. Currently in civil engineering neural network and fuzzy system used widely. Fuzzy Logic based approach is used to select the contractors in the construction industry. Artificial Neural Network used to create technique for estimating the coefficient of friction in open-channel flows in the field of hydraulics. Every civil engineering projects are unique in nature due to some of known and unknown influencing factors in it and repetitive activities in construction projects are negligible as compared to other industries. Hence, to obtain systematic and efficient approach for construction industry is one of the greatest challenges for experts. Many specialized systems have been developed and implemented in the field of civil engineering in last few years, with application in construction architecture and optimization, project management technology, road and bridge health identification, project assessment, decision-making and other specialized areas.
Following are the some highlighted approaches of AI which are used in fields of civil engineering.

3.1 Structural Engineering

AI aims to create computational components that evaluate human thought processes and reproduce the same. Lee and Eun (2018) tested methods for analyzing damage of truss components before and after the crash with strain or inconsistency in the stiffness. To quantify harmed elements based on a full and partial estimation, they implement the harm recognition approaches, sub-structuring technique, and static and dynamic substructure methods

3.2 Construction Management

Conventional methods of construction management depend on manual observation, experience of the employee and operation, which may cause the complex errors and time consuming activity. It has been shown that AI based approach can solve the problems occurring in the project management field. Machine learning approach can be used to analyze the large amount of data that acquired for the purpose to know the previously unknown information. AI tools coordinately used with Building Information Modeling (BIM) can give the accurate estimation with the stipulated duration. AI has potential to make efficient supply chain management in construction industry which is one of the greatest challenges in field of construction project management.

3.3 Quantity Surveying

Tarek and Osama (1994) proposed the system as a solution on civil engineering problem. Artificial neural network were ideally suited for the design of decision aids with problem-solving skills based on analogy. Approach used to build a realistic estimation model using the expertise gained from contractors. The design, training, and testing of the model were defined along with the changes to generalization made using the technique of genetic algorithms.

3.4 Geotechnical Engineering

Hanna (2007) developed a approach of neural network regression to assess the capacity for nonlinear liquefaction in soil. For review, planning, and research the case reports were randomly divided into databases. The approach gives a feasible solution for geotechnical engineers to determine seismic conditions at liquefied sites.

3.5 Transportation Engineering

An intelligent transportation system (ITS) is an advance application of artificial intelligence which aims to develop innovative approaches and systems related to the transportation system and traffic management. This ITS enables the users to avail the services related to different transportation modes in safer and smarter way. Under ITS various technologies are developed that are implemented and used successfully. All these methods are generally developed for road transportation system to avoid accidents and follow the rules prescribed by authority.

In 2015, European passed a law for automobile manufacturers to equip all new manufactured cars with one of the ITS technology i.e. emergency vehicle notification system.

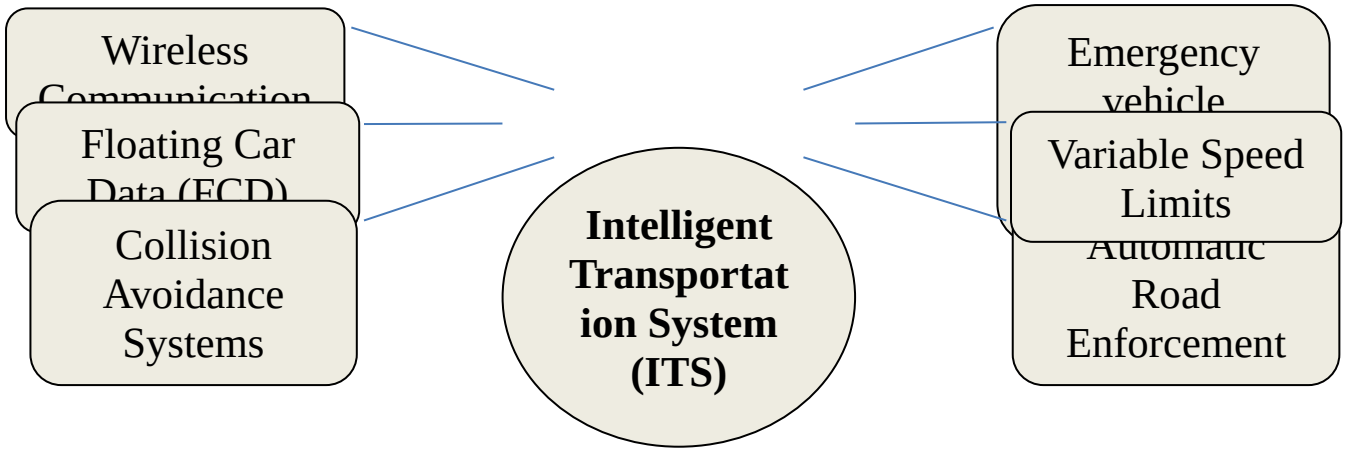

Figure: Technologies in Intelligent Transportation System

IV. ADVANTAGES, DISADVANTAGES AND FUTURE SCOPE OF AI IN CIVIL ENGINEERING

4.1 Advantages

AI has the potential to make drastic change in the field of civil engineering, to overcome complex problems arrived in various stages of construction projects. Following are some of the highlighted advantages of application of AI in civil engineering:

- It mitigates the risk involved in various phases of construction project
- Effective use of automation in construction industry improves the productivity
- Speed and accuracy of doing activities increases which enhance the quality of the finished product
- With the help of ANN, it can develop predictive models on the basis of previously known data which gives more accurate estimates, budgets and timelines
- Use of drones and robots in t filed provides a safer workspace to engineers and workers also

- AI powered generative design provides the better design of buildings which identify and mitigate clashes between the different models generated by the different teams in building information models (BIM)
- Off site construction can be achieved with the help of autonomous robots piece together components of a building, which are then pieced together by human workers on-site.

4.2 Disadvantages

- Use innovative approaches of AI can be extremely expensive
- One of the biggest fears people have is the potential job loss caused by AI
- AI software can be unsecured to outside attacks like data manipulation, theft, etc.
- Not able to work outside of what they are designed and programmed to do

4.3 Future Scope

The integration of Robotics, AI, and the Internet of Things has the potential to significantly lower construction expenses. Engineers have the ability to wear virtual reality goggles and deploy miniature robots within construction sites, equipped with cameras to monitor the ongoing work. In addition, AI is now playing a crucial role in optimizing the layout of electrical and plumbing systems in contemporary buildings. Companies are also harnessing AI for the development of safety protocols at construction sites. This technology enables real-time monitoring of interactions between workers, machinery, and objects on-site, promptly notifying supervisors about potential safety concerns, construction errors, and productivity challenges.

V. CONCLUSION

The use and application of artificial intelligence in the field of civil engineering and construction industry are discussed in this paper. Various developed approaches under the AI are effectively implemented and used in civil engineering to solve their complex problems involved in various stages of the project. Artificial intelligence algorithms and neural networks have been utilized on a large scale in specialized area of civil engineering such as quantity surveying, transportation engineering, construction project management, geotechnical engineering, structural engineering, building engineering and so on. Artificial intelligence is continually evolving and expanding as computer programs are deployed on a massive scale. With each step, our understanding of AI advances, evolving in a manner that mirrors the increasing complexity of its foundational structure and its systemic depth.

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Preparation of Tin Oxide (SnO2) Thick Film by Screen Printing Method

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ABSTRACT

In hybrid electronics cct the thick film technology is more widely used than thin films. Because it needs much smaller initial investment, but yields circuits with good performance for all general applications. Thin and thick film technologies have been going though several significant changes over the years. There have been several new developments in the methods of deposition of films. Thick film technology is cost effective & highly reliable. About 75% of all Hybrid Circuits produced are based on thick film technique, the remaining 25% being thin film hybrids. Screen printing is method completed by a mesh used to transfer paste onto a glass substrate, except in areas made impermeable to the paste by a blocking stencil. A Squeege is moved across the screen to fill the open mesh apertures with paste and reverse stroke then causes the screen to touch the substrate momentarily along a line of contact. This causes the paste to wet the substrate and pulled out of the mesh apertures as the screen springs back after the Squeege has passed. This process of using a mesh based. stencil can be used to apply paste onto substrates such as glass material. Composite 1%,3%,5%,7% and 9% dopants incorporated in pure SnO2 thick film of dimension 2cmX1cm were prepared by standard screen printing method.

Keywords: - Thick film, Screen printing method, glass substrate

I. INTRODUCTION

Thick film technology was introduced about thirty years ago as a means of producing hybrid circuits. Hybrid microelectronics based on thick and thin film technologies has shown rapid growth in the past few years and is emerging as an important technique for a small-scale representation of electronic systems. Its main features are lower cost of design and production, higher frequency and power capability and more flexibility in design and fabrication. In view of these attractive features thick film technologies has become extremely popular in certain special applications where size reduction required is not as much as in monolithic IC's but the performance requirements are stringent. In hybrid microelectronics, the thick film technique is more widely used than thin film technique because it needs much smaller initial investment, but yields circuits with good performance for all general applications. The thin and thick film technologies have been going through several significant changes over the years. There have been several new developments in the methods of deposition of films.

Thick-film technology based on glass and ceramic compositions is very stable in severe conditions such as high temperature or corrosive environments. Thick-film technology is used for electronic devices such as sensors, packages and high-reliability modules. Classical thick-film technology mostly uses pre- fired 96% alumina substrates. Manufacturing process consists of successively printing, drying and firing a series of functional material layers such as conductors, dielectrics, resistors, sensor materials and over glazes. Deposition of the layers is most commonly carried out by using screen-printing for high volume and low-cost production. For prototypes, dispensing may also be applied. Each layer is printed with a paste comprising of a functional mineral material and a temporary organic vehicle. After deposition, drying removes the solvent in the vehicle, allowing the part to be handled. The final operation is firing, in order to eliminate the organic binder and sinter the materials. Glass frits are commonly used alone for over glazes and as a permanent binder in thick film technology for dielectrics, resistors, and to some extent for conductors

1.1. Preparation of active powders and fabrication of Thick Film Resistors

The preparation of active powders and fabrication of undoped and doped SnO_2 thick film resistors are described in the following sub-sections.

1.1.1. Preparation of active powder

For undoped SnO_2 thick film resistors, the organic to inorganic materials ratio was maintained as 30:70%. Organic part consist of 92 % butyl carbitol acetate (BCA liquid, Merck, Munchen, C10H20O4, BP 245OC) as a vehicle to make the paste. Butyl carbitol acetate was added drop by drop to obtain the proper viscosity and thixotropic properties of the paste and 8% ethyl cellulose (EC, Loba Chemicals) as a temporary binder. In inorganic materials, the commercially available AR grade SnO_2 powder (99.9% pure, Loba Chemicals) was used as a functional material. The SnO_2 powder was weighed and calcined in air atmosphere at 400°C for 2 h. The ratio of active SnO_2 powder to permanent binder was kept as 95:5 % in 70 % part. Glass frit (70 wt.% PbO, 18 wt. % Al2O3, 9 wt. % SiO2 and 3 wt.% B2O3) was act as a permanent binder [1,2,3].

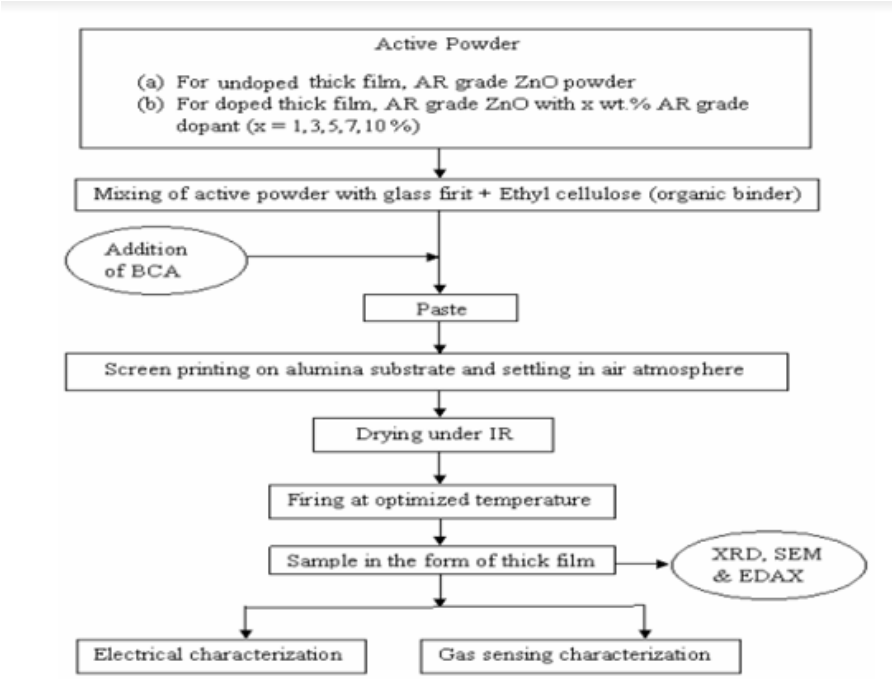


Fig. 1.1: Flowchart for powder preparation and Thick film resistor fabrication

For doped SnO_2 thick film resistors, Fe_2O_3, Cu and Al were used as dopants. All the ratios were maintained as above. The AR grade SnO_2 with x wt. % AR grade dopant (x = 1, 3, 5, 7 and 10 %) of 95 % was used as a functional material. 5 wt. % above mentioned glass frit was used as a permanent binder. 92 % butyl carbitol acetate (BCA) as a vehicle and 8% ethyl cellulose (EC) as a temporary binder in 30% was used to make the paste.

1.2. Fabrication of Thick Film Resistors

The various steps of fabrication of the thick film resistors of undoped and doped SnO_2 are described in the following sections.

1.2.1. Substrate Cleaning

The glass substrates used for deposition of thick film resistors using screen printing technique were cleaned initially by using soap solution. Then cleaned by using the chromic acid to remove the other impurities and finger prints present on the substrates. Finally, all the substrates were washed by distilled water and then with acetone. Lastly, the substrates were dried under the IR lamp and used for thick film screen printing.

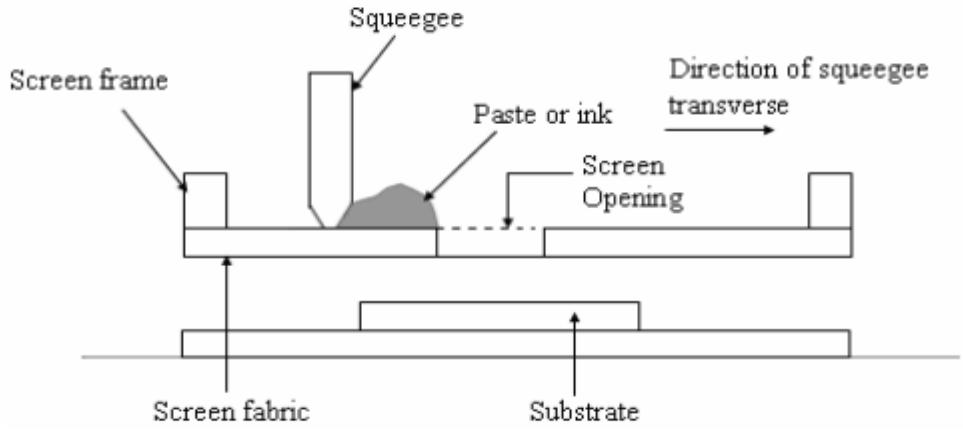
1.2.2. Paste Formulation

i) For doped thick films, the calcined SnO_2 powder with x wt. % AR grade dopant (x = 1, 3, 5, 7 and 10 %) was mixed and crushed thoroughly with glass frit and ethyl cellulose in an acetone medium with mortar and pestle. During this mixing process, BCA was added drop by drop to obtain the proper viscosity of the paste. This paste should have the thixotropic property for printing through screen on the substrate.

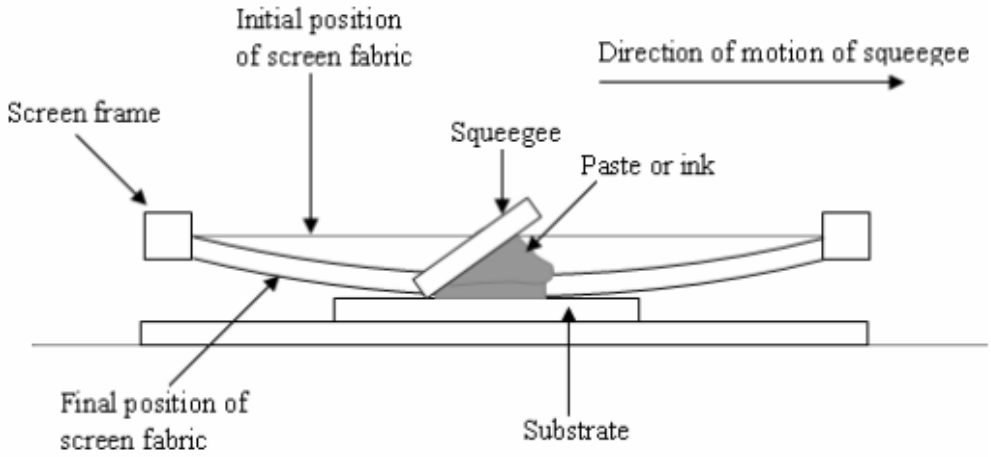
ii) For undoped SnO_2 thick films, the calcined SnO_2 powder was mixed and crushed thoroughly with glass firit and ethyl cellulose in an acetone medium with mortar and pestle. During this mixing process, BCA was added drop by drop to obtain the proper viscosity of the paste. This paste should have the thixotropic property for printing through screen on the substrate.

1.2.3. Screen printing

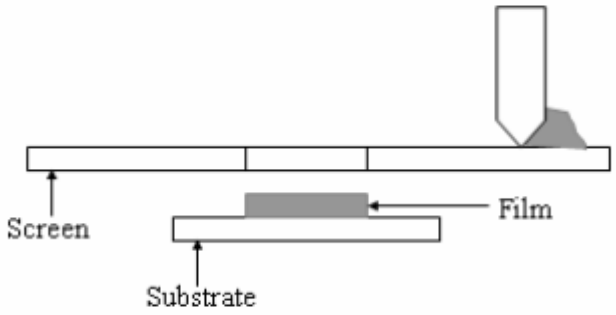
- The screen frames are used for supporting the woven mesh. These are produced from wood, plastic or metal. Most of the frames are made up of cast aluminum. The wood frames are also used for thick film printing applications
- The screen of nylon (140S, 355 mesh counts/cm) was selected for screen-printing. The required mask (2.00x 1.00 cm) was developed on the screen by using a standard photolithography technique.
- The screen-printing of the paste of active powder (undoped/doped) was done in three different steps as shown in Figure 1.2.
- The formulated paste was printed on glass substrates (3.00x1.5cm) with help of mask. The pattern was allowed to settle for 20 to 25 minutes in air. The printed samples were dried for 45 minutes under an IR lamp to evaporate BCA and then fired at an optimized temperature in the time temperature profile of 2.3 to 3 hrs.



Step-1: Start



Step-2- During stroke



Step-3- Snap back

Fig. 1.2: Screen printing steps for thick film sensor

1.2.4. Firing

The dried undoped SnO2 thick film samples were fired at 700, 800, and 900 °C and doped SnO2 thick film samples were fired at only 700°C for 2.5 to 3 hr (which includes the time required to achieve the peak firing temperature and then maintained constant temperature for 30-35 minutes at peak value and decrease to attain

the room temperature) in muffle furnace. The cooling rate was at 26°C/min. These thick film samples were used to study the different characterizations viz.: electrical, structural, and gas sensing properties.

1.3. Advantages and limitations of thick film technology

- The advantages of thick film technology are fourfold viz:
  - *Higher Performance
  - *Greater Flexibility
  - *Outstanding Reliability and
  - *Economy (Cost-effectiveness)

1.3.1. Performance:

1. Thick film technology has the advantage of reduced parasitic capacitive coupling between components, and minimized lead resistance and inductance. This allows for improved high-speed and high frequency performance.
2. High thermal conductivity of substrates minimizes thermal gradient between components, which leads to improved stability of circuits at high temperature.
3. Resistors having similar TCR can be made using paste having same resistivity, leading to excellent TCR tracking of 10-25 ppm/0C.
4. Resistor power ratings are high 40 to 50w/in2
5. Resistors can be precisely trimmed to achieve accurate values making it possible to obtain close resistor tolerances and ratio matching. Functional trimming of circuits is also possible.
6. TFT provides high dielectric isolation useful in high frequency, high Voltage and radiation ambient.

1.3.2. Flexibility:

1. Existing designs from bread-boards or PCBs can be converted on a Direct one-one basis with minimum design changes.
2. Fast turnaround times are possible and design changes can be achieved with minimum time and effort.
3. A wide selection of active and passive components with closely controlled parameters, in packaged and unpackaged form are possible.
4. Custom built circuits for specific needs and variety of patterns can be achieved with no variation in the manufacturing process.

1.3.3. Reliability:

1. Increased reliability is due to reduction in number of physical interconnections.
2. Since solder connections are replaced by chemically bonded material interfaces, the susceptibility to wiring errors, shock, vibration and acceleration damages are reduced.
3. Close bounding between resistive elements and hot spots in the resistors.

1.3.4. Economy:

1. Initial investments in equipment and personal training as well as development costs are very low.
2. Thick film process is suited for mass production and prototype and evaluation modules can be assembled at minimal costs.
3. Circuit changes can be easily accomplished and final product assembly time is reduced

1.3.5. Limitations of thick films:

1. In most of the practical circuits the value of resistances is limited in the range of 10 Ω to 10 MΩ.
2. Through by trimming any tolerance can be obtained. The practical limit is 0.25 % using air abrasive trimming.
3. The high voltage and high power circuits can occupy more space and hence to be avoided in miniature circuits.
4. Even though there is size reduction, it is not comparable to that of monolithic particularly this technology is component limited; too many components can not be accommodated on single substrate.
5. Mounting capacitance more than 22μF is space consuming and hence is not economical. Transformer, large inductors and large capacitors are to be kept out of the circuit.

1.3.6. Guidelines useful for capability of thick film technology:

1. Divide overall circuit into smaller discrete circuit functions.
2. Keep component count and density fairly equal and keep symmetry whenever possible.
3. Maintain the number of active devices within single circuit to a level commensurate with acceptable yields for mounting process.
4. Spread out heat dissipating elements. Maintain fairly equal power dissipation levels and below the acceptable limits.
5. Make use of IC's and MOS devices for increased density. After taking in to account the scope of thick film hybrid circuits, it is worthwhile to know the materials used for thick film technology

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Design and Testing of Composite Material T-Joint for Naval Ship Using FEA

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ABSTRACT

The preeminent defect that occurs in composite t-joint is the undefined failure at the joint which is the only complex part of the composite structure. Many researchers have done most of the studies to analyse how the t-joint fails and the failure conditions. Many attempts have been made to overcome this problem by CFD or by Finite Element Analysis approach to composite structure, but there is ample scope for modelling composite t-joint and the use of composite materials. The process to manufacture composite structures is a bit complex and requires skills. Composite t-joint is mainly crafted by casting or hand lay-up technique. The sandwich core is which supporting part is built by coating the PVC with glass fiber and epoxy resin. The resin binds with the glass fiber which eventually increases the stiffness of the PVC foam bond. Lamination of the core parts is a critical part in manufacturing of sandwich core. The adhesion of the resin should be strong enough to hold the structure together. The t-joint mainly fails due to the delamination of the core parts. Different angles are provided to the model to test which holds good to expectations. There is a need for lots of modification in modelling for the enhancement of the future of composite structures. The studies on different parameters and defects in composite T-Joint structures are widely used in superstructures, decks, bulkheads, advanced mast sensor systems, propellers, aircraft carriers, propulsion shafts, pipe, pumps, valves, machinery, etc. Four different categories have been distinguished to study defects in composite T-Joint and the effect of various parameters

Keywords: Composite Material, Design, Material selection and FEA of Composite T-Joint

I. INTRODUCTION

The purpose of the project is to determine the methodology to predict the damage criticality of a composite marine structure T-joint. This knowledge will enable the prediction of the life and reliability of the structure. To acquire this, it is very useful to do the preliminary design using a FE package. The FE tool has been proved useful in predicting the behavior of composite structures. It allows for cost savings by reducing the amount of required experimental works. The FE prediction methodology is very commonly used on composite structures for not only marine structures but also for aerospace applications. Since last decade, with the advent of powerful finite element analysis (FEA) packages, these have been proven good tool to perform accurate

stressanalysis. The geometry of composite T-joint is complicated and analysis is comparatively difficult. Optimized meshing and accurate simulation of boundary conditions along with ability to apply complex load, provided by various FEM packages has helped the designer to carry out analysis with the investigation of critical stresses. FEM enables to find critical locations and quantitative analysis of the stress distribution and deformed shapes under loads. However detailed modeling and specialized Knowledge of FEM theory is indispensable to perform these analyses with high accuracy. It also requires complicated meshing strategies. Simulations of actual boundary conditions to equivalent FE boundary conditions have to be done carefully because a wrongly modeled boundary condition leads to erroneous results. The solution of such large scale FEM problem requires both large memory and disc space as computing resources.

The main motivation behind the work was to go for complete FEA of T-joint with different materials for skin, core and filler. By performing structural analysis of skin, core, filler etc at different loads, overall deflection and stresses are studied.

1.1 Functions of T-joint

For a hull structure with a number of compartments, a typical joint, known as a T-Joint is used to join the hull and bulkhead sections (see Figure1.1). It consists of composite over laminates over a shaped fillet constructed by stacking up layers of laminates through hand-lay-up process. Filler made from chopped fiber reinforced resin is used to form the fillet. The function of the T-Joint is to transfer flexural, tensile and shear loads between the hull and bulkhead and to maintain watertight integrity between compartments separated by the bulkhead [1]. There are two types of T-Joints depending on the over laminates shape. They are triangular and circular T-Joints. Unlike triangular T-Joints, much research has been done for circular T-Joints. The over laminates and the resin filler in the fillet are the load transmission path between the hull and bulkhead. Hence, the strength of the joints depends on the strength of both parts stated that there were two load conditions experienced by T-Joints. The first condition was the compression at the interface between hull and the over laminates due to hull pressure. The second one was the tension at the same interface due to heavy machinery's weight. In addition, over laminate can be the main source of delaminating due to the variable quality of the interfaces and the presence of defects. The hull and bulkhead are the primary structures in maintaining the ship stiffness under various loadings.

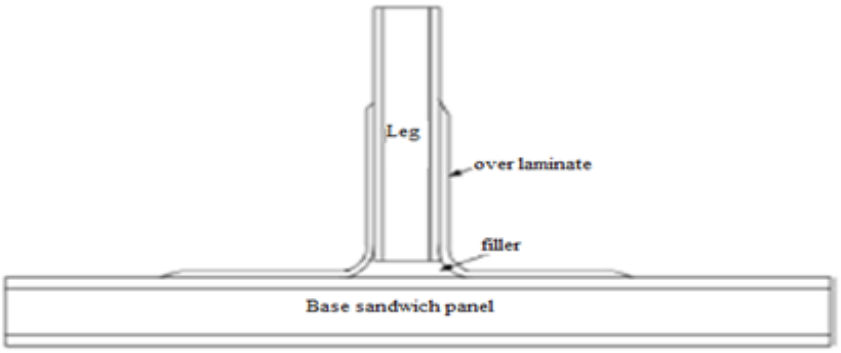


Fig. 1. A Typical Composite T-Joint

Therefore, their reliability depends mainly on the T-Joint as the connection between both structures. Since a T-Joint is a bonded connection, it is the weakest link by nature. Its weaknesses are attributed to the following conditions.

II. DESIGN OF COMPOSITE T-JOINT

According to research paper discussed in literature survey following conclusions can be made. In order to construct a new design of composite T- joint based on research paper these conditions and criteria are considered.

Main features of New T-joint as follows

1. Skin is provided to both vertical as well as horizontal plates.
2. Overlaminate covers are not only providing to vertical and horizontal plates it is also proving the main bonding zone.
3. PVC foam is used to make it light weight as a core material and has laminated with fibreglass to increase its tensile strength.
4. Supporting core pieces are used to ensure vertical plate is normal to horizontal plate.
5. Core pieces also increase the bonding surface area and protect the filler material. It is useful in minimizing the quantity of resin required for joining both plates.
6. No curvature is provided, hence simplicity in manufacturing and ease in use.

Complete assembly is symmetric about Y-axis.

Sufficient width is provided (150 mm) for more contact and cross sectional area in order to manufacture above composite T-joint we need PVC foam sheet of size (700X150X30) mm. Mentioned thickness here is 30 mm, but the PVC foam with 30 mm thickness is rarely used and it is not easily available in market. Maximum thickness of PVC foam sheet available is 18 mm. That's why we have decided to modify the design. Instead of using single sheet of 30 mm thickness we've decided to use 2 plates of maximum thickness as 18 mm and join them by same adhesive material which is used for main filler i.e. Epoxy. In above modification we strengthen the concept of composite material of using more than two material or constituents by introducing third element i.e. a layer of epoxy resin between PVC foam sheets. Hence our requirement of maximum thickness is fulfilled without breaking composite definition.

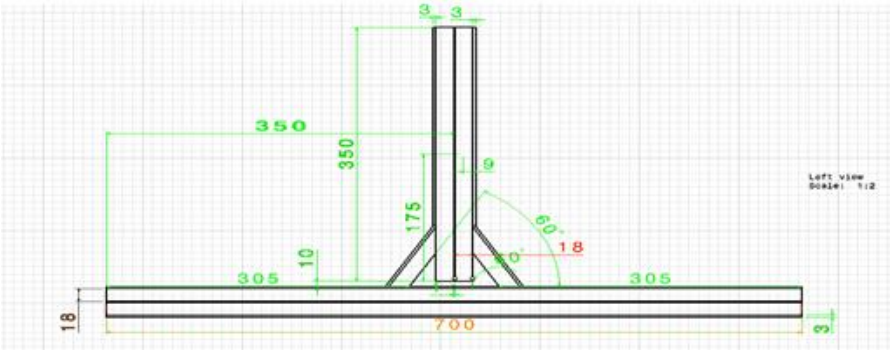


Fig. 2. Conceptual composite T- joint outline

2.1 3D Modelling of Composite T-joint

This T-joint is 3D modelled in CATIA V5 R21 with proper constraints with material properties. I have used Sketcher, Part design and Assembly for making composite T-joint with the help of CATIA software.

- Sketcher

We are used sketcher tool to sketch the T-joint. Sketcher consists of different commands like profile, rectangle, line, axis, trim, corner, chamfer etc.

- Part design

Before going on part design we need to exit workbench. After completion of sketch we used pad command to creating a pad by extruding an open or closed profile. Pad consists of different commands like as drafted filter pad, multi-pad, shaft, groove etc. We used pocket command to create pocket by removing material.

- Assembly Design

For assembly design we used the constraint tool. It consists of different constraint like coincidence constraint, contact constraint, offset constraint, fix component, quick constraint etc. We used contact constraint to make assembly of T-joint.

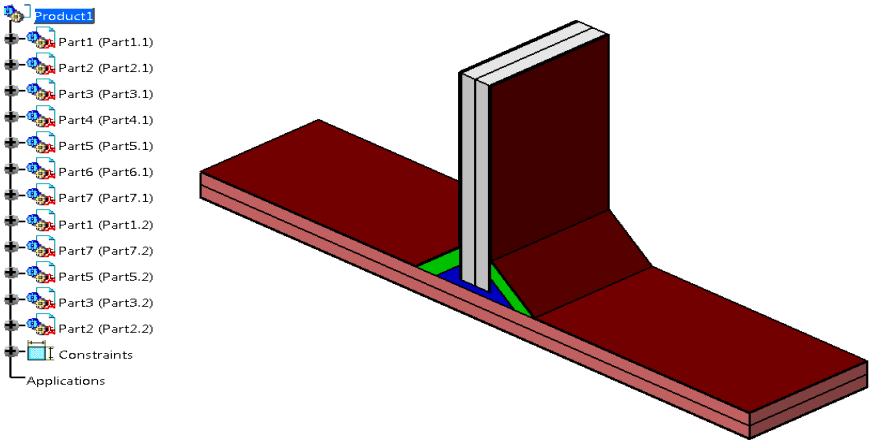


Fig. 3. 3D Modelling of Composite T-joint

III.MATERIAL SELECTION

Composite materials, often shortened to composites or called composition materials, are engineered or naturally occurring materials made from two or more constituent materials with significantly different physical or chemical properties which remain separate and distinct at the macroscopic or microscopic scale within the finished structure. Composites are hybrid materials made of a polymer resin reinforced by fibres, combining the high mechanical and physical performance of the fibres and the appearance, bonding and physical properties of polymers see figure 4.

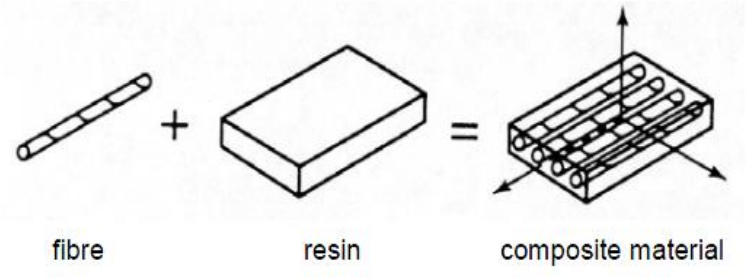


Fig. 4. Model of a perfectly bonded lamina

a) RESIN:EPOXY RESIN 520 / HARDENER EPOXY PAM

Epoxy resins are now used as binders in materials for construction. 32 Generally a two-component system containing liquid epoxy resin, diluents, fillers, thickening agents, and curing agents is used. They are used

to bond concrete, composite and to produce industrial seamless thin-set terrazzo floors. This use has been extended to the laying of roads, construction of buildings, and filling cracks in concrete structures.

Comparison of Resin Properties

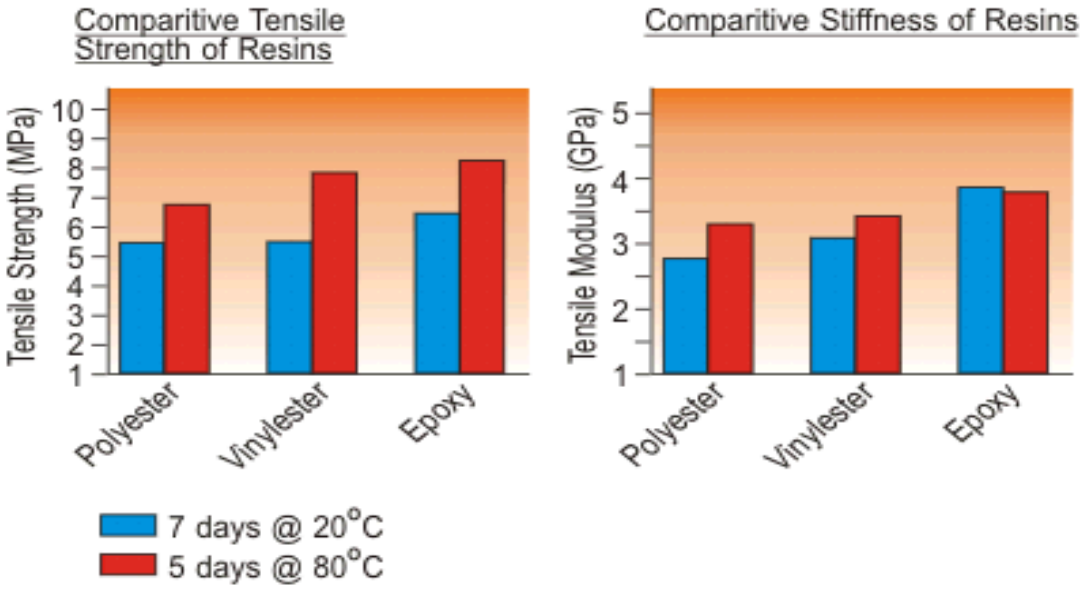


Fig.5. Comparative Tensile Strength and Stiffness of Resins

As has been mentioned previously, resin toughness can be hard to measure,but is broadly indicated by its ultimate strain to failure. A comparison between various resin systems is shown in Figure 6.

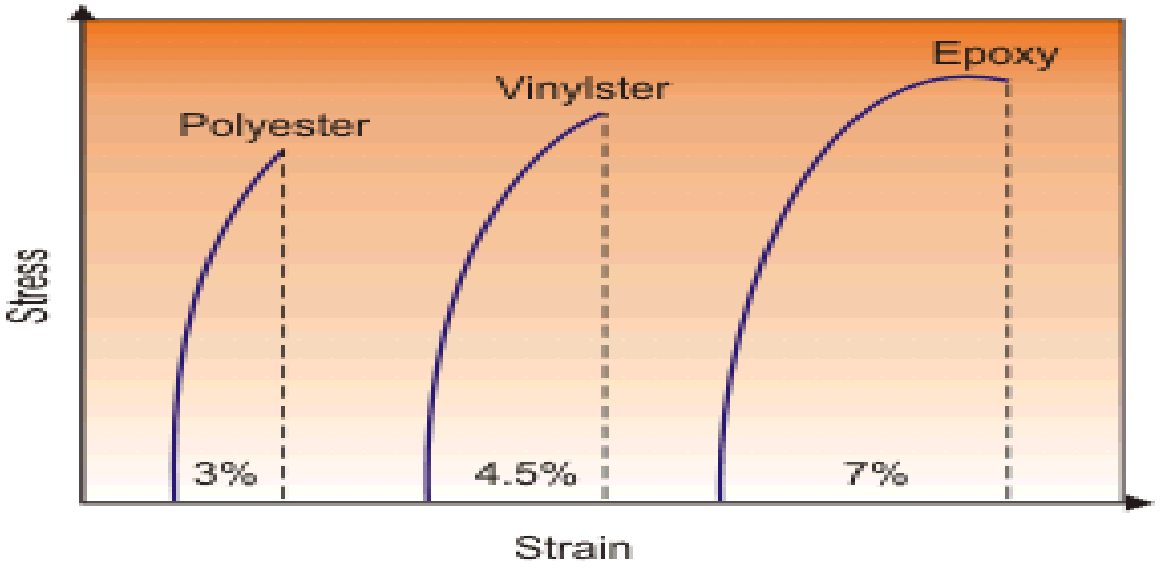


Fig.6 Typical Resin Stress/Strain Curves (Post Cure 5hrs @80°C)

b) Fiberglass

Fiberglass is a lightweight, extremely strong, and robust material. Although strength properties are somewhat lower than carbon fiber and it is less stiff, the material is typically far less brittle, and the raw materials are much less expensive. Its bulk strength and weight properties are also very favorable when compared to metals, and it can be easily formed using molding processes.

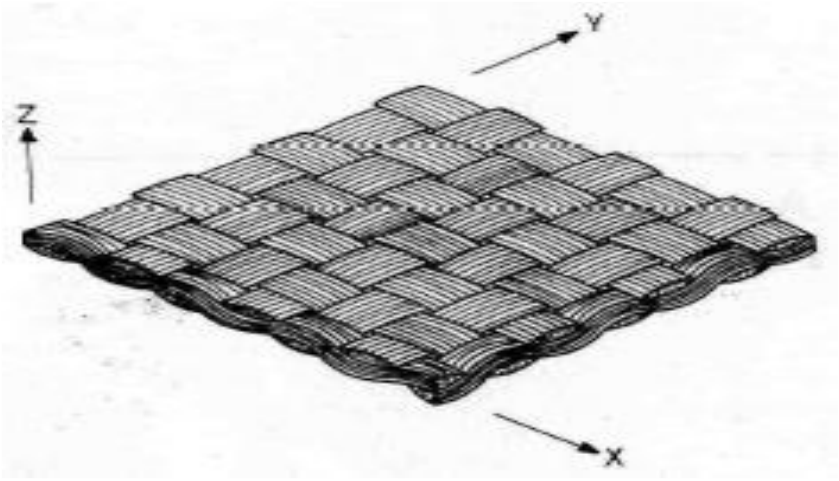


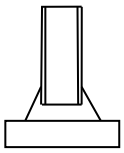
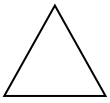
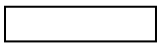
Fig.7. A general plain weave fabric lamina

c) Foam Cores

Foams are one of the most common forms of core material. They can be manufactured from a variety of synthetic polymers including polyvinyl chloride (PVC), polystyrene (PS), polyurethane (PU), polymethacrylamide, polyetherimide (PEI) and styreneacrylonitrile (SAN). They can be supplied in densities ranging from less than 30kg/m3 to more than 300kg/m3, although the most used densities for composite structures range from 40 to 200 kg/m3. They are also available in a variety of thicknesses, typically from 5mm to 50mm.

With the help of above comparison study I have choose below composite materials.

Table 1: Materials and specification of the T-joint

Sr.No.	Part Name	Materials	Dimensions	Value (mm)	Quantity	Shape
1	T-Joint	See below	Overall width Overall length Overall height Base length	150 700 400 90	-	
2	Triangular Fillets	PVC Foam	Height Angle of base	40.70 60^0	2	
3	Skin laminates	Glass Fiber	Thickness	2	4	
4	Core A and B	PVC Foam	Thickness	43	2	
5	Filler	Epoxy Resin 520	Thickness around the fillet	3	-	Liquid

IV. ANALYSIS OF COMPOSITE T-JOINT

The process methodology adopted in the static analysis of T-joint is described as follows. The T-joint is modeled in design software CATIA V5 which is compatible with the simulation software ANSYS 12.

The CAD model is imported into the simulation software. The first step is preparing a proper process plan for the analysis of the T-joint. This process plan involves building the CAD model, determining the boundary conditions, study the material properties and loading pattern. The material properties and

orientation used for each part in various computations are given in table together with description of each part. The elastic constants EX, EY, Gxy and Vxy in the local coordinate system are given together with tensile strength X and Y in the local X-direction and Y-direction respectively. The material are assumed to be linear elastic and orthotropic.

The element (PLANE82) used in the model is a plane 8 node orthotropic element with a 2 x 2 Gauss integration scheme. We used automatic mesh. The automatic mesh initially consists of approximately 10000 elements. The element side length varies from 1mm in the upper skin of panel A and the filler, to 3 mm in the core of panel A and B.

Table 2:- Material properties for each part in various configurations

Part No.	Part description	Material description	EX (MPa)	EY (MPa)	Gxy (MPa)	S (MPa)	Vxy
1	A skin bottom	Glass fiber	26,100	11,500	4,400	31.4	0.14
2	A skin top	Glass fiber	26,100	11,500	4,400	31.4	0.14
3	B skin	Glass fiber	26,100	11,500	4,400	31.4	0.14
4	A Core	PVC Foam	104	104	40	1.4	0.3
5	B core	PVC Foam	104	104	40	1.4	0.3
6	Filler	Epoxy Resin 520	500	500	170	8.7	0.47

By the finite element analysis, it is possible to understand the failure mechanisms associated with the complex structure of the T-joint by indentifying the critical points and improving them. Fig.4.1 shows the distribution of the stresses σy (in the direction of the Y-axis) for a displacement 8mm. The maximum value is located at the corner where there is a stress concentration.

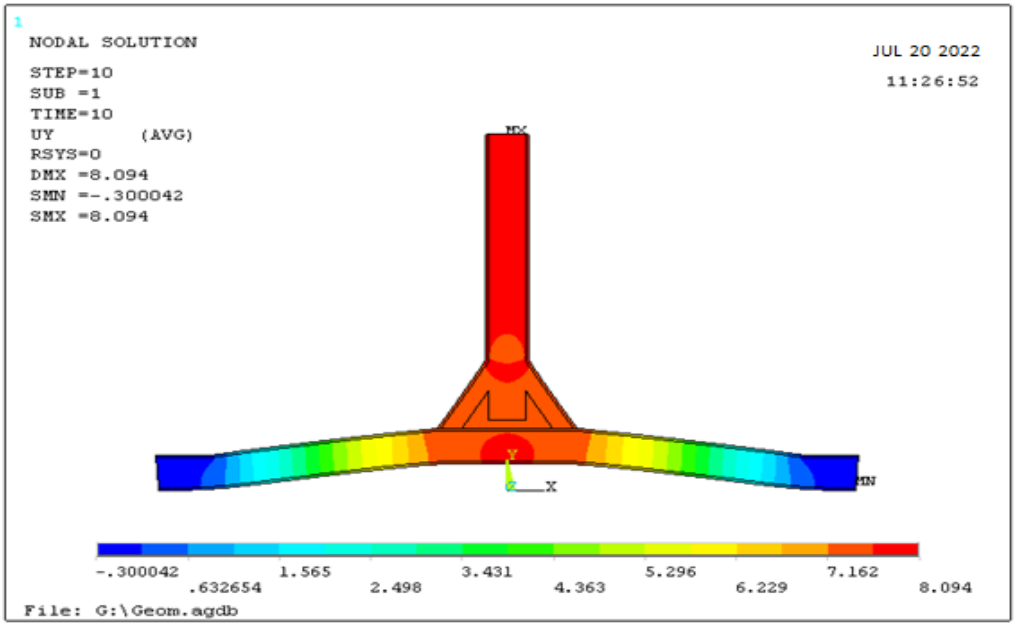


Fig.8. Deflection Plot of composite t-joint

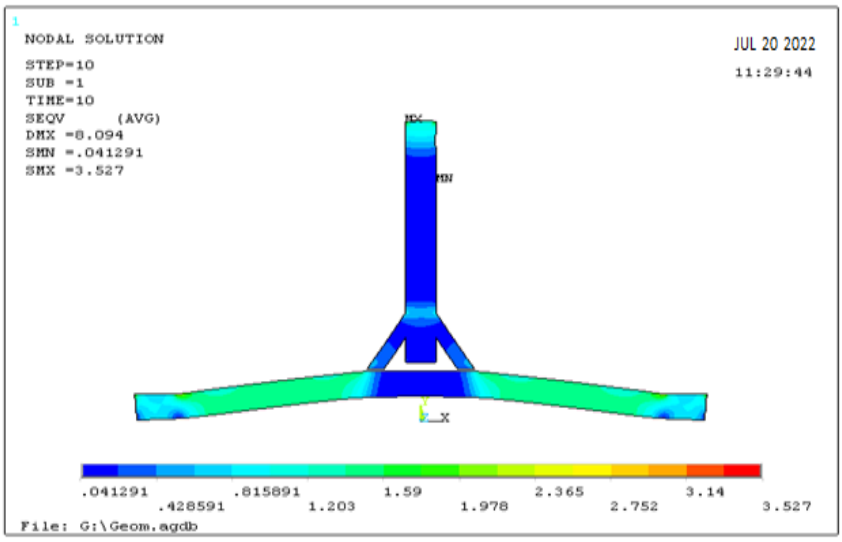


Fig.9. Counter plot example of shear stresses. Since plot were made separately for each part (to increase resolution) the counters are not comparable between parts

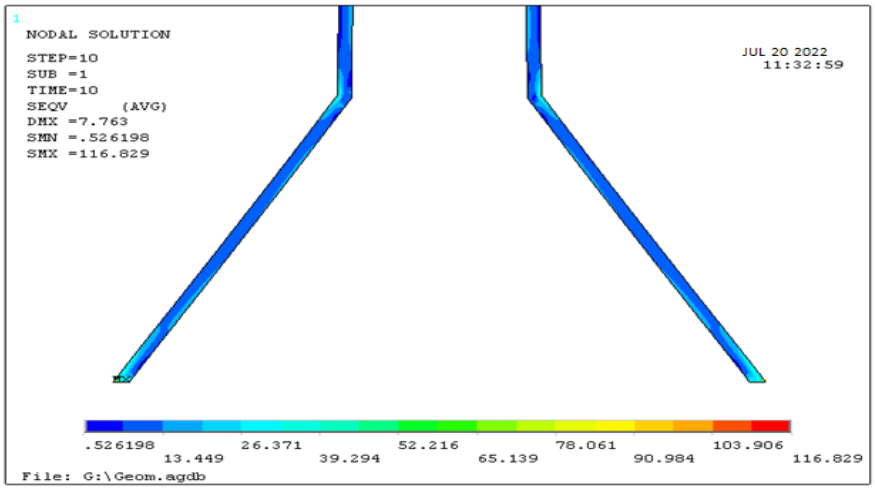


Fig.10. Von-misses stresses of fibre glass (skin)

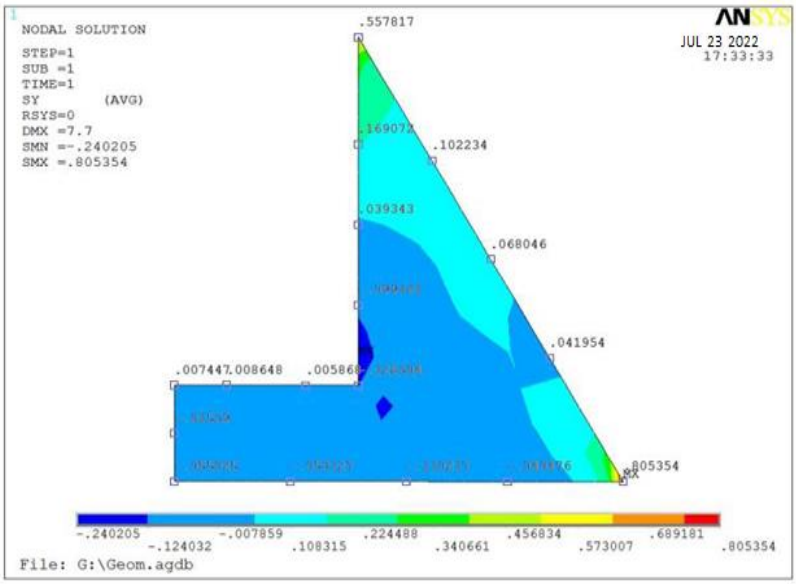


Fig.11. Nodal solution of Filler triangle

Table 3:- Shear value in X and Y direction through path and distance travelled

SY (MPa)	Sx-Yield(Mpa)	SY/SY-Yield	Distance(mm)	Path
-0.126	2.4	-0.0525	0	A
0.0058	2.4	0.002416667	4.625	
0.00864	2.4	0.0036	9.25	
0.0075	2.4	0.003125	13.875	B
-0.0154	2.4	-0.006416667	18.5	
-0.055	2.4	-0.022916667	23.5	C
-0.053	2.4	-0.022083333	28.5	
-0.1102	2.4	-0.045916667	39.75	
-0.0404	2.4	-0.016833333	51	
0.8055	2.4	0.335625	62.25	D
0.0419	2.4	0.017458333	73.5	
0.068	2.4	0.028333333	86.825	
0.1022	2.4	0.042583333	100.15	
0.557	2.4	0.232083333	113.475	E
0.169	2.4	0.070416667	126.8	
0.0393	2.4	0.016375	138.8	
-0.099	2.4	-0.04125	150.8	
-0.126	2.4	-0.0525	162.8	A

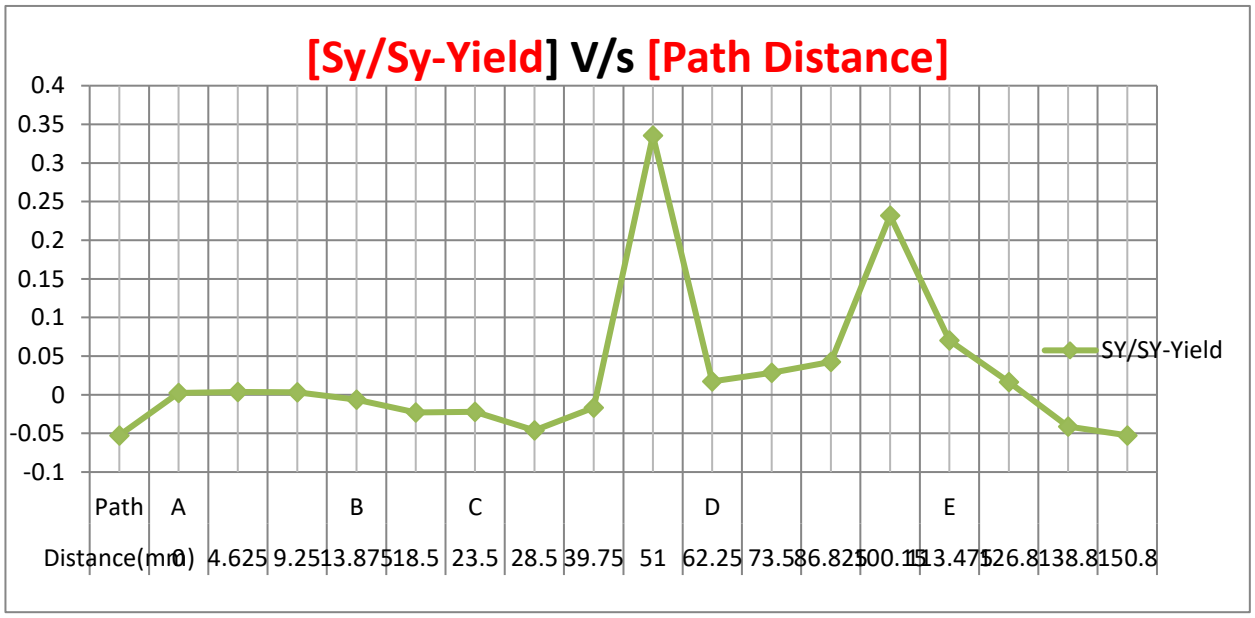


Fig. 12 sy/sy-yield V/S path distance

V. CONCLUSION

1. The lightweight T-joint is designed for sandwich panels with two sheets of 18 mm thick PVC foam core and 3 mm thick fiberglass skin laminates. The panels are joined by use of filler and two supporting core pieces of PVC foam.
2. ANSYS is used for Finite Element study of T-joint with static loading condition.

3. We have compared similar joint configurations on the basis of relative stresses in the different parts of the joint. We compared on the basis of Von Mises stress distribution.
4. It is found that both hull thickness and over laminateangle affected the critical strains in both the over laminate hull, indicating that in the design of suchjoints, these effects must be considered.
5. The load increases linearly until a load and a displacement respectively of about 1982N and 0.7mm are reached.
6. The load increases but the slope changes because the base starts to deform. a load and displacement respectively of about 19800N and are 8.4mm are reached. In this case bending of the base element is evident.

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A Brief Overview of Anti-Cancer Activity of 3, 4-Dihydropyrimidinone / Thione

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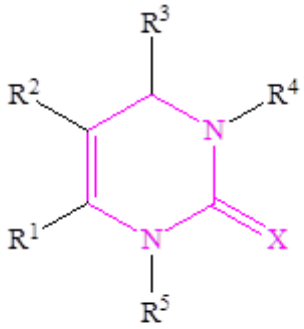
ABSTRACT

The Biginelli reaction, discovered by chemist Pietro Biginelli, has shown potential for the development of compounds with various biological activities, particularly the functionalized 3, 4-dihydropyrimidin-2(1H)-ones/thiones (DHPMs). To investigate the potential anti-cancer activity of dihydropyrimidinone derivatives containing heteroaryl moieties, we conducted a brief study that involved designing, synthesizing, and evaluating a series of compounds. This quick overview will discuss recent new and novel synthesis and the anti-cancer activity of 3, 4-dihydropyrimidinone/thione.

Keywords: 3, 4-dihydropyrimidinone/thione, anti-cancer activity, Biginelli adducts, heterocycle molecules.

I. INTRODUCTION

The year 1891 marked the discovery of a new class of heterocycle molecules called Biginelli adducts. The chemist Pietro Biginelli first reported the simple process that synthesizes organic compounds of this kind [1]. The Biginelli reaction involves the reaction of 1, 3-dicarbonyl compounds with aldehydes and (thio) urea to produce 3,4-dihydropyrimidin-2(1H)-ones/thiones (DHPMs) (**fig. 1**) [2]. Over the past decade, 3, 4-dihydropyrimidin-2-(1H)-one/thione and their derivatives have attracted significant attention in organic and medicinal chemistry as pharmacophores displaying diverse pharmacological and therapeutic properties [3-5]. Their pharmaceutical and biological activities include anti-viral [6], potent-HIV pg-120-CD4 inhibitors [7, 8], anti-cancer [9, 10], anti-inflammatory [11, 12], potent calcium channel blockers [4, 13, 14], antihypertensive [4], anti-bacterial [15, 16] and antifungal agents [16, 17].

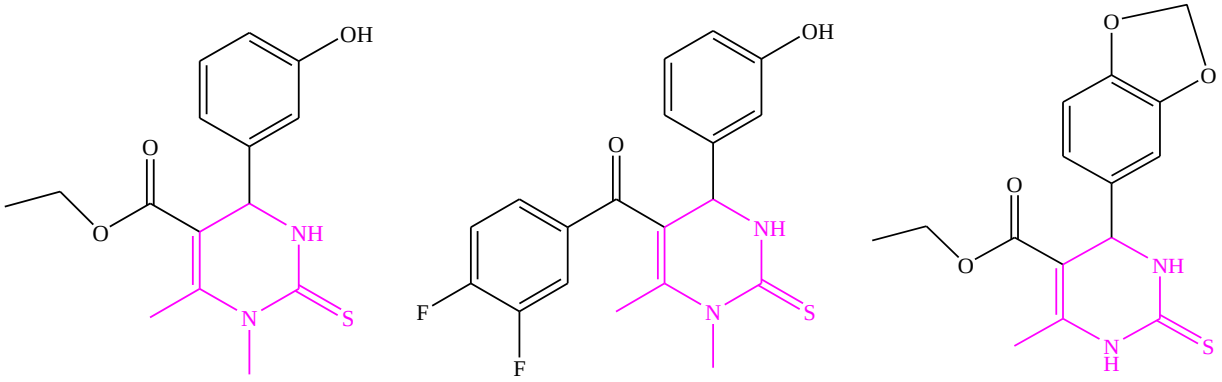


X = O or S.

$\mathbf{R^{1\text{-}5}}$ = H, Alky, Aryl, amide, ester, acyl, (thio) urea or heterocycles

Fig. 1 Basic Molecule of Biginelli Reaction

Monostrol and its analogues are a group of antihuman kinesin Eg5 inhibitors that are highly effective. They are characterised by a dihydropyrimidine nucleus [9, 18]. Monostrol, flourastrol, and Piperastrol are significant biologically active representatives of dihydropyrimidin-2-(1H)-one/thione (**Fig. 2**), used as Eg5 inhibitors and anti-cancer agents.



Monostrol **Flourastrol** **Piperastrol**

Fig. 2 Significant biologically active representatives of dihydropyrimidin-2-(1H)-one/thione

Out of the eleven synthesised monastrol analogues, Piperastrol was identified as a potent anti-cancer agent. This was based on the concentration of the adduct required to inhibit cell growth by 50% (EC_{50}, IC_{50} or GI_{50}) in various cancer cells as listed below: MCF-7 breast cancer: 1.9 µg/mL, 786-0, kidney cancer: 2.0 µg/mL, HT-29 colon cancer: 2.5 µg/mL, UACC.62 melanoma: 6.0 µg/mL, OVCAR03 ovarian cancer: 6.6 µg/mL [19-20].

The fundamental reagents used in the Biginelli reaction remain unchanged. However, the reaction conditions, reagent derivatives, and specific catalysts have been modified. Recent studies have demonstrated that these modified protocols result in higher product yields and shorter reaction times than the traditional Biginelli reaction.

DIFFERENT NOVEL REACTION FOR THE SYNTHESIS OF 3, 4-DIHYDROPYRIMIDINONE VIA THREE-COMPONENT BIGINELLI CONDENSATION WITH THEIR EFFICIENT ANTICANCER ACTIVITY

SCHEME: - 1

Synthesis of 3, 4-Dihydropyrimidinone using DMF-DMA:

In their study, Bhat *et al.* [21] successfully synthesised nine new derivatives of dihydropyrimidinone 9 with good yields. To begin the synthesis process, they obtained enaminone (II) without using any solvents by reacting 3, 4, 5-trimethoxy acetophenone (I) with dimethylformamide dimethylacetal (DMF-DMA). The final derivatives of dihydropyrimidinone were then produced by reacting the enaminone with substituted benzaldehydes, urea, and glacial acetic acid. Only compounds with 3,4,5-trimethoxy benzaldehydes displayed significant anti-cancer activity. During the apoptotic assay, necrosis was considerably increased from 1.97% to 12.18% compared to the control. Only the given compound (**Fig. 3**) showed crucial anti-cancer activity. During the apoptotic assay, necrosis was substantially increased from 1.97% to 12.18% compared to the control.

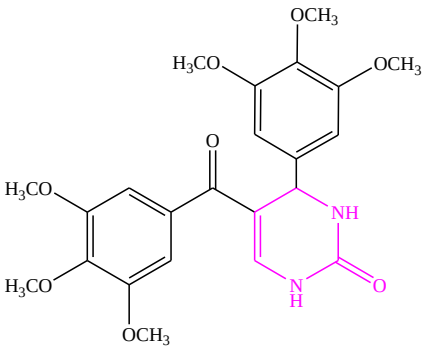


Fig. 3 Compound showing Anti-cancer activity

SCHEME: - 2

Synthesis of 3, 4-Dihydropyrimidinone using tetrabutylammonium hydroxide:

Liu and colleagues [22] showed selectivity towards gliomas. The introduction of aryl/alkyl chains in R3 and low electron-donating groups in R1 of DHPMs resulted in potent anti-proliferative activity. The in vivo efficacy study demonstrated that the compound illustrated in **Fig. 4** has potential as a lead compound in developing novel anti-tumor drugs for glioma treatment. This study can lay a foundation for the future development of DHPMs as a new anti-tumor drug.

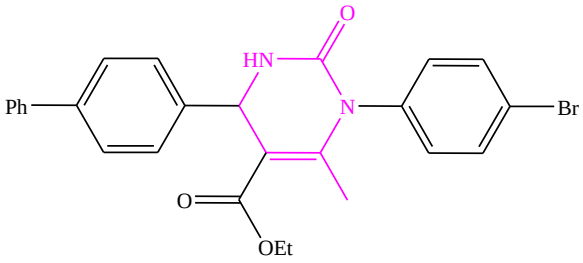


Fig. 4 The novel anti-tumour drugs to treat glioma

SCHEME: - 3

Synthesis of Acetophenone-Based 3, 4-Dihydropyrimidinone:

In a study by Saeed and colleagues [23], an Acetophenone-Based 3, 4-dihydropyrimidinone was prepared using acetone as the solvent and reagent. The self-condensation of acetone resulted in the intermediate 4-methylpent-3-en-2-one, which reacted with KSCN and 4-acetyl aniline to produce the final molecule (as shown in **Figure 5**) in a high yield of 95%. The following compound has the potential to act as a multi-target inhibitor. It has promising DNA groove-binding properties that can efficiently block DNA proliferation and cell growth.

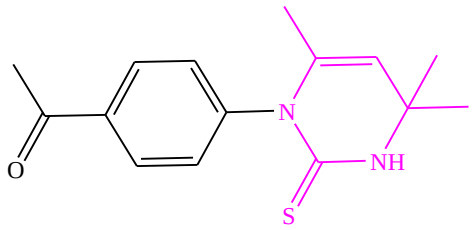


Fig. 5 Efficient block for DNA proliferation and cell growth

SCHEME: - 4

Synthesis of new 3, 4-Dihydropyrimidinone:

A new anti-cancer 3, 4-dihydropyrimidinone series bearing various heteroaryl moieties was synthesised and evaluated for activity by Amany and Khalid [24]. The following compound (**Fig. 6)** possessed the most significant activity against NCI-H460, SK-MEL-5 and HL-60 (TB) cell lines. It proved to have a dual inhibitory effect against VEGFR-2 and m TOR.

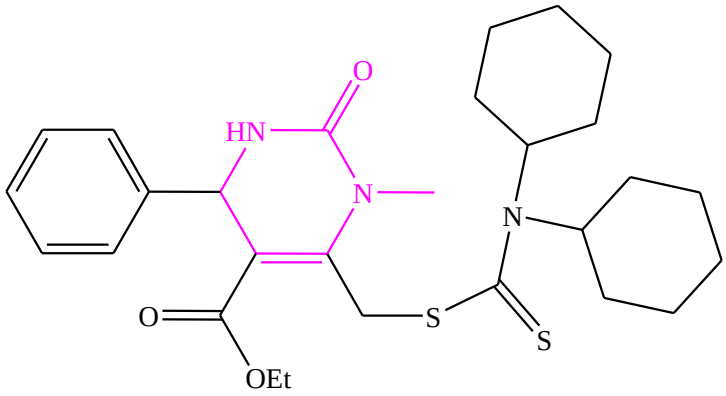
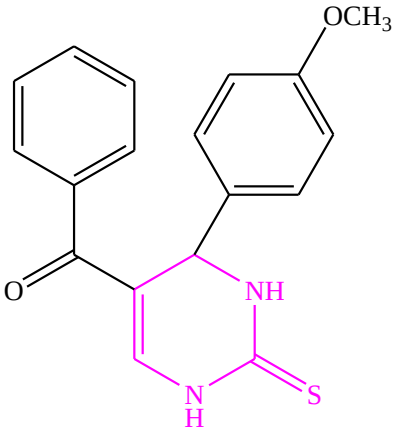


Fig. 6 Most significant activity against NCI-H460, SK-MEL-5 and HL-60 (TB) cell lines.

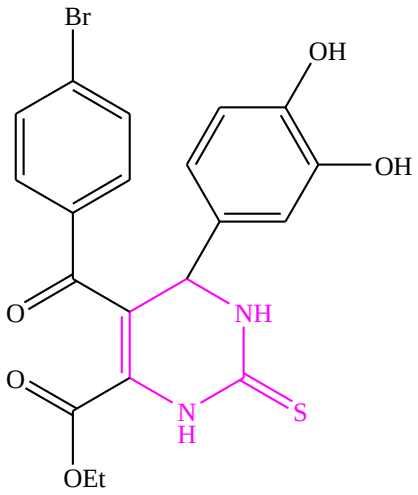
SCHEME: - 5

Synthesis of new 3, 4-dihydropyrimidines using β-aroylpyruvates as synthons:

A new synthesis of 3, 4-dihydropyrimidines was reported by Afaf El-Malah *et al.* [25]. The synthesis was achieved through a multicomponent one-pot reaction of β-aroyl pyruvates, substituted benzaldehyde and thiourea to form β-aroylpyruvates as synthons (**Fig. 7**). Most of the colon cancer and leukaemia cell lines were found to be highly responsive to the anti-tumour properties of compound 7(a). The growth-inhibiting effect of the compound was found to exceed 50% in these cell lines. Among them, the colon cancer HT29 cell line showed 53.16% growth inhibition, while the leukaemia cell lines K-562 and SR exhibited growth inhibition rates of 64.97% and 71.68%, respectively. Compound **7(a)** showed enough anti-cancer activity against colon cancer cell lines, including HCT-15, KM12, HCT-116 and SW-620, with cell growth inhibition of 49.22%, 48.55%, 38.75% and 33.42%, respectively. Compounds **7(a)** and **7(b)** displayed an extreme anti-tumour influence against UO-31, with growth inhibition of 35.64% and 24.15%, respectively.



7(a)



7(b)

Fig. 7 The *in vitro* anti-cancer activity of new 3, 4-dihydropyrimidines using β-aroylpyruvates.

II. CONCLUSION

Dihydropyrimidinones are a class of compounds that exhibit a range of beneficial biological activities, such as anti-cancer, anti-bacterial, anti-oxidant, and anti-viral effects. Here, we discussed the anti-cancer activity of the 3, 4-Dihydropyrimidinones compounds. There is a scaffold for developing a variety of novel drugs, those used for cancer treatment. The newer modified synthesis methods have significantly transformed the study and design of novel drugs from Dihydropyrimidinone derivatives. The studies that have been reported indicate that Dihydropyrimidinone derivatives are exhibiting promising activity. Hence, the optimization of Dihydropyrimidinones is paving new paths in medicinal chemistry.

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Application of Information and Communication Technology (ICT) in Textile Industries of Dhule District, Maharashtra

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ABSTRACT

ICT has been playing vital task in developed as well as emergent countries in globe. Information and Communication Technology (ICT) can increase the industrial activities along with improve competitiveness and efficiency in various manufacturing and service sector. ICT has to support increased efficiency, shrink costs, get better organizational services, reduce delays and encourage corporate social responsibility, which builds a good image in addition to improve new marketplace opportunities.

At present, adoption of Information and Communication Technology (ICT) is become increasingly more essential in textile industry. The paper determines the current situation of textile industries in ICT environment in Dhule District, Maharashtra State. It describes the implementation and utilization of ICT in various activities in textile industries in research area. The study has been collected primary data and results drawn. Simple random sampling method used to collect data. In research area, textile industries have been preferred implementation of ICT and its facilities in manufacturing process like weaving, wrapping spinning and garmenting. In textile industry use of ICT in their day to day activities such as accounting, management, administration, purchase, sales, storage etc

KEYWORDS: Information and Communication Technology (ICT), Textile Industry, Implementation of ICT, utilization of ICT Resources and Facilities etc.

I. INTRODUCTION

Today, the technology is used in every field for collection, organization, analysis, storage and diffusion of information quickly. Information and Communication Technology (ICT) is a set of technological apparatus to assemble, recognize, arrange, generate and diffusion information and data. The Information and Communication Technology (ICT) embraced telecommunication technologies like a telephone, satellite, television, cable and radio, video conferencing , mobile phones, as well as digital technology like a network , computers, internet, computer applications, world wide web, hardware etc. In other words, Information and Communication Technology (ICT) is a combination of telecommunication technologies, computer technologies and media communication technology.

Information and Communication Technology can increased business practices and improve efficiency and effectiveness in numerous manufacturing and service sector. Such as food product industry, textile industry, wood industry, paper product industry, chemical industry, leather and rubber industry, mineral products industry, machinery and equipment, metal product industry, electric machinery and equipment, transport equipment, scientific equipment, electricity industries etc.

II. APPLICATIONS OF ICT IN TEXTILES

Information and Communication Technology (ICT) is used to reduce cost, support energy consumptions, improve management services, reduced delay etc. Use of ICT resources and facilities in textile sector are as follow –

1. **Spinning and Weaving-**In spinning and weaving process ICT based Textile Network, LAN (client-server model), Sensor, Computerised Machines etc. are used for cotton mixing, carding, wrapping, yarn making and winding.
2. **Dyeing and Printing-** In dyeing and printing process various software (print pro v3.0, VYX Platinum DTG RIP PRO) are used in doubling, bleaching and dyeing process.
3. **Garmenting (Lay and Cutting)** – In garmenting process Computerised Cutting Table and Sewing Machines are used for planning, cutting, sewing etc. For designing, drawing, colouring, punching and colour filling also Computer Aided Design (CAD), CAM, and CAA, CIM, EPOS used.
4. **Other**- For administrative and organization purpose ICT is used for purchasing, selling, inventory, accounting and costing, marketing, distribution and transportation, advertising, purchase and sales, accounting and financial reporting, inventory and it's costing. For Data analysis, Office Automation, M.S. Office, Tally and MIS and other management software, SAP etc. are used.

III.LITERATURE REVIEW

1. Popli, G.S. and Rao D.N. (2009)–This study high-lightened that Government should play important and supportive role in growth and development of SME textiles. The major requirement of strong and supportive financial system and technological up-gradation. Investment should make in marketing, employees welfare, research and development etc.

2. Praveen Kumar (2011) -The present study focused on current position of textile libraries in environment availability of ICT infrastructure and e-resources in Hariyana State. With the help of questionnaire, researcher investigates well ICT infrastructure, different aspects of ICT such as internet, email, online journals, Wi-Fi connectivity, imitativeness in automation etc. Also author suggested that give attention on e-books, e-thesis, and e-newspaper etc.

3.Radhika (2013) – Researcher concludes that in today's competitive world there is a need of research and development in a new products, reduction in transaction cost, deduction in per unit costs and optimum use of raw material. Further researcher also suggested that urgent requirement of modernization, technical change, restructuring financial support, innovation required in manufacturing unit in changing scenario.

4.Veena (2014) -The researcher focus that MSME's faced number of problems like inadequate and timely supply of bank finance, difficulties in availability of raw material, marketing and distribution, difficulties in

starting new unit and availability of suitable technology etc. Also researcher find out barriers regarding labour, finance and marketing. This study was based on primary data collected from 45 textile units of Panipat District.

NEED OF THE STUDY

Research studies are done on the ICT and its utilizations in many fields like manufacturing and service sector in India, but no work has been done yet in ICT in textile industries of Dhule district, Maharashtra. The researcher tries to study the status of implementation of ICT resources and facilities used in textile industries in Dhule district, Maharashtra.

OBJECTIVES OF THE STUDY-

1. To overview the existing status of implementation of ICT in textile industries of Dhule District.
2. To study the ICT based resources and facilities in textile industries of Dhule District.

IV. METHODOLOGY

The paper determines the current situation of ICT environment in textile industries of Dhule District, Maharashtra State. It describes the implementation and utilization of ICT in various activities of textile industries of Dhule. For this study primary data has been collected and results drawn.

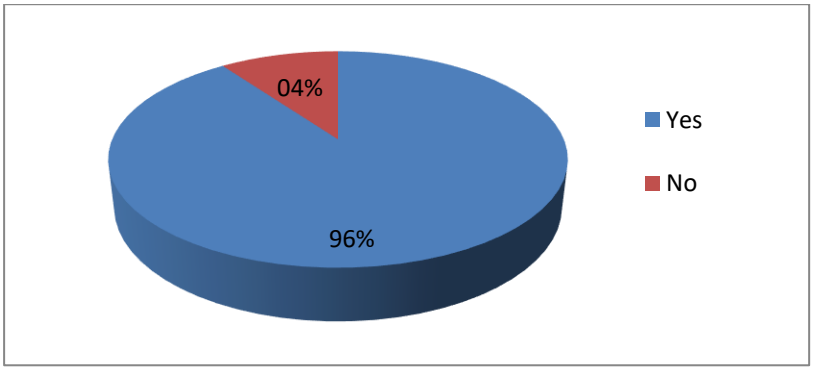
Simple random sampling method used for data collection. 14 composite textile industry and 2 spinning industry are working in Dhule District. 130 questionnaires were distributed among the respondents and 112 questionnaires were filled by respondents. In research area, textile industries have been preferred implementation of ICT and its facilities in manufacturing process like weaving, wrapping, spinning and garmenting.

Use of ICT in other than manufacturing process such as accounting, management, administration, purchase, sales, storage etc. also used.

V. FINDINGS AND INTERPRETATIONS

Awareness about Information and Communication Technology (ICT)-

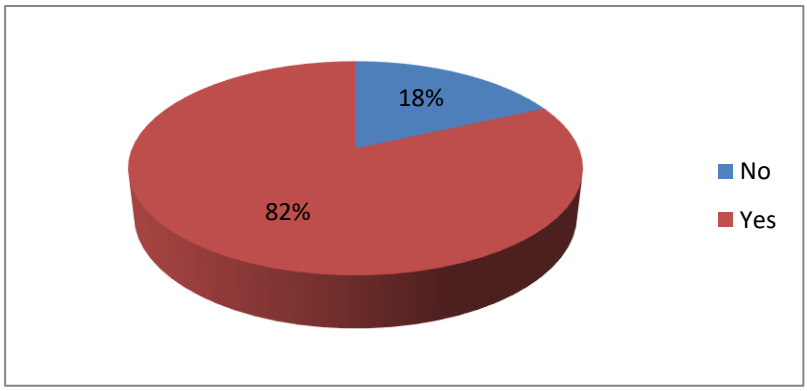
- Table shows that near about 96% respondents know Information and Communication Technology (technology), only 4% respondents don't know about ICT (technology).



(Chart No.1 Awareness about ICT)

Adoption of ICT in Textile Industry-

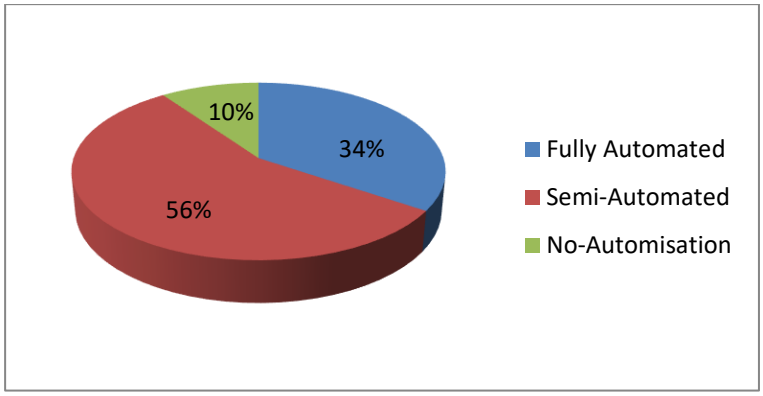
The following are the use of ICT in various activities in textile industries



(Chart No. 2 Adoption of ICT in Textile Industry)

- Chart shows that 82% respondents are using ICT to perform their daily activities of textile industry.
- Only 18% respondents are using less ICT in their day to day activities of textile industries.

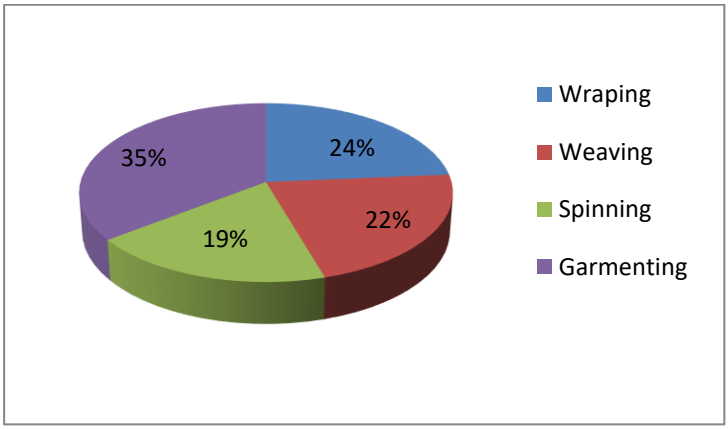
Atomization of Industry -



(Chart No. 3 Atomization of Industry)

- The chart revels that near about 34% textile industries are fully automated.56% semi-automated textile industries and only 10% textile industry are less automated.

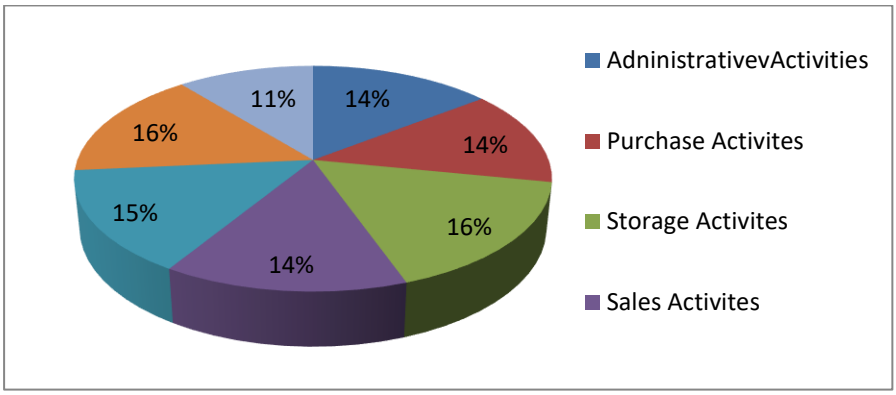
ICT Based Activities in Manufacturing Process –



(Chart No. 4 ICT Based Activities in Manufacturing Process)

- Chart shows ,24% textile industry used ICT based machineries and resources in wrapping process, 22% in weaving process,19% in spinning and 35% in garmenting process.

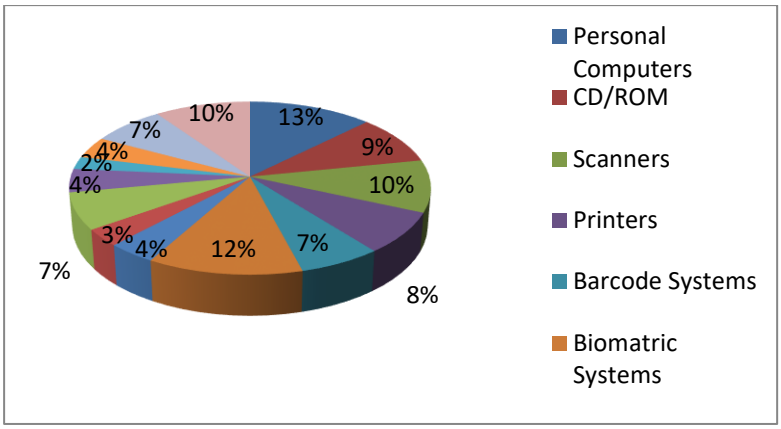
Use of ICT in other than manufacturing process-



(Chart No. 5 Use of ICT in other than manufacturing process)

- Chart demonstrates that 14% ICT is used in administrative work and 15% in financial activities.
- 14 % respondents, ICT is used in purchase activities such as for order processing and follow up.
- Results also show that 16% respondents, ICT is used in storage activities for Quality control, sampling and Warehouse.
- 14%respondents, ICI is used in selling activities. Use of ICT is done for Research and development of product, for sales, advertising and marketing.
- Only 16%respondents ICT are used for communication with employees, consumers or suppliers.
- 11% respondents, ICT based machineries are used for designing, pattern making and grading. Markers (plotter printing), planning line loading, Assembly operations, Production tracking can be done with the help of ICT based resources.

Following are the ICT based amenities helpful-

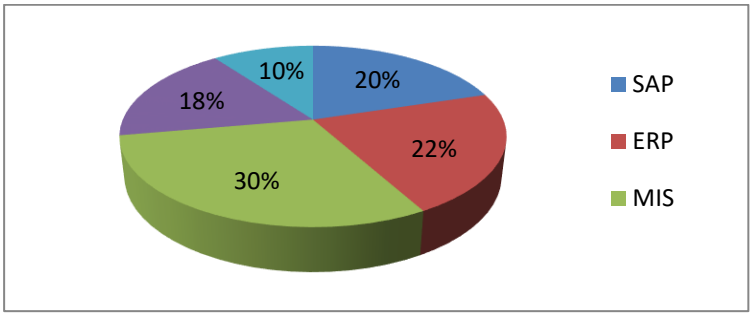


(Chart No. 6 ICT based amenities helpful)

- In textile industries of Dhule District ICT based facilities are available. This includes 13 %Personal computers are available, and 9% CD/ROM are used.
- 10% Scanners and 8% Printers are used by textile industries.Barcode system is used by7% textile industries. 12%Textile industries of Dhule district used biometric system for attendance of employees and only 4% industries use Web camera.
- 3% respondents used LCD projector while providing training to the employees.
- 7% respondents used ICT based technology used for security system.
- Instant messaging technology used by 4% and 2% used video conferencing.

- 4% respondents agree that internet connectivity is available and 7% fax machines used.10% telephones are available in textile industries.

Adoption of Software's of Textile Industry-



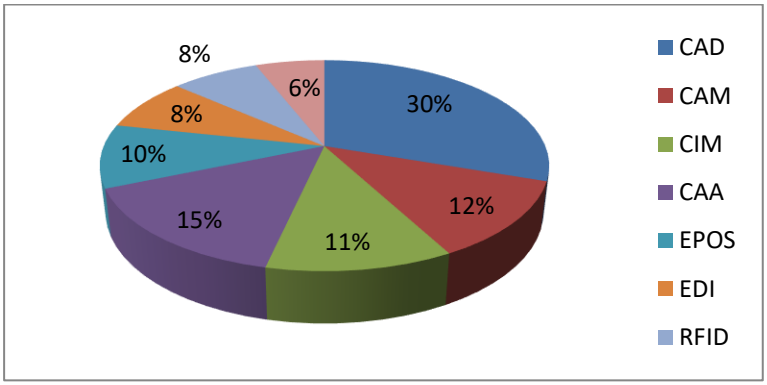
(Chart No. 7 Adoption of Software's of Textile Industry)

- In research area found 20% use of SAP.
- 22% textile industries use ERP.
- Study shows MIS is preferred for textile working environment.
- Other than above software, 18 % software such as billing software, security software, Tally software, attendance software, payroll software, etc. are used by respondents. Only 10% respondents are not using any software.

Software used in Garments units –

Maximum use of ICT in garmenting process for various purposes.

- 30% use of CAD (Computer Aided Design) for Development of Design, Pattern Creation, Pattern Grading, Lay Planning.
- 12% use of CAM (Computer Aided Manufacturer) for Design, Lay Cutting, Sewing, Pressing.
- 11% use of CIM (Computer Integrated Manufacture) for every stage of Planning, Designing, Manufacturing.
- 15% use of CAA (Computer Aided Administration) for Marketing, Sales Order Processing, Monitoring Stock Level.
- For Advertising 10 % (Promoting the product, advertising, sales channels e.g.) on TV, website/ E-tailing, E-commerce, security tagging in sales and marketing of product) Digital Printer, use of EPOS (Electronic Point of Sale) Software, it EPOS use for Sales transactions, accounts of Stock levels.



(Chart No. 8 Software used in Garments units)

- 8% Garmenting process use of EDI (Electronic Data Interchange) , 3D body scanning equipment, computerized sewing, knitting, weaving machine, Lay Planning, Designing and Digital Printer, Scanner, Digital Camera, and Production Patterns.
- In sales8% software's are used for stock control, dispatch, and in order processing. Respondents used Tagging (RFID), Stock tracking software.
- 6% use of PDM Product Data Management) Software for recording and communicating details.

VI. CONCLUSION

Now a day's Information and Communication Technology (ICT) has become integral part of human life. It reduced human efforts and time. Textile sector also use ICT. This present study demonstrates the status of ICT in textile industry in Dhule District. Many textile industries adopted the ICT in their various day to day activities. The study highlighted textile industry also are considering importance of ICT. Maximum use of ICT and ICT based resources and facilities are done by textile industry.

In research area, textile industries have been preferred implementation of ICT in manufacturing process like weaving, wrapping spinning and garmenting. Use of ICT in accounting, management, administration, purchase, sales, storage etc. also reduces the human efforts and save time.

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Plant Disease Detection System

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ABSTRACT

Plant diseases significantly impact agricultural productivity and food security. Rapid and accurate disease detection is vital for timely intervention and effective management. In this context, a plant disease detection system based on image processing and artificial intelligence has emerged as a valuable tool. This paper presents an abstract overview of a plant disease detection system that employs computer vision techniques to analyse images of plant parts, such as leaves or stems, for the early identification of diseases.

The system comprises several key components, including data collection, preprocessing, and feature extraction, machine learning-based disease classification, and a user-friendly interface for capturing and uploading plant images. It relies on a comprehensive database of labelled plant images to train machine learning models, such as Convolutional Neural Networks (CNNs), to distinguish between healthy and diseased plants. Once trained, the system can efficiently classify new images, providing users with real-time information on disease presence, type, and severity.

This innovative technology holds immense promise for agriculture, enabling farmers, agronomists, and researchers to monitor crop health, make informed decisions, and mitigate disease-related losses. Its scalability, accuracy, and real-time capabilities make it a valuable asset in ensuring sustainable agricultural practices and improving food production worldwide. The system's ability to provide timely notifications and recommendations for disease management positions it as a critical tool in addressing the challenges of modern agriculture.

Keywords: SVM (Support Vector Machine), HOG (Histogram of Oriented Gradients), Neural Networks, Random Forest Classifier.

I. INTRODUCTION

Agriculture is a cornerstone of human civilization, providing food, fiber, and resources to sustain our ever-growing population. However, the agricultural industry faces numerous challenges, one of the most significant being the presence of plant diseases that can devastate crops and reduce yields. Early detection and effective management of these diseases are crucial for ensuring food security and sustainable farming practices. This is where the convergence of image processing and artificial intelligence (AI) offers a promising solution.[1]

Traditionally, plant disease detection has heavily relied on manual, visual inspections by experienced agronomists or plant pathologists. These inspections, while valuable, are inherently limited in terms of

scalability and consistency. Furthermore, in a world striving for sustainable and environmentally friendly agricultural practices, minimizing the indiscriminate use of chemical pesticides is a pressing concern. This calls for a transformation in the methods employed for plant disease identification and management. [2]

In recent years, the fusion of cutting-edge technologies such as image processing and artificial intelligence (AI) has redefined the landscape of plant disease detection. Leveraging digital images of plant leaves and advanced machine learning algorithms, these innovative solutions offer rapid, automated, and highly accurate disease identification. They empower farmers, researchers, and agricultural stakeholders to make data-driven decisions, thereby reducing crop losses, optimizing resource utilization, and minimizing the ecological footprint of farming practices.[3]

- **Challenges in Plant Disease Management:**

Plant diseases, caused by various pathogens like fungi, bacteria, viruses, and environmental factors, can lead to substantial economic losses in agriculture. Traditional methods of disease diagnosis, primarily reliant on visual inspection by farmers or agricultural experts, can be time-consuming, labour-intensive, and error-prone. Additionally, these methods may not catch the onset of diseases in their early stages, leading to delayed interventions and the potential spread of diseases to neighbouring plants.[4]

- **The Role of Image Processing and AI:**

Plant disease detection using image processing and AI is a transformative approach that leverages advanced technologies to address the challenges in disease management.[5] Here's how it works:

1. **Image Acquisition:** High-resolution images of plant leaves, stems, or fruits are captured using cameras, drones, or smartphones. These images serve as the primary input for disease detection.
2. **Image Preprocessing:** The acquired images often require preprocessing to remove noise, enhance image quality, and correct for variations in lighting. This step ensures that the AI algorithms receive clean and standardized data.
3. **Feature Extraction:** Image processing techniques are used to extract relevant features from the images, such as color patterns, texture, and shape. These features act as discriminative factors for identifying diseases.
4. **AI Model Training:** Machine learning and deep learning models, including convolutional neural networks (CNNs), are trained on extensive datasets of labeled plant images. The AI models learn to recognize patterns associated with both healthy and diseased plants.
5. **Disease Classification:** When presented with new, unlabeled images, the trained AI model can classify plants into categories: healthy or affected by a specific disease. Some systems can even identify the specific disease type.
6. **Real Time Monitoring:** In agricultural settings, real-time monitoring using cameras or drones can enable immediate disease detection, allowing for prompt intervention.
7. **Notification and Recommendations:** When a disease is detected, the system can send notifications to farmers, agronomists, or researchers. It may also provide recommendations for disease management, including suitable treatments or actions.

- **Benefits of Plant Disease Detection with Image Processing and AI:**

Plant disease detection using image processing and AI represents a significant advancement in modern agriculture, providing a reliable and efficient tool to safeguard crop health, increase yields, and support global food production. This interdisciplinary approach at the intersection of technology and agriculture holds promise for a more sustainable and food-secure future.[6]

1. **Early Detection:** The system can catch diseases in their early stages, facilitating timely intervention.
2. **Accuracy:** AI models offer high accuracy and reliability in disease diagnosis, reducing the chances of misdiagnosis.
3. **Efficiency:** Automated systems can process a large volume of images rapidly and consistently, which is not feasible with manual inspection.
4. **Cost Savings:** It can lead to cost savings for farmers by reducing manual labor and optimizing the use of pesticides.
5. **Data Insights:** The data generated can be valuable for research and analysis, aiding in the study of plant diseases and agricultural practices.
6. **Sustainability:** By reducing the use of pesticides and enhancing disease management, it contributes to more sustainable and environmentally friendly farming.

II. METHODS AND MATERIAL

a. **Image Acquisition or Data Collection:** The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement.[7]

A dataset of images of tomato plant leaves including both healthy and diseased samples were captured using a digital camera. The images were captured during daylight hours when lighting conditions were optimal. Special care was taken to minimize shadows and ensure accurate colour representation. Images are captured at high resolution to capture fine details of leaves. Each image was tagged with metadata, including the date, time, and location of the field. This metadata helps track the progress of the growing season and disease development.

b. **Image Preprocessing:** Once the images are acquired, preprocessing methods are applied to enhance the quality and consistency of the images. It is among rapidly growing technologies today, with its applications in various aspects of a business. Image pre-processing forms core research area within engineering and computer science disciplines too. Image pre-processing basically includes the followingthree steps:[8]

i. Importing the image with optical scanner or by digital photography.
ii. Analysing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
iii. Output is the last stage in which result can be altered image or report that is based on image analysis.

Acquired images were stored in the local hard disk and image preprocessing techniques were applied on it to remove noise and emphasize fine details.

c. **Labelling:** Labelling refers to the process of associating each pixel or region in an image with a specific class or category.This is a crucial step in supervised machine learning algorithms. Collected images were annotated with labels as healthy or unhealthy for supervised learning.

d. **Feature Extraction:** Feature extraction involves identifying relevant visual features in the images that can help distinguish between healthy and diseased plants. Common features include:

i. **Color Features:** Measuring color characteristics, such as color histograms or color channels.

ii. **Texture Features:** Analyzing textural patterns, which can be indicative of certain diseases.

iii. **Shape Features:** Examining the shape or structure of plant parts, such as leaves or lesions.

Feature extraction is a dimensionality reductionprocess, where an initial set of raw variables is reduced to more manageablegroups (features) for processing, while still accurately and completelydescribing the original data set. Determining a subset of the initial features is calledfeature selection. The selected features are expected to contain the relevantinformation from the input data; so that the desired task can be performed byusing this reduced representation instead of the complete initial data.[9]

Histogram of Gradients (HOG) feature extraction technique was used for object detection and recognition using Convolution Neural Network (CNN) to extract features.

e. **Model Training and Evaluation:** The dataset was split into training set, validation set and testing set to train the model. Convolution Neural Network (CNN) was the machine learning model selected for image-based classification of disease detection. The model was then trained on the training dataset so as to recognize and learn the patterns and features of healthy and diseased plants. Then the validation dataset was used to fine tune the model and optimize hyperparameters.The model's performance was assessed on the testing dataset.

III.RESULTS AND DISCUSSION

The main aim of our project is to detect whether it is diseased or healthy leaf. The objective of this algorithm is to recognize abnormalities that occur on plants in their greenhouses or naturalenvironment. The image captured is usually taken with a plain background toeliminate occlusion. The algorithm was contrasted with other machinelearning models for accuracy. Using Random Forest classifier, the model was trained using 160 images of tomato leaves. The model could classify withapproximate 70 percent accuracy. The accuracy can be increased when trainedwith vast number of images and by using other local features together with theglobal features such as SIFT (Scale Invariant Feature Transform), SURF(Speed Up Robust Features) and DENSE along with BOVW (Bag of VisualWord). There are many methods in automated or computer vision plantdisease detection and classification process, but still, this research field islacking. In addition, there are still no commercial solutions on the market, except those dealing with plant species recognition based on the leaf's images.

IV.CONCLUSION

The main aim of our project is to detect whether it is diseased or healthy leafwith the help of a Random Forest classifier. The objective of this algorithm is to recognize abnormalities that occur on plants in their greenhouses or naturalenvironment. The image captured is usually taken with a plain background toeliminate occlusion. The algorithm was contrasted with other machinelearning models for accuracy. Using Random Forest classifier,

the model was trained using 160 images of papaya leaves. The model could classify withapproximate 70 percent accuracy. The accuracy can be increased when trainedwith vast number of images and by using other local features together with theglobal features such as SIFT (Scale Invariant Feature Transform), SURF(Speed Up Robust Features) and DENSE along with BOVW (Bag of Visual Word).

There are many methods in automated or computer vision plantdisease detection and classification process, but still, this research field islacking. In addition, there are still no commercial solutions on the market,except those dealing with plant species recognition based on the leaf's images. Drone photography allows images and audio/video to be captured that might not be otherwise possible for human photographers and videographers. Capacity can be enabled by the flight abilities of drones, their small size or their ability to tolerate harsh environments.

Future enhancement for this project is to implement a cloud storage in order to consists of the results of plant disease defect detection which has to be sent to the farmers so as to they can use the right fertilizers for that particular disease.

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A Study of E-Recruitment : From the Perspective of the Job Applicant

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ABSTRACT

E-Recruitment is the current trend in the recruitment process and it has been adopted by many large and small organisations as the role of human Resource manager in the recruitment process is changing, with line managers becoming more involved in dealing with specific job openings and human resource manager taking on a more co-ordinating and strategic role. Increased use of e-recruitment methods and systems is helping to facilitate this trend by eliminating much of the routine administrative work involved in recruiting and allowing human resource manager to more easily monitor and track recruitment related activities. E-Recruitment has great potential to any organization as it's up to date recruiting method provides current information; open up geographical borders searching for talents and is time and cost saving.

The study reveals that the use of e-recruitment have made easy for the job applicants to search and find an appropriate job that meets their expectations. Further it also reveals that the most important attribute encouraging job applicant to apply on-line is a strong organisational culture which allows potential applicants to assess their fit with companies' culture and good reputation.

Keywords: e-recruitment, job portals, organizational culture, database management, job aspirants.

I. INTRODUCTION

In an organization, human resources are the most important assets and play a vital role in the its progress. The success or failure of an organization is dependent on the caliber of the employee working in the organization. Without creative work and positive contributions from employees, organizations cannot progress. Therefore, there is a need of the recruitment and selection process in the organization. The word recruitment means the right person for the right job, according to their skills and qualification. In the age of technological development all the work has to be done with the help of internet. Everything, including our way of thinking, living, communicating, culture, economies, demographics and even society has been affected by these technological changes. Changing technologies have changed the work of the life. In the organization, there is always a requirement for the trained and expert employees. E-recruitment is the use of technology to assist the recruitment process. In the traditional way, the process of the recruitment is different and in the modern way e-recruitment process is transformed in the organization. Now there are different networking sites that recruit the skilled employees into the organization, for e.g. Nakuri.com, Monster.com, Shine.com, fresher's world, Times jobs, LinkedIn, Free jobs alerts, etc. have become the important source of getting the good resources for

the employees and organization. These are the best job portals of our nation which helps the people in their recruitment process in the organization as the area is broader for choosing the right candidate for the right job.
Different authors have given various definitions regarding e-recruitment; some of them are given below: According to Edwin B. Flippo (1979) "recruitment is the process of searching the candidates for employment and stimulating them to apply for jobs in the organization".
E-recruiting is using the internet to recruit through corporate websites, specialized websites or online advertisement, according to Galanaki (2002).
Raymond J. Stone (2005) in the fifth edition of his book Human Resource Management defines recruitment as the process of seeking and attracting a pool of applicants from which qualified candidates for job vacancies within an organization can be selected.
Parry & Wilson (2009) stated that recruitment includes those practices and activities carried out by the organization with the primary purpose of identifying and attracting potential employees.

II. LITERATURE REVIEW

Fred and Kananga (2016) explored the current e-recruitment activities adopted by the organization; e-recruitment process has an impact on organization, efficiency and performance of e-recruitment process in the organization. The HR department manages the workforce diversity in culture, time zones, expertise, benefits and compensations. The study was based on secondary data which was collected through books internet and scholarly articles. This study found that businesses appear to be concerned quality oriented, competent candidate for vacancies that mainly focus on the cost. Interest to third parties play an active role in the recruitment process such as recruitment agencies and head hunters. E-recruitment adds to efficiency, effectiveness of the recruitment process and increases performance for organizational recruiting, specific internet recruitment methods attribute to the organizational developments.
Nasreem et al. (2016) identified the sources mostly used for e-recruitment by Small and Medium Enterprises (SMEs) of Industry, level of management positions for which e-recruitment is preferred by IT, evaluated the e-recruitment outcomes in terms of advantages mostly enjoyed by IT industry SMEs of Pakistan. They compared the views of male and female recruiters, differences and identified the disadvantages of IT industry SMEs about the e-recruitment outcomes in Pakistan. The study found that most of the organizations were currently using both e-recruitment and traditional recruitment sources for their recruitment function in Pakistan and IT based organizations are still reluctant to fully rely on the electronic recruitment. Also, it was found that study reveals the majority of respondent organizations do e-recruitment to fill all the top, middle and lower level positions by using all three sources (own websites, commercial jobsites and social networking sites).
Ahlawat and Sangeeta (2016) explored the different sources of e-recruitment in the organization like ease of use for the organization, increasing the speed to hire, keeping ahead of competitors, cost savings, to ease of use for candidate, to provide large candidate pool. This study was a set of comprehensive overviews of e-recruitment, also to see the benefits and challenges of using e-recruitment technologies. The organization could use internet based system to track and manage candidate's application, that provide significant benefits in the term of efficiency, cost and capability to monitor on recruitment activities.
Sherkar (2015) identified the various e-resources available to assist the recruitment and selection process in hotels, the advantages of e-resources and check the efficacy of e-resources in recruitment & selection. Simple random sampling was used. The study covered the hospitality industry for the five stars, four star, three-star

and budget hotels. The author suggested HR should identify suitable e-resources for recruitment in the top management cadre, and e-resources should be used predominantly for attracting talent and for simplifying the recruitment process. The utilization of e-resources in recruitment and selection can be increased to achieve desired results.

Kaur (2015) focused on the criteria for effective e-recruitment, methods, trends of e-recruitment and benefits & drawbacks of the e-recruitment. The research methodology was exploratory and qualitative. Secondary sources of data were taken from various journals, articles, and research papers. The author suggested traditional method should not be replaced by the e-recruitment, it should supplement and cover the traditional method and recruitment process will be faster and time saving. No doubt there has been a paradigm shift in the recruitment process by companies and the credit goes to the value, efficacy and ease of using career site.

Ozuru and Chikwe (2015) investigated the successes associated with adopting electronic recruiting strategy by corporations in Nigeria. This study adopts the documentary and survey methods, tools adopted Spearman rank order correlation and Pearson product moment correlation. The study found that there was a significant relationship between relative advantage and website design; significant relationship between web design and complexity on corporate adoption in Nigeria and that indicated an influence on the relationship between e-recruitment strategy and corporate adoption in Nigeria. This study suggests that there should be diffusion study of e-recruitment to identify the underlying determinants of the level of acceptance of the technology by the corporations in Nigeria.

III. BENEFITS OF E-RECRUITMENT IN THE ORGANIZATION

There are many benefits to be had by online recruiting. They are given below

1. **IT's cost effective** Placing job advertisements on the internet is a lot cheaper than placing them in newspaper, magazines and other media. Using social media like facebook and twitter can even make publicizing a position an essentially free exercise for companies web site where candidates can view the job specs, input their CVs, apply and follow up.
2. **Clear communication** Press insertions have word and space limits that can lead to unclear message. On the internet, there is no word limitation and all relevant details can be expressed unambiguously. In addition, the automated application process can immediately provide feedback to candidates who are under qualified or not suitable for the position.
3. **Improved standardization and compliance** The information provided by candidates is obtained in a standard, uniform format, which facilitates easy comparison. This allows for more objectives adjudication of candidates in order to compile shortlists, and provides an auditable data trail, which assists with regulatory compliance.
4. **Faster time** to appointment Automating recruitment administration, like posting a job opening complete with all the specification on the internet, takes only a few minutes. Delivery time and response time are immediate. The prospective candidates can visit the company site, post their CVs and expect responses through e mails. As mentioned above, e recruitment can also cut out all non-appropriate candidates automatically, producing a shortlist with minutes, rather than days of time.

IV. IMPACT OF E-RECRUITMENT ON THE EMPLOYEES

Impact on employee's satisfaction:

Employees are satisfied while adopting the e-recruitment process because internet is a best source of finding the job as compared to newspaper, friends and any other source. In this way internet help in the career development path for the recruitment in the different organizations.

Galanki (2002) established the connection between the employee's satisfaction and online recruitment practices.

Cober (2003) examined effects of usability that perceptions of online system usability are positively related to employee's satisfaction with online recruitment and time spent using the system.

Sylva (2009) in a research done on Online Application System found that features of the website, perceived efficiency and user-friendliness, were by far the most important determinants of applicant satisfaction.

Impact on performance of the employees: Impact of e-recruitment on the performance of the employees is good because it saves the time, easy to use, opportunities for the development, work life balance, online assessment, interview and improves the employee's performance. E-recruitment has a positive impact on the performance of the employees. Tong and Sivanand (2005) confirmed that e-recruitment emerges as a handy and advantageous method over traditional methods of recruitment. According to the authors, advancement of technology and approaches facilitates the processes and operations of companies and enhance their performances. Plessis and Frederick (2012) suggested that efforts should be made to allocate the funds to measure the performance e-based systems.

Better chance of success**:** using the e-recruitment process employees has a better chance of success;employee's performance is better using this technological aid. 24 hour resources are available.They motivated the employees for their success and development.

Ease of use: Impact of e-recruitment on the employees is ease of use. E-recruitment is not only helping employees in the private sector but also the organizations in public sectors. Candidates send resumes to the central database; the system then filters the application and sends it according to their needs.

V. CHALLENGES OF E-RECRUITMENT

Traditional recruitment method have been replaced by the online recruitment or e recruitment with the entry of internet. Most of the small and large scale organizations are adopting to the e recruitment process. But in this process the e recruitment face many challenges in the organization manner. The main challenges are explained given below

1. **Managerial challenges**: The managerial challenges are listed as follows.

- Any technology would remain unused without user acceptance. It is important that hiring and recruiting managers are knowledgeable and comfortable about the use of online recruiting methods. Organizations must hence conduct a comprehensive training program for HR managers to help them use the e recruitment tool without any difficulty.
- The use e recruitment method has not put an end of the use of other recruitment methods such as employees referrals, newspapers, ads etc..given the limited financial resources, finding the optimal mix of various recruitment methods is a challenge for human resource managers.

2. Organizational challenges

- Most qualified applicants are often passive job seekers, who are presently employed but may be interested in new job opportunities. A strategy to recognize passive job seekers and motivate them to apply must be developed.
- Business process redesign is needed across the whole process of human resource management to realize the online recruitment benefits (taylor,2005) .

3. Technical challenges

•Lack of confidentiality and security of information discourages the posting of job applications by job seekers. While security is one of the biggest challenges with job applicants, top most companies do not specify it explicitly on the career websites.

• Combining the process online recruitment with process of conventional recruitment is critical due to limited availability of software resources. Paper based resume must be converted into a digitized form and stored in the database.

VI. 6. SUGGESTIONS

The company can give more job offers to the employees to take them to the desired level and the recruiter can increase the information about the job vacancy and position. That may create sufficiency to the job seekers. The job sites have to give assurance and trustworthiness for personal information of the job seekers and assured that the applications and data uploaded in the job sites are accessible only by the recruiters and by applicants, It should not shown to others. The company can give internet services to reduce the expenses and cost of internet connection to the employees. These things can took the recruitment process of the company to the next level.

VII. CONCLUSION

The was good in their recruitment process. The expenses and trustworthiness of the E-Recruitment was in a satisfactory level. The present condition of electronic recruitment was too good and the job seekers are utilising to take them to a desired level. Electronic recruitment has changed the way jobs are applied for and has become so simple that anyone can do it.

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Interaction of SO_2, CO2 & CO Molecules with Doped Carbon Nanotubes : A DFT Study

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ABSTRACT

This research embarks on a theoretical exploration employing advanced computational methods to elucidate the interactions between boron-doped carbon nanotubes (B-doped CNTs) and diatomic molecules, notably sulfur dioxide (SO_2), carbon dioxide (CO2), and carbon monoxide (CO). In our study, we specifically examined the effectiveness of boron-doped carbon nanotubes (B-doped CNTs) in removing sulfur dioxide (SO_2), carbon dioxide (CO2), and carbon monoxide (CO) from gas mixtures. Additionally, we observed a notable transfer of electric charge from SO_2, CO2 & CO to the boron-doped CNTs during the adsorption process. The Density of States (DOS) and adsorption energy analyses. DOS calculations afford us a deeper comprehension of the electronic structure of B-doped CNTs and the energy distribution of adsorbed SO_2, CO2 &CO molecules, shedding light on the evolution of the nanotubes' electronic properties during adsorption and elucidating the intricacies of chemical bonding. Crucially, assessing adsorption energy, a key parameter, reveals a strong binding affinity SO_2, CO2 &CO B-doped CNTs. This underscores the potential of these doped nanotubes as highly efficient sorbents for the capture and storage of these gases. The implications of our insights extend to practical applications, including carbon capture and gas separation processes, thereby underscoring the substantial promise of B-doped CNTs in addressing pressing environmental challenges.

Keywords: Carbon Nanotubes, boron-doped CNTs, Sulfur dioxide (SO_2), Carbon dioxide (CO2), Carbon monoxide (CO)

I. INTRODUCTION

Toxic gases, such as sulfur dioxide (SO_2), carbon dioxide (CO_2), and carbon monoxide (CO) are known to be severe threats to both human health and the environment. As a result, there is a pressing need for the development of efficient gas sensing and removal technologies to combat the detrimental effects of these pollutants. In recent years, carbon nanotubes (CNTs) have emerged as a class of nanomaterials with exceptional properties and extensive potential for a wide range of applications. The graphene sheets known as carbon nanotubes (CNTs) have a diameter of nanometers and a length of micrometers. Carbon atoms are organized in a hexagonal lattice to form cylindrical, one-dimensional nanostructures known as carbon nanotubes (CNTs). Their unique cylindrical lattice structure composed of carbon atoms grants them extraordinary strength, electrical conductivity, and thermal properties, making them the focus of intensive research and innovation in

various fields, including materials science, electronics, and energy-related technologies. Our understanding of CNTs has been deepened over time and can harness their extraordinary attributes for practical use. The adsorption of toxic gases in CNTs is a complex process that involves interactions at the nanoscale. Gas molecules sit on the CNT surface through physisorption or chemisorption processes. In recent years, carbon nanotubes which are particularly doped with other elements, have become the subject of research with a primary focus on the adsorption and removal of toxic gases such as sulfur dioxide (SO_2), carbon dioxide (CO_2), and carbon monoxide (CO). These gases are leading pollutants with significant harmful effects on air quality, public health, and the environment. To gain a deeper understanding of the mechanisms and energetics of the adsorption processes involving CNTs and toxic gases, researchers have turned to Density Functional Theory (DFT), a powerful computational tool. DFT enables precise calculations of adsorption energies, binding energy, and electronic structures, which are essential for understanding the interactions between CNTs and toxic gases.

Recent research in this field shows significant findings. For example, a study conducted by Hossein Tavakol and Hamed Haghshenas in 2021, titled "A DFT Study on the Interaction of Doped Carbon Nanotubes with H_2S, SO_2, and Thiophene," [9] employed DFT calculations to gain insights into the adsorption mechanisms, energetics, and charge transfer processes associated with these interactions. The study focused on the interactions of CNTs with SO_2, aiming to provide a deeper understanding of how doped CNTs can be potentially used in applications related to gas sensing, environmental remediation, or materials science. This research contributes to the growing body of knowledge surrounding the utilization of CNTs for sulfur-containing gas adsorption and may have implications for environmental and industrial applications.

This research engages in a theoretical exploration using advanced computational methods to clear the interactions between boron-doped carbon nanotubes (B-doped CNTs) and diatomic molecules, notably carbon dioxide (CO_2), sulfur dioxide (SO_2), and carbon monoxide (CO). The significance of the investigation as they bear the potential to combat air pollution and reduce the concerns associated with greenhouse gas emissions, both of which have global complications. In the ongoing quest for innovative materials capable of capturing and reducing harmful gases from the atmosphere, carbon nanotubes have surfaced as promising candidates due to their distinctive properties. Our study theoretically demonstrates that boron-doped carbon nanotubes (B-doped CNTs) have exceptional promise in adequately removing carbon dioxide (CO_2), sulfur dioxide (SO_2), and carbon monoxide (CO) from toxic gasses. The introduction of boron significantly increases CO_2 adsorption, contributing to more effective greenhouse gas reduction.

Crucially, the assessment of adsorption energy, a key parameter, reveals a strong binding affinity between CO_2, SO_2, CO, and B-doped CNTs. The potential of these doped nanotubes as highly efficient sorbents for the capture and storage of these gases. The implications of our understanding of the extent of practical applications, including carbon capture and gas separation processes, B-doped CNTs promise to address pressing environmental challenges. As the global focus on air quality and environmental sustainability increases the research into CNT-based materials for removing toxic gases also expands. Currently, the efforts are directed toward increasing the efficiency, selectivity, and scalability of CNT-based adsorption systems and toxic gas removal.

II. COMPUTATIONAL DETAILS

In the realm of computational calculations, Density Functional Theory (DFT) [15, 16, 17] stands as a cornerstone technique for probing the intricate details of the material systems. DFT leverages the principles of

quantum mechanics to provide a comprehensive understanding of the electronic structure, energetics, and properties of a wide array of material systems. By solving the Schrödinger equation through the electron density, DFT affords researchers a powerful tool to explore the behavior of electrons and atoms in various contexts. As computational methods have advanced, DFT has evolved to become increasingly accurate and versatile, rendering it indispensable in the study of diverse systems. In this study, we focus on a specific application of DFT, where we employ it to investigate the electronic structure and properties of materials. Through DFT simulations, we aim to elucidate the electronic properties and structural stability of these materials, ultimately contributing to the ongoing efforts to advance renewable energy solutions.

All the calculations have been performed in the DMol³ package [1, 2, 3]. The geometry optimization of structures was performed using the Perdew-Wang function within the framework of local density approximation (LDA-PWC) [4, 5, 6, 7, 8]. The polarization function (DNP) and double numerical basis sets were used for all-electron calculations. On an atomic-centered spherical-polar mesh, all electron Kohn Sham wave functions were enlarged in the local atomic orbital basis set. With 64 atoms in the supercell, all computations were done with periodic boundary conditions. The lattice parameter (along the x, y, and z axes) is cubic supercell 16 Å×18 Å×8.52 Å dimensions. There isn't any contact between the surrounding cells because of this considerable distance. SCF convergence of 1×10^{-6} eV. The Brillouin zone sampling was approximated by 1 x 1 x 2 special k points Monkhorst-pack Scheme.

E_b= - [E_T (adsorbent + adsorbate) – E_T (adsorbent) – E_T (adsorbate)] gives the binding energy (E_b) of all ground state structures. Here, E_T (adsorbent + adsorbate) represents the total energy of the molecule and CNT system, E_T (adsorbent) represents the total energy of CNT, and E_T (adsorbate) represents the total energy of the isolated gas molecule.

Binding Energy = $E_{(SO_2\text{-B-CNT})} - E_{(B\text{-CNT})} - E_{(SO_2)}$

We have calculated the binding energy of carbon nanotubes (CNTs), the density of states, and the band gap, which are equivalent to the reported results, to confirm the computational accuracy of the model.

III.RESULTS AND DISCUSSION

The selection of SO_2 and CO_2 gases for removal is driven by their specific roles in environmental pollution and greenhouse gas emissions. Both gases are the main components that are emitted by industries, making them appropriate participants for the removable gas study. Sulfur dioxide (SO_2) is a basic air pollutant generated by industries it includes the combustion of fossil fuels and metal smelting. Which is released into the atmosphere and converted into acid rain causing respiratory diseases, it also highlights the urgency of the removal of these toxic gases. Carbon dioxide (CO_2) is a key greenhouse gas responsible for global warming and climate change. Its removal is vital for reducing the harmful effects of climate change. CNTs are used for the removal of gases by the use of chemical affinity and selectivity. CNTs interact with the gases through various mechanisms, which are chemisorption and physisorption. The selectivity is denoted by the unique electronic and structural properties of CNTs, allowing them to absorb specific gases.

Carbon atoms are organized in cylindrical, one-dimensional nanostructures known as carbon nanotubes (CNTs) [18, 19, 20, 21]. Because of these nanotubes' remarkable mechanical, electrical, and thermal capabilities, materials science has seen an important change in perspective. They are electrically and thermally conductive, with high mechanical strength. Carbon nanotubes (CNTs) find use in thin-film electronics, automobile components, boat hulls, sporting goods, water filters, coatings, actuators, electromagnetic shields, and energy

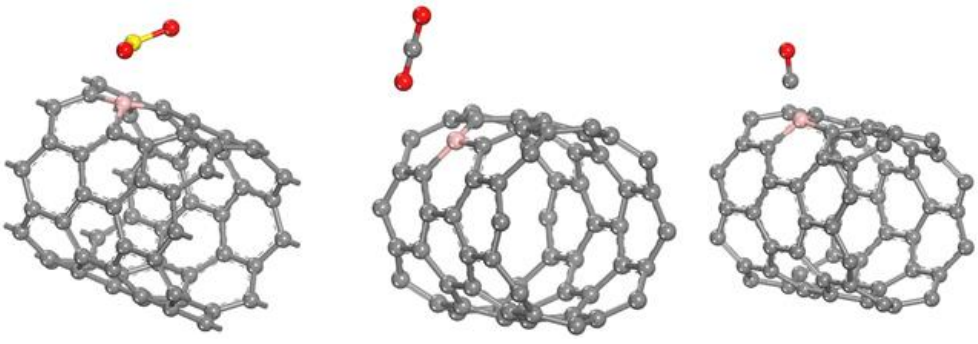
storage. Among its unique qualities are high surface-to-volume ratios, improved strength and conductivity, biocompatibility, simplicity in functionalization, and optical properties. The atomic organization and intrinsic structure of CNTs result in their remarkable strength. Due to its strength, a lot of curiosity has been aroused, leading to in-depth research into its possible applications in various industries. The covalent bonds that hold the carbon atoms in the nanotube structure together provide strength. Doped carbon nanotubes (CNTs) offer several advantages in gas adsorption processes, including improved surface functioning, enhanced adsorption capacity, and customized material properties. These advantages include enhanced adsorption efficiency, enhanced surface area, and selective adsorption of specific gases. Because doped CNTs have a stronger affinity for target molecules, pollutants can be effectively removed from the environment. Because doped CNTs are more resilient and ideal for long-term gas adsorption applications, they can be used to address a range of industrial and environmental issues. Everything being considered, doped CNTs provide customized approaches to effective gas collection and purification, showcasing their potential to tackle a range of industrial and environmental issues.

The Boron is doped in the CNTs [9, 10] because of its low atomic number and mass, and its structure is relatively close to Carbon. Boron doping introduces p-type (positive charge) doping to CNTs, which is reflected in their electronic properties. Boron doped also helps in the adsorption of SO_2 and CO_2. The CO_2 and SO_2 adsorption on B-doped CNTs encompasses physical (physisorption) interactions. Physisorption involves weak van der Waals forces which is a reversible process.

Table 1: Binding Energy

Structure	B.E of CNTs (eV)	B.E of B-CNT (eV)
SO_2	-0.1372	-0.3595
CO_2	-0.05605	-0.100168
CO	-0.13829	-0.82266

The intensity of interaction between the gas molecule and the absorbent is denoted by binding energy (B.E) [11, 12, 13, 14] like the adsorption of the molecules with the carbon nanotubes (CNTs) or the boron-doped carbon nanotubes (B-CNTs). A substantial binding affinity is shown by the negative binding energy of SO2 on B-CNTs. Because of its low binding energy value of boron-doped CNTs, it is favorable in the removal of SO_2 gas molecules. In the CO_2 molecule both the binding energy is negative and their difference is relatively small but it also indicates that boron-doped CNTs are more efficiently adsorb on the surface. Similarly, CO molecules also get adsorb effectively in boron-doped CNTs. This finding has significant ramifications for eliminating this dangerous pollutant from the air and for air purification [Table 1].



(a) (b) (c)

FIG 1: Boron-doped CNTs with (a) SO2 (Sulfur dioxide) (b) CO2 (Carbon dioxide) (c) CO (Carbon monoxide).

Where red is oxygen, yellow is sulfur, grey is carbon, and pink is boron.

After geometry optimization, the boron-doped CNTs bond length becomes 1.495Å while before for CNTs was 1.412Å which shows there is not much difference after the CNT is been doped by boron atom. The molecules are been adsorb in the pure CNT with a separation distance between them is 2.868Å, 2.730Å, 2.995Å (SO_2, CO_2, CO) while for boron doped CNT is 2.514Å, 2.730Å, 1.539Å. By comparatively analyzing the data we can suggest that the less the separation between the molecules the stronger the interaction and the more the strength of absorption which is mostly useful for the removal of toxic gasses from industries. A contrast examination of separation lengths shows how the interaction between gas molecules and CNTs is affected by boron doping. B-CNTs have superior adsorption capabilities for all three molecules; these characteristics particularly have a significant effect on CO adsorption.

Adsorption energy study with the Density of States (DOS). Through the use of DOS calculations, we can gain a better understanding of the electronic structure of B-doped CNTs as well as the energy distribution of adsorbed molecules of SO_2, CO2, and CO. This helps us to comprehend the intricacies of chemical bonding and the evolution of the nanotubes' electronic characteristics during adsorption.

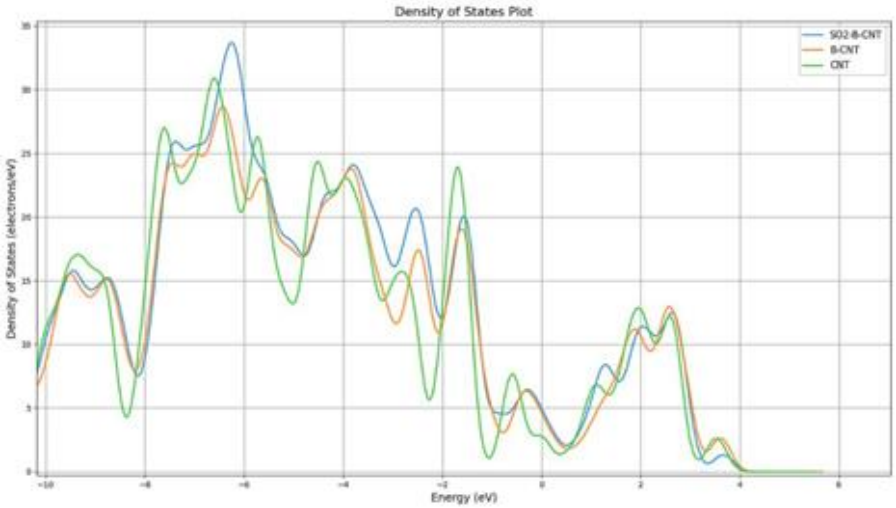


FIG 2: TDOS of SO_2-B-CNT, B-CNT, CNT.

FIG 2 shows the comparison between TDOS (Total Density of States) of B-doped CNT and SO_2-B-CNT, near Fermi level density has increased at -0.9eV after SO_2 adsorption. The increased height of the peak of TDOS at -1.8eV, -3.9eV and -7eV show the binding of SO_2 on B-doped CNT.

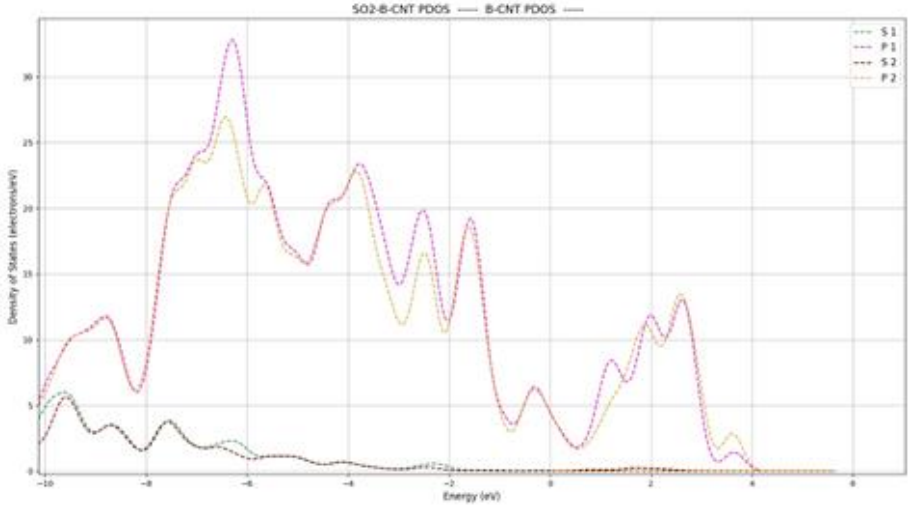


FIG 3: PDOS of SO_2-B-CNT & B-CNT.

FIG 3 shows the partial density of states (PDOS) of SO_2-B-CNT and B-CNT, at -2.4eV and at -6.2eV overlapping of peaks of s and p orbitals took place which confirmed sp3 hybridization which was responsible for the binding of SO_2 molecule on B-CNT.

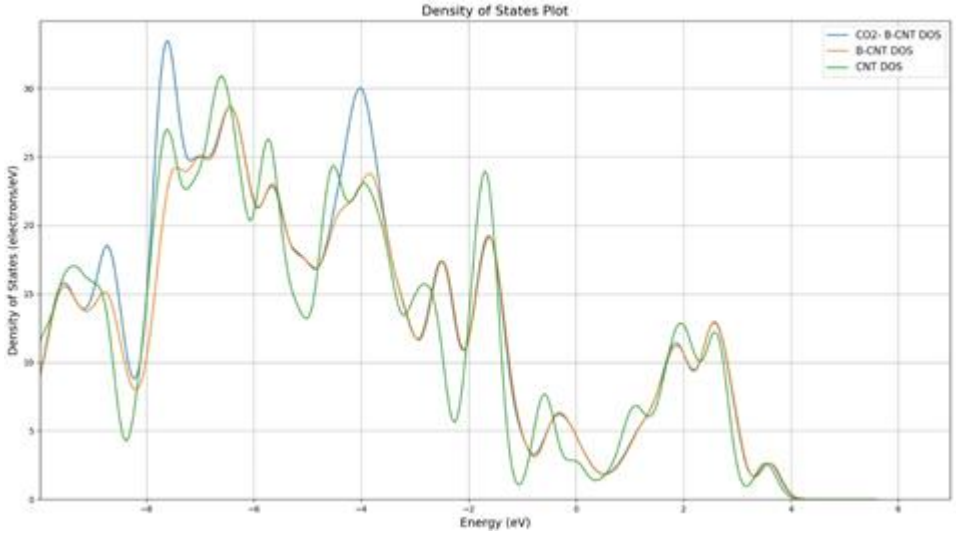


FIG 4: TDOS of CO_2-B-CNT, B-CNT, CNT.

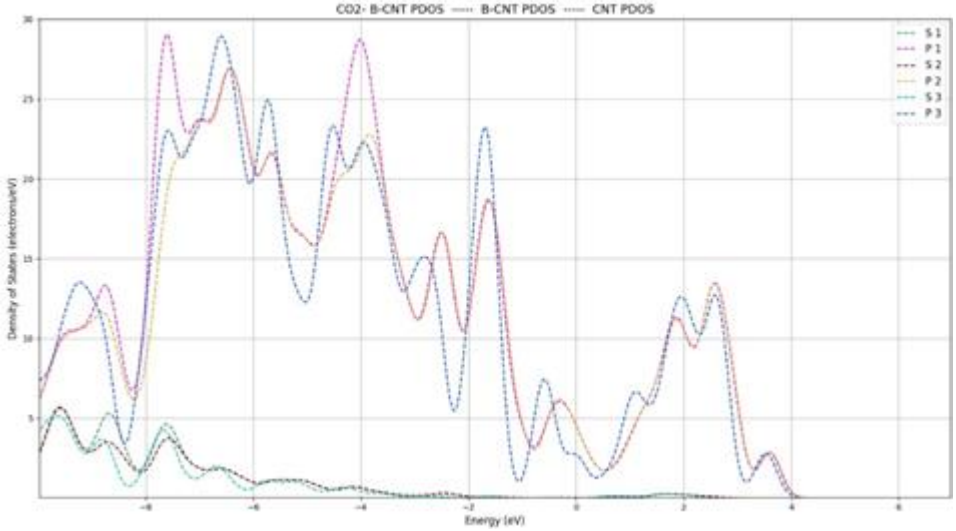


FIG 5: PDOS of CO_2-B-CNT, B-CNT, CNT.

FIG 4, Again the TDOS between B-CNT and CO_2-B-CNT has been compared, and the height of the peak of p orbital at -4eV increased after the adsorption of CO_2 molecule on B-doped CNT. These peaks of s orbitals and p orbitals are overlapping at -4eV. The TDOS and PDOS diagrams support the weak adsorption of CO_2 than SO_2 and CO_2 which is consistent with Binding energies.

IV. CONCLUSION

In this study, the ability to adsorption of the boron-doped CNTs interact with some molecules such as sulfur dioxide, carbon dioxide, and carbon monoxide (SO2, CO2, CO). In this line, the adsorption energies and associated parameters were computed by DFT simulations. All gas molecules are physisorbed and have very weak Van der Waal forces on B-CNT. The lesser Van der Waal adsorption of SO2 and CO2, which is compatible with binding energies, is supported by the TDOS and PDOS diagrams. The aim was to find more

adsorption occurs in the CNT which is been shown by the boron-doped CNT where the low binding energy shows the adsorption than that occurs in CNT which gives the phenomenon of weak Van der Waal interaction and physisorption. Because of low Binding Energy, it is mostly favorable for the removal of toxic gasses.

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Comprehensive Exploration of Digital Technology and AI Integration to Optimize Doctor Availability and Appointment Allocation in Hospitals

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ABSTRACT

This study aims to explore how healthcare facilities can improve doctor availability and expedite appointment scheduling by integrating digital technologies and artificial intelligence (AI) to a great extent. AI-driven solutions are necessary to meet the increasing demands in healthcare. The research prioritizes telemedicine, real-time updates, and predictive analytics for effective patient care. However, ethical and data privacy issues require careful consideration. This concept underscores the crucial role of digital technology and artificial intelligence (AI) in streamlining healthcare systems, ultimately improving patient access and treatment quality.

Keywords: healthcare, artificial intelligence, digital technologies, improving patient access, treatment quality.

I. INTRODUCTION

A paradigm-shifting upheaval in the healthcare sector is imminent due to the confluence of digital technology and artificial intelligence (AI). The healthcare sector is a cornerstone of social well-being. Using digital technology and artificial intelligence (AI) to optimize doctor availability and appointment scheduling in hospitals is a promising solution to major healthcare management concerns in this age of rapid technological innovation [1]. The world's healthcare systems are under increasing strain due to growing populations, rising life expectancies, and a rise in medical complexity. To guarantee prompt and effective patient treatment, creative solutions are required to strike a delicate balance between few resources and rising patient expectations.

By optimizing the distribution of medical staff and patient appointments, the convergence of digital technology and artificial intelligence has the potential to completely transform the delivery of healthcare. Additional hospital resource optimization research is required in today's overburdened and expensive healthcare systems [2]. Optimizing resources has the potential to lower expenses while enhancing medical results. For example, when optimization leads to improved time management in hospitals, it can even save lives. Optimized time management frees up hospital testing facilities and beds for many patients, allowing caregivers to handle more patients. While waiting for their turns, some patients can pass away in the absence of caretakers and rooms.

We demonstrate the significance of fully digitalized and automated electronic Clinical Pathways (e-CPs) in the field of hospital resource optimization in this research [3].

II. DATABASE

We will begin gathering data from research papers and publications for the database's benefit based on the following criteria: title, authors, publication date, abstract, keywords, date of issue, or URL. Regarding technological solutions, we will investigate the technology's name, its developer or provider, an explanation of their methodology, successful technology use cases, implementation challenges to boost the functionality and efficiency of our solution, and success stories to steer us on the right path [4].

In addition, we will work on Case Studies that include the names of healthcare facilities with real- time data, the specific location of their medical services, implementation details, results and outcomes of the many activities carried out, and lessons gained regarding whether they were effective. Additionally, we will be attempting to learn about the many difficulties they have in their line of work. We will try to gather as much as possible data from hospitals and clinics [5].

To maintain the solution authorized, we will also be ensuring Regulatory and Ethical Frameworks, such as applicable laws governing healthcare institutions, moral principles for everyone engaged in the medical process, compliance standards to save patients' lives, Legal considerations to ensure that every procedure operates within the bounds of the law, as well as privacy protocols to safeguard the privacy of every single individual. We will set up the Adoption and Training Programs, comprising Adoption Strategies, Training Initiatives, User Feedback, Performance Assessment, and Measures of Continuous Improvement. Additionally, we will include technologies for patient engagement, such as developing many digital platforms, producing several kinds of patient portals, utilizing wearable technology, and gathering feedback and satisfaction from clients. For Predictive Analytics and AI Models, we will also leverage contemporary and digital technologies, including different kinds of algorithms, and data sources, working on accuracy and performance metrics, integration challenges, and continuous improvement strategies [6].

By using interconnected systems, standardization campaigns, integration success stories, and interoperability challenges, we will offer interoperability solutions. We will be focusing on the platform's name, features, accessibility, user feedback, and integration with digital and artificial intelligence systems for telemedicine. In addition, we will be working on data security measures such as blockchain integration, encryption protocols, security audits, compliance, and (if any) data breach incidents [7].

Planning for a cost-benefit analysis entails calculating the solution's initial costs, and the operational costs necessary to carry out various procedures and operations, acknowledging the solution's benefits, and considering the idea of return on investment (ROI). Future Trends and Innovations will also be covered, like working with industry partnerships, working on various pilot programs, trying to generate predictions and speculations, and utilizing emerging technologies [8].

III.METHODOLOGY AND RESEARCH

The methodology of our solution is a Needs Assessment to describe the existing difficulties with scheduling appointments and finding doctors. It will also help us to learn about the needs and viewpoints of hospital staff, patients, and administrators, and gather their input. It will also include Literature Analysis such as Examine

case studies and current research on the use of AI and digital technology in healthcare. Also working to discover successful implementations and gain knowledge from their approaches and results. Working on the perspective of Analysis of the Technology Landscape [9].

Examine the most recent advancements in AI and digital technologies that are pertinent to appointment scheduling and healthcare. Also Analysing their advantages, disadvantages, and possible effects on the best possible doctor availability and appointment scheduling. Also working hard in Gathering and analyzing Data in gathering pertinent information about patient preferences, doctor availability patterns, and current appointment scheduling. It will also work to find patterns and insights that can guide optimization strategies, and apply data analytics.

We will collaborate with Joint Stakeholders Action as well [10].

Make sure that you understand the needs and concerns of doctors, IT specialists, administrators, and patients by having conversations with them. Promote collaboration to arrive at a user-friendly solution that meets the needs of all stakeholders. To fully test and prototype the recommended AI and digital technology integration, proofs of concept or prototypes must be made. Additionally, it will cover the need for pilot testing in controlled environments to assess feasibility and gather suggestions for enhancements. Additionally, it will include combining and putting into practice several ways to support IT teams as they integrate the chosen technologies into the hospital's existing framework. Additionally, it will design a phased implementation plan to reduce interruption and allow for constant enhancement [11].

A paradigm shift that has the potential to completely transform healthcare delivery is the integration of digital technology and artificial intelligence (AI) in hospital operations. We want to address one of the persistent issues in healthcare—efficient resource utilization—by concentrating on maximizing doctor availability and appointment scheduling. Benefits of Integration: Enhanced Appointment Scheduling: AI algorithms that evaluate past data to forecast peak appointment periods help hospitals deploy resources more efficiently [12].

Additionally, digital scheduling technologies that can offer real-time updates will be included, which will shorten wait times and increase patient satisfaction. Flexible Medical Allocation, which takes into consideration patient demand, individual preferences, and peak hours, may examine patterns of doctor availability with the use of artificial intelligence. By maximizing their time and skills, this dynamic strategy guarantees that physicians are accessible when and where they are most needed. By offering digital solutions that may present patients with customized appointment alternatives based on their preferences and past data, we will also improve the patient experience. [13]

Artificial intelligence (AI)-powered chatbots can instantly respond to questions about appointments, enhancing patient experience and communication. Our system will also include tools for data-driven decision-making and analytics, which can convert enormous volumes of medical data into useful insights. Hospital administrators who can make defensible choices about workforce levels, infrastructure expenditures, and resource distribution will also be included.

The following are the many Issues and Things to Keep in Mind. Data Privacy and Security Patient data security becomes more and more important as we use digital solutions. Adherence to healthcare legislation and the implementation of strong security measures are necessary. The seamless integration of new technology with legacy systems seen in many hospitals presents another challenge: system integration. Issues with compatibility and interoperability must be carefully considered. The Ethical Use of AI presents another difficulty. AI procedures will be ethical and transparent, particularly in the healthcare industry. Priorities include preventing prejudice in AI systems and guaranteeing accountability and fairness. Staff Adoption and Training will be

Another Major Issue as the competency and buy-in of the workers are critical to the success of any technology integration. To ensure a seamless transition, sufficient training programs must go hand in hand with the implementation. Our solution's outlook for the diagnostics, individualized treatment regimens, and predictive analytics for illness prevention. future is There is a lot of promise in the further development of AI and digital technologies in healthcare [14].

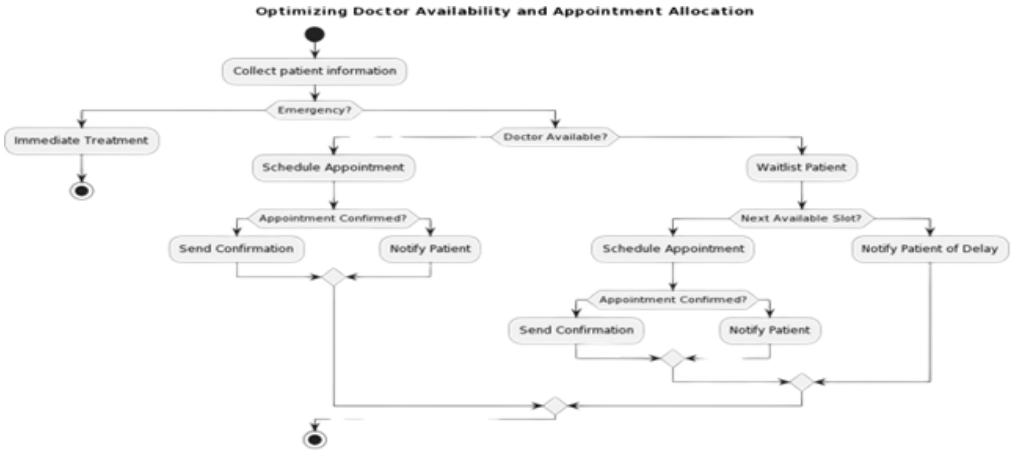

Figure 1. Process Flow Diagram of the solution.

The process flow of our solution is as follows. In this diagram, you will be able to understand the various processes that will give a satisfactory solution. Explaining the process flow of our solution to optimize doctor availability and appointment allocation First, we will collect information about the patient's details, family details, contacts, and past medical details, which will help us to use these details in emergencies. Along with that, we will also provide a special feature that will provide an emergency button to the patient. If there is any kind of emergency, the patient will click on that button, and he will get immediate treatment at the nearest hospital. If there is no emergency, the patient will ask for the doctor's availability. If the doctor is available, the patient will schedule the appointment, and the patient and the doctor will receive notification via our application that the appointment has been confirmed. If the doctor is not available, the patient will go to the patient waiting list and check the available slot of the doctor appointment, after which he will schedule the appointment, and the patient and the doctor will receive notification about the appointment. If the doctor is not available then the patient will get notification about the delay in appointment. While going through this process, we will store all the information and medical history of the patient in the database, as well as the previous appointment history of the patient and information about the doctor [15].

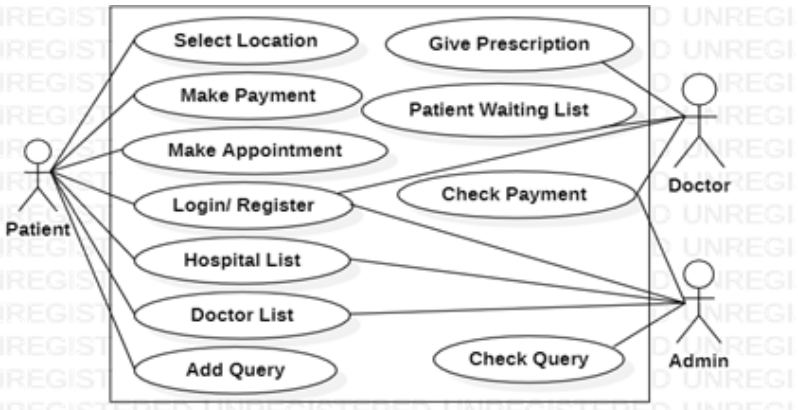

Figure 2. Different cases for the solution.

Explaining the use case diagram for optimizing doctor availability and appointment allocation in hospitals, in this diagram we declare three actors: the first is the patient, the second is the doctor, and the third is the administrator. Firstly, the patient must log in or register for our application. After that, he must select the location, and then he will check for the hospital list and the available doctor list. After that, he will make an appointment and make a payment. If he has any queries, he will add them.

Like doctors, you also must log in or register for our application. Then, he will check the patient waiting list, and after that, he will check the patient and give permission to the patient, and he will check if the payment is successfully done or not. Now the third actor is admin, and the admin also must log in or register in our application. Then he will make the hospital list and the doctor list, then he will check if the payment is successfully done or not, and he will check for the query that is added by the patient [16] Explaining the dependency diagram for optimizing doctor availability and appointment allocation in hospitals, in this diagram, the patient will first look for the nearest hospital available, then check for the appointment scheduler of the doctor, and the application will give a notification to the doctor through AI integration about the appointment as well as to the patient. We will install our application on the mobile device through the app. The patient's data will be stored in the database, and then we will provide a notification system. In the above illustration, you can easily understand the simplicity of our solution that will give the desired result to all the parties involved in using our solution. The doctor will be able to get the benefits of our solution, the patient will be able to monitor his appointment details as well as past medical details, and the admin will be there to monitor all the processes as well as to solve various issues that will be raised by the patient as well as the doctor [17].

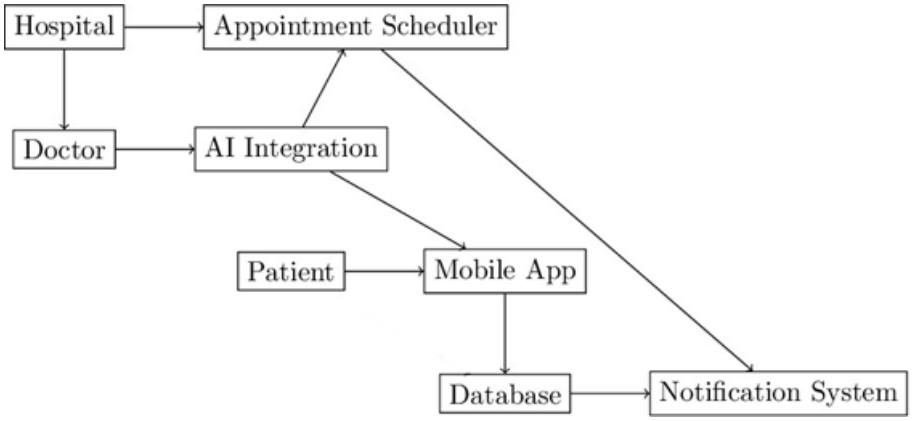

Figure 3. Dependent Technology for the solution.

IV. RESULT AND DISCUSSION

Here are some images that will showcase a first look at the solution that we have designed for our purpose. As a result, we have produced for the problems that we face while booking an appointment with a doctor, we expect to make the loss of time as much as possible. Our main aim in the result is to reduce the time wastage as much as possible. By reducing the time, the probability of saving a patient's life can be increased. With the use of our solution, and making continuous improvements we will be able to bring a major change in the medical field.

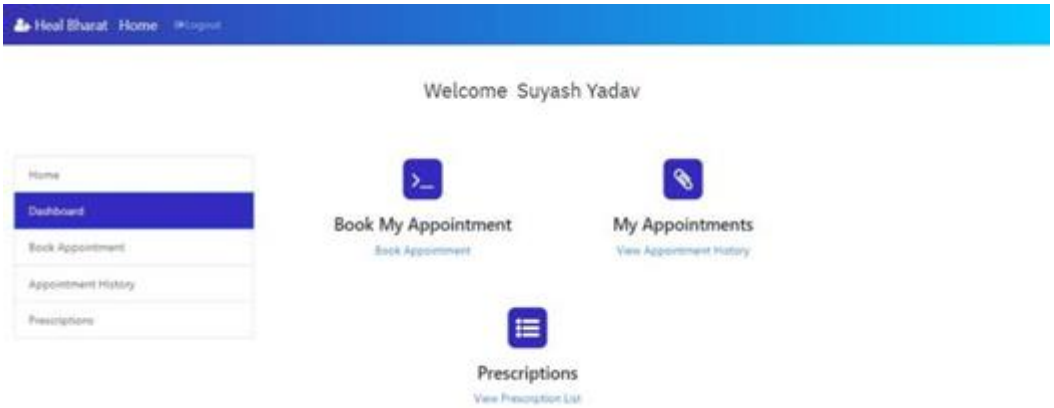

Figure 4. Welcome Page of Our Website.

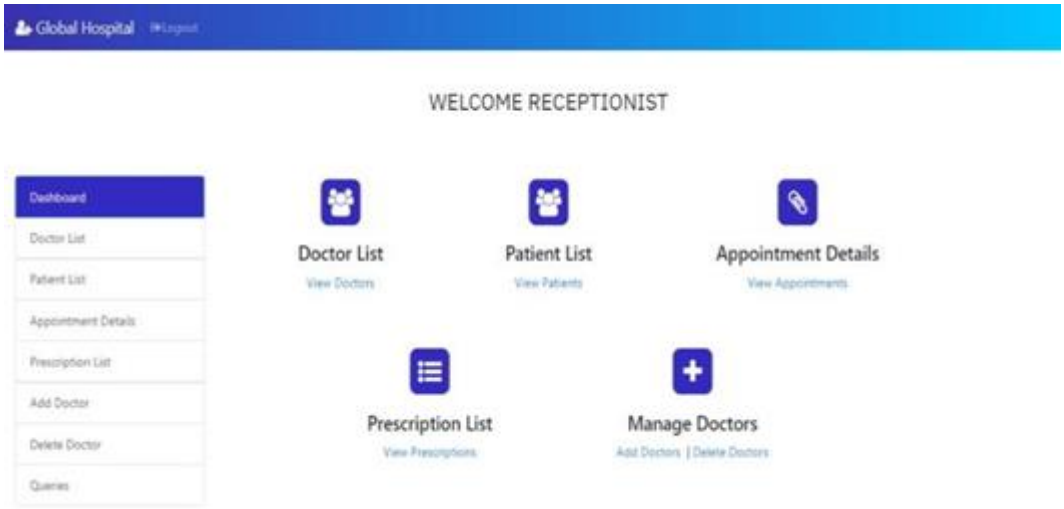

Figure 5. Page Of the Admin of The Application.

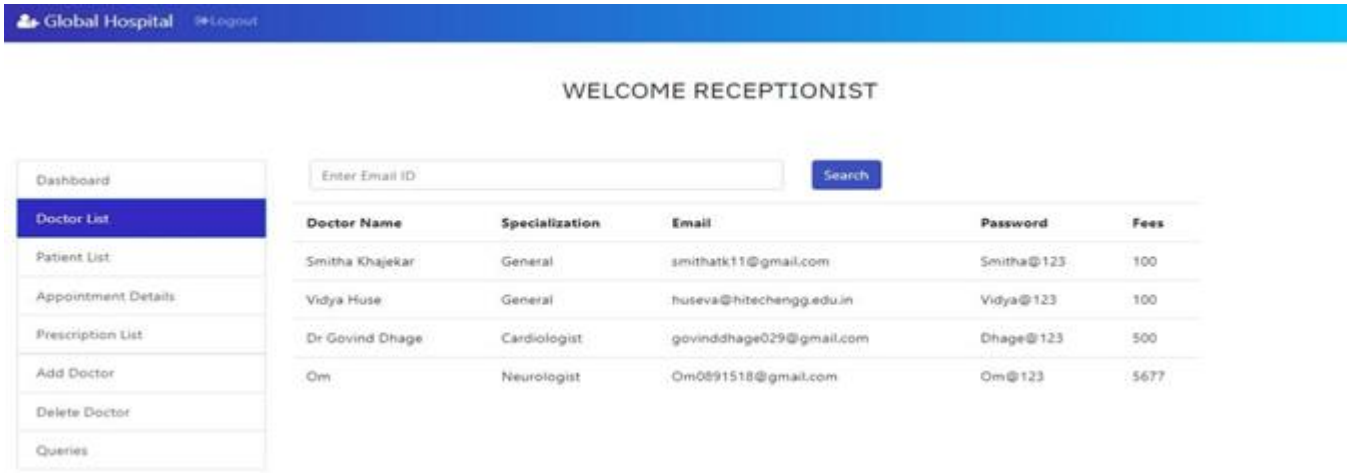

Figure 6. Data getting stored about the doctors.

In the above images, you can clearly understand the various pages that we have designed for the doctor, the patient, and the doctor. The page consists of the various facilities and options available for the respective user. We have also designed the solution in such a way that the data related to all the users of our solution will be stored in the database and can be used for further studies and emergencies. This data will prove useful and will help us to deal with worse medical situations. As well as the risk will be reduced and the patient's life can be

saved. Here the admin will be able to get the required details about the doctor. In case of any situation or medical emergencies, the admin will be able to play the role of the mediator in the situation and will be playing a crucial role in handling situations. Along with this we will able to continue making improvements on our solution so that with the help of modern technology we can provide much more efficiency to our solution.

V. CONCLUSION

To sum up, a revolutionary future for healthcare is promised by the thorough investigation of digital technology and AI integration to maximize physician availability and appointment scheduling in hospitals. Hospitals may improve access to healthcare, increase efficiency, and simplify operations by utilizing technology. AI and digital technologies working together open new possibilities and make it possible for the healthcare system to become more patient-centered and cutting-edge at the same time. The idea of a highly accessible and completely integrated healthcare experience is becoming a reality as we embrace this innovative era. We plan to design such a solution that will reduce the risk as much as possible so that the probability of a patient's life can be saved.

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Improving Vision Health : A Machine Learning Solution for Diabetic Retinopathy Screening

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ABSTRACT

Diabetic retinopathy is a retinal disease that affects patients with diabetes, and it is a leading cause of blindness in the elderly population. It is often asymptomatic and involves changes to blood vessels, which can lead to bleeding or fluid leakage, ultimately distorting vision. Detecting and extracting information from these blood vessels is crucial for aiding ophthalmologists in identifying the disease at an early stage and preventing potential vision loss. Diabetic retinopathy (DR) is a disabling chronic condition and a primary contributor to blindness and visual impairment in developed countries among diabetic patients. Studies have shown that early detection and treatment can prevent a significant number of cases. Physicians employ eye screening techniques using retinal images to identify lesions associated with this disease. However, with the increasing number of diabetic individuals, manually analyzing these images has become time-consuming. Additionally, training personnel to perform image-based diagnoses of this nature is a lengthy process, as it requires gaining expertise through daily practice. In this paper, we present an approach for the automatic classification of diabetic retinopathy based on retinal fundus images using image processing techniques. To achieve this, we employed a feature extraction method based on a pre-trained deep neural network model and used a support vector machine classification algorithm based on machine learning.

Keywords: DR, NN, MLP, SVM

I. INTRODUCTION

Diabetes is a common cause of diabetic retinopathy (DR), an eye condition that damages the retina and can result in total blindness. Diabetes mellitus, a metabolic disease characterized by hyperglycaemia brought on by a pancreatic insulin production defect, can cause long-term micro vascular problems that impair the retina. Among people who are actively involved in life, DR is the primary cause of blindness. The World Health Organization (WHO) estimates that 347 million people worldwide have been diagnosed with diabetes, with a projected increase to over 640 million by 2040. Disturbingly, more than 75% of diabetic patients face the risk of developing DR within 15 to 20 years of diabetes diagnosis. This asymptomatic retinal disease, primarily a

consequence of diabetes, manifests in changes to blood vessels, leading to microaneurysms, haemorrhages, exudates, malformations, and vascular tortuosity (Non-Proliferative Diabetic Retinopathy). If left untreated, this can progress to abnormal retinal blood vessel growth (Proliferative Diabetic Retinopathy), ultimately causing blindness. Given the asymptomatic nature of diabetic retinopathy, early identification is crucial. The extraction of blood vessels plays a pivotal role in assisting ophthalmologists in diagnosing the disease at its early stages, preventing irreversible vision loss.

II. LITERATURE REVIEW

Meher Madhu Dharmana et al. [1] introduced a method incorporating an efficient feature extraction approach centered on blob detection, coupled with machine learning for the classification of various stages of diabetic retinopathy. The proposed feature extraction method facilitates the automatic characterization of retina images, achieving an accuracy of 83 percent using the most effective machine learning classification algorithm. This advancement aids specialists in accurately identifying a patient's condition, providing a more precise diagnosis. Messadi Mohamed et al. [2] introduced an approach centered on blood vessel segmentation and the extraction of geometric features for early diabetic retinopathy detection. The segmentation process utilizes the Hessian matrix, ISODATA algorithm, and active contour to identify blood vessels. Subsequently, the decision tree CART algorithm is applied for classifying images into normal (NO-DR) or diabetic retinopathy (DR). The system underwent testing on the DRIVE and Messidor databases, achieving an average sensitivity, specificity, and accuracy of 89%, 99%, and 96%, respectively, for retinal vessel segmentation, and 91%, 100%, and 93%, respectively, for diabetic retinopathy classification. These results highlight the effectiveness of the proposed approach in diabetic retinopathy detection, surpassing existing methods and offering improved accuracy for early diagnosis by ophthalmologists. Doshna Umma Reddy et al. [3] employed a convolutional neural network, utilizing the VGG-16 model as a pre-trained neural network for fine-tuning, to classify the severity of diabetic retinopathy (DR). The model incorporates advanced deep learning techniques, such as data augmentation, batch normalization, dropout layers, and learn-rate scheduling, specifically designed for high-resolution images to enhance accuracy. Notably, the model achieved an average class accuracy (ACA) of 74%, sensitivity of 80% with a specificity of 65%, and an area under the curve (AUC) of 0.80. These results surpass previous findings using other pre-trained networks or models, indicating the effectiveness of the proposed approach in diabetic retinopathy severity classification. J. Anitha et al. [4] assessed computer-aided diagnosis (CAD) techniques, focusing on performance evaluation, and delved into the associated challenges. The paper discusses potential solutions to enhance system accuracy, offering valuable insights for improvement. R. Subhashini et al. [5] endeavors to create a user-friendly graphical interface that integrates various image processing techniques. The primary objective is to predict whether a given fundus/retinal image, obtained from a patient, shows signs of Diabetic Retinopathy. If the condition is identified, the graphical user interface will present the severity level and recommend necessary actions for the user or patient. This streamlined approach reduces the processing time for disease detection, and the graphical user interface can serve as a supplementary tool for ophthalmologists, providing support in disease validation and detection. Manoj Kumar Behera et al. [6] introduced a research approach incorporating two established predefined feature extraction techniques, namely, scale-invariant feature transform (SIFT) and speeded-up robust features (SURF). Both techniques are applied concurrently to retinal images to identify Exudates regions. The extracted Exudates from each image are stored in a feature matrix, subsequently utilized by the support vector machine (SVM) classifier for predicting diabetic

retinopathy (DR). The model exhibited an average sensitivity of 94% when tested on a set of 100 images. Karan Bhatia et al. [7] concentrated on determining the presence of disease by employing an ensemble of machine learning classification algorithms. These algorithms operate on features extracted from various retinal image processing algorithms, encompassing factors such as optic disk diameter, lesion-specific characteristics (microaneurysms, exudates), and image-level attributes (prescreening, AM/FM, quality assessment). Decision-making for predicting diabetic retinopathy presence utilized a range of algorithms, including alternating decision tree, AdaBoost, Naïve Bayes, Random Forest, and SVM. Masoud Khazaee Fadafen et al. [8] introduced a method evaluated on the DIARETDB1 database, consisting of 89 selected images for diabetic retinopathy diagnosis. The study compared four saliency recognition models: the frequency-tuned method (FT) model, the spectral residual approach (SR) model, and the SDSP model—a novel saliency detection method combining simple prior. The proposed method, while preserving key image information such as vessels, outperformed the other four models by enhancing image points with superior quality. Performance assessment, utilizing Ground Truth images, involved ROC curve analysis and AUC calculation, with the proposed method exhibiting the highest AUC value. Visual comparisons, ROC curves, and calculated AUC values collectively indicate the superior performance of the proposed method compared to alternatives. Ali Shojaeipour et al. [9] devised a system employing a Gaussian filter for image enhancement, effectively isolating vessels with high brightness intensity distribution. Subsequently, the wavelet transform was employed to extract vessel information. Criteria such as vessel density were then utilized to pinpoint the location of the optic disc. Following optic disc extraction, regions containing exudates were identified. Ultimately, image classification was carried out using a boosting classifier. The suggested system, powered by the boosting algorithm, constitutes a robust classifier formed through the amalgamation of weak and simple learners. This approach serves to mitigate complexity and reduce the time-intensive nature of the operation. Yuhanis Yusof et al. [10] concentrated on classifying fundus images with or without signs of diabetic retinopathy (DR) using an artificial neural network (NN), specifically the Multi-layered Perceptron (MLP) trained by Levenberg-Marquardt (LM) and Bayesian Regularization (BR). Nineteen features were extracted from the fundus images and utilized as inputs for the neural network in the classification process. The analysis involved evaluating different numbers of hidden nodes. The results revealed that MLP trained with BR demonstrated superior classification performance, achieving 72.11% (training) and 67.47% (testing), compared to the use of LM. This finding suggests the potential applicability of Bayesian Regularization for other artificial neural network models.

III.METHODOLOGY

The suggested system architecture is depicted in Figure 1. The Retinal Fundus Image dataset, complete with annotations, undergoes labeling by trained human readers under quality control management. The classification process involves categorizing patients into labels, distinguishing between normal (N) and diabetes (D) based on the analysis of retinal images.

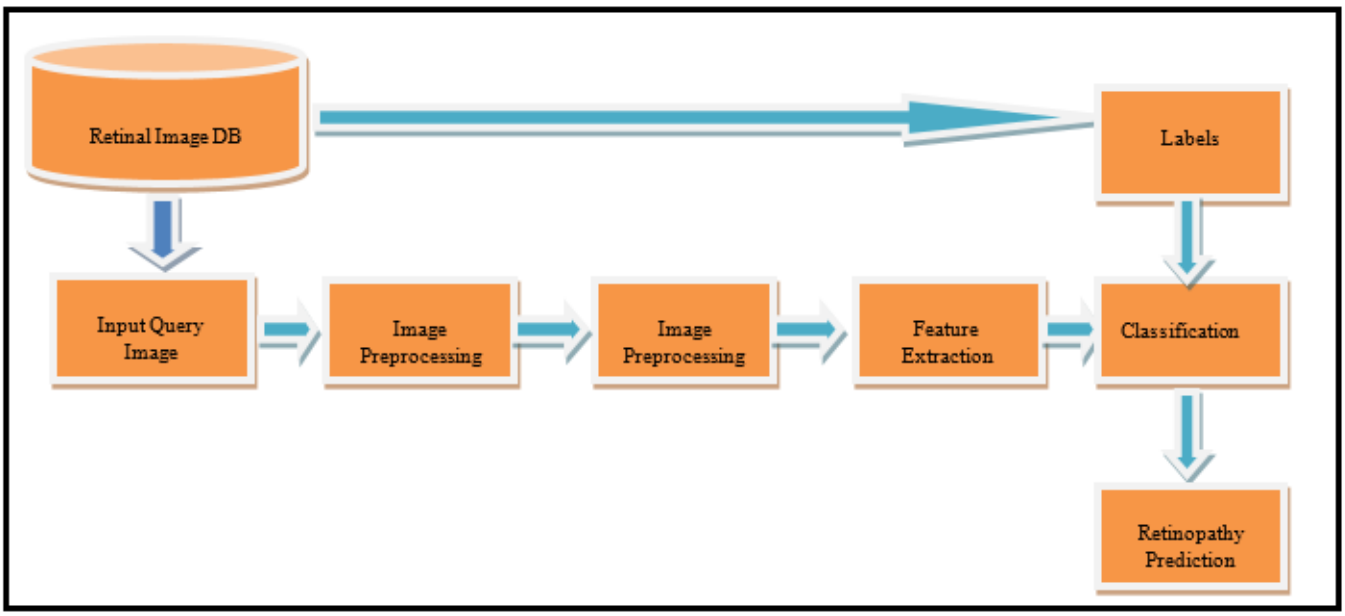

Figure1: Proposed Block Diagram

➢ Data Set

Our methodology is being tested on a well-established benchmark image database, specifically the publicly accessible Kaggle dataset (APTOS 2019 Blindness Detection). This dataset comprises a diverse collection of retinal fundus images that serve as the foundation for our design. In the experimental phase, a total of 100 images were employed. Subsequently, the dataset was divided into a 70-30% ratio, allocating 70% for training and the remaining 30% for testing the set of images.

➢ Pre-Processing

Pre-processing, an essential step at the lowest level of image abstraction, aims to enhance image data by eliminating unwanted distortions or accentuating crucial features for subsequent processing. Image processing, a technique applied to refine raw images from various sources, involves improving pictures captured by cameras, sensors on satellites, or in everyday scenarios for diverse applications. Given that our dataset is already preprocessed, the input images only require scaling or resizing before being provided as input to the model. This resizing is achieved by adjusting the image dimensions to match those of the pre-trained model used for feature extraction, ensuring uniformity without loss. In this experiment, a 299*299 image dimension is employed for resizing all training and testing images. This standardization aids in reducing the number of pixels, offering advantages such as faster machine learning model training and simplified model complexity.

➢ Feature Extraction

In the subsequent stage, a set of crucial features is extracted from the segmented image employing a pre-trained deep learning model. The selected pre-trained model is Inception-v3, a convolutional neural network with 48 layers, originally developed by Google and trained for the ImageNet Competition using 2012 data. The choice of this model is driven by its impressive classification performance.

➢ **Classification**

Following the feature extraction stage, image classification is conducted using a machine learning classification model, ultimately producing classified images categorized as either 'nondiabetic' or 'diabetic.' In our approach, we employ a multi-kernel support vector machine (SVM) for this purpose. The training and testing of computer-aided diagnosis models for the detection and diagnosis of diabetic retinopathy are integral to our proposed methodology.

The proposed approach is primarily divided into two phases: Training and Testing. Initially, the retinal fundus image dataset is split into a 70-30% ratio for the training and testing image sets. In the training phase, preprocessing is applied to the training image set, involving noise removal, image enhancement, and image resizing operations. Feature extraction is then performed, utilizing an automated technique with a pre-trained deep convolutional neural network to extract low to high-level features. The input and output data are collected as a feature dataset from the training image set and labels from its corresponding set. This data is used to train and validate the machine learning model, employing a support vector machine classifier. Upon successful validation, the trained model is saved.

In the testing phase, the same operations, up to feature extraction, are applied to the test image set. After obtaining the test feature set, the trained model is loaded, and predictions are made for healthy and unhealthy retinal images. This systematic approach streamlines the development of trained prediction models from filtered features, ensuring efficiency and accuracy in the diagnosis of diabetic retinopathy.

IV. RESULTS AND DISCUSSION

The implemented work utilizes an Intel Core i5 processor with 8GB RAM, running on a laptop with Windows 10 operating system. MATLAB R2018b serves as the software platform for coding, leveraging the Image Processing, Statistics, Machine Learning, and Deep Learning toolboxes. The input images for experimentation are sourced from the Kaggle dataset (APTOS 2019 Blindness Detection) [11].

In this experimental process, following the proposed block diagram, two distinct phases were implemented—first, the training phase, and then the testing phase. In the training stage, the set of training images underwent pre-processing to align with the dimensions of the employed deep network. For the feature extraction of the training images, an automated feature extraction method based on the Inception V3 pre-trained deep convolutional neural network was employed, encompassing a total of 316 layers, including input, feature, classification, and output layers (as illustrated in Figures 3 and 4). The 'avg_pool' feature layer was specifically utilized to extract features from the images. Subsequently, after feature extraction, the model underwent training using a multi-kernel SVM, with input derived from the training image feature dataset and output from the corresponding labels. Following successful validation of the training model, the trained model was saved.

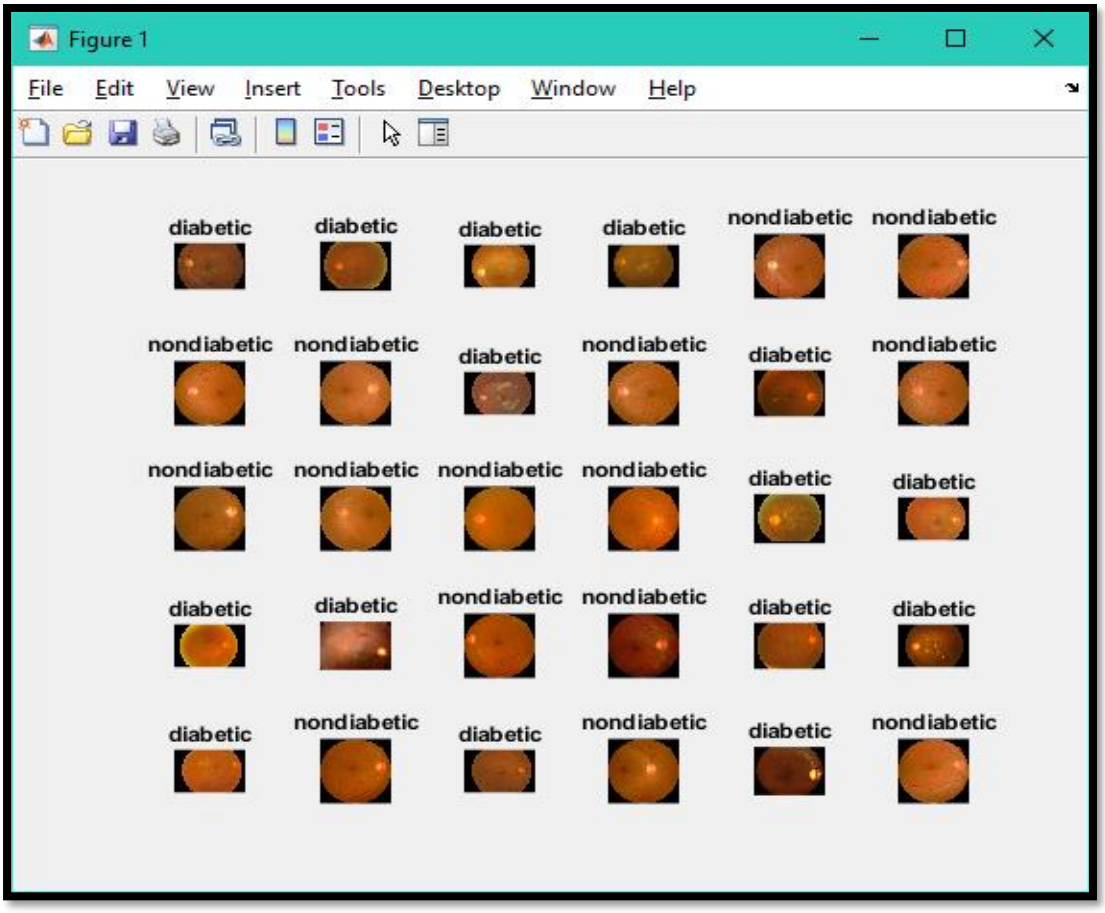

Figure 2: Sample images of retinal image dataset

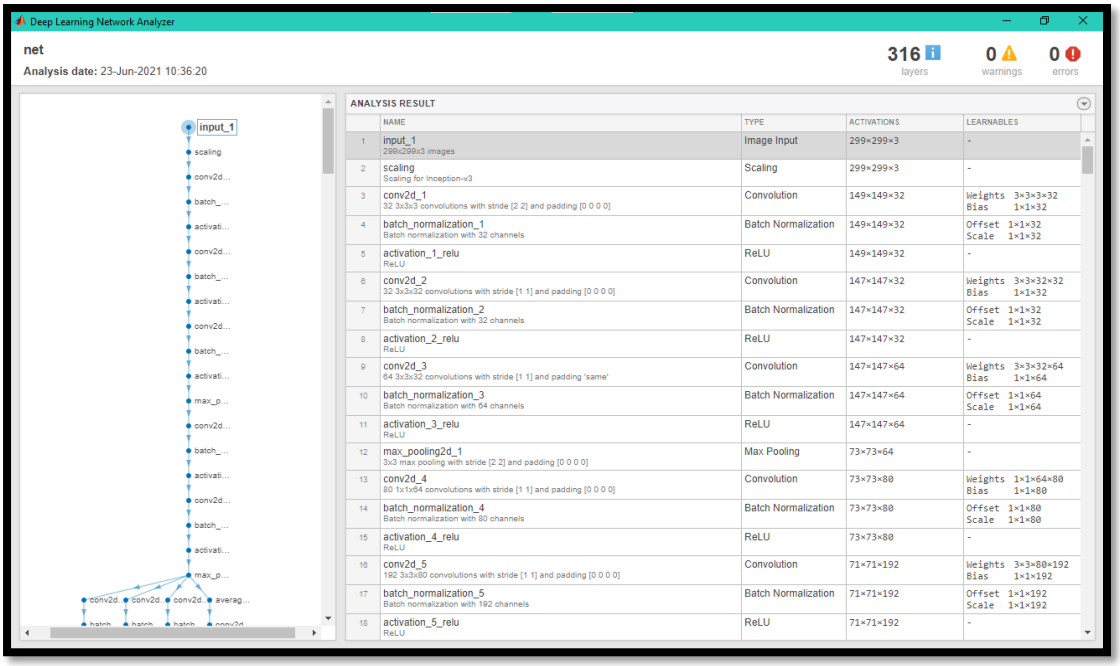

Figure 3: Initial layers of Inception V3 architecture

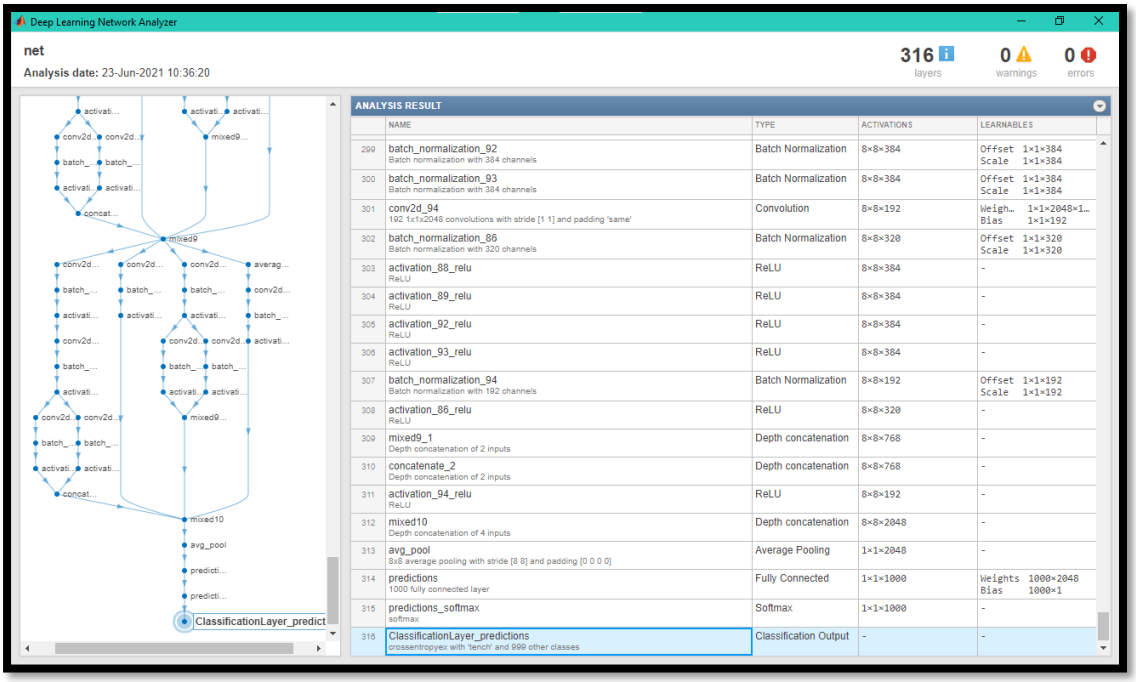

Figure 4: Final layers of Inception V3 architecture

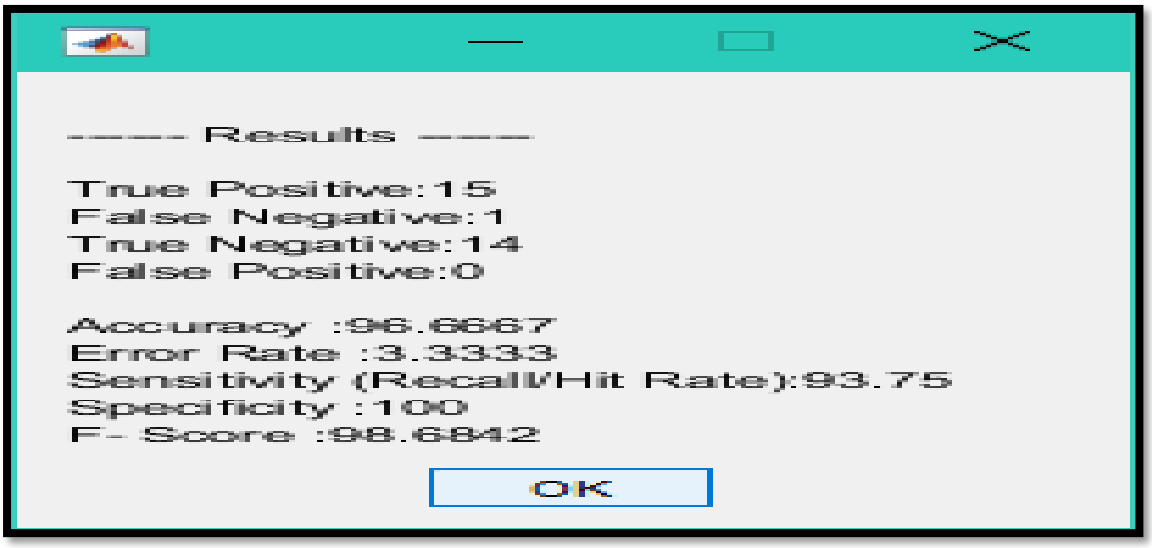

Figure 5: Result Performance

V. CONCLUSION

Diabetic retinopathy, once advanced, is irreversible. However, to prevent vision loss, timely laser analysis can be highly effective, especially if conducted before significant harm occurs to the retina. In cases where severe damage to the retina hasn't occurred, surgical removal of the vitreous gel can potentially improve vision. This study focuses on early-stage retinopathy detection, emphasizing the importance of timely intervention to prevent permanent vision loss. The proposed machine learning system encompasses a series of steps, from image pre-processing to classification, establishing an approach with enhanced detection accuracy through effective feature extraction using a pre-trained deep neural network model. The achieved overall class recognition accuracy stands at an impressive 96.66%. The model's simplicity, high recognition rate, and

efficient classification speed make it well-suited for the implementation of a robust and beneficial computer vision system within the healthcare domain.

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A Review on Vibratory Models of Defective Bearings

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ABSTRACT

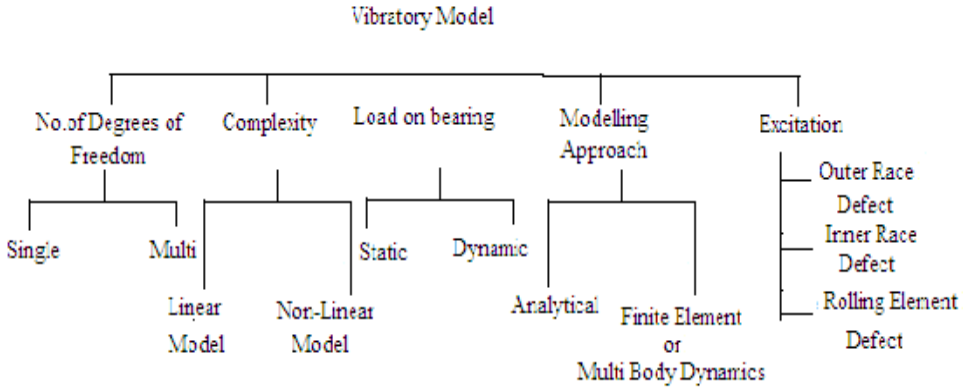
Rolling element bearings are widely employed in industrial settings worldwide. Failure to address bearing deficiencies promptly can result in machinery malfunction. Vibratory analysis has emerged as a potent technique for the identification and diagnosis of bearing defects, enabling proactive maintenance strategies to be implemented. This research article provides a comprehensive review of vibratory models used in the analysis of defective bearings. Various factors influencing the vibrational behavior of defective bearings, including defect size, location, and morphology, is discussed. The article then delves into different approaches employed in modeling bearing defects and their associated vibration signatures. One commonly used method to obtain the vibration signal is through the acquisition of vibratory models of bearings. This paper examines different vibratory models of bearings in the presence and absence of local and dispersed defects. The comparative analysis of the various vibratory models provides valuable insights into their strengths, limitations, and areas of application. Additionally, this review aims to provide an overview of existing research and advancements in vibratory models of defective bearings. This study acts as a thorough reference for scholars and professionals interested in comprehending and applying vibratory models for the examination of faulty bearings. The knowledge and insights gained from this review can contribute to the development of effective predictive maintenance strategies, leading to optimize operating efficiency, dependability, and reduce downtime in rotating machinery applications.

Keywords: Vibratory model; Defective Bearings; Vibration analysis; Spring-Mass-Damper; Bearings

I. INTRODUCTION

Rolling element bearings (REB) are indispensable components across a diverse spectrum of machinery, encompassing both portable devices and large-scale industrial systems. Their pivotal function lies in ensuring optimal performance and seamless operation within these machines, making them an integral part of their functionality. Factors such as fatigue on rolling surfaces, manufacturing errors, improper installation methods, and wear during operation can degrade bearing health and lead to defects in the bearing elements. These defects can cause machinery malfunctions, which are reflected in vibration signatures obtained from the bearings. Predictive maintenance endeavors to prevent unforeseen catastrophic failures by promptly identifying faults and executing the essential maintenance measures to isolate them. In doing so, it restores the

well-being of the machine, component, or system, ensuring its continued smooth operation. Distributed defects and localized defects are the two different forms of bearing flaws. Spalls, cracks and pits encompassed in local defects, which are caused by fatigue failure, where as distributed defects encompass unequal rolling element diameters and surface waviness among others. Vibration analysis is a common method used for condition monitoring and quality inspection, particularly for distributed defects. These real-world scenarios underscore the significance of vibratory models across various industries, spanning manufacturing, automotive, aerospace, and renewable energy. Vibration analysis is based on the fact that the housing structure is vibrated by successive impulses at every contact point of a defect with its mating part. In bearing diagnostics, the use of vibratory models has been widely employed to aid in measurement and analysis of vibration signals.



This article explores various vibratory models and the methodologies used to derive these models. The analysis of the various vibratory models provides valuable insights into their strengths, limitations, and areas of application. Additionally, challenges and future research directions in the field of vibratory modeling for defective bearings are identified, including the need for more accurate and robust models, integration of multi-modal sensing techniques, and the development of real-time fault diagnosis algorithms.

The vibratory models are presented in three stages: the first stage focuses on articles published concerning localized defects in bearings, the second stage encompasses articles published on distributed defects, and the third stage involves articles considering the effect of lubrication. However the broad classification of vibratory models can be observed in Figure 1.

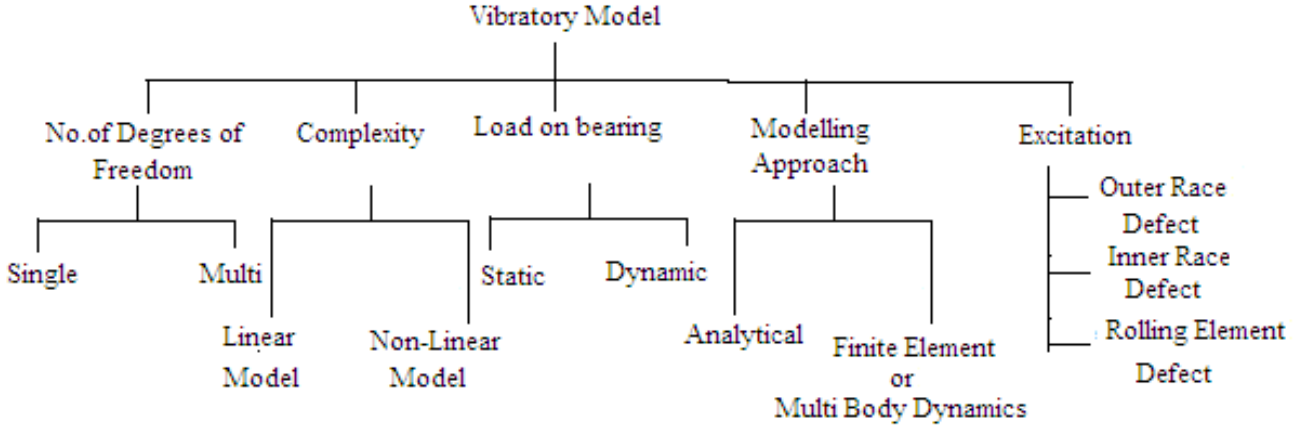


Fig.1 Classification of Vibratory models

II. VIBRATORY MODELS OF BEARINGS WITH LOCALIZED DEFECT

According to Remington (1976), the Hertzian contact stiffness between the wheel and rail in local contact was minimal. This had the effect of reducing the effective impedance of the wheel and rail, which had a further impact on the response. Sound radiation from the wheel and rail was primarily caused by localized movements at the contact point [1]. Thompson (1993) developed a theoretical model of multi-degree-of-freedom for wheel-rail interaction, considering that the excitations were a result of surface roughness [2].

In a study by Sassi et al. (2007), a conceptual framework of a bearing was modeled to analyze the dynamic response caused by localized defects. The framework shown in Figure 2, depicts the vibratory model of the bearing with three degrees of freedom system for simplification purposes.

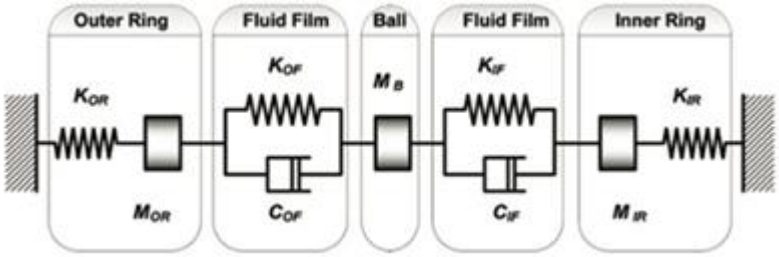


Fig.2 Vibratory model proposed by Sassi et al. (2007) [3].

The proposed model incorporates various factors to obtain the response for Dirac's excitation. These factors include bearing rotation, load distribution, elasticity of the bearing structure, characteristics of the elasto-hydrodynamic oil film, and the transfer function between the transducer and bearing. The model introduces several novel considerations. The total impact force causing vibration is comprised of the static force, as seen in other published models, along with an additional component that accounts for the impulses generated by the defect. To ensure a comparison between theoretical and experimental results, a geometric correction of the response has been implemented. This correction factor acknowledges that the recorded results by the unidirectional sensor, while the damaged ring experiences pulsation and rotation simultaneously [3].

The bearing and its test rig are represented by a lumped mass with 34 degrees of freedom as depicted in Figure 3 [4]. This model possesses the capability to simulate different types of faults occurring in various parts of the bearing, including the outer, inner races and rolling elements. Furthermore, the model has been extended to incorporate gear tooth deterioration.

A notable modification in the model is the construction of the zone of spall, which reflects the path of rolling element accurately. The simulated signals generated from localized defects exhibit similar fundamental characteristics to the measured signals. Specifically, they clearly exhibit the characteristic double pulses that correspond to the entry into and exit from a localized fault. The close resemblance between the synthetic and recorded signals, as observed through various diagnostic techniques, indicates the capability in replicating faults of diverse sizes ,shapes and positions of model.

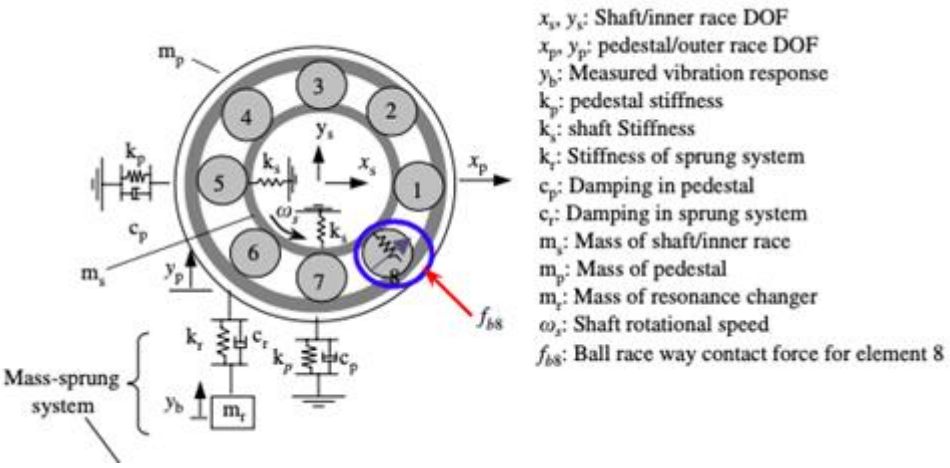


Fig.3 Vibratory model proposed by Sawalhi and Randall [4]

Arslan and Akturk (2008) conducted a dynamic study focusing on defect free and defected angular contact ball bearing. To investigate this, they formulated a bearing-shaft model, considering the assembly as a spring-mass model. Figure 4 illustrates the shaft-bearing assembly. It should be emphasized that the system exhibits nonlinear behaviour amidst dynamic scenarios. The mathematical model representing the motion of shaft and rolling elements were derived in both the axial and radial directions. These equations were then simultaneously simulated utilizing computational software. The study also examined the impact of localized defects on the response of the balls, specifically on the outer ring, inner ring and ball running surfaces. The analysis of the radial direction vibration of the rolling elements was conducted in both the time and frequency domains [5].

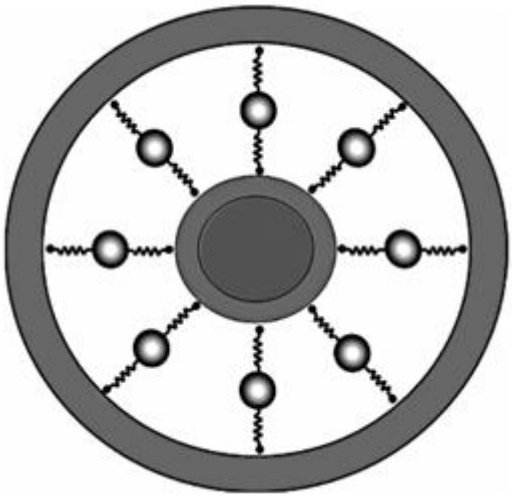


Fig. 4 Vibratory model proposed by Arslan and Akturk [5]

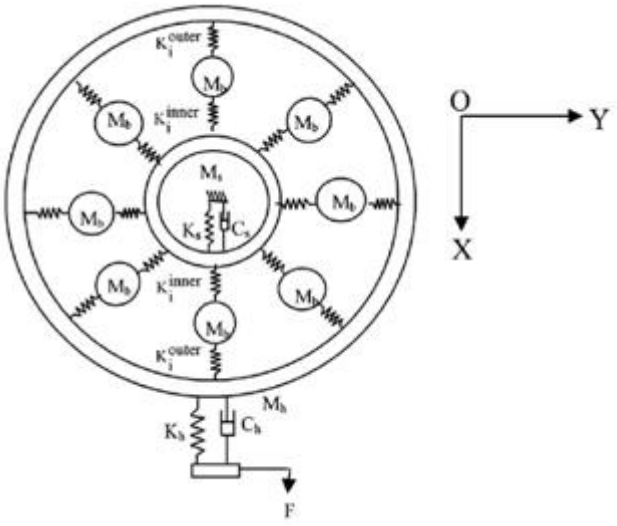


Fig. 5 Vibratory model proposed by Patel et al. [7]

A mathematical model was created to forecast the unbalanced, non-linear dynamic characteristics of a high-speed rotating shaft. The model considered variations in the number of balls and ball size. The interaction between the balls and the inner and outer races was simulated as a non-linear spring, incorporating stiffness values derived from Hertzian elastic deformation theory. In addition, a comprehensive contact-damping model was incorporated, which meticulously accounted for the effects of surface profiles and velocities of the interacting components. The formulation encompassed various sources of nonlinearity, fluctuations in the number of balls, Hertzian contact force and the presence of off-sized balls during the transition from non-contact to contact states. To analyze the vibration properties of a rolling element bearing, the equations of motion for the inner race, outer race, rolling elements, and shaft were established employing Lagrange's equation [6].

A study on the vibrations of deep groove ball bearings with localized flaws on the internal and external race surfaces was done by Patel et al. in 2010. They presented a dynamic model that considered the masses of the shaft, housing, races, and balls. The coupled solution of the governing equations of motion was obtained using the Runge-Kutta method. The model provided vibrations of the balls, shaft and housing in both the frequency and time domains. Experimental results were compared with computed results from the model for healthy and defective bearings, allowing for the investigation of characteristic defect frequencies and their harmonics [7].

An analytical approach to forecast the impact of localized flaws on ball bearing vibrations was presented by Patil et al. in 2010. Models of the contacts between the balls and the races used non-linear springs using the Hertzian contact deformation theory to calculate the contact force. A computer program was developed to simulate flaws on the raceways, and the acceleration of bearing vibration components was analyzed in the time and frequency domains. The size and location of the defect were examined in the study [8].

Tadina and Boltezar (2011) investigated a ball bearing vibrating during run-up and developed an enhanced bearing model. The numerical bearing framework considered the inner race to have two degrees of freedom, while the outer race was modelled with finite elements to account for radial deformation. The model also considered the centrifugal load effect and radial clearance. A non-linear Hertzian contact deformation was employed to describe the contact force for the balls. The developed model incorporated various surface defects due to local deformation, and the geometry of these defects was accurately modelled. The coupling between

the outer ring and the housing finite element model allowed for the consideration of the transmission path of the bearing housing [9].

An enhanced non-linear dynamic model that took into consideration interaction forces and response to vibration in broken rolling element bearings was presented by Ahmadi et al. (2015). This work overcame the drawbacks of modelling the rolling parts as point masses by taking into account their finite size as opposed to earlier models.The occurrence of low-frequency events in the vibration response when a rolling element encountered a line spall defect was reliably predicted in this model. Comparisons were made between the proposed model, previous models, and experimental findings to demonstrate the improved prediction of low and high-frequency events [10].

Harsha (2006) conducted a study on the nonlinear dynamic analysis of a balanced rotor with roller bearings. The author proposed a mass-spring model of the bearing, as shown in Figure 9.

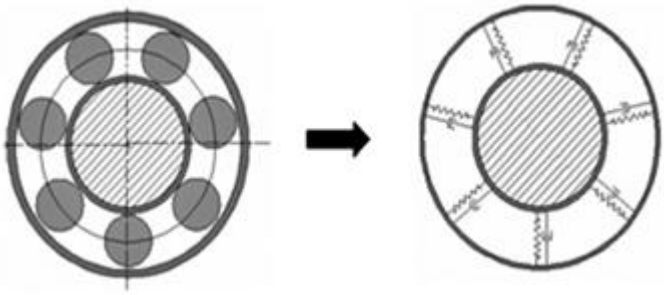


Fig.6 Vibratory model proposed by Patil et al.[8]

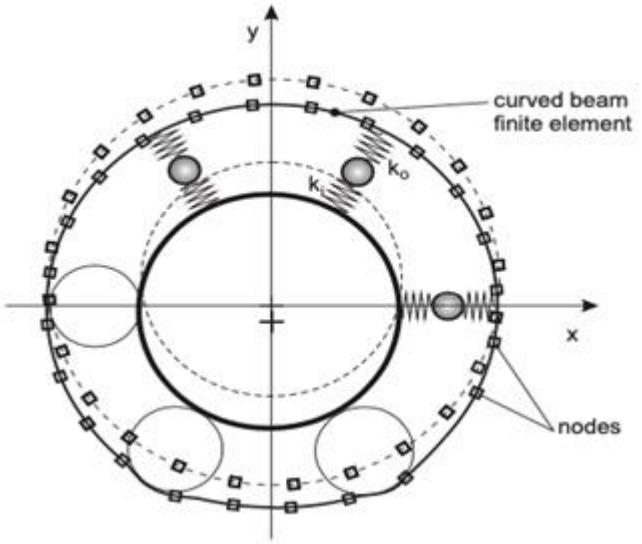


Fig. 7 Vibratory model proposed by Tadina and Boltezar [9]

The mathematical formulation considered the tangential motions of rolling elements, internal races, and external races, taking into account sources of nonlinearity such as Hertzian contact force and radial internal clearance. The contacts between the rolling elements and races were referred to in the formulation as nonlinear springs. The Hertzian elastic contact deformation principle was used to calculate the springs' stiffness. To solve the resulting nonlinear differential equations, an iterative approach employing the Newmark-β method with the Newton-Raphson method was utilized. When the speed of the rotor-bearing mechanism was varied, the results revealed the emergence of chaos and instability in the vibration response. It

was observed that intervals were doubled and intermittent processes contributed to the occurrence of chaos. These imperfections played a significant role in the appearance of intermittent, sub-harmonic, and chaotic activity regions. Charts, phase graphs, and Poincaré frequency spectra were employed to illustrate and demonstrate the diverse behavior exhibited by the system [11].

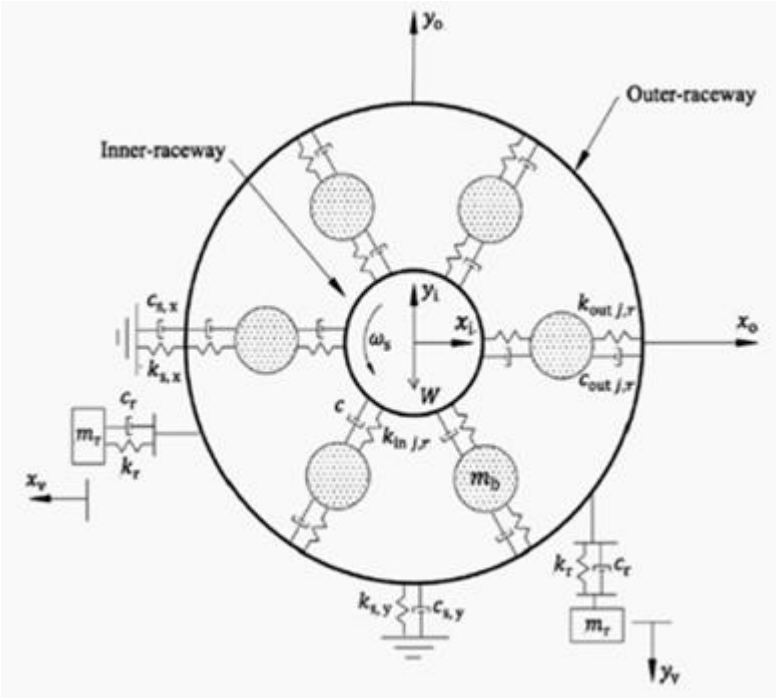


Fig. 8 Vibratory model proposed by Ahmadi et al.[10]

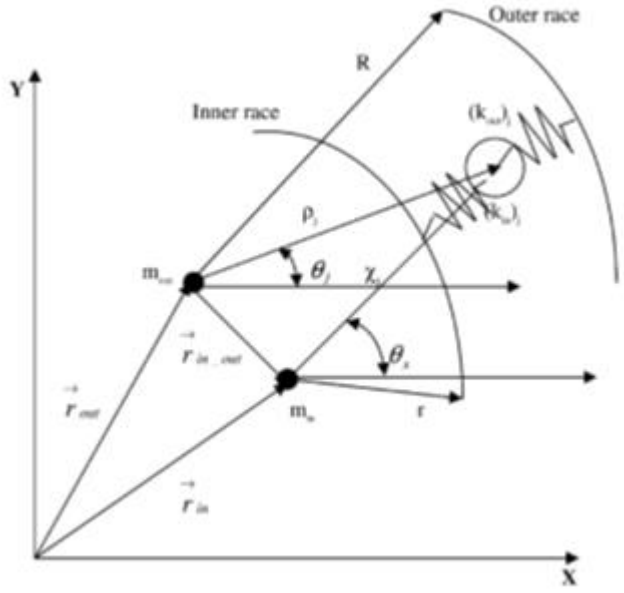


Fig.9 Mass-spring model of the rolling element bearing [11]

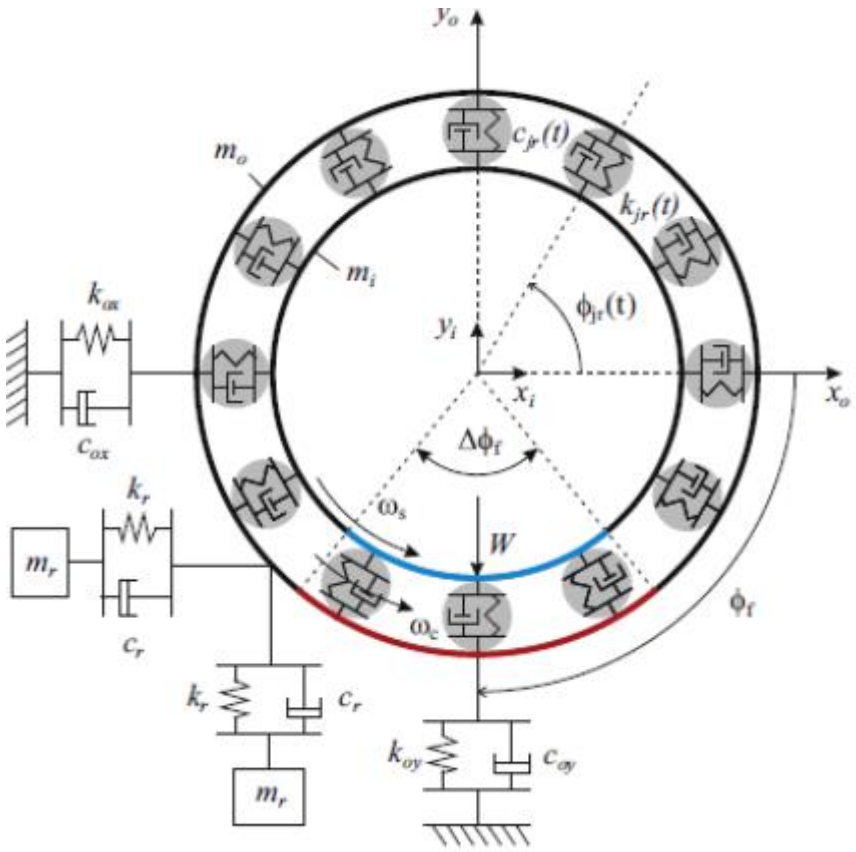


Fig.10 Vibratory model proposed by Petersen et al [12]

Figure 10 illustrates the vibratory mode of a bearing with a defect on races, proposed by Petersen et al. (2014). The study focused on the measurement and analysis of the defect of varying length, surface roughness and depth under the quasi-static load distribution and varying stiffness. The proposed method was applied to ball bearings that were intentionally seeded with line or extended outer raceway defects on gearbox and fan test rigs. As the balls passed through the defect, they experienced a redistribution of load, leading to a loss of load carrying capacity. The presence of the defect caused parametric excitations in the bearing assembly due to the differences in stiffness. The qualitative nature of the vibration response corresponded to the variations in stiffness. Rapid changes in stiffness at the exit of a fault resulted in impulsive impulses, while slower variations in stiffness caused by broad wavelength waviness characteristics generated low-frequency excitation in extended spalls, manifesting as defective components in the velocity spectrum. The contact forces on the balls exhibited fluctuations around the quasi-static loads, with abrupt changes in stiffness leading to high-magnitude impulsive forced fluctuations. Furthermore, the study presented an examination of the properties of the dynamic model linearized with quasi-static solutions. This approach provided a deeper understanding of the time-frequency characteristics of the vibration response [12].

III.VIBRATORY MODELS OF BEARINGS WITH DISTRIBUTED DEFECT

Wardle (1988) argued that stiffness, denoted as k, represents the slope of the load-deflection curve of a bearing at a specific load level and in the relevant direction, whether it is axial, radial, or tilted. In the analysis of small amplitude vibrations in structures involving rolling bearings, each bearing was simplified as a linear spring with stiffness k, accompanied by an active excitation source. This excitation was attributed to waviness errors

on the bearing surfaces and could manifest as relative motion between the inner and outer rings or variations in bearing load over time. For unconstrained bearing arrangements, the excitation was in the form of displacement, whereas for fixed ring positions, the excitation occurred as force [13].

In 1990, Lim and Singh explored vibration transmission in a single shaft-bearing-plate system, creating a novel mathematical model for precision bearings. They integrated this into linear dynamic models using various techniques, showing most designs were dynamically stable. Through three cases, including experiments, they proved their model's superiority, accurately predicting resonant frequencies and force transmission. They also analyzed bearing stiffness and found increased bearing loads raised resonant frequencies. Their model's utility extended to predicting vibrations in multi-component rotating systems, with potential applications in linear systems [14].

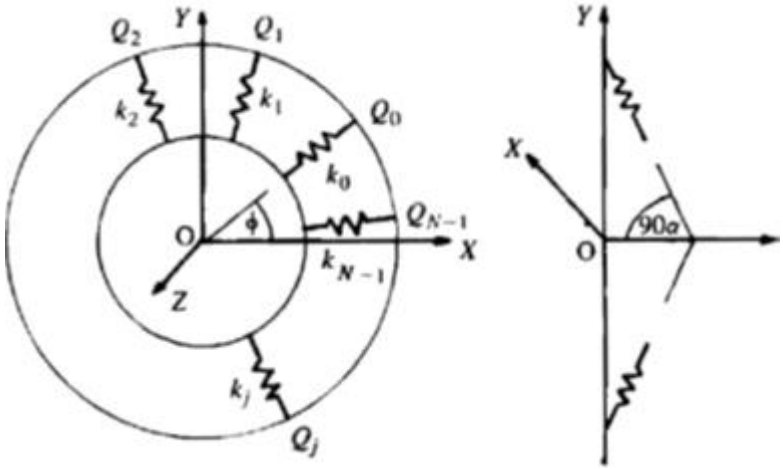


Fig. 11 Vibratory model proposed by Wardle [13]

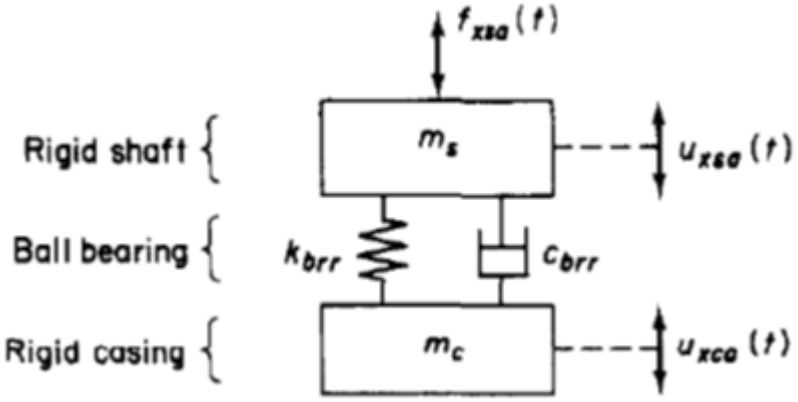


Fig. 12 Vibratory model proposed by Lim and Singh [14]

In 1998, Ono and Okada introduced a model (Figure 13) to examine outer race waviness in bearings. Their model featured a soft rubber support for the outer ring while keeping the inner ring fixed to the shaft, rotating at a constant speed. They assumed only the outer race had waviness due to centerless grinding during manufacturing, represented as a simple harmonic function. A radial gap was considered between the ball and both inner and outer races. The model considered two primary forces: constant gravity and a smaller centrifugal force from shaft imbalance, applied at the inner ring's centre. This caused a specific displacement.

Without imbalance, the inner ring moved downward vertically, but with an imbalance, the contact angle varied [15].

Fig.13 Vibratory model proposed by Ono and Okada [15]

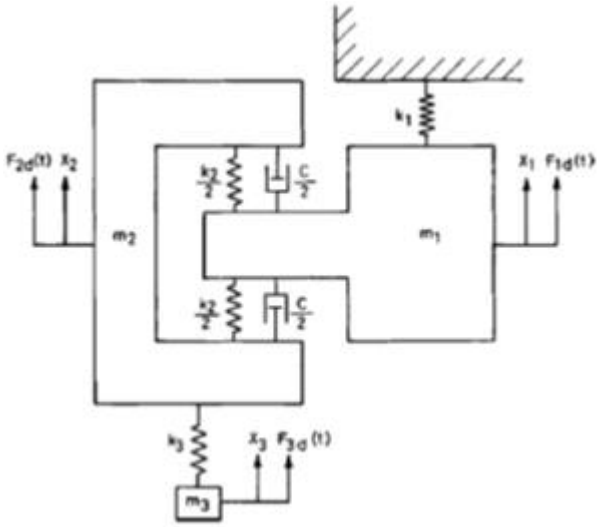


Fig.14 Vibratory model proposed byTandon and Choudhury [16]

Tandon and Choudhury (2000) have formulated a theoretical model, depicted in Figure 14, to predict the vibration response of rolling element bearings subjected to distributed defects under radial load. In their model, the rotor bearing system was represented by three degrees of freedom, serving as a prototype. The considered distributed defects included waviness in the external and internal races, as well as the presence of off-size rolling elements.

For each order of waviness, the model generated a discrete spectrum characterized by specific frequency components. When dealing with outer race waviness, the spectrum exhibited components at the frequency of the outer race defect and its harmonics. In the case of internal race waviness, the waviness orders were proportional to the number of rolling elements, resulting in spectral components at the frequency of the internal race defect and its multiples. Additionally, other waviness orders produced sidebands around these

peaks at multiples of the shaft frequency. Comparatively, the model predicted significantly larger amplitudes for spectral components arising from outer race waviness compared to those originating from internal race waviness. Moreover, in the presence of an off-size rolling element, the model anticipated distinct spectra with significant components at multiple cage frequency components [16].

Harsha et al. (2004) employed statistical modeling to address varying waviness characterized by peaks and valleys on surfaces. The analysis considered flexural vibrations and rigid body motion in rolling element-loaded rings. Assumptions included non-bending inner and outer rings, a sinusoidal waviness, and a large wavelength compared to the ball-to-race footprint width[17].

In 2004, Harsha predicted nonlinear rotor-bearing system responses due to ball size variations. The model included nonlinear springs representing element-to-race contacts and derived governing equations using Lagrange equations. For different ball sizes, symmetric combinations induced vibrations at various cage speeds, and a single off-sized ball caused vibrations at the cage speed. This held true for linear and nonlinear ball-to-race deflection coefficients. More balls reduced peak vibration amplitude, revealing significant peaks at frequencies associated with off-sized balls [18].

In 2006, Harsha examined structural vibration characteristics of rolling element bearings. The outer race was fixed, and the inner race rigidly attached to the shaft. Elastic deformation between races and rollers followed a nonlinear Hertzian theory. Factors like internal radial clearance, ball shifts, and race waviness led to occasional stiffness variations, resulting in nonlinear vibrations. The rolling element bearing was modeled as a spring-mass mechanism with rolling elements as nonlinear contact springs, with Hertzian forces only when deformation occurred [19].

In 2007, Raje et al. showed that rolling element bearing fatigue life varies significantly due to statistical failure mechanisms. Most existing models addressing this dispersion were primarily empirical and lacked insights into the underlying physical processes causing the variation. The inhomogeneous nature of the bearing material was identified as one of the primary factors contributing to the scattering of fatigue life. To address this, a novel approach utilizing a discrete representation of material was proposed. This discrete representation simulated the inherent randomness of the material, considering two sources of randomness: (i) topological randomness resulting from geometric variability in the microstructure of the material, and (ii) material property randomness due to non-uniform property distribution within the material. The study investigated the influence of these variations in Hertzian line contacts on the stressed subsurface field. Fatigue life was formulated based on the Lundberg-Palmgren theory, with a critical stressed quantity and its corresponding depth determining the occurrence of fatigue failure [20]. Raje and Sadeghi (2009) focused on sub-surface initiated spalling in bearing line [21].

IV. VIBRATORY MODELS OF BEARINGS WITH LUBRICATION

Johnson et al.(1972) integrated the established elasto-hydrodynamic theory with Greenwood and Williamson's theory of randomly rough surfaces in contact. This fusion provided a theoretical framework for highly loaded lubricated contacts, where load is shared between hydrodynamic pressure and asperity contact. The study revealed that when a significant portion of the load was supported by elasto-hydrodynamic action, the distinction between the rough surfaces could be approximated by the film thickness that would exist between two smooth surfaces under the same load, speed, and lubricant conditions. Consequently, asperity pressure largely depended on the ratio of the theoretical film thickness to the combined roughness of both surfaces,

both actual and apparent. Moreover, an increase in total load, while minimally affecting film thickness, resulted in higher fluid pressure and only a slight increase in contact pressure asperity [22].

Wardle (1983) discussed the investigation of static and dynamic rigidities in spindle-bearing structures. The study concluded that spring or hydraulically preloaded bearing systems could offer greater rigidity for general-purpose spindle designs compared to traditional bearing arrangements. The introduction of adjustable preload was suggested as a means to match bearing damping with the spindle bearing system, thereby achieving maximum dynamic stiffness. The method of RHP variload bearing was introduced in this context [23].

Wijnant et al. (1999) examined the behaviour of a rolling component operating on a lubricated rolling bearing raceway, considering the elastic deformation of both the rolling component and the raceway caused by the applied load. As the surfaces approached each other at remote points, this behaviour was characterized by the flexibility of contact in relation to the applied load. The stiffness, known as elasto-hydrodynamic lubrication (EHL) stiffness or EHL spring, was the reciprocal of this flexibility, incorporating forces arising from the inertia of the system. This approach enabled the calculation of damping resulting from viscous losses in the lubricant, allowing for the simulation of the system. In the experiment, the rolling element was slightly lifted or given an initial velocity from its equilibrium position, initiating a damping phase in the rolling component [24]. In seismic structures bearings are modelled by the combination of axial and shear springs [25]. The friction between the interaction between contact surfaces are modelled with the help of spring and damper elements [26]. A degrees of freedom vibratory model with time varying excitation is validated with experimental data [27]

V. SOME POSSIBLE LITERATURE GAPS AND OBJECTIVES

The existing literature on vibratory models for defective REB in various structures may have certain gaps that could be addressed through further research. Some possible literature gaps in this field could include:

a) Limited focus on specific defect types.
b) Insufficient consideration of material heterogeneity.
c) Limited focus on specific distributed defect types.
d) Insufficient consideration of defect patterns and distributions.
e) Lack of understanding of dynamic interaction effects.
f) Limited application to different structural materials.
g) Limited understanding of lubrication effects on vibratory behaviour.
h) Insufficient consideration of defect-lubricant interactions.
i) Characterization of lubricant-structure interactions.
j) Development of defect detection algorithms.
k) Optimization of lubrication strategies.

VI. SCOPE OF FUTURE WORK

The scope of future work in developing vibratory models for localized and distributed defects considering lubrication is broad and encompasses various aspects. Here are some potential areas of focus:

a) Experimental validation under lubrication conditions:

b) Characterization of lubricant-structure interactions:
c) Development of defect detection algorithms:
d) Quantification of defect severity and remaining useful life:
e) Optimization of lubrication strategies
f) Integration with structural health monitoring systems
g) Practical implementation and applicability

Overall, the future work in developing vibratory models for localized and distributed defects considering lubrication should aim to bridge the gap between theoretical developments and practical applications. By addressing the research areas mentioned above, this work can contribute to the advancement of structural health monitoring, maintenance practices, and the reliability of lubricated systems with defects by encouraging the collaboration between experts Engineers, data scientists, and domain specialists to work together to interpret and integrate data effectively. Developing decision support systems that use integrated data to make informed decisions about maintenance, repairs, or structural modifications may also help.

VII. CONCLUSION

Vibratory models of defective rolling element bearings are widely used for fault diagnosis in rotating machinery. These models rely on the analysis of vibration signals to detect and diagnose various of bearing defects. Several vibratory models have been proposed in the literature, including time-domain models, frequency-domain models, and time-frequency models. Each vibratory model possesses its own set of advantages and disadvantages, making them suitable for specific types of bearing defects and operating conditions. Overall, vibratory models of defective rolling element bearings have shown promising results in detecting and diagnosing bearing faults, providing early warning of potential failures, and helping to avoid costly downtime and maintenance. Nevertheless, it's crucial to emphasize that the precision and efficiency of these models hinge on various factors, including the vibration signals quality, the type and severity of the defects, and the operating conditions of the machinery. In summary, vibratory models of defective rolling element bearings are a valuable tool for monitoring and diagnosing bearing faults in rotating machinery, but their efficacy relies on multiple factors that must be meticulously assessed and optimized for each specific application.

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Thought Experimentation of Music and Science Fiction: Evolution of Music

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ABSTRACT

The present paper has focus on the thought experimentation of music and science fiction from different perspectives, such as Music has crossed all the boundaries of nationality, caste, creed, panth, sampraday, religion, regional, state and national and international. That's why it is called universal language in today's world. The basic aims and objective of the present paper is to focus on the need and importance of music, to elaborate features of music, state some recommendation to the new research students. Hindustani music is the classical music tradition of north India. It can be traced back to distinctive musical practices from the 8th and 9th centuries A. D. by the 12th and 13th centuries waves of invaders from West and Central Asia brought their musical cultures to north India.

Keywords: Experiment, thought, music, classical, western, eastern,

I. INTRODUCTION

The present form of Hindustani music thus represents a confluence of foreign influences with indigenous practices. The tradition consists of two major subgenres, dhrupad and khayal and a group of semi-classical subgenres broadly categorized as the 'thumri' family. Instrumental musicians may perform in any one of or a blend of these formats. Hindustani music shares with Carnatic music the basic principles of raga (melodic frameworks) and tala (rhythmic cycles), and performances feature both compositions as well as improvisation.
India is home to a diversity of folk music. Each form is intimately tied to a particular community or region, but dwells on themes that are universal. Some forms are elaborate and performed only by trained artistes, while others are simple enough for the whole community to participate in. Dance is often intertwined with folk music. The small samples of folk music forms here have been categorized according to their particular contexts, but in reality their practice is flexible.

Songs of Legends and heroes: -

—Legends of heroes and gods are kept alive through oral histories and songs. The themes are universal, tragic tales of star-crossed lovers and heroic accounts of the triumph of good over evil but they vary from one region to the next

Songs of celebration: -

Diwali and Dussehra are celebrated across the country with a riot of color and sound. Other festivals are marked across state or geographic regions. Local deities are commemorated with festivities within a village or village cluster. Irrespective of the scale, festivals bring communities together with song and dance.

Songs of Life: -

Our lives are dotted by events big and small, marking the passage of time. In India, every first be it a baby's first morsel of food or the commencement of a child's education is steeped in ceremony. These life events are celebrated and chronicled in songs.

Songs of work: -

For centuries, work has played a central role in defining communities and determining their ways of life. From fisherfolk to washermen, each community has songs of work to suit its labours. These songs alleviate the monotony of repetitive tasks and provide rhythms to unite the group; they provide company to those in solitary occupations and chronicle the diverse experiences of life in India.

Songs of struggle: -

Emotions ran high as the movement for independence from British rule peaked. The promise of a free nation brought hope, yet people across the country were subject to large and small acts of injustice and oppression. The senseless loss of life during World War II, the horror of the Bengal famine of 1943 that claimed 1.5 million lives, and the everyday struggles of peasants against subjugation were etched in public memory. Music served as the means to tell these stories in ways that conveyed far more than words alone ever could.

Gandhi and the bhajan :-

Mahatma Gandhi's non-violent resistance to colonial rule was rooted in the principles of Satyagraha – an insistence on truth, and Swaraj, self-rule, both political and personal. Music, in the form of sung-prayers and chants played a vital role in amplifying his message uniting the satyagraha community, connecting it with the nation, and enabling its moral force to reach every household. Twice daily before dawn and after dusk the satyagraha community renewed their dedication to the principles of truth and non-violence through prayer songs and chants. Over the years, their rhythms and words became a formidable source of strength and inspiration for satyagrahis in times of adversity. The chosen prayers were compiled into a handy volume titled the Ashram Bhajanavali that included verses from the Upanishads and popular bhajans, along with lines from the Quran and Zend Avesta, Buddhist chants, and Christian hymns.

Rabindranath Tagore: -

A towering literary figure, Rabindranath Tagore transformed Bengali literature. He broke away from classical forms of verse rooted in Sanskrit and created ones that used colloquial language. He was a humanist who combined open-mindedness with a deep love for the land. Although he was against the Western domination of India, he was not against western culture. He opposed violence in political struggle and favoured reason over blind adherence to tradition. Tagore won the Nobel Prize for Literature in 1913 for his poetic work *Gitanjali*. The thousands of songs that he composed live on as the popular body of music known as Rabindra Sangeet. Many of these songs dwell on themes of nature, the changing of seasons, life and romance, as well as

nationalism and spirituality. Tagore's creative genius lives on in the national anthems of three countries. He composed '*Jana gana mana'*, which was adopted as India's national anthem in 1950. His paean in praise of Bengal, 'Amar sonar Bangla', was adopted by Bangladesh as their national anthem in 1971. He was also the inspiration for the lilting melody of 'Sri Lanka matha' composed by Ananda Samarakoon, who was once a student of Visva Bharati, the university founded by Tagore in Santiniketan.

Patriotism in Popular culture: –

When India began a new chapter as a sovereign democracy, cinema was claiming the hearts and minds of its people, mirroring and magnifying their emotions and aspirations. The prevailing national sentiment was one of patriotism, and it found powerful expression in film songs. Through the decades, these songs have united legions of Indians over their love for the country. Patriotism in song has also proven to be good business for producers, especially in the 21st century, when sporting arenas have become the new battlefields. Numbers like 'Chak de! India' from the 2007 movie by the same name and 'Maatujhe salaam' by AR Rahman become anthems that unite across all divides.

Nation of storytellers: –

When it first began, the movie industry attracted artists and technicians from the world of theatre. They brought ideas about performance, drama, staging and storytelling to the new medium. Music, an integral part of theatre, found a place in cinema as well. Early silent films were accompanied by live orchestras, and songs were so important in the early talkies that someone even suggested they be called "singies" instead. Music continues to be a vital part of our films today. The legacy of early cinema's roots in Sanskrit classical, folk and urban traditions of drama is that even today, we tell our stories through song. Even now, Indian movies use songs to depict character's emotions and have become a cultural phenomenon in the Indian celluloid world.

Indian classical music is ancient in origin, yet constantly evolving. Its earliest sources include the ritual incantations of vedic scriptures over 2,000 years ago and the timeless wellspring of folk music of the subcontinent. Alongside the two main streams of Carnatik and Hindustani classical music, are numerous tributaries of devotional music traditions, which have both received from and given back to the two main traditions. Classical music is guided by well-defined structures and frameworks, and yet brims with scope for creative articulation. It stimulates the mind, soothes the soul, and continues to be the benevolent mother to a variety of musical expressions.

India has a very rich heritage which has been passed down from generation to generation. Be it the age of the Indus civilization or the number of invasions and culture clashes this land has witnessed. All this has contributed to the complex history of Indian music which has been one of the most important aspects of our heritage. All these factors have led to the current generation thinking.

Many studies in the field of positive media psychology have investigated the effects of meaningful film on viewer's feelings and openness to others, all the while music is the number media source for feeling moved, touched or inspired. Therefore, the current study examined the role of meaningful compared to pleasurable music on listeners' emotional experiences, feelings of connectedness, and altruistic behaviors. Findings revealed that listening to meaningful music leads to stronger feelings of being moved, having a lump in one's throat and tears crying, more contemplation, a stronger motivation to seek what matters in life, and a stronger desire to express love to close others, compared to listening to pleasurable music. Both listening to meaningful and pleasurable music were found to lead to a wide range of intense and blended emotions, a desire to connect to

others, and same levels of altruism. In sum, meaningful and pleasurable music can evoke a different mix of emotions, however, both are strong and open our hearts to others.

II. THEORETICAL BACKGROUND

Listening to music as a transcendent experience

In their most recent work, scholars in the field of positive media psychology have identified research designed to investigate and understand self-transcendent media experiences as essential to moving the field forward. Self-transcendence refers to "a motivational state in which the person seeks something beyond personal benefit, for example, the furtherance of some greater cause, union with a power beyond the self, and/ or service to others as an expression of identification beyond the personal ego".

Physiological responses to music

Meaningful affect upon watching a film has been found to be associated with a particular set of physiological reactions such as having a rising or open chest, chills, a lump in one's throat, and tears crying. These reactions are different from pleasurable reactions that are characterized by light and bouncy feelings, high energy, relaxation, and laughter. Findings from music psychology studies indicated that pieces of music that express different emotions yield different physiological reactions in listeners as well. One powerful emotional response to music is shivery, commonly called "chills" or "thrills," which is more prevalent for sad than for happy music. Chills are also an indication of being moved and listening to music that is considered to be meaningful also appears to lead to chills or shivers (Craig, 2009). In contrast, happy music is found to lead to smiling. Based on these findings, it can be hypothesized that, Physical responses associated with meaningful affect are more common for meaningful than pleasurable music.

Music and contemplation

Watching a meaningful film often provides insights about life. These thoughts are not only related to the film, but also concerning reflections about one's own life and thoughts about future moral intentions, such as, "useing every minute to let people know that you love them". These introspective thoughts about what is important and meaningful in life have been conceptualized as contemplation. It appears that the more moving a film is, the stronger the reflective thoughts in its viewers. As listening to music seems to be able to evoke an intense experience of being moved, touched, or inspired, it is likely that it will also trigger contemplation similar to meaningful films.

Music, human connectedness, and altruism

Feelings of connectedness to loved ones can arise when music evokes memories, but also listening to "sad" music can lead to feeling close to loved ones. Listening to music can also result in a transcendent experience leading to feelings of connectedness. It appears that these feelings of connectedness not only apply to close others, but can also concern other listeners, the performers, or even to everyone else. Research on film found a consistent effect of meaningful but not pleasurable content on moral motivations and connectedness to humanity. In contrast to pleasurable film, meaningful film is more likely to motivate people to be a better person, to do good for others and to seek what really matters in life. Contemplatives experiences, the extent to which listening led to contemplation was measured with the four-item "Contemplative experiences" subscale

from the Revised Emotional Gratification Scale. Participants were presented the half-sentence: "It was good to experience these feelings … " along with items as: " … because it encourages me to focus on things that are important to me" and " … because it inspires new insights". Participants were asked to indicate how well each statement described their experience with the response options:

Esthetic emotions

To examine esthetic emotions, nine subscales from the Esthetic Emotions Scale asthmas were included. For this measure, participants were presented the question: "Which emotional effect did the song/ music piece have on you?," following with statements about emotions along with the response options: 1 = Not at All to 5 = Very. Of the prototypical esthetic emotions, the subscale "Being moved" included: "Felt deeply moved" and "Touched me" (α = .897), the subscale "Fascination": "Was impressed" and "Fascinated me" (α = .732), the subscale "Feeling of beauty/liking": "I found it beautiful" and "Liked it" (α = .533), and the subscale "Awe": "I found it sublime" and "Felt awe" (α = .720). Of the epistemic emotions, the subscale "Intellectual challenge" included: "Challenged me intellectually" and "Was mentally engaged" (α = .752), and the subscale "Insight": "Felt a sudden insight" and "Sensed a deeper meaning" (α = .706). Of the emotions indicative of amusement, the subscale "Joy" included: "Delighted me" and "Made me happy" (α = .738). Of the activating effects of esthetic experiences, the subscale "Energy" included: "Motivated me to act" and "Energized me" (α = .854). Finally, the subscale "Sadness" included: "Made me sad" and "Made me feel melancholic" (α = .832).

Physical reactions upon listening

Physical indicators of meaningful affect were assessed with seven bodily reactions borrowing from previous research, including "Lump in throat" and "Tears crying". The reaction "Goosebumps" was added as this is another important physical response to music (Hodges, 2016; Cronbach's α = .743). Physical indicators of pleasure were assessed with four items, including: "Light bouncy" and "Laughter". For all physical reactions, participants were asked to indicate how much they experienced each reaction. Response options were: 1 = Not at All to 7 = Very Much.

Motivations upon listening

To assess motivational outcomes upon listening, participants were presented a list of ways the music may have motivated them to behave, including both moral motivations and motivations not related to meaning making. After the half-sentence: "As a result of listening to this song/ music piece I (more or less) feel like … " motivations were presented, such as: "seek what really matters in life," and "make people laugh". Participants were asked to indicate the extent to which each motivation applied to them. Response options were: 1 = Much Less to 9 = Much More.

Spontaneous motivations to connect

Spontaneous reactions and motivations concerning connectedness were assessed with the Twenty Statements Test. After listening to the music, participants were asked to describe the strongest emotion they felt while listening. Next, they were asked to list all the things they would like to do at that moment given this feeling. These instructions were followed by 20 blank lines that began with: "I would like to_____." A content analysis was done on the written responses. Two independent coders classified each written response into:

1) whether or not each participant indicated a desire to connect or to affiliate with others

2) the extent to which participants desired to express their love for others, for instance, by wishing to thank others, to tell beloved ones how much they love them or to hug a beloved one. The Krippendorff's alpha test was used to estimate the inter-rater reliability between the two coders. The inter-rater reliabilities were excellent (α = .956 for the overall desire to connect and α = .931 for the desire to express love).

Altruistic behavior

Altruism was captured with whether or not the participants donated to charity at the end of the study. Upon finishing the posttest questionnaire, the participants received the following instruction: "For your participation, you receive a voucher of 5 euro. Obviously, you can keep it, but you can also give it away to help others. For this study, you can donate your voucher to the foundation De Vrolijkheid. He has organized weekly music lessons and workshops at many asylum seekers centers, because they believe in the power of art and because music plays a huge connecting force. As they state on their website: 'The language of music is universal.' For more information, would you prefer to keep the voucher or give it away to help them?" Subsequently, they were able to donate anonymously by putting the voucher in an envelope.

Control variables

In the analyses, the following potential confounders were included: sex (Panksepp, 1995; Pohling & Diessner, 2016; Raney et al., 2018), age (Oliver & Raney, 2011), currently singing or playing an instrument and how many minutes the participants listened to music every day (Molnar-Szakacs, 2017). Engagement with beauty as a trait was also included with the subscale "Artistic Beauty" from the Engagement with Beauty Scale (Diessner et al., 2008; α = .860), along with need for affect (Appel et al., 2012; α = .723), empathy with "Empathic Concern" subscale from the Interpersonal Reactivity Index (IRI; Davis, 1980; α = .751), and feelings of nostalgia (Juslin & Laukka, 2004; α = .929).

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Current Patterns and Advancements in AI-Powered Applications

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ABSTRACT

AI is a revolutionary world that has completely taken over our daily lives. It is the special fusion of machines and minds. Artificial intelligence has been gradually growing over the last few years and has become ingrained in practically every profession. Artificial intelligence (AI) has led to new discoveries and technological advances. There are many uses for artificial intelligence (AI), ranging from tiny objects to cutting-edge breakthroughs. A new world has been made possible by the development of many technologies and devices, and there are yet many breakthroughs to come. As a result, it offers an automatic route to a promising future.

We have provided a thorough overview of all the advancements and current developments in artificial intelligence in this paper.

Keywords: AI (Artificial intelligence), Technological, Automated, Trends.

I. INTRODUCTION

The rate at which science and technology are developing has accelerated in recent years. The idea of artificial intelligence and its integration into daily life have greatly improved the globe to unprecedented levels. The 21st century's rapid advancements and new trends have more applications than ever in every industry, supporting economic development and expansion. AI's future essentially consists of a schedule of both digital and physical gatherings and exhibitions [1]. The artificial intelligence market is expanding daily. The machines that display intelligence, making them smarter than humans, are the most significant element of artificial intelligence. Because of all these innovations, a thorough understanding of artificial intelligence is now required. We will summarize the most recent developments and trends in the field of artificial intelligence in the following section.

II. NEW AI-BASED TECHNOLOGIES

Many innovations in AI have been made. Here is a thorough survey:

1. Tesla's Pilot System:

One of the best examples of the automated revolution is Tesla's Autopilot. This is the first AI-powered driving experience in history. It is the semi-autonomous driving feature that prevents collisions and accidents while adjusting speed, changing lanes, and applying automatic braking.

The driver in this cutting-edge, artificial intelligence-powered vehicle is there solely for legal purposes. It drives itself, so he doesn't need to do anything. Tesla uses data from each vehicle equipped with the new automated steering or lane change system to train its algorithms for autopilot. Following that, Tesla tests these algorithms and integrates them into the operating system.

Tesla's Autopilot is a significant AI technology that is on the horizon. Machine learning is the process by which computers can become artificially intelligent [2].

2. Boxever:

With the goal of enhancing the travel industry customer experience, this intelligent customer cloud primarily relies on machine learning. It is therefore capable of reimagining the client experience by utilizing artificial intelligence and machine learning. Boxever clearly activates the states surrounding every customer. It provides a single contextual view of every client. Boxever is an AI-powered brand that offers one-to-one personalization [3].

3. The fin motion:

The newest AI-based technology, called Fin Gesture, is a smart ring that can convert hand gestures into commands. Wearing this device on the thumb allows it to identify each finger's segment and then tap into commands. In essence, it uses Bluetooth to send commands to other devices [4].

4. Robotic AI:

The world's most advanced robot—which can accomplish challenging tasks—is an artificial intelligence (AI).It not only understands our mood but also our facial features. Jia Jia is the robot's given name. She is able to view the world exactly as humans do. We are able to ask it anything. She is aware of the meaning behind what we say. She plays music, arranges meetings, sets alarms, plays schedules, tells us the weather and news, and manages all of our connected devices with our voice [5].

5. Vinci:

The first AI-powered smart headphones that can comprehend you are called Vinci. All you have to do is inform Vinci, and it responds appropriately. You can adjust the tracks appropriately, and it also provides details about your extensive inquiries [6].

6. AI Eyewear:

Artificial intelligence has been shown to work a great magic with AI glasses, particularly for children with autism.The disease prevents the children from understanding facial expressions that convey emotion. Autism glass are wearable glasses that facilitate social interaction between individuals with autism by using real-time social cues and machine learning. A patient only needs to put it on his eyes whenever he wants to use it [7]. The glass has a front-facing camera that recognizes other people's expressions using artificial intelligence and

machine learning. The wearable is linked to a smartphone app, allowing professionals and the patient's parents to monitor the patient's progress in identifying emotions [8].

7.Touchiva:

Emotional intelligence is one of the most significant advances in artificial intelligence. Consider for a moment: what if technology could adjust to the emotions of people? In response, Affectiva The program that recognizes emotions and introduces emotional intelligence to the digital sphere is called Affectiva. It's changing not just how people interact with technology but also, in essence, how people interact with each other (Kour and Gondhi 336)[9]. It is an automated facial coding system that facilitates assessment, prediction, and optimization. By looking at our faces, it can tell how we are feeling. As a result, it is reintroducing feelings into digital encounter.

8. Alexa and Siri:

Siri is essentially a computer program that functions as a knowledge navigator and intelligent personal assistant.It is an iOS component made by Apple Inc. Put differently, it's Apple's virtual assistant. Siri underwent a significant series of brain transplants by switching from a silicon-powered mind to an AI-powered mind with the aid of machine learning. Siri's voice recognition significantly improved once Apple began utilizing machine learning, following a number of trials and attempts. Subsequently, by repeatedly applying machine learning, it becomes more intelligent and starts to comprehend natural language. As we converse with our friends, we can converse with Siri, and it facilitates a number of tasks, including messaging and making phone calls.It functions without a hand and can provide us with the optimal path to any destination [10].

It can also find directions, set reminders, schedule dates, and provide answers to all of our questions. Similar to Siri, Alexa is another AI-powered technology. It has an AI-like sensation to it. She is our virtual personal assistant, listening to us all the time through various brain-powered physical devices. In terms of hearing, she is even more perceptive than Siri [11].

9. Netflix:

Netflix:Netflix's latest AI modifies every scene separately to optimize video quality, even on extremely slow internet connections. It reduces the amount of data it uses by using artificial intelligence techniques to analyze each shot in a video and then compress it without compromising the quality of the image [12]. As a result, it not only enhances video quality to a greater extent but also reduces data usage.

10. Intelligent Speaker

A new innovation known as the Smart Speaker is emerging in the world of headphones technology. To play music is essentially to tread on emotions. It instantly detects the user's emotions and mood before playing the correspondingly, music. As a result, Mood Box is the emotionally aware speaker system that selects the appropriate music to play using AI. EMI, an emotionally intelligent program, is essentially what it uses. It plays music in accordance with the moods it has learned [13].

11. Recognition of Faces

Facial recognition algorithms are used by our favorite gadgets, such as mobile phones, laptops, and PCs, to recognize and detect faces in order to grant safe access. Facial recognition is a popular artificial intelligence use outside of personal use, even in high-security settings across a variety of industries[13].

12. System of Recommendations

Recommendation systems are used by many of the platforms we use on a daily basis, including social media, e-commerce, entertainment websites, and video sharing sites like YouTube, to gather user data and offer consumers personalized recommendations in an effort to boost engagement. In practically every industry, this is one of the most common applications of artificial intelligence [14].

III.CONCLUSION

Over the past few decades, artificial intelligence has advanced dramatically in practically every field, not just one. The world has completely changed as a result of it. As a result, it offers an automated route that leads to a promising future. But if used improperly, it also has drawbacks. It is also very expensive, hard to manage, causes unemployment, etc. Thus, while AI has many benefits, it can also be harmful if not used carefully.

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Analysis of Water Samples from Different villages of Majalgaon Taluka

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ABSTRACT

Water plays a significant role in sustaining the human health and prosperity. Clean drinking water is now accepted as a fundamental right of human beings. In view of this ground water quality with Total Dissolved Solutes (TDS) parameter is assessed from different villages of the Majalgaon taluka.

I. INTRODUCTION

Groundwater is one of the most precious natural resources. The availability of good quality water avoids many diseases, improving health.[1] Many people die every year due to water related diseases therefore water quality control is a top-priority policy in many parts of the world[2]. Bore water is one of the major source for drinking water as well as for irrigation purpose in Majalgaon taluka. In continuation to our earlier interest on the water analysis of Majalgaon area[3,4] we here in assessed 25 water samples from different villages of Majalgaon taluka in the month of October-2023.

II. INSTRUMENTATION

Sophisticated instruments like TDS meter were purchased and used to calculate TDS. 30 ml air tight plastic bottles were used for collection of water sample.

III.COLLECTION OF SAMPLE

Prepared plan is used for collection of general data of villages. Survey of different villages was carried out. About 25 different sites from different villages were identified (Table-1). Water sample from these sites were collected in sample bottles and brought to chemistry laboratory for further analysis. (Water source – mainly bore water/water from well or other source)

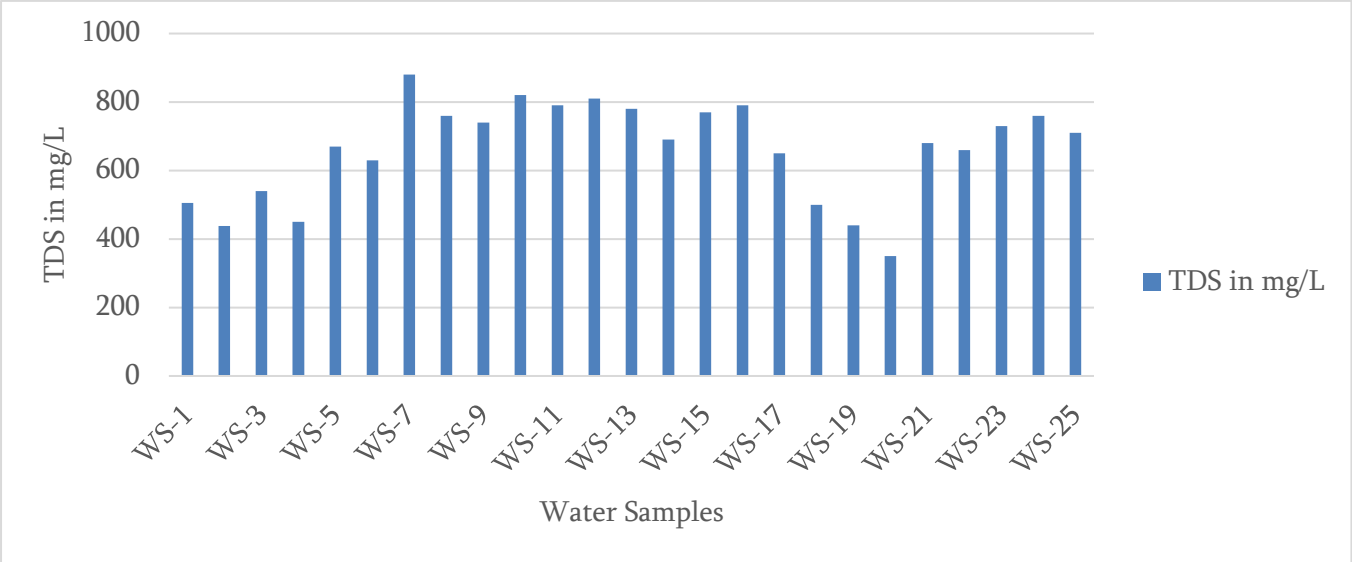
IV. ANALYSIS OF SAMPLE

Samples were analyzed by standard methods. Important parameter TDS was analyzed. Standard benchmarks from WHO (World Health Organization) and BIS (Bureau of Indian Standard) for drinking water were used to compare with these results.

Table-1: TDS parameter of Bore well water from different villages of the Majalgaon taluka.

Sr. No.	Area/Ward	Sample No.	TDS in mg/L
1	Kesapuri	WS-1	505
2	Chinchgavan	WS-2	438
3	Ekdara	WS-3	540
4	Renapuri	WS-4	450
5	Rajegaon	WS-5	670
6	Nitrud	WS-6	630
7	Nakhalgaon	WS-7	880
8	Pawarwadi	WS-8	760
9	Longaon	WS-9	740
10	Babhalgaon	WS-10	820
11	Pimpalgaon	WS-11	790
12	Aalapur	WS-12	810
13	Kharat Adgaon	WS-13	780
14	Ramgaon	WS-14	690
15	Kothala	WS-15	770
16	Patrud	WS-16	790
17	Laul Tanda	WS-17	650
18	Shindewadi	WS-18	500
19	Paytalwadi	WS-19	440
20	Ghalatwadi	WS-20	350
21	Talewadi	WS-21	680
22	Shindewadi	WS-22	660
23	Takarwadi	WS-23	730
24	Anandgaon	WS-24	760
25	Warola	WS-25	710

TDS parameter of water samples of Majalgaon taluka- Graphical presentation



V. RESULTS AND DISCUSSION

The results obtained by analyzing water samples collected from 25 different villages of the Majalgaon taluka are shown in the Table-1. Comparison of the obtained values for total dissolved solids of ground water samples has been made with permissible limits of WHO, and BIS standards for Drinking water. All the water samples were collected in the month of October-2023. All the samples were colorless and odorless. The air temperature is 28 to 30°C, and water temperature ranged from 23 to 25°C.

As the table shows according to standards for drinking water, major villages of the Majalgaon taluka having TDS values ranging from 500mg/L to 800mg/L. The lowest value observed in sample 20 i.e. 350mg/L and the highest TDS value observed in sample 7 i.e. 880mg/L. Results shows that even the lowest value is also not satisfying the standard norms and it is above the permissible limit.

The study further revels that out of 25 samples all the samples fall in hard category as they fall >300 permissible limits, while one sample is having highest value of 880mg/L is away from permissible limit, whereas only one samples is having value 350mg/L which is near to the permissible limit, falls in soft category. When sample TDS values were compaired with BIS values only 4 samples out of 25 fall under permissible limit having values <500mg/L.[5]

VI. CONCLUSION

Total Dissolved Solids might impact on water quality adversely in many ways. According to WHO who have published the standards for the TDS as 300 mg/L (Permissible) and 500 mg/L (Excessive). Whereas according to BIS acceptable limit is 500mg/L. The values of TDS of major water samples fall above permissible limits. TDS of water is important in determining the suitability of water for domestic uses. One reason for increasing the TDS level might be less rain fall during rainy days that is during June to September 2023. However hard water with more TDS creates problem of kidney failure. High TDS in ground water may be due to ground water pollution when waste waters from both residential and other units are discharged into pits, and ponds enabling the waste

migrate down to the ground water. Such low water quality is also harmful to soil health and can affect the production. TDS up to 500 mg/L can be relished if got acclimatized to or by refilling the bore wells. There should be increase in awareness among the people living in above affected area to maintain the groundwater at their highest quality and purity levels and the present study may prove to be useful in achieving the same.

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A Comprehensive Review of Contemporary Developments in Research Concerning Mathematics Education

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ABSTRACT

The use of technology in mathematics classrooms has been the subject of a great number of research, exploring the ways in which various digital tools might enhance the learning experience of students. In the intention of classifying and evaluating the part that digital technologies play in these investigations, the major objective of the study is to provide a comprehensive overview of the numerous empirical attempts that are currently proceeding in the topic area. We chose last decade published research on technological interventions in mathematics education from a pool of over studies in order to carry out our systematic review. This research employs a classification system that classifies digital resources, the pedagogical basis and purposes of activities, and the degrees of technological integration. The findings of this classification, when compared to the methods that are known to be effective in leveraging the potential of technology to improve mathematics instruction, demonstrate a difference set studied. We postulate and investigate the factors that lie behind the surface of modern tendencies.

I. INTRODUCTION

Some believe that digital technologies and appropriate pedagogy can help solve some maths teaching problems. These technologies could help students learn arithmetic more realistically, problem-solving, and collaboratively, and bring context and consistency to their lectures. Many authors believe that the results do not match the enthusiasm of mathematics, even though more courses are using technology [1]. To understand this phenomenon, this research compiles recent empirical studies on technology in mathematics education to find parallels. Our custom classification gives us an overview of the field's current state. This suggests that constructivist philosophical pedagogy is the norm, and that technology is largely used to "augmentation" traditional classroom methods. One can better understand the reasons that lead to underuse of technology in mathematics teaching. Additionally, the classification results provide a framework for

classifying current advances in the subject and guiding future research [2].

The background literature overview provides context for the study by reviewing mathematics education and its issues and technology-enhanced mathematics education. The background research seeks to determine, what problems digital technologies may be able to answer and what defines outstanding mathematics education, specifically the characteristics of arithmetic learning activities aided by technology that are most likely to solve these difficulties. Answering both questions is the goal [3-4].

This study begins with a discussion of the categorization system's design after reviewing treatments from various research articles on empirical investigations in mathematics education with technology. Meta-analyses and research articles evaluating many therapies increased the number of interventions in publications [5]. This includes all interventions. We classify the therapies by their objectives, methodology, and digital technology use, then analyse the study using these categories. In this research, "intervention" means analysing a technology or its use to solve a problem. The authors of this review study highlight a discrepancy between field practices and literature on incorporating technology in mathematics instruction.

2.Mathematical Education Issues

Recent revisions to the curriculum have shown that the idea that gaining mathematical skills solely involves acquiring methods and concepts via practice is not only incorrect but also unsuitable. Meticulousness in mathematics encompasses metacognitive skills, such as the capacity to think creatively and find solutions to problems. Unfortunately, many people continue to hold the belief that mathematics is nothing more than a collection of unrelated rules, facts, and "tricks" that are "hard, right or wrong, routinized, and boring," and that teaching mathematics is all about teaching students to memorize and follow procedures that should produce unique, unquestionably correct answers [6]. Because of this, a behaviorist approach to education has emerged, and the curricula of many countries continue to place an emphasis on formal and abstract mathematics. As a result of the fact that the major responsibility of the teacher in this setting is to impart knowledge to the students, people typically consider them to be the most knowledgeable authority on the topic. Students now view mathematics as a collection of distinct rules and procedures, rather than as an all-encompassing and interconnected field of study, because of this, which, when combined with an emphasis on testing, has come about. Commonly used didactical tactics train students on how to proceed, rather than putting an emphasis on they comprehend the material. Most of the time, teachers place more of an emphasis on material rather than mathematical literacy, and they do not encourage students to look for alternate techniques or sources of answers. A subsequent decontextualized and fragmented understanding of the topic is typically the cause of problems with motivation and interest in the subject matter [7].

So far, there have been a few attempts made to find a solution to these problems, but none of them have been successful. Pseudo-real-world questions are merely typical computational problems that are given the impression of being "real-world" by being translated into easy word problems. This is a result of the recognition of the significance of incorporating mathematics into meaningful contexts, which has led to the invention of these questions. Students could have difficulty using their mathematical knowledge outside of their comfort zones if they lack the ability to solve problems, if they place an excessive amount of importance on performing routines and processes, and if they have an overly narrow sense of context [8].

The implementation of digital technologies in the field of mathematics education has the potential to solve a significant number of the problems that have been recognized in the past. It has the potential to generate new opportunities for students to produce and engage with mathematical knowledge, to place the topic in contexts that are relevant to the real world, and to provide them with the ability to make sense of what they are

studying. Increasing processing capacity is not the only thing that modern technology is capable of doing; it may also improve collaboration and place a greater emphasis on the practical applications of mathematics through modeling, visualization, manipulation, and the introduction of increasingly complicated scenarios. The utilization of technology in mathematics education is becoming increasingly important as a result of these forces, which are driving international policy and curriculum [9].

As a result of an increasing awareness of the potential impact that technology may have on mathematics education, a significant number of individuals are of the opinion that the foundation of mathematics education in schools should be based on problem-solving and inquiry rather than the rote memorization of facts and procedures. Even if the presence of technology in the classroom does not ensure that students will work together or ask questions, it does help to facilitate these activities [10]. It is dependent on the role of the teacher, the task design, and the consideration of the learning environment in order to bring about a climate in mathematics classrooms that is conducive to inquiry and discourse. It is important to take into consideration the potential enhancements to mathematics education that could result from the adoption of technology, in addition to providing an appropriate schedule for activities. When we look back at the development of technology in mathematics education, we see two quite different instructional methods that led to the creation of rather different instruments [11]. The CAI multiple-choice examinations, on the other hand, used a strong behaviorist approach to learning and had a far lower degree of expressivity than other types of tests. Alternatively, Logo fostered a constructionist approach to education, which was highly expressive in the field of mathematics. Additionally, it improved the connection between the activities of students and the symbolic representations of those activities. Students can improve their understanding of mathematics by using digital technologies, which can serve as a conceptual toolkit and a "source of questions concerning mathematical knowledge." Additionally, there is a distinction that can be made between the pragmatic and epistemic value that technology can offer to activities.

This will assist students in designing interesting tasks that will require mathematics and technology. Several authors emphasize the significance of authentic and compelling contexts for activities as a basis for task design. This will help students construct interesting difficulties. A considerable number of people are of the opinion that technology should be utilized solely for activities that are significantly enhanced by it, as opposed to activities that could have been accomplished without the utilization of technology. In this kind of setting, students are not only allowed to apply what they have learned about mathematics to issues that occur in the real world, but they are also allowed to experiment with technical tools in order to draw conclusions about the usefulness of mathematics that are applicable to the real world setting [12].

Techniques that are based on inquiry are the most effective for solving mathematical problems that take advantage of technological advancements. In the field of mathematics education, it is possible to make the transition from a transmission-based, teacher-led classroom to a student-centered, investigative, and constructivist classroom. This is made possible by technological capabilities that enable the testing and experimentation of ideas, modeling, and visualization of abstract mathematical concepts. When it comes to the design of the tasks, the fact that they are free-form is a fundamental component of the inquiry-based learning environment. By giving students the ability to take care of their own education, digital technology in mathematics education can provide students with a wide range of options for how they might tackle obstacles and accomplish their objectives. Providing pupils with the opportunity to take responsibility for their own education in this manner might help them feel more confident and increase their excitement for mathematics.

A shift in pedagogy and the learning experiences of students is required in order to establish an environment that supports the use of technology in an inquiry-based and constructivist manner. This transition is mostly dependent on the attitudes and behaviors of teachers. The problems that arise from the worldviews of educators, on the other hand, can be persistent and challenging to alter. The traditional viewpoint of the classroom believes that the instructor should be in a position of authority, that they should be considered the "knower," and that their primary function should be that of a communicator. It is not uncommon for this teaching culture to come into conflict with pedagogical approaches that involve the utilization of technology. Some people believe that initiatives to incorporate technology and other "21st Century" pedagogies into the classroom can pose a challenge to the authority of the teacher [13]. This is because these initiatives aim to shift the teacher's role from that of an initiator and controller to that of a facilitator. There is a possibility that educators will try to incorporate the technology into their existing "lecture-based" approach rather than modifying their methods in order to make the most of digital materials. It is not uncommon for teachers to be unable to make effective use of technology, even when they are prepared to experiment with novel approaches, because of systemic challenges such as inadequate class numbers and short class durations.

3.Implications, barriers, and recommendations

In the past, teachers have frequently taken a behaviorist approach to teaching mathematics. This means that they have placed a greater emphasis on students' ability to retain facts and processes than they have on their capacity to apply what they have learned. Regrettably, in this kind of educational setting, mathematics presentations frequently lack the necessary background information and relationships that are necessary to make the subject flow smoothly [14]. This is causing students' interest in the subject matter as well as their trust in it to decrease. In spite of the fact that there have been numerous modifications to the curricula in both the United States and Europe in order to address these concerns, teachers continue to frequently fall back on the traditional methods.

According to the findings that have been presented here, it would appear that digital technologies that are aligned with an epistemic and constructivist approach to education may hold the key to resolving these issues, bringing mathematics into a framework that is more coherent and contextual, and encouraging students to collaborate in meaningful ways in order to find solutions to problems [15]. Rather than simply incorporating technology into the processes that are already in place, it has been determined that technology should be utilized in a manner that is both significant and has the ability to completely transform the game. To put it another way, when technology is of the utmost significance, there need to be a significant focus on developing applications for it. On the other hand, there are authors who suggest that there is a theoretical gap when it comes to combining the inquiry-based method with more conventional forms of instruction.

In a similar vein, shifting the function of the teacher from that of an instructor to that of a facilitator can be challenging and challenging to implement in a conventional classroom setting. It is clear that this highlights the significance of using a methodical and research-based approach. The use of technology in educational settings has been the subject of meta-analyses carried out by a number of writers in order to evaluate what is successful and what is not. According to their findings, it would indicate that a constructivist, team-based, project-based pedagogical approach, in conjunction with non-standardized evaluation techniques, was able to increase the positive benefits that technology had on learning [16]. The advantages to learning are much larger when youngsters do not have direct interaction with technology on a one-on-one basis. When it comes to effective interventions, teachers play the role of facilitators by giving students with structure, counsel, and the ability to track their progress. draws attention to the fact that many teachers will only take to the trouble of

incorporating technology into their courses if they believe that doing so will result in significant improvements in the results that their students achieve. In contrast to the interactive, communicative, and easily accessible nature of technology, the current forms of standardized, high-stakes testing and assessment that are common in many countries primarily focus on routine skills rather than the types of problem-solving, creativity, and decision-making abilities that these tools better support [17]. This is because these tools are more likely to be able to support these abilities. If there is no evidence that technology is beneficial and that the abilities that may be developed via its usage are recognized in evaluation, then it will be difficult to convince educators to modify their practices on their own. Not only do teachers need the appropriate methods of teaching and learning, but they also need tools, examples from the real world, support from their peers and from administration in order to successfully implement change strategies.

Technology-enhanced mathematics education, which is an organized approach to activities transformed by digital resources, should be considered an effective practice, according to a recent empirical study on the subject [18]. The instructor acts as a learning facilitator in this technique, which encourages students to engage in greater investigation, inquiry, and cooperation. Through the process of conducting this analysis, we hope to gain a better understanding of the manner in which academics are incorporating this methodology into the process of designing technology-enhanced learning experiences. In the following section, we will delve into the process of developing a classification system that serves as the foundation for this system.

4.Conclusion:

We understood the newest research on using technology to improve math instruction by analyzing existing approaches. This classification strategy simplified pertinent research systematic reviews. This study reviewed and analyzed relevant literature to identify technology-enhanced mathematics instruction components. Digital tools schedule exploration, inquiry, and cooperation. Teachers teach hands-on. Several studies target instructor power and redefine students as "generators of mathematical knowledge and activities" rather than passive learners. Technological integration intends to "inspire learners to increasingly assume the role of facilitator in their own mathematics education." Additionally, students are gaining new tools to construct ideas and solve issues dynamically. These tools make real-world data and scenarios easy to employ. An increasing number of empirical research on technology in mathematics education include constructivist and social constructivist activities, which are fantastic for group collaboration, problem solving, and questioning. Even though most people utilize digital tools for creativity daily, published works aim to better conventional ways. Digital technology may help kids learn and solve math problems differently. Classroom approach must change to active student learning. This would require more educator resources and a more coordinated, research-based approach. Academics developing and implementing new ideas may spark thought, but not always. Compared to technological innovation, explaining educational philosophy is like "attempting to walk on a shale hillside". Researchers leave teachers alone after creating and implementing exemplars. Methodical and innovative technology utilization may benefit the region and instructors. This study reveals this condition is rare to date. This research gives scholars a thorough perspective of technology-enhanced math instruction and identifies gaps. This data can help researchers correct these flaws and learn more. This technique and the anticipated establishment of an open-source platform to track technology-based mathematics education achievements may answer Papert's challenge by identifying areas for improvement.

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Design and Analysis of Hard Material Turning Process : Review Approach

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ABSTRACT

This paper presents a comprehensive examination focusing on the design and analysis of the hard material turning process. The advent of modern technology has facilitated the achievement of difficult turning tasks. The process involves the utilization of sophisticated machine tools for the production of durable materials. In the realm of high-precision machining, one encounters challenges pertaining to the optimal selection of a tool insert that offers improved tool longevity. The process of machining hardened materials using a single-point cutting tool has garnered significant interest from professionals in various industries, including cutting tool manufacturers, ball bearing producers, vehicle manufacturers, gear manufacturers, and die makers. The present study suggests that the optimization of cutting parameters, including cutting speed, feed rate, and depth of cut, has not been performed for hard AISI M3 material (62-64 HRC) while utilizing the utility concept of multi-response optimization with a coated carbide tool. The research will focus on optimizing the process parameters of the turning operation, specifically with regards to surface roughness and material removal rate. The purpose of this project is to utilize the utility idea of multi-objective optimization to optimize the set turning process parameters in order to achieve improved surface finish and material removal rate simultaneously.

Keywords: Design, Analysis, Hard Turning, AISI M3, 62-64 HRC.

I. INTRODUCTION

The feasibility of hard turning has been made possible by advancements in modern technologies. The process involves the fabrication of solid objects utilising advanced machinery. High-precision machining presents various obstacles, one of which involves the selection of a tool insert that offers enhanced tool longevity. Various industries, such as cutting tool manufacturing, ball bearing production, automotive manufacturing, gear production, and die making, exhibit a shared interest in the process of turning hardened materials through the utilisation of a single-point cutting tool. The utilisation of hard turning presents several advantages in comparison to conventional grinding. These advantages encompass reduced equipment expenses, decreased setup durations, and a diminished number of process stages. Consequently, these factors contribute to enhanced

adaptability and the capacity to fabricate intricate geometries. The utilisation of hard turning often involves the omission of cutting fluid, hence reducing the requirements for storing, managing, and disposing of this fluid. The promotion of operators' health is beneficial. This review article provides a comprehensive overview of previous research conducted on hard turning, focusing on the utilisation of several hard turning tools such as PCBN, CBN, ceramics, and carbide, among other options. The evaluation of hard turning cutting materials and the impact of hard turning process parameters on cutting forces, heat production, surface finish, and tool wear has been conducted based on previous research findings..

II. LITERATURE SURVEY

This section includes some selected articles for an in-depth investigation to find a research gap or further extension of research in the area of hard turning. The selected papers for the study are as follows:

Alok, A., & Das, M. (2019) [1] executed a new type of coating material, HSN2 with 12 μm thickness on carbide insert by using physical vapor deposition technique for machining hard AISI 52100 steel of hardness 55 HRC is evaluated. DSC and TGA assess coated carbide insert thermal and oxidative stability. Cutting speed, feed rate, and depth of cut affect primary cutting, radial and feed pressures, maximum flank wear, and workpiece surface quality. Statistics examine how cutting parameters affect machinability. Regression models connect input and output process features. A response surface optimisation and validation test follows. The confirmation test found percentage errors for main cutting force, radial force, feed force, surface roughness, and flank wear. Maximum tool wear is 292 m, which is ISO 3685-compliant. Cutting speed works best among output parameters. The current endeavor is unusual in that it machines AISI 52100 steel with a 55 HRC hardness at 102–287 m/min with a new 12 m-thick HSN2 coating.

Aouici, H., et al. (2012) [2] investigated experimentally the effects of cutting speed, feed rate, workpiece hardness and depth of cut on surface roughness, and cutting force components in the hard turning. Sandvik milled AISI H11 steel with cubic boron nitride (CBN 7020), a 57% CBN/35% TiCN blend. They employed ANOVA for four-factor (cutting speed, feed rate, hardness, and depth of cut) and three-level fractional experiments. This method represents surface roughness and cutting force components mathematically. The depth of cut and workpiece hardness has the greatest impact on cutting force components, while feed rate and hardness affect surface roughness statistically. Finally, industrial production cutting circumstances should be optimised.

Aouici, H., et al. (2011) [3] investigated turning conditions of hardened AISI H11 (X38CrMoV5-1), the effects of cutting parameters on flank wear (VB) and surface roughness (Ra) using the CBN tool. The response surface method is utilised in machining experiments. This study examines how cutting speed, feed rate, and duration affect two performance outputs (VB and Ra) (ANOVA). The ideal cutting conditions for each performance level are calculated using quadratic regression. The findings show that flank wear is primarily affected by cutting time, then speed. Feed rate appears to be the key factor affecting workpiece surface roughness.

Azizi, M. W., et al. (2012) [4] investigated the effect of cutting parameters (cutting speed, feed rate, and depth of cut) and workpiece hardness on surface roughness and cutting force components. Coated Al2O3 + TiC mixed ceramic cutting tools on AISI 52100 steel. The experiment was planned using Taguchi's L27 orthogonal array. The response table and ANOVA helped us validate the linear regression model and discover surface roughness and cutting force components. The statistical investigation found that depth of cut, workpiece hardness, and feed rate affect cutting force components more than cutting speed. Empirical models linked

cutting parameters, workpiece hardness, surface roughness, and cutting forces. The desired function technique for multiple response factor optimisation was used to identify the best machining settings for low surface roughness and low cutting force. The presented empirical models were validated via experiments.

Azizi, M. W., et al. (2020) [5] optimized machining parameters to achieve the desired technical parameters such as surface roughness, tool radial vibration, and material removal rate using response surface methodology (RSM). Hard turning EN19 alloy steel with GC3015) cutting tools were studied. Hard and high-precision component manufacturers face a big difficulty in surface finish quality and manufacturing rate. RSM can solve this problem using a mathematical model and tests. A face-centered central composite design (FCCD) with cutting parameters (speed, feed rate, and depth of cut) was used in the statistical analysis. Cutting parameters affected surface roughness, tool vibration, and material removal. The ideal cutting parameters for surface roughness, tool vibration, and material removal rate were found using a desirability function and numerical and graphical optimisation. The mathematical models were validated by experiments.

Bouzid, L., et al. (2015) [6] attempted to statistically model the relationship between cutting parameters (speed, feed rate, and depth of cut), cutting force components (Fx, Fy, and Fz), and workpiece absolute surface roughness (Ra). The AISI 420 martensitic stainless steel is subjected to machining using a chemical vapour deposition (CVD)-coated carbide tool. The full-factorial design with a 4^3 configuration is used to assess experimental outcomes via the application of analysis of variance (ANOVA) and response surface methodology (RSM). The best cutting conditions are determined by the interaction of mutually responsive surfaces and desire functions, while the accuracy of the model is confirmed by the residual values. The surface roughness (Ra: 81%) is influenced by the depth of cut (Fx: 86%), dominance (Fy: 58%), and feed rate (Fz: 81%). The observed cutting force and surface roughness exhibited a strong agreement with the expected values. The results were examined for potential inaccuracies, with the following percentages of inaccuracy identified: Fx (6.51 percent), Fy (4.36 percent), Fz (3.59 percent), and Ra (5.12 percent). Ultimately, it is essential that the ranges for industrial production cutting be optimised.

Cakir, M. C., et al. (2009) [7] examined the effects of cutting parameters (cutting speed, feed rate, and depth of cut) onto the surface roughness through the mathematical model developed by using the data gathered from a series of turning experiments performed. Another research was conducted to investigate the impact of two commonly used coating layers on surface roughness. Two CNMG 120408 carbide inserts, designated according to the International Organisation for Standardization (ISO), were subjected to testing under comparable cutting circumstances. These inserts had identical geometry and substrate, but differed in terms of their coating layers. The machining process was performed using AISI P20 cold-work tool steel. Insert 2 is subjected to a physical vapour deposition (PVD) process, resulting in the application of a thin layer of titanium aluminium nitride (TiAlN) measuring 31 micrometers in thickness. On the other hand, Insert 1 undergoes a chemical vapour deposition (CVD) process, which involves the deposition of a titanium carbonitride (TiCN) underlayer, an aluminium oxide (Al2O3) intermediate layer, and a titanium nitride (TiN) outer layer. The average error of the model was found to be 4.2 percent for Insert 1 and 5.2 percent for Insert 2, indicating a measure of dependability for the equations.

Das, D. K., et al. (2014) [8] investigated surface roughness during hard machining of EN 24 steel with the help of coated carbide insert. Testing was done in dry conditions. The Grey-based Taguchi approach optimised process parameters. The regression-based surface roughness prediction models were also evaluated. Hard machining yields 0.42micron surface roughness. The grey-based Taguchi technique's optimum depth of cut (Ra)

and cutting speed (Rz) were 0.4 mm, 0.04 mm/rev, and 130 m/min. Feed matters more for Ra and Rz. The prediction models have high R2 values (0.993 and 0.934). This improves model fit and is important.

Das, S. R., et al. (2015) [9] investigated the dry hard turning of AISI 4140 steel using PVD-TiN coated Al2O3+TiCN mixed ceramic inserts. This ANOVA examines how cutting factors (cutting speed, feed, and depth of cut) affect performance variables like surface roughness and flank wear. Surface roughness is most affected by cutting feed and speed. Though not statistically significant, flank wear is a function of incision depth. The process is established by SEM studies on the machined surface and worn tool. Abrasion dominated wear throughout the range. Also examined were tool wear and surface roughness. It predicted flank wear and surface roughness. With 95% confidence, RSM-based mathematical models for surface roughness (Ra) and flank wear (VB) were created. Tool life was examined under ideal cutting conditions (obtained by response optimisation) to justify coated ceramic inserts in hard turning. TiN coated ceramic has a 51-minute tool life and a reduced anticipated machining cost per item (Rs. 12.31).

Das, S. R., et al. (2017) [10] addressed surface roughness, flank wear, and chip morphology during dry hard turning of AISI 4340 steel (49 HRC) using CVD (TiN/TiCN/Al2O3/TiN) multilayer coated carbide tool. Taguchi's L9 Orthogonal array (OA) and ANOVA examined how cutting parameters affect tool and workpiece flank wear and surface roughness. SEM was utilised to investigate machined workpiece surface topography, coated carbide tool wear, and chip morphology. Thus, multiple regression analysis was utilised to develop a mathematical model for each response, and several diagnostic tests were done to verify its validity and utility. Finally, a Gilbert's method cost analysis (recommended by response optimisation methodology) showed coated carbide tools' economic feasibility in hard turning. Statistics show that feed and cutting speed effect surface roughness and flank wear. Faster cutting improves flank wear and surface polish. Abrasion from flank land rubbing on machined surface and high cutting temperatures damage tools. Saw-tooth chip morphology shows significant serration from cyclic fracture propagation caused by plastic deformation. Hardened AISI 4340 steel with a coated carbide tool costs $0.13 per item to machine. A multilayer TiN/TiCN/Al2O3/TiN coated carbide tool for hard turning in dry cutting circumstances is cheaper than cylindrical grinding, according to the study. Alternatives to CBN and ceramic tools are cheaper.

Davoodi, B., et al. (2015) [11] investigated the effects of cutting parameters on tool life of PVD TiAlN-coated carbide tools, and volume of workpiece material removed during the machining of the N-155 iron–nickel-base superalloy is evaluated. Cutting variables comprised five levels of feed rate and speed. RSM modelled machining parameter-output variable interactions. ANOVA tested the mathematical model and variables. Overall, model projections and actual tool life and material removed matched well. SEM was used to study cutting tool insert wear at various speeds. Adhesion caused most tool failures. Finally, the intended function approach improved tool life and material removal for productivity.

Davoodi, B., et al. (2014) [12] investigated the effects of cutting speed and undeformed chip thickness on cutting and feed force components, and tooltip temperature was experimentally investigated in order to remove the cutting fluid. AA5083-O wrought alloy with 4.5% Mg was machined dry and wet using coated carbide tools. ANOVA was employed in two-factor (cutting speed and undeformed chip thickness) and five-level fractional experiments. Cutting, feed force, and tool tip temperature (RSM) mathematical models were created using this strategy. Results show that undeformed chip thickness influences output variables. AA5083 may be machined without fluid at high speed and low undeformed chip thickness. Cutting speed and chip thickness statistically affect cutting and feed force in dry and wet machining. We finally have industrial production-friendly turning circumstances.

Devi, K. D., et al. (2015) [13] studied an optimization problem that seeks the identification of the best process condition or parametric combination for the said manufacturing process. Single-objective optimisation involves one quality characteristic. When several characteristics are evaluated, choosing the best choice that fulfils all quality requirements is tough. This study solved a Multi-Objective Optimisation problem by straight turning brass bar using Response Surface Methodology. Research sought the best process environment for quality and productivity. Finally, the study evaluates how cutting speed, feed, depth of cut, and coolant type affect output parameters. The predicted optimal setting reduced surface roughness and increased MRR, tool life, and machinability index. The confirmatory test confirmed the perfect result.

Dureja, J. S., et al. (2009) [14] attempted to model the tool wear and surface roughness, through response surface methodology (RSM) during hard turning of AISI-H11 steel with TiN-coated mixed ceramic inserts. Using ANOVA and factor interaction graphs in the RSM, machining parameters such cutting speed, feed rate, depth of cut, and workpiece hardness were examined on flank wear and surface roughness. This model matches experiments best. A desirability function optimizes several response components. Validation trials predicted response factors within 5%. Surface roughness and flank wear depend on feed rate, workpiece hardness, and depth of cut. A toolmaker's microscope monitored tool wear, and SEM-EDX characterized typical inserts. Rubbing and impingement of hard work material particles causes tool surface abrasion, notch wear, and chipping.

Dureja, J. S., et al. (2014) [15] attempted to investigate tool wear (flank wear) and surface roughness during finish hard turning of AISI D3 steel (58HRC) with coated carbide (TiSiN-TiAlN coated) cutting tool. Design utilized Taguchi L9 (3)3 orthogonal array. S/N ratio and ANOVA were utilised to identify tool wear and surface roughness parameters. Cutting speed and feed affected flank wear and surface roughness. Tool wear and surface roughness models were created using regression analysis. The confirmation trials utilising Taguchi's optimal parameter combination predicted response factors within 5%. RSM's Desirability function module reduced tool wear and surface roughness. The ideal Taguchi parameters and desirability function optimisation were compared. Optimisation results are comparable for both approach.

Kaladhar, M., et al. (2013) [16] attempted to explore the influence of machining parameters on the performance measures, surface roughness, and flank wear in turning of AISI 304 austenitic stainless steel with a two-layer chemical vapor deposition(CVD) coated tool. The Taguchi method was used to accomplish this. The data show that cutting speed affects surface roughness and flank wear the most. Also projected are ideal process parameter settings and performance measure ranges.

Kaladhar, M., et al. (2010) [17] studied the optimization of machining parameters in turning AISI 202 austenitic stainless steel using CVD coated cemented carbide tools. The experiment encompasses an investigation of many process parameters, including speed, feed, depth of cut, and nose radius. The experiments were conducted on a computer numerical control (CNC) lathe, using a full factorial design within the framework of the Design of Experiments. The analysis of variance (ANOVA) was used to investigate the impact of process parameters and their interaction on the machining process. According to the study findings, it has been shown that the feed rate has the most significant impact on surface roughness, with the nose radius ranking second in terms of influence. An attempt was undertaken to predict the level of surface roughness. Validation trials are conducted to verify or confirm the accuracy and reliability of the anticipated results.

Keblouti, O., et al. (2017) [18] investigated the effects of cutting parameters and coating material on the performances of cutting tools in turning of AISI 52100 steel. A comparison was conducted between uncoated cermet tools and cermet tools covered with a TiCN-TiN coating layer. The inserts exhibited same substrate

composition and form. The mathematical model, known as RSM, was used for construction purposes. The present study used ANOVA to investigate the impact of cutting settings on both machining surface quality and cutting forces. The results indicate that the feed rate variable has the highest level of significance. Nevertheless, the cutting force components are influenced by the cutting depth. The evaluation of the impact of the coating layer on surface quality was also conducted. The use of physical vapour deposition (PVD) coated inserts, namely those coated with a combination of titanium carbonitride (TiCN) and titanium nitride (TiN), resulted in a reduction in surface roughness. A regression model of second order was constructed, with correlation coefficients ranging from 95% to 97%.

Keblouti, O., et al. (2017) [19] presented work concerns an experimental study of turning with coated cermet tools with TiCN-TiN coating layer of AISI 52100 bearing steel. The main objectives are to study how cutting settings and coatings affect cutting tool performance. Second, minimize surface roughness (Ra) and enhance material removal via multi-objective optimisation. A mathematical model was built using it. ANOVA investigated how cutting factors affected machining surface quality and material removal. Results reveal feed rate affects surface quality most. They examine coating layers' impact on surface quality. The PVD-coated insert has less surface roughness than the uncoated tool. We also offer the root mean square deviation and correlation coefficient between theoretical and experimental data, with a maximum calculated error of 2.65%.

Khellaf, A., et al. (2017) [20] presented a comparison of surface roughness between both ceramic cutting tools namely, TiN coated mixed ceramic CC6050 and uncoated mixed ceramic CC650 when machining hardened hot work steel X38CrMoV5-1 [AISI H11] treated at 50 HRC. A mathematical model connecting surface roughness needs to cutting radius, speed, feed rate, and depth of cut was created using response surface methodology (RSM). Cutting settings are checked to reduce surface roughness. Several linear models were created between cutting settings and surface roughness using response surface approaches. The most essential surface roughness machining parameter is feed, followed by cutting radius. Within the analysed parameter ranges, optimal circumstances minimize AISI H11 steel machining surface roughness. Good surface roughness was achieved by hard turning using CC650 tools. Coated ceramic tools had no advantage over CC650 in surface roughness.

Kumar, R., et al. (2018) [21] focused on mathematical modeling, multi-response optimization, tool life, and economical analysis in finish hard turning of AISI D2 steel ((55 ± 1) HRC) using CVD-coated carbide (TiN/TiCN/Al2O3) and uncoated carbide inserts under dry environmental conditions. Modelling and multi-response optimisation using regression and grey relational methods. Comparisons of both inserts' economic data evaluated the correlation model's suitability. All experimental and predicted results were close, proving the model's applicability and tight correlation coefficients. The best parametric combinations for Al2O3-coated carbide were d1–f1–v2 (0.1 mm depth of cut, 0.04 mm/r feed, and 108 m/min cutting speed) and d1–(0.1 mm)–f1 (0.04 mm/r)–v1 (63 A 0.3 mm flank wear criteria gave the coated carbide insert 15 times the tool life of the untreated insert. The coated carbide insert generated 26.14 times greater chip volume than the untreated insert, speeding material removal. Main wear processes include abrasion, diffusion, notching, chipping, and built-up edge. Coated carbide inserts saved 3.55 times more on machining than uncoated ones.

Labidi, A., et al. (2018) [22] developed predictive models for the arithmetic surface finish (Ra), flank wear (VB), and tangential force (Fz). Optimisation using desirability. A coated ceramic tool (CC6050) was utilised to hard turn X210Cr12 hardened steel (56 HRC) utilising the Taguchi L27 experimental plan. ANOVA was used to determine how cutting parameters (Vc, f, and t) affected output parameters (VB, Ra, and Fz). Technical parameters were modelled using RSM and ANN. DF determined the best machining conditions (VB, Ra, and

Fz). The statistics indicate that Vc (39.96%) dominates VB, followed by f (35.36%). Additionally, f and t were shown to affect Ra by 31.71 and 23.78 percent, respectively. However, t and f contribute 75.74 and 22.66 percent to Fz. However, ANN and RSM models fit experiments well. ANN predicts cutting process parameters more accurately than RSM. Optimise multi-objective machining with Vc = 80 m/min, f = 0.08 mm/rev, and t = 4 min.

Laghari, R. A., et al. (2020) [23] established the second-order model of cutting force for obtaining an effective mathematical model for the cutting force. Using RSM, they examined cutting speed, feed rate, and depth of cut. The optimised mathematical model examined how actual processing conditions affect SiCp/Al composite turning cutting force generation. RSM parameters match experimental data with a slight error. Quantitative evaluations included ANOVA, main effects plot, interaction effect, residual analysis, and desirability function optimisation of cutting forces. Cutting force rises with feed rate and depth of cut. Cutting power decreases with speed. SiCp/Al component model predictions and experiments correspond well.

Laouissi, A., et al. (2019) [24] undertook a comparative study in terms of the surface roughness criterion (Ra), the tangential cutting force (Fz), the cutting power (Pc), and the material removal rate (MRR) in turning of EN-GJL-250 cast iron using both coated and uncoated silicon nitride ceramics (Si3N4). L27 Taguchi is used to construct the experiment, and ANOVA is used to find the cutting variables that most affect responses. ANN and RSM were used to create the genetic algorithm optimisation strategy's mathematical prediction models. The ANN and RSM models' prediction ability were assessed using MAD, MAPE, RMSE, and R2. The ANN approach is more precise than RSM. Coated ceramic tools had better surface quality and needed less cutting force. The wear tests show that when flank wear reaches [Vb] = 0.3 mm, the ratios are 0.88, 1.4, and 0.94.

Manohar, M., et al. (2013) [25] discussed the use of the Box Behnken design approach to planning the experiments for turning Inconel 718 alloy with an overall objective of optimizing the process to yield higher metal removal, better surface quality, and lower cutting forces. The input process parameters determine the output parameters (responses) represented by the RSM. A RSM evaluates the relationship between input and output parameters. RSM designs evaluate interaction and quadratic effects, revealing the response surface's shape. For an experiment with three components and three levels, the Box-Behnken design is more economical and needs fewer tests than a central composite design. The recommended Box-Behnken design requires 15 trials to acquire data. The experiment was prepared and run utilising expert software. We evaluated a regression model to predict output values in most cases. Three random input sets were utilised to test the model. Actual output parameters match model expectations. Design-expert software plotted the RSM in 2D and 3D. This graph shows the dominant process variable, its order of dominance, and the process variable interaction trend. This study determined Inconel 718 coated carbide tool turning settings to increase surface roughness and material removal. A reliable model was constructed, validated, and optimised with two purposes in this research.

Mia, M., et al. (2017) [26] studied the quality characteristics such as cutting force, surface roughness, and specific cutting energy in internal cryogenic cooling assisted milling of hardened steel vis-à-vis mathematical modeling and multiple attributes optimization by using response surface methodology. A 27-run complete factorial design examined cutting speed, feed rate, and condition. Selecting the best cooling process is important since cutting condition affects all responses. Through-tool cryogenic cooling outperformed dry and wet cooling. Since mathematical connections improve prediction accuracy, they may be applied. Cutting speed of 26 m/min, feed rate of 58 mm/min, and through-tool cryogenic cooling were excellent for simultaneous quality decrease.

Mia, M., et al. (2018) [27] discussed some of the sustainability issues in machining by studying the cutting energy, surface finish, and Minimum Quantity Lubrication (MQL). The specific cutting energy (Esp) and average surface roughness parameter (Ra) in end milling hardened AISI 4140 steel were examined using MQL. The experiment's full factorial design determined cutting speed, feed rate, and lubricating flow. RSM was researched step-by-step. A complete statistical study using the perturbation plot, interaction effects, and 3D response surface plots. The Taguchi technique and Desirability-based duplex optimisation in RSM were utilised for Esp and Ra. Ra was changed by lubrication flow rate, but Esp by cutting speed. The best settings are 46 mm/min feed, 32 m/min cutting, and 150 mL/h coolant. RSM and Taguchi-based models yielded comparable results, showing their validity. The models were verified using statistical indicators.

Mia, M., et al. (2018) [28] presented the development of mathematical, predictive, and optimization models of average surface roughness parameter (Ra) in turning hardened AISI 1060 steel using coated carbide tool in dry condition. The mathematical model used in this study is Response Surface Methodology (RSM), which is utilised to analyse and optimise the experimental data. The predictive model employed is Fuzzy Inference System (FIS), which is utilised to forecast and make predictions based on the available data. Additionally, the optimisation model employed in this study is Simulated Annealing (SA), which is utilised to find the optimal solution within a given search space. All of the aforementioned models used cutting speed, feed rate, and material hardness as input variables. Following the completion of the trials, the gathered data is used for the purpose of constructing and validating the model. The statistical analysis indicates that the quadratic model is recommended for the response variable Ra in response surface methodology (RSM). The correctness of the models was evaluated by error analysis and validation testing. The constructed model was also subjected to a comparative analysis using an analytical model. The feed rate has the second highest level of significance, subsequent to the cutting speed. The RSM model exhibited a coefficient of determination of 99.64 percent, indicating a strong relationship between the variables. The FIS model had a prediction accuracy of 79.82 percent, suggesting a moderate level of accuracy in its predictions. Furthermore, the SA model resulted in an improvement in surface roughness by almost 70 percent, indicating a substantial enhancement in this aspect. By exerting control over the hard turning process, these models have the potential to achieve a high level of surface quality.

Panda, A., et al. (2017) [29] addressed the assessment, modelling, and optimization study of surface roughness in finish dry hard turning (FDHT) of AISI 4340 steel with the coated ceramic tool by considering the cutting speed, axial feed, depth of cut, and nose radius as machining parameters. RSM, PSO, and Gilbert's procedure are used for mathematical modelling, response optimisation, tool life evaluation, and economic analysis. Data of the recommended model was tested for statistical significance, validity, appropriateness, effectiveness, and fitness using ANOVA and Anderson-Darling normal probability test. From the data, nose radius and feed are the most controlled and dominant components for hard turning. With 220 m/min cutting speed, 0.05 mm/rev feed, 0.193 mm depth of cut, and 1.6 mm tool nose radius, the RSM model and PSO technique provide 0.2021 m surface roughness. The use of coated ceramic tools in hard turning was justified by tool life analysis under ideal machining conditions. Longer tool life (44 min), shorter downtime, and savings make hard turning cheaper per piece ($0.34). Novel aspects of this work include (i) replacing expensive and time-consuming cylindrical grinding processes with coated ceramic tools in hard turning processes and (ii) contributing to the practical industrial application of finish hard turning.

Panda, A., et al. (2018) [30] addressed the machinability investigation of high strength low alloy grade AISI 4340 steel with coated ceramic tools on surface roughness, tool wear, and economic analysis by considering the

hard turning process parameters such as cutting speed, feed and depth of cut. Studies employ a full factorial design for 27 trials. An analysis of variance examines parametric factors. Costing predictive modelling, response optimisation, and tool life estimation follows. Hard turning operations depend on feed and cutting speed to reduce surface roughness and cutting tool flank wear. Hard turning is cost-effective because the coated ceramic insert had a tool life of 47 minutes under optimal cutting conditions, resulting in a reduced total machining cost per component ($0.29) and less downtime. This research presents the most expensive CBN tool alternative using coated ceramic tools in hard turning from a techno-economical and ecological perspective.

Panda, A., et al. (2019) [31] addressed the machinability investigation in finish dry hard turning of high strength low alloy steel with the coated ceramic tool by considering cutting speed, feed, and depth of cut as machining parameters. Factors such surface roughness, flank wear, chip form, and economic feasibility were examined. Parametric impact research, mathematical modelling, multi-response optimisation, tool life prediction, and economic analysis use analysis of variance, multiple regression, Taguchi, desirability function approach, and Gilbert's technique. Results reveal that feed and cutting speed are the most essential hard turning controls to decrease machined surface roughness and tool flank wear. Abrasions, adhesion, and plastic deformation provide a coated ceramic insert a 47-minute tool life under optimal cutting conditions. Hard turning reduces machining costs per item by $0.29 owing to longer tool life, fewer downtime, and savings. Recently, coated ceramic tools have replaced expensive and tedious cylindrical grinding in hard turning.

Panda, A., et al. (2016) [32] investigated the parametric optimization of multi-responses such as flank wear and surface roughness during machining hardened AISI 52100 steel (55±1) steel using mixed ceramic insert under dry environment through grey relational analysis combined with Taguchi approach. Predicted mathematical models of the first and second-order were also built and evaluated for correctness. The second-order mathematical model had a higher R2 value and was better fitted than the first-order model. The model predicts the experimental data well. In a harsh machining environment, the suggested grey-based Taguchi approach showed effectiveness for handling multi-attribute decision-making issues.

Parida, A. K., et al. (2019) [33] performed the hot turning of Monel-400 has been to investigate the influence of four machining factors (cutting speed, feed rate, depth of cut, and workpiece temperature) on flank wear and surface roughness. The workpiece underwent a heating process with a combination of oxygen and LPG. The research used a face-centered composite design (CCD) in its methodology. This study focuses on the use of Response Surface Methodology (RSM) to mathematically simulate flank wear and surface roughness. The analysis of variance (ANOVA) was used to evaluate the influence of each parameter on the number of answers. The regression equation's projected model demonstrates a strong alignment with the testing results in terms of flank wear and surface roughness. The disparity in flank wear and surface roughness between the simulation and experimental results is 13% and 7%, correspondingly.

K.P.Pawar & R.D. Palhade (2015) [34] investigated the effect of insert nose radius and machining parameters including cutting speed, feed rate and depth of cut on surface roughness (Ra), and material removal rate (MRR) in a turning of HSS (M2) using the Taguchi method and ANOVA. The purpose of this study is to examine the performance characteristics of carbide inserts with a Tin coating when used for turning High-Speed Steel (M2) material. The investigation focuses on three different nose radiuses (0.4, 0.8, and 1.2 mm) and is conducted on a CNC turning centre. A three-level, four-parameter design of experiment is used to analyse the data. ANOVA is used in the CNC turning process of HSS (M2) material to ascertain the respective influence of individual machining parameters. All experiments are conducted under controlled conditions characterized by a low humidity environment, ensuring minimal moisture interference. The rotational speed of the spindle is

maintained at a consistent rate of 2800 revolutions per minute (rpm) throughout the testing process. Confirmation experiments serve to confirm the results. The present investigation demonstrates that the feed rate and nose radius are significant factors affecting both the material removal rate and surface roughness during the turning process of High-Speed Steel (M2).

Ramana, M. V., et al. (2012) [35] investigated the optimization of process parameters for surface roughness in turning of Ti-6Al-4V alloy under dry, flooded, and Minimum Quantity Lubrication (MQL) conditions using Taguchi's robust design methodology and development of prediction models for surface roughness using multiple regression analysis. MQL shows better performance and surface roughness reduction than dry and flooded lubricants. MQL may cut deeper than dry and flooded lubricants, according to ANOM. According to ANOM, uncoated tools perform better in MQL settings than CVD and PVD coated tools, although CVD coated tools perform better in dry and flooded lubricant conditions. ANOVA also indicates that feed rate affects surface roughness. Multiple regression models predict Surface Roughness for three instruments. Models fit experimental data well.

Ramanujam, R., et al. (2014) [36] presented a statistical approach for optimization of dry turning parameters of Inconel 718. Turning experiments measured cutting force, surface roughness, and tool wear using Taguchi's L9 orthogonal array. The medium-duty lathe used a PVD-coated carbide cutting insert for turning. Taguchi's Signal to Noise (S/N) ratio for Ra, Rt, Rz, and Fz determined optimal cutting circumstances. Tool wear was examined using SEM micrographs. ANOVA showed that feed rate and depth of incision most affected responses. Regression analysis using cutting parameters as independent variables modelled individual responses. Ra, Rt, Rz, and Fz exhibit excellent determination coefficients (R2 = 0.912, 0.943, and 0.882), validating the hypothesis. The model's relevance is shown by its close match to experimental data. Trials proved Taguchi's algorithm for optimum cutting conditions.

Routara, B. C., et al. (2012) [37] applied response surface methodology to determine the optimum cutting conditions leading to minimum surface roughness in CNC turning operation on EN-8 steel. Surface roughness prediction was achieved by constructing second-order mathematical models for machining parameters using response surface methodology (RSM). The EN-8 steel specimen was subjected to machining operations using coated carbide tools. The selected model for optimisation has undergone an F-test. The validity of the surface roughness models was assessed by the use of analysis of variance (ANOVA). The researchers used a Genetic Algorithm in order to enhance the accuracy of the surface roughness prediction model, with the objective of determining the most favorable cutting parameters.

Sahoo, A. K., et al. (2011) [38] presented the experimental study, development of the mathematical model, and parametric optimization for surface roughness in turning D2 steel using TiN coated carbide insert using Taguchi parameter design and response surface methodology. The experimental study included cutting parameters, namely cutting speed (v), feed (f), and depth of cut (d). The impact of machining parameters on surface finish has been examined, along with the identification of the most favorable cutting conditions for minimizing surface roughness. The parametric combination of V3-f1-d3 demonstrates superior performance for the TiN coated cutting insert. The process parameter that has the most significance in determining surface roughness is feed rate, with cut depth ranking second in importance. The study found no statistically significant difference in cutting speed. The RSM model has a high level of accuracy in predicting values, as seen by the 95% confidence intervals. The RSM model that has been developed demonstrates a high level of accuracy in predicting the surface roughness of D2 steel throughout the turning process.

Sahoo, A. K., et al. (2012) [39] presented work deals with some machinability studies on flank wear, surface roughness, chip morphology, and cutting forces in finish hard turning of AISI 4340 steel using uncoated and multilayer TiN and ZrCN coated carbide inserts at higher cutting speed range. The process's hard turning efficiency is economically justifiable. The multilayer TiN/TiCN/Al2O3/TiN carbide insert had better flank wear and surface roughness than the uncoated and ZrCN-coated inserts. TiN and ZrCN-coated tools survived 19 and 8 minutes under intense cutting conditions. Broken uncoated carbide inserts for difficult steel cutting. Abrasion, chipping, and catastrophic failure are the major machining wear mechanisms. Hard turning requires less cutting, thrust, and feed pressures using multilayer-coated carbide inserts. The 2nd order regression model explains 98.3% of the variability of responses (flank wear and surface roughness) and matches multilayer TiN coated carbide insert data better than the 1st order model. For ZrCN-coated carbide inserts, the 2nd order flank wear model corresponds better than the surface roughness model in ANOVA. Multilayer TiN inserts save 93.4 percent compared to uncoated carbide and 40% compared to ZrCN in severe machining. This final hard turning carbide insert has multilayer TiN coating.

Sahoo, A. K., et al. (2013) [40] presented the mathematical modeling and parametric optimization on flank wear and surface roughness based on response surface methodology and grey-based Taguchi method in finish hard turning of AISI 4340 steel (HRC 47 ± 1) using multilayer coated carbide (TiN/TiCN/Al2O3/TiN) insert under dry environment. Use of a multilayer TiN-coated carbide insert was described. Model fit was tested via correlation coefficients. The main influence on flank wear is cutting speed, followed by depth and feed. Again, feed, cutting speed, and depth effect surface roughness. The RSM models' R2 is over 75%, showing a strong connection between experimental and predicted values. Rz) are also quite close to experimental values, demonstrating the relevance of the models. In grey relational analysis, the improvement in grey relational grade from starting (d2–f3–v4) to optimal (d1–f1–v3) is 0.3093. Optimal multi-response parametric combinations minimize flank wear (VBc) and surface roughness (Ra and Rz) by 1.9, 2.32, and 1.5 times. Multilayer TiN-coated carbide inserts last 47 minutes at optimal. It cuts downtime and saves.

Sahoo, P. (2011) [41] applied Taguchi's design of experiment methodology and regression analysis for optimization of process parameters in turning AISI 1040 steel using coated carbide insert under dry environment. The surface roughness and material removal rate were tested using a L9 standard orthogonal array design with cutting speed, feed, and depth of cut. S/N analysis recommends cutting speed at level 3, feed at level 1, and depth of cut at level 3 (v3-f1-d3) for surface roughness. Cutting speed, feed, and depth of cut at level 3 (v3-f3-d3) are optimal material removal rate process parameters. Surface roughness and material removal rate depend primarily on cut-off speed, followed by feed. Both responses are least affected by incision depth. Individual response mathematical models were created using regression. The recommended regression models are statistically significant due to their higher R2 values. The normal probability plot of the model shows that residuals follow a straight line, indicating important variables. Both anticipated and experimental values are close, showing the models' relevance. Taguchi and Grey relational analysis were used for simultaneous response optimisation. The predicted value (0.779) matches the experimental value (0.821), and the grey relational grade changes by 0.284 from the first parameter combination (v2-f2-d2) to the best (v3-f3-d2). The suggested procedure improved.

Sarıkaya, M., & Güllü, A. (2015) [42] presented an approach for optimization of machining parameters with multi-response outputs using the design of experiments in turning. The experiment employed Taguchi's L9 orthogonal array. When turning cobalt-base superalloy Haynes 25, flank wear, notch wear, and surface roughness were evaluated. The process parameters cutting fluid (CFs), fluid flow rate (Q), and cutting speed (Vc)

were modified simultaneously utilising Taguchi-based grey relational analysis. The ideal combination was found using Taguchi's signal-to-noise ratio. Three mathematical models were created using response surface regression. The multi-response optimisation found that vegetable base cutting fluid, 180 mL/h fluid flow rate, and 30 m/min cutting speed reduced tool wear and surface roughness best. Multiple responses improved GRG by 39.4%. This method improved performance metrics.

Selvakumar, S., & Ravikumar, R. (2014) [43] attempted to investigate the effect of process parameters cutting speed, feed rate, and depth of cut on tool wear and surface roughness in micro-turning of titanium alloy using Cermet insert. The research employs a rotatable second-order Box-Behnken design and utilizes response surface methodologies. A mathematical model is required to accurately forecast tool wear and surface roughness under optimal micro-turning circumstances. The optimal process parameters were determined via the use of analytical and graphical optimisation methodologies. The parameter that has the most significant influence on both tool wear and surface roughness is the feed rate, with cutting speed and depth of cut following in importance. The aforementioned cutting parameters, namely a cutting speed of 3180 rpm, a feed rate of 8 m/rev, and a depth of cut of 15 μm, have been found to effectively minimise tool wear and surface roughness.

Shihab, S. K., et al. (2014) [44] attempted to investigate the effect of cutting parameters (cutting speed, feed rate, and depth of cut) on the cutting temperature in hard turning of AISI 52100 alloy steel using multilayer coated carbide (TiN/TiCN/Al2O3/TiN) insert. CCD was used to collect machining data. Certain diagnostic tests were performed to confirm assumptions. The importance of cutting parameters was tested using ANOVA. Model equation for cutting temperature prediction. The optimal cutting parameters were calculated via RSM. Our ANOVA shows that all three cutting parameters impact cutting temperature. Within the investigated range, cutting speed and feed rate strongly affect cutting temperature. Traditional turning was 100% economically beneficial, according to the optimised model. The regression equation's cutting temperature predictions were close to experimental results. The cutting tools were mixed ceramic inserts of aluminium oxide and titanium carbo-nitride (SNGA) with different nose radius and effective rake angles. Surface polish depends on feed, nose radius, and cutting velocity. Although effective rake angle has minimal impact on surface quality, nose radius and rake angle are crucial. Surface roughness mathematical models were built using response surface approach.

Singh, D., & Rao, P. V. (2007) [45] investigated the effects of cutting conditions and tool geometry on the surface roughness in the finish hard turning of the bearing steel (AISI 52100). The cutting tools used in the study consisted of a combination of ceramic inserts, namely constituted of aluminium oxide and titanium carbo-nitride (SNGA). These inserts were characterized by different nose radius and effective rake angles. The surface finish is determined by the feed rate, which is then influenced by the nose radius and cutting velocity. While the impact of effective rake angle on surface quality is minimal, the correlation between nose radius and effective rake angle holds significance. The response surface approach was used to develop mathematical models for surface roughness.

Subbaiah, K. V., et al. (2020) [46] attempted to evaluate the performance of wiper ceramic cutting insert and observe the influence of hardness on Arithmetic Mean Roughness (Ra), Mean depth of roughness (Rz), Total roughness (Rt) and Tool wear (Vb) during the hard turning of AISI4340 steel. A total of twenty-seven experimental trials were devised via the Response Surface Methodology and then executed on a computer numerical control (CNC) lathe. An analysis of variance (ANOVA) is used to evaluate the significance and proportional contributions of input factors. The use of Response Surface Methodology (RSM) was employed in

order to construct mathematical models pertaining to surface roughness and tool wear. The findings indicate that variations in hardness and feed rate have a discernible impact on both surface roughness and tool wear. The Desirability function was used to utilise the experimental data in order to predict optimal machining settings for the purpose of optimizing various response variables.

Yurtkuran, H., et al. (2016) [47] focused on a predictive model for Ra and optimization of cutting conditions in high speed hard turning of X40CrMoV5-1 steel by CBN insert. Cutting Speed, feed rate, depth, and coating condition are cutting parameters. Studies employed Taguchi L32 orthogonal array. Multiple regression analysis created a first-order Ra mathematical model. In dry-cutting optimisation studies, feed rate was Ra's biggest unfavorable factor. Uncoated CBN inserts and lower feed rates generated the best surface roughness.

Zahia, H., et al. (2015) [48] focused on the exploitation of the response surface methodology (RSM) to determine optimum cutting conditions leading to minimum surface roughness and cutting force components. RSM creates a good statistical model for surface roughness and cutting forces. Testing cutting conditions on hardened steel alloy (AISI 4140) (56 HRC) with a PVD-coated ceramic insert. The surface roughness and cutting force equations were derived from experiments using ANOVA. Results are presented as means and confidence intervals. The feed rate and depth of cut most affect surface roughness and cutting forces. Additionally, surface roughness is related to cutting speed and depth of cut to cutting force development. Research found that optimal machining settings minimize cutting force components (Fa, Fr, Ft) by 6.88, 3.65, and 19.05 percent. Letters are compared to hard turning AISI 4140 steel initial cutting parameters.

III. RESEARCH GAP

After studying research papers, we have concluded that design and analysis of cutting parameters such as cutting speed, feed rate, and depth of cut are not done for hard AISI M3 material with coated carbide tool using utility concept of multi-response optimization. The material hardness will be 62 to 64 HRC for further investigation of our work. AISI M3 is raw material of company.

IV. PROPOSED METHODOLOGY

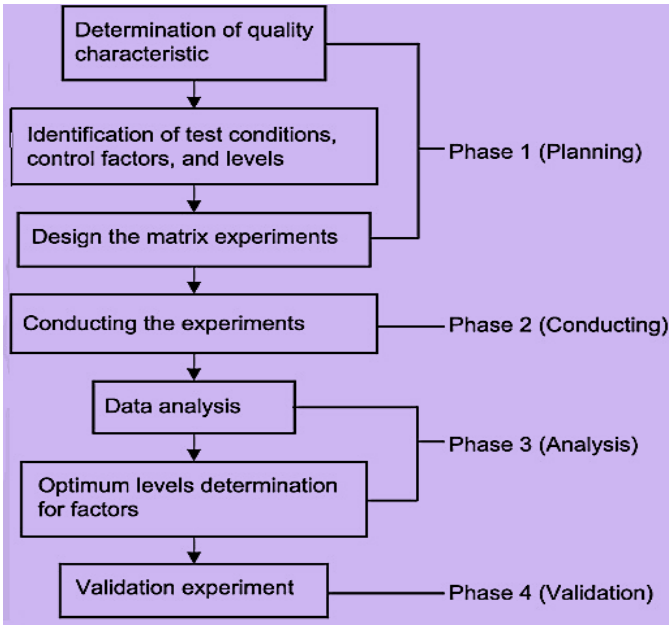

Figure1. Taguchi Methodology

After visiting to company and brainstorming with production manager we have decided to work on AISI M3 material for CNC hard turning process. The quality characteristics such as surface roughness (Ra) and Material Removal Rate (MRR) is selected for project. The DOE is designed and analysed using MINITAB software. Figure 1 shows the phases in Taguchi Method. This is the proposed methodology for investigation so nominal changes in steps for execution of project.

V. CONCLUSION

It can be concluded that optimization of cutting parameters such as cutting speed, feed rate, and depth of cut are not done for hard AISI M3 material (62-64 HRC) with coated carbide tool using utility concept of multi-response optimization. In the research work will be done to optimize the turning process parameters such surface roughness and material removal rate. As an outcome for this project, we will get optimize set turning process parameters for better surfacefinish and material removal rate simultaneously using utility concept of multi-objective optimization.

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Analyze E-Commerce Product Reviews

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ABSTRACT

This project aims to analyse e-commerce product reviews using various Python technologies such as Pandas, NLTK, Matplotlib, Requests, Beautiful Soup, and Tkinter. By leveraging these libraries, we can extract data from online platforms, perform sentiment analysis on customer reviews, visualize the results, and create a user-friendly interface for interaction. The project begins by utilizing the Requests and Beautiful Soup libraries to scrape product reviews from e-commerce websites. The extracted data is then processed and organized using Pandas, a powerful data manipulation and analysis library. Next, the Natural Language Toolkit (NLTK) is employed to perform sentiment analysis on the collected reviews. This involves processing the textual data, identifying sentiment-bearing words and phrases, and determining the overall sentiment polarity of each review. To visualize the sentiment analysis results, Matplotlib and its pyplot module are used to create insightful graphs and charts. These visual representations provide a comprehensive understanding of customer sentiments towards the products. Finally, Tkinter, a popular Python GUI toolkit, is employed to develop a user-friendly interface for the project. This interface allows users to input their desired product and view the sentiment analysis results in an intuitive manner. By combining the power of Pandas, NLTK, Matplotlib, Requests, Beautiful Soup, and Tkinter, this project offers a comprehensive solution for analysing e commerce product reviews. It enables users to gain valuable insights into customer sentiments, helping businesses make data-driven decisions and improve their products and services.

Keyword: Python, Matplotlib, Natural language toolkit, Pyplot, Graphical User Interface

I. INTRODUCTION

In the era of digital commerce, e-commerce platforms have become a prominent avenue for customers to share their experiences and opinions about products they purchase. Analyzing these product reviews can provide valuable insights to businesses, helping them understand customer sentiments, identify strengths and weaknesses of their offerings, and make data-driven decisions to enhance customer satisfaction [1]. This project aims to develop a system for analyzing e-commerce product reviews using a combination of powerful technologies and libraries, including Pandas, NLTK, Matplotlib, Requests, Beautiful Soup (BS4), Tkinter, and Python. Pandas is a versatile data manipulation and analysis library in Python that provides efficient data structures and data analysis tools. It allows for easy handling, filtering, and aggregation of large datasets, making it an ideal choice for organizing and manipulating the collected e-commerce product reviews. With

Pandas, businesses can efficiently extract insights, identify trends, and analyze customer sentiments based on the gathered reviews [2].

Matplotlib and its pyplot module are powerful libraries in Python for data visualization. They allow for the creation of various charts, graphs, and visual representations based on the sentiment analysis results. By utilizing Matplotlib, businesses can visualize sentiment distributions, review ratings, and frequently mentioned words or phrases. These visualizations provide a comprehensive and intuitive view of customer sentiments, facilitating easy interpretation and actionable insights [3].

Tkinter is a Python GUI (Graphical User Interface) toolkit used to develop the user interface for the system. It provides a set of components and functions for creating interactive interfaces that allow users to input their desired products, initiate the analysis process, and visualize the sentiment analysis results. Tkinter ensures a user-friendly and intuitive experience, enabling businesses to interact with the system effortlessly [4]. By harnessing the capabilities of Pandas, NLTK, Matplotlib, Requests, BeautifulSoup, Tkinter, and Python, this project aims to develop an efficient and user friendly system for analyzing e-commerce product reviews. The integration of these technologies empowers businesses to gain valuable insights into customer sentiments, enhance their products, and optimize marketing strategies, ultimately leading to improved customer satisfaction and business success[5].

1.2 Necessity

The Analyzing e-commerce product reviews has become a crucial practice for businesses in today's digital landscape[6]. It is essential due to the following reasons:

1 Customer Insight and Understanding.

2 Quality Assessment and Improvement.

3 Competitive Advantage.

4 Decision-Making Support.

1.3 Objective

The primary objectives of analyzing e-commerce product reviews are as follows:

1.3.1 Understand Customer Sentiments.

1.3.2 Identify Areas for Improvement.

1.3.3 Make Data-Driven Decisions.

1.3.4 Monitor Competitor Performance.

I. Methods & Material

2.1 Performance Analysis

Performance analysis is a crucial aspect of any system to evaluate its efficiency, accuracy, and scalability. In the context of the "Analyse E-commerce Product Reviews" system, several factors can be considered for

performance analysis:

2.1.1 Data Extraction Performance**:** The performance of data extraction can be measured by evaluating the speed and accuracy of retrieving product reviews from e-commerce websites[6].

4.1.2 Sentiment Analysis Performance: The performance of sentiment analysis can be assessed based on the accuracy of sentiment classification. This can be measured by comparing the sentiment labels assigned by the system to manually labeled reviews. KPIs include precision, recall, and F1 score, which indicate the system's ability to correctly classify positive, negative, and neutral sentiments. The efficiency of sentiment analysis algorithms in terms of processing time is also important to ensure real-time or near-real time analysis.

4.1.3 Data Manipulation and Analysis Performance**:** The performance of data manipulation and analysis tasks can be evaluated based on the speed and efficiency of operations such as filtering, grouping, and aggregating the reviews. KPIs may include the time taken to perform specific data manipulation tasks on different dataset sizes, the ability to handle large volumes of reviews without significant performance degradation, and the accuracy of analysis results derived from the manipulated data [7].

4.1.4 Visualization Performance: The performance of visualization can be assessed based on the rendering time of visualizations, especially when dealing with a large number of reviews or complex charts. KPIs include the time taken to generate visualizations, the interactivity and responsiveness of the visualizations in the user interface, and the ability to handle different types of visualizations without compromising the system's performance [8].

4.1.5 Scalability: Scalability is a crucial aspect of the system's performance analysis. It refers to the system's ability to handle increasing amounts of data, such as an increasing number of reviews or concurrent user requests [9]. Evaluating the system's performance under varying loads and assessing its ability to scale horizontally (across multiple machines) or vertically (increasing resources on a single machine) is essential [10].

4.1.6 User Interface Responsiveness: The responsiveness of the user interface is critical for a positive user experience. KPIs include the time taken to load the interface, the responsiveness of user interactions, and the system's ability to handle multiple user requests simultaneously without significant delays or freezes[11].

To conduct a performance analysis, various techniques can be employed, such as benchmarking the system against different datasets, conducting stress tests to simulate high loads, profiling the system to identify performance bottlenecks, and collecting user feedback to assess usability and responsiveness [12]. By analysing and optimizing the system's performance, businesses can ensure efficient and reliable analysis of e-commerce product reviews, leading to improved decision making, enhanced customer satisfaction, and better product offerings.

Government and private industry budgets continue to shrink, executives are plotting new strategies to become more efficient and cost effective. Cloud computing has gleaned a lot of attention over the past several years as a means to reduce IT expenditures, improve scalability and reduce administration over head [13]. The General Service Administration (GSA) has recently announced

they have achieved a cost savings of almost $2 million dollars a year since migrating from Lotus Notes to Google's Cloud based email.

3.2 Result & Discussion

The results obtained from the analysis of e-commerce product reviews using the implemented system provide valuable insights into customer sentiments and preferences. These insights can aid businesses in making informed decisions to enhance their products, optimize marketing strategies, and improve overall customer satisfaction.

The sentiment analysis component of the system effectively classifies the sentiment polarity of each review, providing sentiment labels or scores indicating positive, negative, or neutral sentiment. This allows businesses to gain a comprehensive understanding of customer perceptions towards their products. The accuracy of sentiment analysis can be evaluated by comparing the predicted sentiments with manually annotated sentiments. High accuracy indicates the reliability of the system in accurately capturing customer sentiments [14]. The data manipulation and analysis tasks performed using the Pandas library enable businesses to organize and analyse the collected reviews efficiently. Filtering, grouping, and aggregating the reviews based on various criteria provide valuable insights into customer preferences, product strengths, and weaknesses.

The visualization component utilizing the Matplotlib library plays a vital role in presenting the sentiment analysis results in a visual format. The visualizations, such as bar charts, pie charts, and word clouds, help businesses understand sentiment distributions, review ratings, and frequently mentioned words or phrases. The user interface developed using Tinter enhances the usability of the system. The interface allows users to input their desired product or search criteria, initiates the data extraction process, and presents the sentiment analysis results. In the discussion, the system's performance can be compared to existing approaches. The advantages and limitations of the implemented system can be highlighted.

Overall, the results obtained from the analysis of e-commerce product reviews using the implemented system provide businesses with valuable insights into customer sentiments. The system's accuracy, efficiency, and usability contribute to informed decision-making, improved product offerings, and enhanced customer satisfaction. Regular evaluation and refinement of the system based on user feedback and evolving requirements are essential for its continuous effectiveness and relevance.

4.5 Screenshots of Code & Output

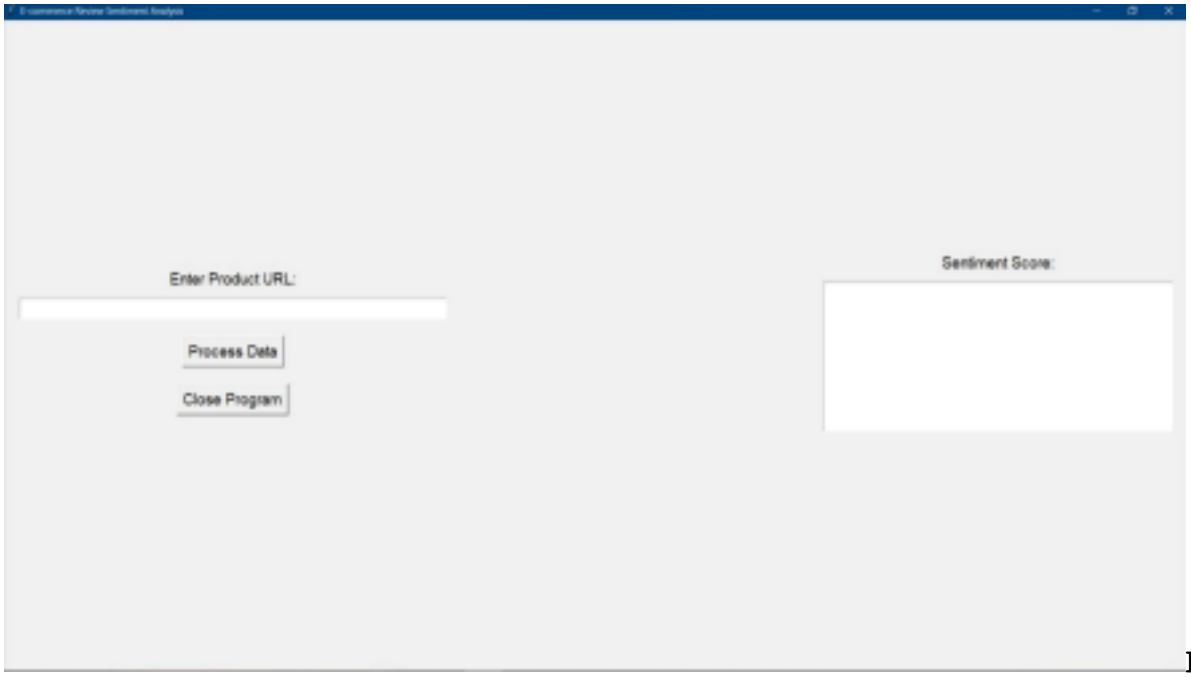

Figure 4.3

Analysis of E-Commerce Product Reviews

As you can see from the screenshot, this is an analysis of an E-Commerce review. On the left side, there is an interpreter URL box where you can paste the URL of the product. Below that, there is a process data button that allows you to extract data from the website. The close program button closes the software's window. On the right side, you can see the sentiment score that's show all reviews & count of them, which indicates how many reviews are available. Below that is a box that contains a chart. Positive, negative, and neutral.

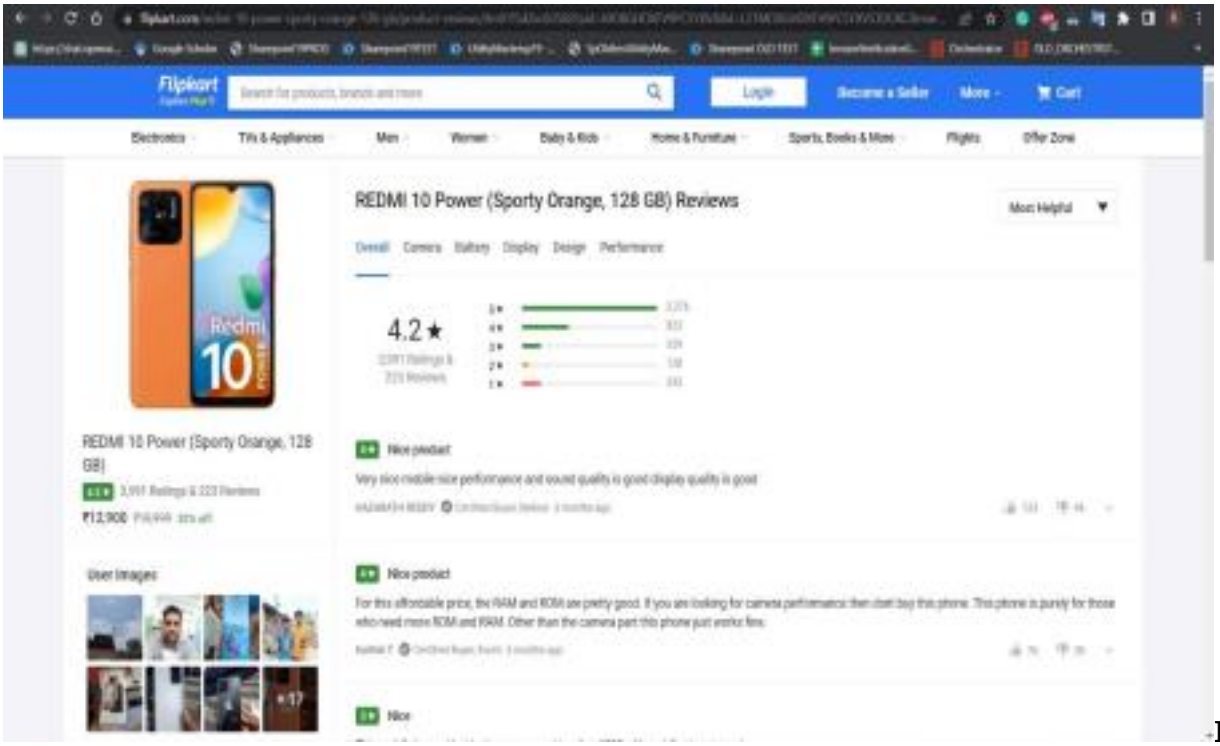

Figure 4.3.2 Product Page

The provided screenshot presents a captivating product page on a prominent e commerce website. Here, we are granted access to a wealth of information regarding the featured product, including its name, price, and customer rating. A notable feature of this page is the ability to conveniently copy the product's URL and seamlessly paste it into our cutting-edge application. Our app is specifically designed to harness the power of advanced analysis techniques to thoroughly evaluate and interpret the multitude of product reviews available. By employing this innovative solution, we empower users to gain comprehensive insights into the overall sentiment expressed within these reviews. Armed with this invaluable knowledge, individuals can confidently make informed decisions about whether to proceed with purchasing the product or explore alternative options.

II. CONCLUSION

4.1 Conclusion

In conclusion, the developed system offers businesses a valuable toolkit to analyze and understand e-commerce product reviews. By leveraging Python technologies and incorporating data extraction, sentiment analysis, data manipulation,

4.2 Future Scope

The analysis of e-commerce product reviews is a dynamic field with continuous advancements in technology and evolving customer behaviors. The developed system foranalyzing e-commerce product reviews has potential for future enhancements and expansions. Here are some future scope considerations:

1. Advanced Sentiment Analysis Techniques specific insights.
2. Aspect-Based Sentiment Analysis
3. Social Media Integration
4. Sentiment Trend Analysis
5. Recommendation Systems
6. Real-time-Analysis

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Characteristics of a Trimurty Dairy Industry Wastewater, Lonikalbhor

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ABSTRACT

This paper focuses on the specific attributes of wastewater generated by the Trimurty Dairy Industry. This particular industry releases wastewater characterized by elevated levels of total solids, Chemical Oxygen Demand (COD), and Biological Oxygen Demand (BOD) directly into the primary sewer system without prior treatment. To ensure compliance with the discharge limits established by the Central Pollution Control Board, it is imperative to subject this influent to appropriate treatment. Failure to do so could result in significant pollution of the receiving body, which, in this case, is a river. The Indian government has responded to this concern by implementing stringent regulations governing the discharge of effluents.
Keywords: Influent, Effluent, Wastewater, Dairy Industry.

I. INTRODUCTION

Water is one of the most essential basic component and basic need of our life. The Indian environmental researchers have explained the condition of freshwater resources in India and their management is a serious environmental problem which includes acidification, nutrition enrichment, domestic waste, sewage, agricultural waste and industrial effluents toxic substances identified as major impacts for water pollution. High turbidity can retard the effects of disinfection against micro-organisms and results in the bacterial growth. The quality of water body is studied by reference of amount of Total solids, Hardness, Biological oxygen demand, Chemical oxygen demand, Alkalinity, in the water body. Hence, to study how the dairy wastewater is responsible in polluting the the water bodies it is required to determine and study the characteristics of wastewater generated in dairy industries.

1.0 Dairy Industry:

The milk is one of the most important product as it is required in everyday life as an important article of food. Since the milk is highly perishable, public health and economic consideration are required that consumer should be provided with the product which is rich in quality, pathogen free and pure. To maintain the quality standard, quality control operation needs to be performed at each stage of production of milk which includes sanitary conditions at milking place, storage, processing, packing and transportation. Till the milk is transported to its consumer.

The processes performed are homogenization, separation, pasteurization, clarification and separation. The products made at the dairy industry are Ghee, Butter, Buttermilk, Sweetened condensed milk, Curd, Lassi, Shrikhand. The characteristics of a dairy effluent contain pH, suspended solids, total solids, total dissolved solids, BOD, COD, Turbidity, Alkalinity, Hardness. These characteristics depends mostly on the quantity of the milk processed and types of product manufactured.

1.1 Wastewater generated during milk processing:

1.1.1 Milk receiving: Wastewater due to detergent, wash water and sanitizing agents.
1.1.2 Storage Tank: Wastewater due to detergent, wash water, and sanitizing agents.
1.1.3 Clarification (i.e. removal of suspended matter): Wastewater due to sanitizing agents, detergent and wash water.
1.1.4 Pasteurization: Wastewater due to wash water, detergent, sanitizing agents, cooling water, and steam.
1.1.5 Homogenisation: Wastewater due to wash water, detergent and sanitizing agents.
1.1.6 Packaging: Wastewater due to wash water, detergent and sanitizing agents.

2.0 CHARACTERISTICS OF DAIRY WASTEWATER

2.1 P^H: pH indicates of acidity or alkalinity that is basicity of a solution. Neutral solution has a pH of 7, acidic solutions have pH values ranging between 0- 6 and alkaline solutions have pH values ranging between 8-14.

pH determination is one of the primary and important objective in biological treatment of the wastewater. In anaerobic treatment, if the pH goes below 5 , the process is severely affected. pH goes beyond 5 due to accumulation of acids. Shift in pH beyond 5 to 10 upsets the aerobic treatment of wastewater. pH range is of monumental importance for any chemical reaction. Disinfection, chemical coagulation, water softening and corrosion control are governed by pH adjustment. Lower value of pH below 4 produces sour taste and higher value above 8.5 produces bitter taste. Higher values of pH hasten the scale formation in water heating apparatus and also reduces the germicidal potential of chlorine. High pH induces the formation of tri-halomethanes, which cause cancerin human beings.

The pH of dairy wastewater was found as;

Table 1: pH result table

Sr.No.	Test Result	Nominal Range by CPCB
1	pH= 7.44	pH= 6.5-8.5

It is observed that the pH value of this dairy wastewater is within permissible range set by CPCB for discharging in waterbody.

2.2 Alkalinity Test: Alkalinity is primarily a way of measuring the acid neutralizing capacity of the water. It is the ability to sustain a relatively constant pH. Calcium ions and carbonate ions both are from calcium carbonate or limestone. So water that comes in contact with the limestone will contain high level of both Ca^{++} and $CO3^{-}$ and have higher hardness and alkalinity.

Table 2: Alkalinity test result table

Sr. No.	X (ml)	Y (ml)	Total Alkalinity (mg/lit)	OH- Alkalinity	CO_3- Alkalinity	HCO_3- Alkalinity
1	0	2.4	960	Nil	Nil	960
2	0	2.3	920	Nil	Nil	920
3	0	2.4	960	Nil	Nil	960

Sample Calculation:
Dilution Factor=10
HCO^{3-} Alkalinity = ((2.4*0.02*50*1000)/25) * 10HCO^{3-} Alkalinity = 960 mg/lit.

2.3 Hardness Test: Hardness is caused by divalent cations. The main hardness causing cations are calcium, magnesium, strontium, ferrous and manganese ions. The major anions associated with these cations are carbonates, sulphates bicarbonates, nitrates and chlorides. Groundwater is more harder compared to water flowing on surface. The hardness of water gives information about geology of its source and stream through which it has been to.
The total hardness of water is the sum of calcium and magnesium concentrations, both expressed as calcium carbonate; in mg/l. Hardness are of two types, temporary hardness (carbonate hardness) and permanent (non carbonate hardness). Temporary hardness is one in which carbonate and bicarbonate ions are precipitated that is removed by boiling.
Non-carbonate hardness is that in which these ions cannot beprecipitated, that is it can't be removed when boiled.

Test Results:
1. Volume of EDTA used for 10ml of $ZnSO_4$ = 19 ml
2. Volume of EDTA used for 100ml distilled water = 2.8ml
3. Volume of EDTA used for 25ml of $ZnSO_4$ = 4.7ml(Dilution Factor = 10)

Total Hardness= 760 mg/litCH= 760 mg/lit
It is found that this wastewater is very hard.

2.4 Total solids test: It is amount of solids present in wastewater.

Test Results:
Empty Weight of crucible = 52.755gmWeight after oven drying = 53.142gm Volume of Sample = 50ml
TS= { (53.142 – 52.755) * 1000 * 1000}/ 50
=7740 mg/lit.

2.5 Total Dissolved Solids Test: Dissolved solids are organic particles smaller than 2 microns, refer to any salts, minerals, metals, in the form of anion, cations, molecules, atoms, dissolved into the water sample. Total dissolved solids (TDS) comprise inorganic salts (Generally potassium, magnesium, calcium, sodium, sodium,

bicarbonates and sulfates) and some small amounts of organic matter that dissolves in water. The TDS concentration is all the filterable substances in water that can be determined gravimetrically. TDS determination is mustin determining water quality.

Test Result:

Empty weight of the crucible = 50.740 gmWeight after oven drying = 50.996 gm Volume of Sample = 50ml

TDS= [(50.996 – 50.740) * 1000 * 1000]/ 50 mg/lit

= 5140 mg/lit.

Table 3: TDS result table

Sr. No.	TDS Value	Permissible Limit
1	5140 mg/lit	<2100 mg/lit

It is found that TDS value exceeds the permissible limit.

Total Suspended Solids Test: Total suspended solids (TSS) is harmful when it is in excess and it is listed as a conventional pollutant in the Clean Water Act; It indicates the quality of any water specimen; from highly saline ocean water to wastewater. When water is poured through a pre- weighed filter, the particulate matter that remains even after the filter dries is classified as Total Suspended Solids. This measurement provides actual dry weight of suspended solids, so while determining water quality, professionals often pair TSS measurement with the standard turbidity measurements to develop site-specific correlations that can help create time- saving efficiencies.

Test Result:

Total Suspended Solids = Total solids – Total dissolved solids

= 7740 – 5140 mg/lit

= 2600 mg/lit.

Table 4: Suspended solids result table

Sr.no.	Suspended Solids	Permissible limit
1	2600mg/lit	<100 mg/lit

2.0 Turbidity Test: Turbidity is a physical characteristic of water which measures the cloudiness of water caused due to suspended solids (eg sediment, algae). Turbidity is expressed in Nephelometric Turbidity Units (NTU) and is measured using a relationship of light reflected from water sample.

Test Result:

Turbidity = 121 NTU

2.1 Biological Oxygen Demand Test: BOD is the amount of oxygen required by micr-organisms for stabilizing biologically decomposable organic matter (carbonaceous) in water under aerobic conditions. The test is used to determine the pollution load of wastewater, the degree of pollution and the efficiency of wastewater treatment methods. 5 Day BOD test being a bioassay procedure (involving measurement of oxygen consumed by bacteria for degrading the organic matter under aerobic conditions) requires the addition of nutrients and maintaining the standard conditions of pH and temperature and absence of microbial growth inhibiting substance.

Table 5: BOD Test Results

Sr.No.	Dilution Factor	Bottle	Initial DO (titrant used)	Final DO (titrant used)	BOD Mg/lit
1	500	A	8.5	4.5	2000
		B		4.4	2050
2	1000	A	7.9	5.8	2100
		B		5.8	2100

BOD= 2062mg/lit.

Table 6: BOD discharging limit table

Sr.No.	BOD	Limit for discharging in water body
1	2062 mg/lit	<30 mg/lit

2.0 Chemical Oxygen Demand Test: Chemical oxygen demand (COD) is the measure of oxygen required for chemically oxidizing of the organic matter present in the water sample that is susceptible to oxidation by a strong chemical oxidant. The intrinsic limitation of the test lies in its ability to differentiate between the biologically oxidisable and inert materials. It is measured by the open reflux method.

Test Result:
COD= 4850 mg/lit

Table 7: Chemical oxygen demand result table

Sr.No.	COD	Limit for discharging in water body
1	4850 mg/lit	<250 mg/lit

3.O CONCLUSION

It is found that the wastewater is turbid, rich in BOD, COD, suspended solids, dissolved solids. It is highly alkaline and very hard. Hence, it requires proper treatment before discharging. The BOD/COD ratio is 0.425

that means biological treatment is necessary. An effluent treatment plant must be designed to treat the wastewater and bring the characteristics within the discharging limits.

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A review on Study of disposal of E-Waste and its Impact on Human Health

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ABSTRACT

The rapid modernization of society has led to the widespread replacement of traditional electronic devices, such as old TVs, cell phones, and computers, with the latest thin LCDs, handsets, and laptops. Consequently, electronic waste (e-waste) has emerged as the fastest-growing waste stream worldwide, constituting 5% of all municipal solid waste. This issue is not confined to developed countries alone; Asia, for instance, discards an estimated 12 million tons of e-waste annually, contributing to environmental contamination. This paper explores the global scenario of e-waste generation and its disposal methods, with a particular focus on the alarming situation in India. In 2008, India generated approximately 380,000 tons of e-waste, primarily managed through recycling in economically disadvantaged urban areas. Delhi, for instance, hosts scrap yards employing around 25,000 workers, handling 10,000 to 20,000 tons of e-waste each year. Unfortunately, these so-called 'Recycling Centers' often exacerbate environmental issues by contaminating air, land, and water bodies with hazardous chemicals. The study delves into various methods employed for the disposal of e-waste and the chemicals released during these processes. Additionally, it addresses the potential health hazards posed to humans due to improper e-waste disposal. The diverse range of electronic equipment in e-waste, including microwaves, electric kettles, and cameras, adds complexity to the challenge of managing this waste stream. Consequently, there is an urgent need for sustainable and environmentally friendly e-waste management practices to mitigate the adverse effects on both the environment and human health.

Keywords: E-waste, recycle, Incineration, landfill, ecosystem, pollution, human health.

I. INTRODUCTION

The global electronic industry stands as the largest and most rapidly expanding manufacturing sector, marked by the informal term "e-waste" to describe electronic products nearing the end of their functional life. The surge in market penetration in developing nations, the development of replacement markets in developed countries, high product obsolescence rates, decreasing prices, and the widespread use of the internet contribute to the accelerated growth of electronic waste (e-waste). E-waste, encompassing discarded, obsolete, or

malfunctioning electrical or electronic devices, is increasing at nearly three times the rate of municipal solid waste worldwide [1,2,3].

This proliferation of e-waste, a major source of heavy metals and organic pollutants in municipal waste, poses a serious environmental challenge, particularly in China and other developing Asian nations [4]. These countries not only generate substantial domestic e-waste due to their rapid consumption of electrical and electronic (EE) products but also receive vast quantities of used information technology (IT) devices from abroad [5]. In China, the informal sector predominantly handles e-waste recycling, employing numerous workers at meager wages who utilize crude methods for component separation and metal recovery. These unregulated practices often occur in uncontrolled environments [6].

The majority of e-recyclers export toxic materials like leaded glass, circuit boards, and mercury lamps, primarily to China, Africa, and India [7,8]. This emerging challenge also presents a business opportunity due to the significant volumes of e-waste containing both toxic and valuable materials. Metals such as iron, copper, aluminum, and gold constitute over 60% of e-waste, while plastics account for about 30%, with hazardous pollutants making up only 2.70% [9]. E-waste, growing at about 4% annually, amounts to approximately 40 million tons globally [10].

In recent years, there has been a heightened awareness of our environmental impact, prompting a shift towards more sustainable consumption habits. This trend is particularly evident in industrial sectors, notably the electronic industry, where short product life cycles and rapid technological advancements contribute to escalating e-waste volumes. While a significant portion of e-waste ends up in landfills, the recyclability of these materials, coupled with landfill limitations, has led to the development of retrieval techniques for recycling and reusing valuable components [11].

The escalating threat posed by E-waste to health results from three key factors. Firstly, there is a significant lack of awareness and understanding regarding the proper management and handling techniques of E-waste [12]. Secondly, as the volume of electronic waste continues to rise, it becomes an increasingly hazardous risk to both human health and the environment. The presence of various types of waste significantly impacts physical and emotional health, whether through direct or indirect means [13].

Sources and Categories of E-Waste

E-waste emanates from diverse origins, encompassing government and commercial sectors, institutional and research organizations, households, and manufacturing industries. These sectors significantly contribute to the growing volume of e-waste when their equipment becomes obsolete. While larger institutions and government organizations may be obligated to dispose of their waste through proper channels, household waste often ends up being informally handled by local waste pickers, leading to improper handling and potential adverse health effects on those involved in recycling. Key sources include large and small home appliances, government offices, information technology and telecom equipment, medical equipment from hospitals and private sectors, and industrial machines and equipment.

The major components of e-waste comprise washing machines, dryers, vacuum cleaners, air conditioners, coffee machines, and irons, accounting for approximately 30%. Refrigerators contribute 20%, while computers, telephones, printers, CDs, DVDs, fax machines, and hi-fi sets collectively make up 30%. Televisions represent 10% and monitors alone contribute another 10% [14]. The global e-waste quantity in 2019 is predominantly composed of small equipment, followed by large equipment and temperature exchange equipment, constituting 17.4, 13.1, and 10.8 million tons, respectively [15].

Electronic Waste and its Impact on Human Health and the Environment: A Global Ecological Challenge and Management

The exponential growth in the IT sector, driven by high demand for electronic products such as mobile phones, computers, solar cells, electric vehicles, and laptops, has significantly contributed to economic prosperity. The introduction of new technology to the market prompts the replacement of outdated electronic products, leading to a surge in e-waste. Various entities, including households, small and large enterprises, PC manufacturers, and institutions, contribute to domestic e-waste. Although households contribute the least compared to mobile phones and computers, in many countries, the disposal of such items is prohibited, posing challenges for e-waste management.

Illegal e-waste imports have increased due to lower processing costs, reduced labor expenses, and inadequate enforcement of environmental regulations. The accurate estimation of e-waste production, import and export remains challenging; as precise data on the generated, imported, and recycled e-waste are not readily available. Accurately gauging the extent of e-waste recycling across different sectors presents its own set of challenges [16].

China tops the list in e-waste generation with 10.19 metric kilotons, followed by India (3.230 kt), Japan (2.569 kt), and Indonesia (1.618 kt) [15]. India, second only to China, attributes its high e-waste generation to a large consumer base for electronics, a rapidly growing economy, and an increased demand for home appliances due to improved standards of living and e-governance initiatives. Western India contributes the most to e-waste generation at approximately 35%, with southern, northern, and eastern regions contributing approximately 30%, 21%, and 14%, respectively [17]. The top sixty-five cities in India contribute 60% of e-waste, with ten states, including Andhra Pradesh, Maharashtra, Delhi, Tamil Nadu, Uttar Pradesh, Karnataka, Gujarat, Madhya Pradesh, West Bengal, and Punjab, responsible for 70% of the total e-waste generated. The nature of e-waste management in developing countries like India is distinctive, with the informal sector dominating. A collaborative approach, incentivizing informal recyclers to connect with formal recycling facilities, is suggested to enhance collection efficiency [18]. Due to the absence of stringent measures and well-structured management policies, unregulated recycling activities, particularly in the informal sector, have resulted in environmental pollution due to the release of hazardous materials [19]

Household E-Waste

Estimating the precise amount of e-waste generated by households is challenging, given their relatively lower contribution to overall e-waste production. According to surveys, household appliances, including personal computers, freezers, generators, etc., constitute only about 20–21% of e-waste production. The major share of e-waste production, approximately 79–80%, is attributed to other sectors [16, 20]

Business Sector E-Waste

The business sector, encompassing government departments, public and private sectors, and multinational corporations (MNCs), plays a pivotal role in e-waste production. According to surveys, this sector accounts for approximately 79% of the total installed PCs, making it the largest contributor among all sectors. About 1.38 million outdated PCs are discarded from this sector, as well as from households [16, 20]

Manufacturers and Retailers E-Waste

The manufacturing and retail sector, involved in the production of PCs, IC chips, motherboards, cathode ray tubes (CRTs), and various peripheral devices, stands as the second significant contributor to e-waste. Approximately 1050 million tonnes of these peripheral devices are discarded from this sector annually (16).

Review on E-waste management and its impact on the environment and Society

Various recycling methods for electronic waste: Numerous sectors have adopted various techniques and methods for the recycling of electronic waste. This review paper focuses on four primary approaches to electronic waste recycling.

Landfill Disposal

The breakdown of E-waste in landfills is a labor-intensive and time-consuming process. While meeting compliance requirements, the environmental effects of E-waste land filling are no longer overlooked. Landfills receive and mix a diverse range of waste types.

Numerous studies on land filling of E-waste underscore its environmental consequences [21, 22, and 23]. Notably, cadmium and mercury emissions, including from the combustion of landfill gas, are well-documented. However, for compounds that are unstable and do not naturally degrade, an environmentally sound treatment method based on land filling may not be a viable alternative. The product mix in E-waste facilities suggests that long-term environmental risks associated with land filling cannot be ignored.

Incineration Process

The incineration process involves pyrolysis, occurring in the absence of oxygen, leading to the conversion of materials into gases, oils, charcoal, and ashes after combustion. This process poses certain risks. Gasification, on the other hand, requires only a minimal amount of air to transform components into fumes, ash, and tar. In regions such as the African continent and neighboring countries of India, incinerating electronic waste is a common practice.

When heating a plastic or PVC motherboard, the process releases harmful substances such as PCAs, PCDDs, PCDFs, carbon monoxide gas, SO2, and NO2 into the air, generating poisonous gases detrimental to human health and the environment. Additionally, the smoke may contain trace amounts of heavy metal oxides, including antimony, lead, thallium, arsenic, copper, manganese, mercury, and nickel [24, 25, 26, and 27]

Acid Bath Treatment

The acid bath treatment involves immersing the circuit board in sulfuric acid for approximately 10–15 hours to dissolve metals like copper and facilitate their removal. Following this, a steam bath is used to blend the remaining precipitated copper sulfate into the residual solution, effectively eliminating any remaining copper spots. Acid treatments are also employed to dissolve lead and extract silver and gold [28, 29].

Biological Processes for E-Waste

The application of biological techniques for metal extraction in materials like gold (Au) and copper (Cu) represents a distinctive innovation. A promising and novel approach involves utilizing microbes to break down metallic ores and electronic waste. Bio-metallurgical methods convert metals directly from ores, concentrates, and wastes into soluble salts in liquid media, combining biotechnology and metallurgy in the field of bio-metallurgy [21, 22, 30 and 31]

In clinical terms, ore bioleaching is referred to as "direct" and "indirect" biooxidation, with most investigations focusing on the indirect bio-oxidation route. This hydrometallurgical physicochemical approach utilizes bacteria to generate chemical oxidants, as demonstrated by some researchers [32]. Bacteria such as Acid Thiobacillus ferroxidase, Leptospiral ferroxidase, and Acidithiobacillus thiooxidans are examples of microorganisms employed for extracting metals from this type of waste [33]. This method is widely recognized for its effectiveness in removing metals from diverse materials [34].

Encouraging the design of computers, mobile phones, and other electronic equipment to be ecologically friendly is crucial. Financial incentives can play a role in promoting the adoption of environmentally friendly and safe practices. Business case studies illustrate how modern technology can enhance profitability by

improving recovery and reducing exposure, along with examining the financial impacts of exposure and disease burden [21].

Health Hazards and Challenges in E-Waste Handling:

E-waste is a complex mixture of various toxic elements, and improper handling can lead to irreversible impacts on the environment and human health. The health hazards associated with some toxic elements are outlined below [27, 28, and 29]. Due to its composition, e-waste poses a significant challenge in handling, as it contains multiple components with toxic substances that can adversely affect human health and the environment if not managed properly through appropriate recycling and disposal methods. Residents living in proximity to recycling facilities can be exposed to these hazardous chemicals through various pathways, particularly vulnerable populations such as infants and children. E-waste recycling by-products, such as PCDD/F, are particularly concerning.

Lead, a highly toxic metal with no known beneficial function in the human body, poses a significant risk, especially to children's cognitive and behavioral development, including potential IQ reduction [35]. While formal electronic waste recycling facilities employ specialized equipment to safely extract salvageable materials, protecting workers from adverse health effects, these facilities are expensive to establish and operate, and are rare in less developed countries. Varying national safety standards mean that workers in formal or semiformal recycling centers may still face low-level exposure risks [36].

Electrical and electronic equipment components may contain potentially hazardous chemical elements, including lead, cadmium, chromium, mercury, copper, manganese, nickel, arsenic, zinc, iron, and aluminum [37]. Various regional and international organizations have actively worked on e-waste regulations to prevent negative health effects from informal recycling. However, the focus is gradually shifting from predominantly environmental concerns to encompass health aspects. New challenges are emerging, and international conventions, such as those in Basel [38], Rotterdam [39], and Stockholm [40], face difficulties in effectively addressing the growing domestic e-waste streams in developing countries.

Americium serves as the radioactive material in smoke alarms and is recognized for its carcinogenic properties.

Mercury is present in fluorescent tubes, tilt switches (used in mechanical doorbells and thermostats), and flat-screen monitors. Its health effects include sensory impairment, dermatitis, memory loss, and muscle weakness. In-utero exposure leads to fetal deficits in motor function, attention, and verbal domains. In animals, health effects encompass death, reduced fertility, and slower growth and development.

Sulfur is present in lead-acid batteries, and its health effects include damage to vital organs such as the liver, kidney, and heart, along with causing eye and throat irritation. When released into the environment, sulfur exacerbates the issue of acid rain.

BFRs (Brominated Flame Retardants) are employed as flame retardants in plastics within the majority of electronic devices. Their health effects encompass impaired development of the nervous system, as well as issues with the thyroid and liver. PBBs were prohibited from 1973 to 1977, and PCBs were banned in the 1980s.

Cadmium is present in light-sensitive resistors, corrosion-resistant alloys for marine and aviation environments, and nickel-cadmium batteries, with the most common form found in nickel-cadmium rechargeable batteries containing between 6 and 18% cadmium. The sale of nickel-cadmium batteries has been prohibited in the European Union, except for medical use. Improper recycling of these batteries can lead to cadmium leaching into the soil, harming microorganisms and disrupting the soil ecosystem. Inhalation of cadmium can cause severe lung damage and is associated with kidney damage. Additionally, cadmium is linked to deficits in cognition, learning behavior, and neuromotor skills in children.

Lead is utilized as a soldering agent and is also present in CRT monitor glass, lead-acid batteries, among other applications. Exposure to lead can result in adverse effects, including impaired cognitive function, behavioral disturbances, attention deficits, hyperactivity, conduct problems, and a lower IQ.

Beryllium oxide: Filler in some thermal interface materials such as thermal grease used on heat sinks for CPUs and power transistors, magnetrons, X-ray-transparent ceramic windows, heat transfer fins in vacuum tubes, and gas lasers.

Hexavalent chromium is a known carcinogen, particularly after occupational inhalation exposure. The aforementioned health effects underscore the importance of taking precautions when handling e-waste to mitigate potential health hazards [41].

Disposal of e-wastes presents a significant challenge in many regions worldwide. When computer wastes are land filled, they produce contaminated lichgates that can pollute groundwater. Acids and sludge obtained from melting computer chips, if disposed of on the ground, can lead to soil acidification. For instance, Guiyu in Hong Kong, a hub for illegal e-waste recycling, is grappling with acute water shortages due to water resource contamination [42].

Discarding electronic items with regular household garbage poses a dual threat to both human health and vital components of the ecosystem. Recognizing the detrimental effects of hazardous wastes on both the environment and health, numerous countries have emphasized the need for a global agreement to address the challenges posed by hazardous waste. The Convention secretariat in Geneva, Switzerland, plays a pivotal role in facilitating the implementation of the convention and related agreements. It offers assistance and guidelines on legal and technical issues, gathers statistical data, and conducts training on the proper management of hazardous waste [43, 44].

Discussion:

Electronic equipment and, consequently, e-waste have become ubiquitous in our society. Their complex chemical composition and the challenge of quantifying their flows at both local and international levels contribute to the pollution resulting from their irregular management.While there is a wealth of information on the consequences of e-waste pollution on ecosystems and human health, there is a notable lack of sufficiently documented scientific studies addressing the environmental restoration of areas burdened by certain pollutants from e-waste, such as Li, Sb, and Hg. Implementing effective take-back programs with incentives for producers to design less wasteful, less toxic, and more easily disassembled, reused, and recycled products could contribute to waste reduction. The improper disposal of recycling wastes, such as acids and sludge's, in rivers has led to the transport of water from distant towns to meet the population's demands. Incinerating e-wastes can release toxic fumes and gases, polluting the surrounding air. Land filling brominates flame retardant plastics or cadmium-containing plastics can result in the leaching of both polybrominated diphenyl ethers (PBDE) and cadmium into the soil and groundwater. Notably, the dissolution of significant amounts of lead ions from broken lead-containing glass, such as cathode ray tube cone glass, mixed with acidic waters, is a common occurrence in landfills. The toxic fallout from open-air burning affects the local environment and global air currents, depositing highly toxic byproducts in various places worldwide.

Conclusion:

Efficient E-waste management, encompassing sourcing, collection, extraction, and disposal, can transform the substantial accumulation of E-waste into lucrative products and business opportunities. This comprehensive E-waste management approach should involve technological advancements, institutional arrangements,

operational plans, protective protocols for workers in such units, and educational initiatives, with E-waste management integrated into higher secondary education curricula.

Pollutants associated with each type of appliance broadly fall into hazardous wastes (heavy metals such as Cu, Ni, Pb, Ag, Au, Cr, etc., persistent organic pollutants, and polychlorinated biphenyls) and non-hazardous wastes (ferrous metals like iron and steel, non-ferrous metals such as copper and aluminum, plastic, rubber, glass, etc.). Improper handling of E-waste poses risks to the environment and human health due to its toxic components.

Most waste, inherently dangerous, can produce leachate and explosive landfill gas. Stringent requirements exist for the construction, operation, and aftercare of landfill sites due to associated dangers. Planning authorities prefer repurposing worked out quarries for landscaping over establishing landfill sites. Product design plays a crucial role in minimizing waste and maximizing end-of-life recycling. The responsibility for reducing the environmental impacts of products should be shared among manufacturers, retailers, users, and disposers, following a product stewardship approach.

Proper management and disposal of E-waste, a major source of heavy metals, hazardous chemicals, and carcinogens, can prevent diseases related to the skin, respiratory, intestinal, immune, endocrine, and nervous systems, including cancers. With the exponential growth in the use of Electrical and Electronic Equipment (EEE) to bridge the digital divide, proper scientific disposal of ICT wastes is crucial. Implementing existing policies and guidelines in alignment with international standards is essential for a healthy E-waste management system.

Despite legislation, some countries, like India, struggle to establish effective formal recycling systems. The support and adoption of more precise life cycle assessment models, particularly in developing nations, are critical. Protecting society from E-waste risks must be a priority, and deeper research, especially focused on children and vulnerable groups, is essential for a comprehensive understanding of the health effects of E-waste exposure. Collaboration among the international health community, researchers, policymakers, non-governmental organizations, and national governments is vital to address E-waste exposure and its health implications.

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Information Repository for the 21st Century : Digital Resources

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ABSTRACT

The 21st century's libraries and information services are evolving quickly. Libraries now collect reading materials including print books, journals, and periodicals in addition to coordinating access to a variety of learning resources in electronic format due to the rapid development of digital resources. Users' lives and learning processes are altering as a result of web resources and web tool use. World literature now includes a significant amount of digital materials. They make reference to online information sources. The many sorts of materials include electronic books, journals, periodicals, databases, and CDs. This research paper focuses on the different types of digital resources, their significance and benefits.

Keywords: Digital Resources, E-Resources, E-Journal, E-Books.

I. INTRODUCTION

Correct information to the accurate user at the correct time has been the aim of information Professionals. Significant changes in the means to generate, assign, grant right of entrance, and use have been brought about by recent breakthroughs in information and communication technologies, particularly the Internet. The web-based technology helps to lessen the issues with using information as soon as possible. The types and formats of library resources have been evolving constantly. Electronic publication has been significantly impacted by advances in Web technology and information and communication technology (ICT). The possibilities for storing and accessing information have expanded greatly as a result of the rapid growth of ICT and its usage in a variety of industries; the use of network technology has intensified the process. This modification has resulted in a more varied collection for the Library and Information Centers that includes both printed and non-printed resources.

Digital Resources Definition: assets that were conceptualised and created digitally or by converting analogue assets to a digital format are referred to as digital resources. Digital resources are easy to use, save time, and keep you up to date with the most recent knowledge in the relevant subjects.

There are numerous sorts of digital resources available worldwide. These can be divided into three main groups, i.e.

- Text based: Text based digital resources includes electronic-databases, electronic- conference proceedings, electronic-journal, electronic-reports, electronic-dictionary, electronic-directory, electronic-newsletter electronic-newspaper, electronic-book and electronic-thesis, etc

- Non-text based and Meta resource: The Non-text based category consists with animation, audio file, digital image, book illustrations, periodical illustrations, photographs, computer graphics, space photographs, video file, architectural drawings, maps, paintings, drawings and sketches, etc.

- Meta Resource: includes abstracts, bibliography, catalogue, index, database and archival finding, etc.

1. Text base digital resources:

The information resources that are digitally created and stored of e-databases, e-conference proceedings, e-journal, e-newspaper, e-book, e-Thesis & Dissertations, e-encyclopedia, e-zine, e-reports, e-dictionary, e-directory, e-newsletter etc. can be included in text based digital resources. The digital resources are published in digital form and are accessible only in digital environment.

1.1 E-Database: An electronic database is a collection of data arranged in a systematic way to make the search easy and fast. Out of country is totally work covered with computerized. The most common type of library database consists of records describing articles in journals or newspapers. The process of matching customer's query against information in databases is the essence of computerized information retrieval.A regularly updated file of digitized information consisting of bibliographic records, abstracts, full text documents; images etc. pertaining to a specific subject in a uniform format. A Database may be, Local Database, Remote Database, and CD & DVD Database.

1.2 E-Conference Proceeding: In academia, e-Conference proceedings are the collection of academic papers published in the context of an academic conference. Proceedings contain the contributions made by researchers at the conference. They are the written record of the work that is corrected to fellow researchers.

1.3 E-Journals: a print journal that is also available online or through another method of internet access. E-journal access is often IP enabled. These are only accessible on the campus. Depending on the type of subscription, either a single user or a group of users can access the journals simultaneously. There are many journals that offer full text access without a subscription. In light of the fact that small and medium-sized libraries with limited resources are likely to bear the brunt of any danger to publishers in the new electronic age; the introduction of electronic full-text journals presents a chance for a novel strategy. Online access to several e-journals is now widespread. Some publishers offer free online access to the journals they publish in exchange for library print subscriptions. Users and researchers may easily read electronic journals on computers, mobile devices since they are very easy to search for and download as e-document files.

1.4 E-Books: The book is only available to read on computers or with e-book readers and was released in electronic format. Multiple people can view the e-books simultaneously without worrying about the

contents being harmed. The evolution of electronic versions of printed books has been a component of the e-publishing phenomenon since the 1970s. In most subject areas, there are a sizable number of e-books available online that can be downloaded for free or for a fee. E-books are seen from the standpoint of libraries differently than physical books, which need shelf space and can be damaged or withdrawn from the collection.

1.5 E-Theses and Dissertations: The theses and dissertations of the university are important source of knowledge and information for a researcher. The institutes are digitizing the print theses in electronic form for the easy access of its users.

1.6 E-Newspaper: The digital version of print newspaper accessible using web or other means of internet access. These can be accessed simultaneously by multiple users at the same time.

1.7 E-Newsletter: An online newsletter published by the organization accessible using internet or intranet. The newsletter is useful to get the information about various activities, achievements of organization etc.

1.8 E-Standards: The digital version of print standards accessible using web or other means of internet access.

1.9 E-Encyclopedia: databases for encyclopedias via a method other than the printed page. Numerous general and specialized encyclopedias have started to release electronic versions of their databases as CD-ROM and DVD-ROM products as well as online services. A standalone product that provided a database in a way that was most appropriate for the electronic medium, the electronic encyclopedia evolved as computer technology advanced during the turn of the twenty-first century.

The most obvious benefit of electronic encyclopedias is their multi-media capabilities, which enhance the text, pictures, and line drawings that were passed down from the print medium with animated graphics, recorded sound, and video recordings. There is potential for encyclopedias, which enable readers to retrieve, manipulate, and classify material in accordance with their own designs, as more powerful data-processing technologies evolve.

1.10 E-magazine: An e-magazine, whether delivered on a web site or an email address. Some e-zines are strictly non-profit. Some are extremely profitable. Other would be for-profit if they could attract the necessary audience and advertisers.

1.11E-Report:A document containing information about institute or organized a narrative, graphic, or tabular form, periodic, recurring, regular, or as required basis. Reports may refer to specific periods, events, occurrences, or subjects, and may be communicated or presented in electronic form.

1.12 E-Dictionary: An e- dictionary is a collection normal word with synonyms word whose data exists in digital form and can be accessed easy. Electronic dictionaries can be found in several forms, including: as dedicated handheld devices or tablet.

1.13 E-Directory: e-Directory is directory service software that is used to centrally managing access to resources on multiple servers and computers within a network.

2 **Non-text based resources:** Animation, audio files, digital images, book and magazine illustrations, architectural drawings, maps, paintings, drawings, sketches, pictures, computer graphics, space photos, video files, multimedia, etc. can all be classified as non-text based content. With the aid of the proper technology and software, the materials that are now available in physical (print) formats are converted into digital formats, such as institutional repositories, institute publications, e-newsletters, electronic theses and dissertations, etc. Information resources classified as digital are those that were formerly in print form but are now available online and can be accessed using computers and other associated ICT equipment. Students are motivated by digital information resources because they have the chance to send, obtain or download, process, and share information on a topic of interest. A carefully chosen and arranged collection of digital documents, their corresponding metadata, and at least one interface that allows access to them can all be referred to as digital information resources. These materials might be developed for network sharing, institutional use, or local use.

3 **Meta resources:** abstracts, archival finding aid, bibliography, catalogue, index, database etc. can be included and Database may be, Local Database, Remote Database, CD & DVD.

3.1CD and DVD: CD/DVD-ROMs are now a widely used e-media for information archiving, retrieval, and distribution. With user-friendly software, it is utilised for large-scale data storage. It can operate as a standalone unit with both specific and general coverage, or it can be networked through a CD server. Using CD-ROMs for specialized collections of full-text content is a growing trend.

3.2Reference material: The print reference material like encyclopedia; dictionaries; handbook etc. available in digital form and accessible using internet or intranet. The reference sources are the primary source of information. Some of the reference sources are open source but majority of reference sources are available to the users only when the library subscribes these resources.

3.3Institute publications: The digital version of books; articles, and other informative material written by faculty and students of the organization and available over intranet. The recent growth and development of digital libraries can broadly be grouped into three broad categories;

(i) Digital Library generated as a byproduct
(ii) Digitization of traditional printed resources
(iii) New information sources that are created especially for the web.

The users are helped by the digital information resources by having quick and easy access to information. However, there are still several issues that prevent users from using digital information resources. These include users' inability to find information, ignorance of the resources' existence, lack of interest, and lack of time and commitment.

All computerised and networked online materials that can be accessed through libraries are included in the term "digital information services" in the context of libraries. The services offered to patrons by libraries' digital information services are those that are delivered electronically via computers and the internet or intranet.

3.4 OPAC: While Web OPAC is the bibliographic record of books and other reading material accessible on the Web, Online Public Access Catalogue (OPAC) is the bibliographic record of books and other reading material available online to users within the organisation. One can find out if and where the necessary document or material is by using Web OPAC.

3.5 E-Database service: a digitised, electronically accessible collection that is organised and pertains to a single topic or a range of topics. The electronic database may be an abstracting, bibliographic, or indexing database. The databases assist a user in obtaining the summaries of published material related to information needs.

3.6 Current awareness services in digital form: The service to alert the user about the latest literature published in his/her field of specialization. The service is provided either on demand or in anticipation of demand.

3.7 Bulletin board services: a computer-based online messaging platform that informs users of the events the library plans to host in the future. The service is useful for informing users when a new library service is launched or a new resource is enrolled in the library.

3.8 Discussion groups and forums: a group members with similar interests who get together to discuss current events, exchange novel ideas, work out difficulties, and make comments. Discussion groups are helpful for getting problems solved by the group's participants.

3.9 Blogs: A web page that provides frequent continuing publications of web links or comments on a specific topic or subject.

3.10 Newspaper clippings: The clippings published in the newspapers about the institute in digital form.

3.11 Electronic document delivery: the electronic delivery of necessary papers to consumers via email. Sometimes, users of libraries discover that the necessary documents are available in other libraries but not in their own. If the document isn't already in digital form, it can be ordered on demand by receiving a scanned copy.

3.12 Library portals: The library's website offers thorough details about its resources, facilities, and services, as well as its collection. The user can learn how to use resources and what he can acquire from the library by using the library portals.

3.13 Institute publications in digital form: The institute's annual reports and other significant documents are available online and through the intranet, such as the e-Newsletters, e-Reports, and e-Journals the institute publishes.

4. Importance of digital resources: The amount of knowledge is expanding quickly, and literature, particularly in the fields of science and technology, is expanding greatly. Traditional resources require one to search through the entire collection, but digital resources provide all the pertinent information from the complete collection in one location, making information search easier. The libraries have already embraced

contemporary methods to meet the rising demands of its patrons. The following factors have encouraged libraries and users to turn to digital information sources:

Information explosion: rising interdisciplinary research activities the amount of information is growing every day, making it challenging for researchers to stay on top of the most recent advancements in their areas of interest. One can keep themselves up to date with the most recent advances by using digital tools.

i. Extended accessibility: Digital resources are available for a longer time. The resources can occasionally be accessed from the first issue of the first volume or from back files that are 5–10 years old, depending on the e-journal publisher.

ii. Searching is made simpler: By using digital resources, you may access all of the collection's precise information in one location.

iii. Up to date information: The information contained in the print resources took a time to get updated whereas digital resources are updated regularly so the users get the updated information.

iv. New generation needs: The traditional library cannot provides the multiple inter disciplinary information necessities of the users whereas digital resources subscribed by the library help to meet the information necessities of the users.

5. Advantages of digital resources and services:

Services and resources for digital information are dispersed across the network. The users are free to use a network connection and straightforward search methods to access the data on the machine. The following are some benefits of using digital information resources:

i. The user does not physically need to go to the library in order to access the necessary information because the digital library's materials and services may be accessed via the internet or intranet from anywhere on campus.

ii. Multiple accesses: There are no restrictions on using the library's digital materials more than once. The same resource may be accessed simultaneously by numerous users.

iii. Round-the-clock accessibility: Unlike digital libraries, where users can access materials 24/7 through the internet, access to traditional libraries' resources and services is limited to the hours the library is open.

iv. Structured approach: The digital resources are more structured as compared to print resources. The user can easily move from catalogue to particular book and then to particular chapter/article as per his/her information necessities using digital resources.

v. Enhanced information retrieval: Information that is retrieved from digital sources is precise and complete. One can perform a word or phrase search over the full collection using digital tools. In the digital library, the necessary data can be retrieved with just one mouse click.

vi. Storage: Since libraries subscribe to the majority of digital materials, they assist in solving the storage issue. The users can 12 access these digital materials using institutional IP or by logging in using the login information given by the relevant publisher.

vii. Preservation and conservation: The user may take a copy of the original work whenever they want without having an impact on the original work's quality.

Conclusion: To deal with the current situation, librarians are turning to new forms of communication, especially e-resources from consortia to increase the library's digital assets by collecting documents. All members of society can benefit from digital resources with including libraries. They are scrambling to get information from all across the world. The improvements in ICT services that are currently available have made wonderful impacts to library operations. The adoption of electronic devices benefits technocrats since it increases user knowledge. Knowledge Documents storage has increased due to digital resources. Library readers can access or search E-Books and E- Journals and any other E-Resources anywhere very easily. It saves time of library staff and library users.

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Investigation of Concrete Properties with Different Types of Fibers with Their Variation of Volume Fraction and Different Aspect Ratio:

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ABSTRACT

The current research focuses on a comprehensive review of literature concerning experimental studies on steel fiber reinforced concrete conducted by various researchers. The objective is to analyze the impact of different types of steel fibers on various concrete strength properties. These studies involve the incorporation of steel fibers at different volume fractions, ranging from 0% to 5% by weight of cement. The concrete strengths investigated include compressive strength, flexural strength, split tensile strength, and bond strength.

The findings of multiple researchers are examined, and a comparative analysis of their experimental results for steel fiber reinforced concrete versus conventional concrete is conducted. The results consistently indicate significant enhancements in various strength properties, such as compressive strength, flexural strength, split tensile strength, and bond strength, when different types of steel fibers with various constant volume fractions and different aspect ratios are added to the concrete mix..

Keywords: Concrete, Steel Fibers, Hook end, Crimped, Straight, Compressive, Flexure, Split Tensile and Bond Strength.

I. INTRODUCTION

Fiber Reinforced Concrete (FRC) is a composite material primarily comprising hydraulic cements, aggregates, and discrete reinforcing fibers. The addition of fibers to concrete, mortar, and cement paste significantly enhances various engineering properties, including fracture toughness, flexural strength, resistance to fatigue, impact, thermal shock, and spalling. The utilization of FRC as a construction material is on the rise, prompting the need for continual updates in our understanding of fiber reinforcement in concrete.

The concept of using fibers in concrete is not new, with historical applications involving fibers extracted from organic sources. However, modern industrial use of Fiber Reinforced Concrete began to gain momentum in the 1960s, primarily in defense-related structures. Ongoing research and development have expanded its application as a construction material, making it common in shotcrete, pavements, industrial floors, bridge decks, and precast elements.

Fiber Reinforced Concrete can be produced using various types of fibers, which are broadly categorized into metallic and non-metallic fibers. This discussion will focus primarily on Steel Fiber Reinforced Concrete (SFRC). SFRC is a composite material composed of cement, fine and coarse aggregates, and discontinuous discrete steel fibers. In tension, SFRC typically fails only when the steel fibers break or are pulled out of the cement matrix. The composite nature of SFRC contributes to its properties in both the freshly mixed and hardened states.

SFRC exhibits excellent dynamic performance, including high resistance to explosion and penetration compared to traditional concrete. When used in structural applications, SFRC is typically employed in a supplementary role to prevent cracking, enhance resistance to impact or dynamic loading, and resist material disintegration.

This paper presents an investigation into the behavior of steel fiber reinforced concrete beams under combined loading conditions. The tests involve subjecting rectangular beams to various combinations of loads, and the test results are compared with theoretical predictions. The findings demonstrate a strong agreement between theoretical expectations and experimental outcomes.

1.1 Objectives

The primary aim of this study is to examine the mechanical characteristics of concrete, including compressive strength, flexural strength, split tensile strength, and bond strength. This investigation entails assessing the influence of diverse steel fiber types, various volume fractions, and distinct aspect ratios on these concrete properties.

II. LITERATURE WORK

2.1 Fiber Reinforced Concrete

Fiber reinforced concrete, or FRC, is a composite material characterized by a cement matrix with uniformly or randomly dispersed discrete fibers. These fibers function as inhibitors of crack propagation in the matrix, preventing cracks from spreading and ultimately leading to brittle failure under stress.

Historically, efforts have been made to enhance the tensile properties of concrete structures by using traditional reinforcement with steel bars and applying restraint techniques. While these methods do provide tensile strength to concrete elements, they do not inherently increase the concrete's own tensile strength.

Recognizing this, it has been acknowledged that incorporating small, closely spaced, and uniformly distributed fibers into concrete can serve as crack arresters, significantly improving its static and dynamic properties. This enhanced concrete is referred to as Fiber Reinforced Concrete (FRC). Fibers come in various forms, including circular or flat shapes, and are often characterized by a parameter known as "aspect ratio," which is the ratio of their length to diameter. Typical aspect ratios range from 30 to 150. Fibers can be broadly categorized into metallic fibers and polymeric fibers, each offering distinct effects:

Metallic fibers:

Enhance fracture energy, leading to improved ductility.

Increase various strength properties, such as compressive and tensile strength.

Reduce the propensity for cracking.

Polymeric fibers:

Diminish microscopic crack propagation under heavy loads.

Improve fire resistance.
Mitigate early shrinkage.
Glass fibers:
Alleviate early shrinkage.
In summary, Fiber Reinforced Concrete incorporates various types of fibers, each offering unique benefits, such as increased strength, enhanced ductility, and reduced crack propagation, ultimately improving the overall performance and durability of concrete structures.

2.2 Classification of Fibers

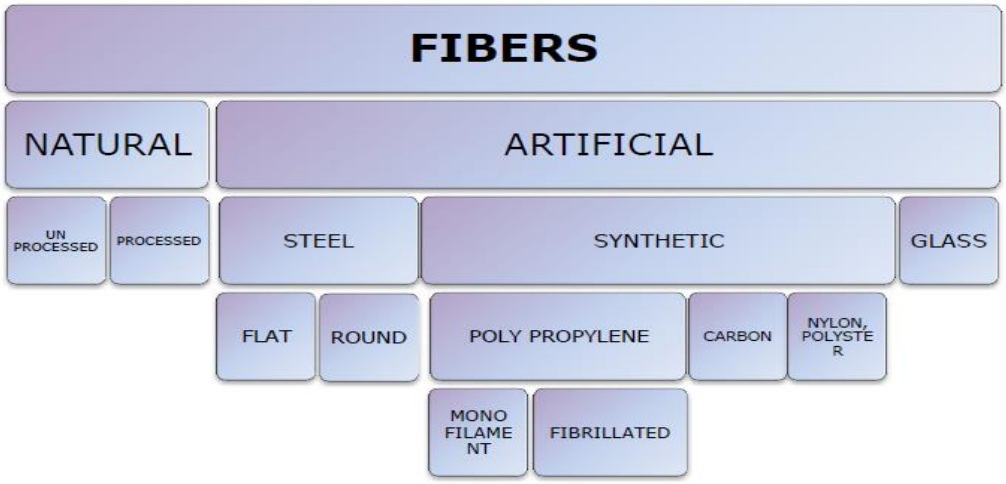


Fig-2.1 Classification of Fibers

2.3. Metallic Fibers

Metallic fibers are made of either carbon steel or stainless steel. The tensile strength ranges from 345 to 1380 MPa. The minimum strength specified in ASTM is 345 MPa. The modulus of elasticity for metallic fiber is 200 GPa. The fiber cross section may be circular, square, or irregular. The length of the fiber is normally less than 75 mm even though longer fibers have been used. The length-diameter ratio typically ranges from 30 to 100 or more.

2.4. Polymeric fibers

Synthetic polymeric fibers have been produced as a result of research and development in the petrochemical and textile industries. Fiber types that have been tried with cement matrices include acrylic, aramid, nylon, polyester, polyethylene, and polypropylene. They all have a very high tensile strength, but most of these fibers (except for aramid) have a relatively low modulus of elasticity. The quality of polymeric fibers that makes them useful in FRC is their very high length-to-diameter ratios; their diameters are on the order of micrometers. Polymeric fibers are available in single filament or fibrillated form. The length used in FRC range from 12 to 50 mm. The number of studies of FRC containing polymeric fibers is very limited.

2.5 Basic Mechanism of Fiber Reinforcement

Fiber influences the mechanical properties of concrete in all modes of failure, especially those that induce fatigue and tensile stresses. The strengthening mechanism of fibers involves transfer of stress from the matrix to the fiber by interfacial shear or by interlock between the fiber and matrix. With the increase in the applied load, stress is shared by the fiber and the matrix. With the increase in the applied load, stress is shared by the fiber and the matrix in tension until the matrix cracks; then the total stress is progressively transferred to the fibers, till the fibers are pulled out, or break, or break in tension.

Fiber efficiency and the fiber content are the important variables controlling the performance of FRC. Fiber efficiency is controlled by the resistance to pullout, which depends on the bond at the fiber matrix interface. Pullout resistance increases with fiber length. Since pull out resistance is proportional to the interfacial area, the smaller the diameter, the larger is the interfacial area available for the bond. For a given fiber length, smaller the area, more effective is the bond. The composite effect of these two variables is expressed by the 'aspect ratio' (length/diameter). Fiber efficiency increases with increase in 'aspect ratio'.

The contribution of fiber to the composite depends upon the fiber material and type, Length (L), diameter (d), and aspect ratio (L/d), and volume concentration of fibers in the matrix.

2.6 Factors Influencing Fiber Reinforced Concrete

Fiber reinforced concrete can be defined as a composite material consisting of a cement-based matrix containing an ordered or random distribution of fibers. The fibers act as crack arrestors that restrict the growth of flaws in the matrix, controlling them from enlarging under stress into cracks which eventually cause failure. By inhibiting the propagation of cracks originating from internal flaws, considerable improvements in static and dynamic properties can be obtained and fibers impart to the composite qualities of crack control, toughness, ductility impact resistance.

The use of continuous, aligned fibers in a cement matrix is fundamentally not different from conventional reinforced or pre-stressed concrete, where the large diameter reinforcing bars or the smaller diameter pre-stressing wires behave analogously to the continuous aligned fibers. The phenomena of multiple cracking and of composite action in such materials have been well established for over a century. Obviously the highest strength characteristics are obtained when the fibers are aligned to resist the critical stresses, but then the material becomes markedly anisotropic.

A more exciting challenge that will find a wider practical application is the use of short, discontinuous fibers that are uniformly in the matrix. It is true that with random orientation not all fibers are equally effective in crack control or in their strengthening and stiffening role: nevertheless, if sufficient strength and crack control improvements could be obtained, the practical advantages of discontinuous fibers will outweigh the strength advantage of continuous aligned fibers.

The effective reinforcement of the matrix and the efficient transfer of stress between the matrix and the fiber depend upon many factors. Many of these factors are intimately interdependent, and exercise a profound but complex influence on the properties of the composite.

- The relative fiber matrix stiffness
- Fiber matrix interfacial bond
- Strain compatibility between fiber and the matrix.
- Shape of fibers

- Strength of fibers
- Fiber orientation
- Specimen size
- Span of specimen
- Spacing of fibers
- Physical and mechanical properties of fibers

2.7 Steel Fiber Reinforced Concrete

Steel fiber reinforced concrete is a composite material made of hydraulic cements, fine and coarse aggregate, and a dispersion of discontinuous, small steel fibers. It may also contain pozzolans and admixtures commonly used with conventional concrete. The addition of steel fibers significantly improves many of the engineering properties of mortar and concrete, mainly impact strength and toughness. Flexural strength, fatigue strength, and the ability to resist cracking and spalling are also enhanced. Similarly, addition of fibers decreases the workability of fresh concrete and this effect is more pronounced for fibers with high aspect ratios. Research and design of steel fiber reinforced concrete began to increase in importance in the 1970s, and since those days various types of steel fibers have been developed. They differ in material as well as in size, shape and surface structure, as shown in figure 2.1. Due to different manufacturing processes and different materials, there are differences in the mechanical properties such as tensile strength, grade of mechanical anchorage and capability of stress distribution and absorption.

Figure 2.2: Different Types of Steel Fibers

There are drawn wire fibers, cut sheet metal fibers and milled steel fibers. Melt extracted fibers are amorphous and thus stainless. In order to improve anchorage and adhesion with the concrete matrix, the shape can be designed with hooked ends, completely corrugated or provided with end cones. Steel fibers are generally 12.7 - 63.5 mm long, and 0.45 - 1.0 mm in diameter. The usual amount of steel fibers ranges from 0.25% to 2% by volume, or 20 - 157 kg/m3.

A lot of research work has been done and is going on the use of different types of steel fibers in enhancing different properties of concrete. Research work done by different researchers is discussed here in brief.

2.8 Research work by different researchers:

Banthia and Sappakittipakorn: In the opinion of these two researchers, crimped steel fibers with large diameters are often used in concrete as reinforcement. Such large diameter fibers are inexpensive, disperse easily and do not unduly reduce the workability of concrete. However, due to their large diameters, such fibers also tend to be inefficient and the toughness of the resulting fiber reinforced concrete (FRC) tends to be low. Hence, an experimental program was carried out to investigate if the toughness of FRC with large diameter crimped fibers can be enhanced by hybridization with smaller diameter crimped fibers while maintaining

workability, fiber dispensability and low cost. The results showed that such hybridization, replacing a portion of the large diameter crimped fibers with smaller diameter crimped fibers can significantly enhance toughness. The results also suggested that such hybrid FRCs fail to reach the toughness levels demonstrated by the smaller diameter fibers alone.

Bayramov, C. Tasdemir and M. Tasdemir: conducted this research to optimize the fracture parameters of steel fiber reinforced concretes to obtain a more ductile behavior than that of plain concrete. The effects of the aspect ratio (L/d) and volume fraction of steel fiber (V f) on fracture properties of concrete in bending were investigated by measuring the fracture energy (GF) and characteristic length (lch). For optimization, three-level full factorial experimental design and response surface method were used. The results show that the effects of fiber volume fraction and aspect ratio on fracture energy and characteristic length are very significant.

Padmarajaiah and Ramaswamy ; carried out an experimental program for eight fully prestressed beams and seven partially prestressed beams made with high strength fiber-reinforced concrete (plain concrete strength of 65 MPa). These studies mainly attempted to determine the influence of trough-shaped steel fibers in altering the flexural strength at first crack and ultimate, the load–deflection and moment–curvature characteristics, ductility and energy absorption capacity of the beams. The magnitude of the prestress, volume fraction of the fibers ranging from 0% to 1.5% and the location of fibers were the variables in the test program. Analytical models to determine the load–deflection and moment–curvature relationships as a function of the fiber volume fraction were formulated. Empirical relationships for the ultimate strength, first crack load level, load versus deflection and moment versus curvature as a function of fiber content were proposed by making use of force equilibrium and compatibility considerations. A primary finding was that the placement of fibers over a partial depth in the tensile side of the prestressed flexural structural members provided equivalent flexural capacity as in a beam having the same amount of fiber over the full cross-section. In large scale precast concrete applications it is expected that this would be economical and lead to considerable cost saving in the design without sacrificing on the desired structural performance. The analytical models proposed in this study predicted the test results closely.

Rao and Seshu Relatively little research work has been done on the behavioral aspects of SFRC under pure torsion compared to its behavior under flexure or shear or under combined loading. The researchers suggested that the enhanced properties of SFRC in particular the ductility of the matrix can be achieved when a minimum volume fraction of fiber content is maintained. They studied the behavioral aspects of plain SFRC members under pure torsion and derived an empirical formula to predict the ultimate torsional strength of the SFRC members under pure torsion.

Wang, Liu and Shen: investigated three types of SRFC specimens with 0.0%, 3.0% and 6.0% (percentage by volume) of ultra short steel fibers subjected to impact compression tests conducted on 74-mm-diameter split Hopkinson pressure bar (SHPB). Based on the stress–strain curves of different strain-rates, as well as the random statistical distribution hypothesis for SFRC strength, a dynamic damage constitutive model of SFRC composite under compression was proposed. It was established that both the volume fraction of steel-fiber and strain-rate of loading exert significant influences on the SFRC strength. The theoretical results were in good agreement with experimental data.

Kurugo, Tanacan and Ersoy : studied the effect of steel fiber reinforcement and polymer modification on the Young's modulus of lightweight concrete aggregates. Through experimental measurements, composite property models that best describe the mixtures in terms of the properties and volume fractions of their

constituents were identified. The relationship between various composite properties and the mixtures used to produce the lightweight concrete were also explored qualitatively.

Yazici, Inan and Tabak: investigated the effects of aspect ratio (l/d) and volume fraction (Vf) of steel fiber on the compressive strength, split tensile strength, flexural strength and ultrasonic pulse velocity on steel fiber reinforced concrete (SFRC). For this purpose, hooked-end bundled steel fibers with three different l/d ratios of 45, 65 and 80 were used. Three different fiber volumes were added to concrete mixes at 0.5%, 1.0% and 1.5% by volume of concrete. Ten different concrete mixes were prepared. After 28 days of curing, compressive, split and flexural strength as well as ultrasonic pulse velocity were determined. It was found that, inclusion of steel fibers significantly affect the split tensile and flexural strength of concrete in accordance with l/d ratio and Vf. Besides, mathematical expressions were developed to estimate the compressive, flexural and split tensile strength of SFRCs regarding l/d ratio and Vf of steel fibers.

Mohammadi, Singh and Kaushik: studied properties of plain concrete and steel fiber rein- forced concrete (SFRC) containing fibers of mixed aspect ratio. An experimental programme was planned in which various tests such as inverted cone time, Vebe time and compaction factor were conducted to investigate the properties of plain concrete and fiber reinforced concrete in the fresh state. Compressive strength, split tensile and static flexural strength tests were conducted to investigate the properties of concrete in the hardened state. The specimen incorporated three different volume fractions, i.e., 1.0%, 1.5% and 2.0% of corrugated steel fibers and each volume fraction incorporated mixed steel fibers of size 0.6 · 2.0 · 25 mm and 0.6 · 2.0 · 50 mm in different proportions by weight. Complete load deflection curves under static flexural loads were obtained and the flexural toughness indices were obtained by ASTM C-1018 as well as JCI method. A fiber combination of 65% 50 mm + 35% 25 mm long fibers can be adjudged as the most appropriate combination to be employed in SFRC for compressive strength, split tensile strength and flexural strength. They found better workability as the percentage of shorter fibers increased in the concrete mix.

Song, Wu, Hwang and Sheu: studied impact resistance variations of high-strength steel fiber-reinforced concrete (HSFRC), versus those of high-strength concrete (HSC). They found that impact resistance of the high-strength steel fiber-reinforced concrete improved satisfactorily over that of the high-strength concrete; the failure strength improved most, followed by first-crack strength and percentage increase in the number of post- first-crack blows. The two concretes resembled each other on the coefficient of variation values, respectively, on the two strengths, whereas the high-strength concrete was much higher in the value on the percentage increase

Lu and Hsu: conducted extensive experimental program which showed the behavior of high strength concrete and steel fiber reinforced high strength concrete under uniaxial and triaxial compression. Triaxial stress–strain relations and failure criteria were used to evaluate the effect of steel fiber reinforcement on the mechanical properties of high strength concrete in triaxial compression, which were found to be insignificant.

Lau and Anson: investigated the compressive strength, flexural strength, elastic modulus and porosity of concrete reinforced with 1% steel fiber (SFRC) and changes of color to different elevated heating temperatures, ranging between 105 °C and 1200 °C. The results showed a loss of concrete strength with increased maximum heating temperature and with increased initial saturation percentage before firing. Mechanical strength results indicated that SFRC performs better than non-SFRC for maximum exposure temperatures below 1000 °C, even though the residual strength remains very low for all mixes at this high temperature. The variations with colour, which occurred, were associated with maximum temperatures of exposure.

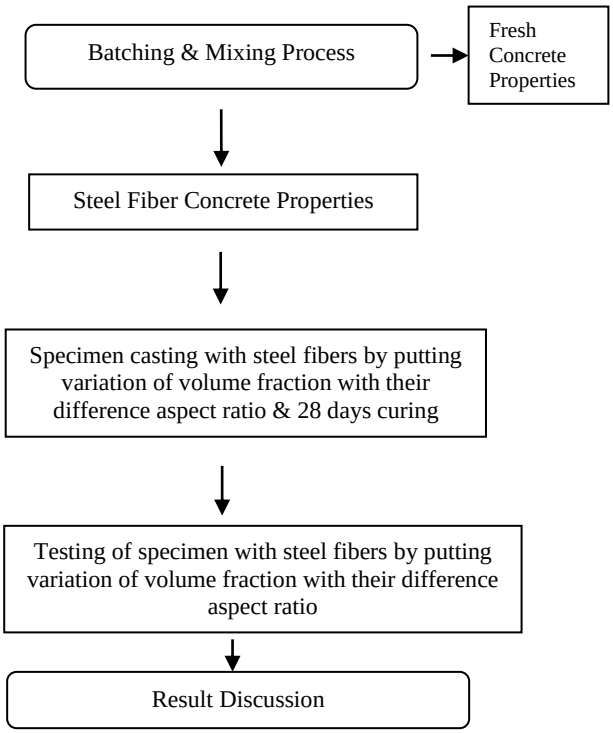
Altun, Haktanir and Ari : studied C20 and C30 classes of concrete produced each with addition of Dramix RC-80/0.60-BN type of steel fibers (SFs) at dosages of 0 kg/m3, 30 kg/m3, 60 kg/m3, and their compressive strengths, split tensile strength, moduli of elasticity and toughness were measured. Nine reinforced concrete (RC) beams of 300× 300 × 2000 mm outer dimensions, designed as tension failure and all having the same steel reinforcement, having SFs at dosages of 0 kg/ m3, 30 kg/ m3, 60 kg/m3 with C20 class concrete, and nine other RC beams of the same peculiarities with C30 class concrete again designed as tension failure and all having the same reinforcement were produced and tested under simple bending. The load versus mid-span deflection relationships of all these RC and steel-fiber-added RC (SFARC) beams under simple bending were recorded. First, the mechanical properties of C20 and C30 classes of concrete with no SFs and with SFs at dosages of 30 kg/ m3 and 60 kg/ m3 were determined in a comparative way. The flexural behaviors and toughness of RC and SFARC beams for C20 and C30 classes of concrete were also determined in a comparative way. The experimentally determined (mid-section load)–(SFs dosage) and (toughness)–(SFs dosage) relationships are given to reveal the quantitative effects of concrete class and SFs dosage on these crucial properties.

2.9 Concluding remark

The review of existing literature reveals that steel fibers, particularly those with hooked ends, crimped fibers, and straight fibers, offer more significant advantages in enhancing the overall mechanical characteristics of plain concrete when compared to other types of fibers. Therefore, it is worthwhile to consider a comparative analysis of these steel fibers by varying the volume fraction and their respective aspect ratios to assess their impact on various engineering properties.

III. EXPERIMENTAL WORK

Flow chart of experimental work:



IV. EXPECTED OUTCOME

From above study is conclude that, all mechanical properties viz. compressive strength, flexure strength, splitting strength and bond strength will be improved by addition of fibers irrespective of fiber type and aspect ratio.

All strength likes compressive strength, flexure strength and splitting strength will be improved with increasing aspect ratio.

Also for same aspect ratio the hook ended fibre will be showing pronounce improvement in all properties of concrete as compare crimped & straight fiber. There might be decrease in the strength with decrease in aspect ratio of same fiber type. The straight fibers will having less strength as compared with hook end and crimped fibers. Also that will be hook end and crimped fibers having because of their shape and anchorage in the matrix resulting in more strength.

V. RECOMMENDATIONS FOR FUTURE WORK

The current research presents promising avenues for future investigations, including:

- Exploring the behavior of concrete with various types of steel fibers, while systematically varying the volume fraction and aspect ratio.
- Evaluating the impact of incorporating fly ash into concrete on its strength characteristics within the same study.
- Investigating the concrete's strength when enhanced with metacoline in the same context.
- Employing Finite Element Analysis techniques to gain a deeper understanding of concrete performance.
- Analyzing the mechanism of torsional strength transfer in circular sections.
- Assessing concrete's resistance to chemical attacks.

These potential research directions hold significant potential for advancing our knowledge and understanding of concrete properties and applications.

VI. APPLICATIONS

Steel Fiber Concrete is being used widely nowadays. SFC has found number of applications, some of which are listed below:

- Construction of highway paving and industrial floors with crimped as well as strength fibers.
- Repairs and new construction on hydraulic structures to provide resistance to cavitations and severe erosion.
- Repairs and rehabilitation of marine structures.
- Tunnel as also as Cannel lining.

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Visualisation of Critical Technologies in Network Security Research

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ABSTRACT

Compared to standard network monitoring, complex enterprise network management requires a higher level of expertise. Connecting and visualising the dynamics and relationships between various parts of a network, such as servers, clients, and software, is not an easy task. The issue of security in network visualisation has received a lot of attention in recent years in the field of network security research. The present status of network security visualisation research is examined. The study initially suggested the network privacy aware model and then analysed the approach before creating and constructing the security situation visualisation model solution based on GPS, network topology graphs, and attack paths. By using visualisation technology, the security situation data is presented to the user in multiple views, from multiple angles, and at multiple levels. As a result, the security situation will be performed with greater accuracy and vividness, and the network security situation will be assessed promptly and accurately, providing the groundwork for quick decision-making.

Keyword : Network Security, Security Situation Visualization, GPS-based Security, Enterprise Network Management, Data Visualization.

I. INTRODUCTION

The swift advancement of network attack methodologies has resulted in a complex, diversified, and rapidly evolving trend in network attacks. This has made traditional network security systems insufficient and has exacerbated network security challenges. Despite the fact that the majority of security devices have the ability to log and record security events, security equipment is separate from one another, and security data is dispersed and cannot be shared. It is also challenging for the security administrator to respond appropriately to an attack based on security information. With the use of security visualization technologies, individuals may more easily notice aberrant values or data mistakes, become aware of network security information, identify new attack patterns, and take proactive measures to defend themselves. Thus, network security research visualization is crucial.

The use of visualization in emerging network security situational awareness solutions is becoming more and more popular. Since log information was not updated in a timely manner, visual information could not satisfy the strict real-time requirements of network systems. This led to the first application of the

visualization approach to system logs and intrusion detection system logs. In order to achieve a visual representation of a network connection, the study [2] produced two visualization tools. The paper [1] established an autonomous system network diagram for network visualization assaults. IP, NVISion, and VisFlowConnect's data sources include log data; these tools can show host-specific information as well as the overall network condition. The studies [3, 4] describe a radar chart visualization technique; the study [5] used a visualization technique to track computer network security alerts; and the study [6] employed parallel coordinate attack visualization (PCAV) to identify previously unidentified large-scale Internet attacks, such as network scanning activities, distributed denial of service attacks, and Internet worms. Using flow information such as source IP address, destination IP address, destination port, and average packet length in a flow, PCAV shows network traffic on the plane of parallel coordinates. A concentric-circle visualization technique was presented in the publications [7, 8] to visualize multi-dimensional network data. The methods to lessen the visual clutter have been examined in the works [9, 10, 11]. The aforementioned papers only address network connections and network traffic visualization at this time; they fall short in terms of comprehensive network security, integrating multiple data sources, and understanding the relationship between macro and micro situations. This is evident from an analysis of the current state of the network security situation.

To solve the aforementioned problems, a prototype security scenario visualization system was created and put into use using geographic information systems, network topology graphs, bar charts, pie charts, line charts, dashboards, attack pathways, tables, tree diagrams, and alert windows. The concept and procedure for network security situational awareness were also developed in this research. The user may observe the security scenario data in numerous perspectives, multiple angles, and multiple level thanks to visualization technologies. The suggested technique can process and display data from an array of sources of data, support show for both macro and micro multi-level security situations, and present both the specific security status and the overall network security condition. The suggested approach addresses the technical issue of non-intuitive visualization, making network security situation assessments timely and accurate and setting the stage for quick decision-making. It is appropriate for security situation analysis of large-scale networks with massive security basis data.

II. NETWORK SECURITY SITUATION AWARENESS MODEL

Based on recent research, we present the concept model of network security situation awareness, which is a multi-level model divided into three layers (as illustrated in Figure 1): situation extraction, situation evaluation, and situation visualisation. Situational awareness is a global concept.

To gather fundamental security information, the security scenario extracts formatting, merging, filtering, prioritising, and other processing operations from infrequent security incidents. Situation extraction is a fundamental component of situational awareness; without accurate security situation information, a security situation view would be incorrect. This layer prepared for situation assessment by using established technology to extract network security situation information from firewalls, identity systems, vulnerability scanning, and other security equipment. It then converted the information into a unified, understandable format.

Security situation assessment was obtained. Situation assessment, which is a dynamic process of understanding the current network security situation, determining the relationship between them by identifying security events in the situation information, and generating the security situation map based on the degree of threats, to reflect the entire network security situation, is the key to security situational awareness after basic security data has been quantified through fuzzy mathematical formula. Situation visualisation provides the security administrator with a visual chart or other visual representation of the attack and threat information from all security equipment, allowing them to act quickly and take appropriate countermeasures.

The last presentation of the security situational awareness is called situation visualisation. It gives the security administrator access to geographic information systems, network topology graphs, bar charts, pie charts, line charts, dashboards, attack paths, tables, tree diagrams, and alert windows, as well as the ability to view security situation data from multiple perspectives and at multiple levels.

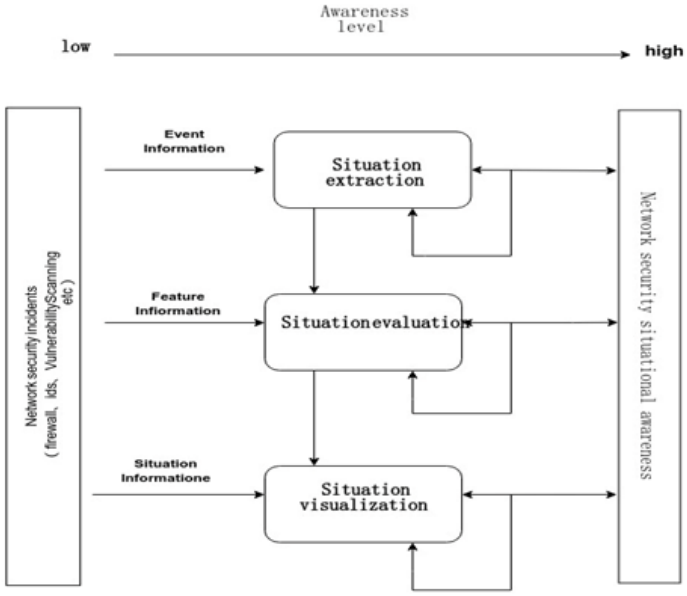

Fig.1 The network security situation awareness model.

III. METHOD OF NETWORK SECURITY SITUATIONAL AWARENES

The steps involved in the network security situation awareness method process depicted in Figure 2 are as follows:

Step 1: Scattered security events and logs are produced by different security devices.

Step 2: Formatting, filtering, and sorting of security incidents: first, all security events produced by security equipment are standardised in terms of format; next, information reported by the security equipment is filtered; and finally, similar or identical security incidents are merged. The received security events are then prioritised to establish the processing order; following formatting, merging, and sorting, the fundamental security data is obtained.

Step 3: Utilising the fundamental security information provided by the security situation index system, quantitatively calculate the security situation index. Then, integrate the formula to obtain the security situation index, the quantified security situation index, and the security situation.

Step 4: Visualisation of the security situation, which is ultimately how the administrator is presented with the security situation through rich charts.

IV. SECURITY SITUATION VISUALIZATION PROTOTYPE SYSTEM

There are a thousand words in a picture. The complexity of security issues makes them hard to explain, the language and concepts become difficult to grasp, and managers face significant challenges due to the volume and variety of security data that is readily available. By handling and quantifying security events and integrating various factors, situation visualisation provides a real-time display of the current security status and expresses it in a graphical manner, allowing the security administrator to quickly assess the level of network security.

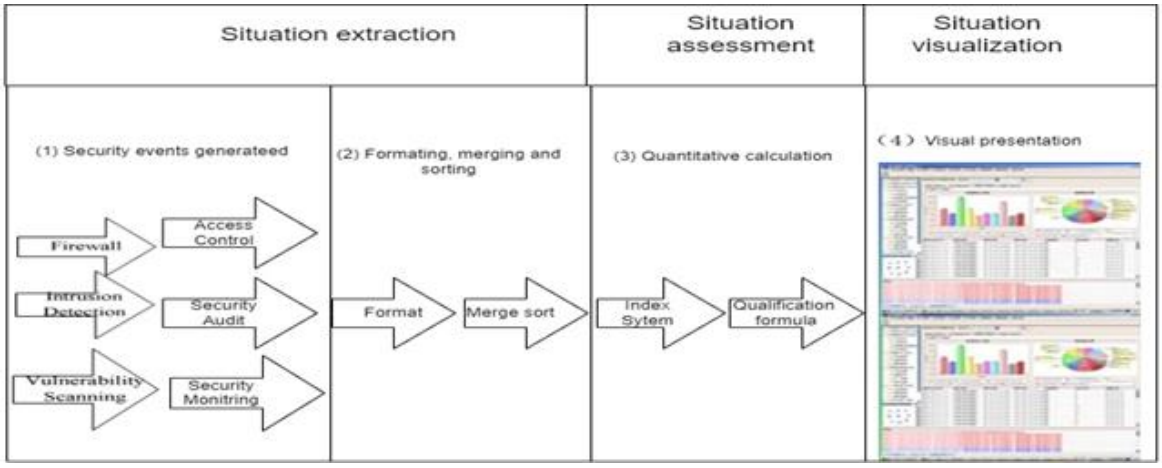

Fig.2 The process of the network security situation awareness method

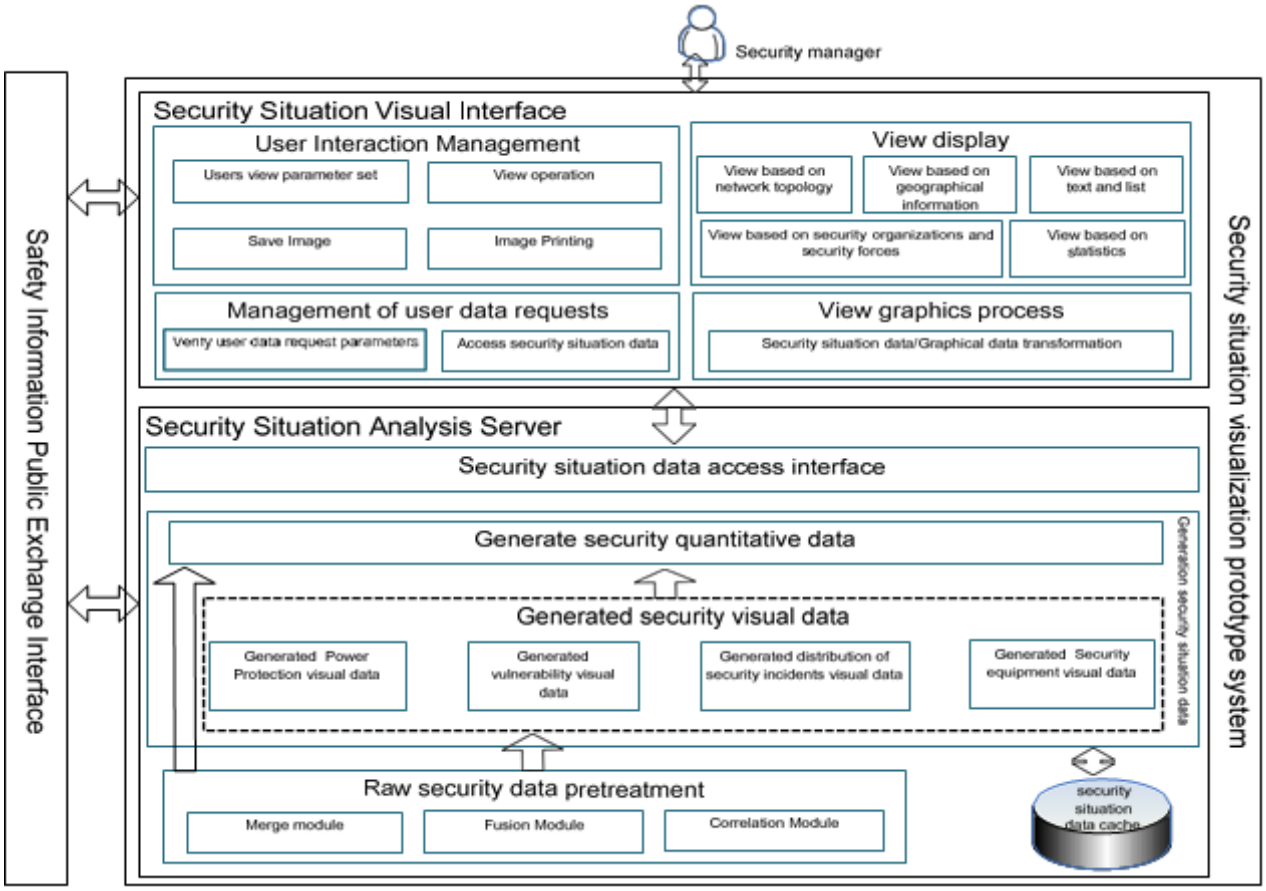

Fig.3 The process of the network security situation awareness method

The prototype system for visualising security situations was designed in the paper. Figure 3 illustrates its components: the security situation analysis server and the security situation visual interface. The former performs the pre-processing of the original security data and generates the security situation data, while the latter gives security managers access to a visualisation of the security situation that makes it simple and straightforward for them to understand.

Data preprocessing: This step finished the initial treatment by combining, correlating, integrating, and performing other operations on the original security data from several types of equipment. By extracting and converting the original safety data, you can make sure that the security analysis engine handles the data effectively, lower system overhead associated with storing and processing the data, and increase the system's analysis accuracy and efficiency.

The security situation analysis server's core module, security situation generation, is primarily responsible for producing security situation data and network security situation data, which includes quantitative security data and visualisations of security equipment, vulnerability, protection power, and security event distribution. They serve as the source data for computing an integrated security situation, objectively reflect the data on the current state of the network security, and support the security manager in simultaneously resolving actual security issues. Quantitative security data integrates other security situation indices and reflects local or global security metric indexes over time. Visual interface for security situations: Security managers are primarily provided with the security situation through visual displays, making it simple for them to intuitively and thoroughly understand the security situation. The visual interface for security situations comprises modules for managing user interaction, managing user data requests, transforming situation data, and displaying views.

Module for managing user interaction: this module primarily handles two tasks. The user interaction management module submitted these parameters to the user data requests management module. Initially, the module gives users access to each view's unique configuration parameters. The object, scope, level, trend type, and other parameters of the security situation view must be shown. Second, the module gives the user control over how they interact with the view, allowing them to save and print view images as well as perform actions on the view, such as clicking, zooming, and changing.

The module responsible for managing user data requests receives the view display parameters from the user interaction module. It then checks to see if the parameters are correct. If they are, it uses the security information public switched interface to obtain security situation data. Alternatively, it calls the security situation analysis server's situation data access interface directly to obtain security situation data.

Situation data transformation module: this module will convert the security situation data into that format and supply the image data of the various views to the view display module.

The primary goal of the view graphics processing module is to visualise the security situation data. To do this, sent graphics data will be rendered graphically by each visual view according to the relevant graph generation algorithm, and the security situation will be displayed in the view model by combining image data. A range of visualisations are included in the view module, such as views based on network topology, views based on the display of geographic information, text-based and list views, views based on security forces and organisations, views based on charts, etc.

Visualisation techniques for the security situation include those based on geographic information systems, network topology, histograms, pie charts, line charts, dashboards, attack paths, tables, tree diagrams, and alarm windows, among others. The security situation is visualised using graph visualisation techniques,

which display the security situation quantitative index in granularity from macro to micro. This provides technical support for the security administrator command decisions. In the security situation map, use quantitative security situation, network location, time, and other information, according to different colours to display network security status, as well as attack status and subject, the source of the attack, attack type, and potential hazards. This allows for centralised management of security better for users through the security management console. The user management interface also offers intuitive network topology and real-time display of the entire network security.

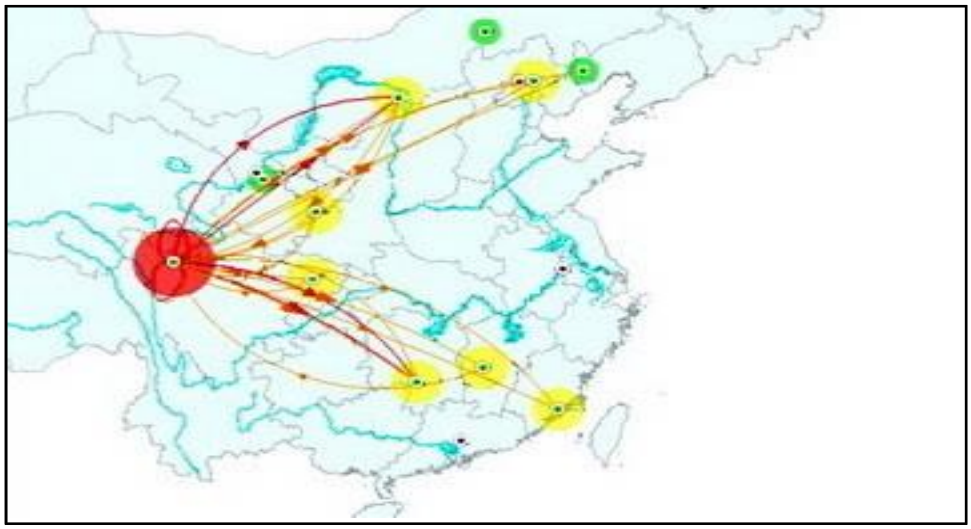

Fig. 4 View of security situation based on geographic information system

In Figure 4, a diagram line with arrows represents security incidents; the direction of the arrow indicates the occurrence of a security event source to the destination. The red circle indicates serious security incidents on the network, the yellow circle indicates general security incidents, and the green circle indicates that the network is in a normal state. This is an example of a security situation based on geographic information systems.

V. CONCLUSION

The model and procedures for network security situational awareness were proposed in this paper. A visual prototype system for security situations was designed and put into use based on geographic information systems, network topology diagrams, histograms, pie charts, line charts, dashboards, attack paths, tables, tree diagrams, and alarm windows. The approach supports multi-layered displays of the security situation in a macro and micro manner. It addresses technical issues with visualisation that are not intuitive, making the assessment of the network security situation timely and accurate and providing the groundwork for quick decision-making. It not only shows the overall security situation but also highlights individual security situations.It addresses technical issues with visualisation that are not intuitive, making the assessment of the network security situation timely and accurate and providing the groundwork for quick decision-making. It not only shows the overall security situation but also highlights individual security situations.

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An Overview of Solar Photovoltaic Technology, Varieties of Solar Cells, and their Prospects

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ABSTRACT

The sun is a massive source of energy. Even though the Sun gives us a tremendous amount of energy, we can only consume a small portion of it. The amount of sunlight that reaches the earth's surface is sufficient to supply all our ever-increasing energy demands. The science of solar photovoltaics is concerned with the conversion of incident sunlight energy into electrical energy. The principal material utilized in the manufacture of the first generation of solar cells was silicon. According to the study's conclusions, more research is needed to achieve significant absorption of incident sunlight and a rise in the efficiency of solar cells. Further research and development on thin-film technology and amorphous silicon solar cells was performed to meet these criteria. In this article, we will look at the evolution of solar cell technology, starting with the first generation and progressing to the most modern technologies, such as quantum dot solar cells, dye-sensitized solar cells, and others. This article also analyses the probable future trends of these many generations of solar cell technologies, as well as the extent to which they can be applied to the establishment of solar cell technology.

Keyword: solar cell; photovoltaics; quantum dot; sunlight.

I. INTRODUCTION

Energy is one of the most fundamental needs for the modern man, along with water, air, and a place to live. Throughout the industrial revolution, the number of energy-intensive applications has increased steadily. Instead, the acceleration of mechanization and industrialization in Europe and the United States can be attributed to developments in steam power and electrical power [1]. Traditional energy sources, which are those that are based on fossil fuels, have been utilized extensively for many years all over the world. While this has improved people's living conditions, it has also had substantial negative effects on the environment. Every nation, no matter its wealth or level of development, recognizes the urgent need to diversify its energy sources and wean itself from its reliance on fossil fuels. In addition to energy sources that are based on fossil fuels, other sources of energy such as waterpower, nuclear energy, wind energy, tidal energy, geothermal energy, solar energy, and biomass are also contributors to the creation of electric power for both commercial and non-commercial reasons[2]. Solar power is inexhaustible, non-polluting, good to the surrounding ecosystem, cost-

effective, and widely available in almost every inhabited region of the planet. To collect and store solar energy, one must make a considerable initial investment. This is necessary because huge collecting areas are required, and the availability of energy varies over time. The rays of the sun can be used in one of two ways: photothermally or electrically (via photovoltaics). In the first scenario, the sun's rays are either immediately utilized for drying, water heating, space heating, and so on, or they are transformed into energy. In the second scenario, the sun's rays are not utilized directly [3]. Solar cells are devices that use photovoltaic conversion to directly convert the energy from the sun's beams into electricity. Solar cells can be thought of as miniature solar power plants. Both enhancing the efficiency of solar cells and decreasing the costs associated with their production are at the forefront of much of the research being conducted in this field at the moment [4].

2.Types of Solar Cell

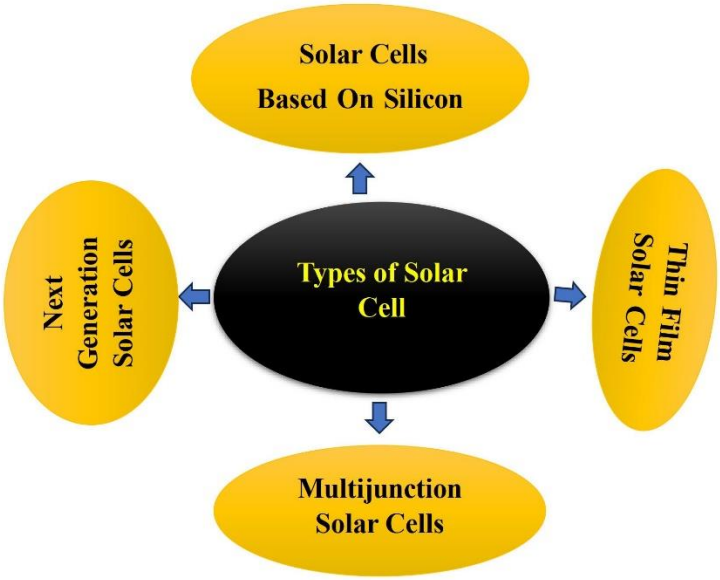

Fig 1. Types of Solar Cell

Solar cell technologies can be categorized into several broad classifications:

1) Solar cells composed of silicon
2) The utilization of thin films in solar cell technology
3) multijunction solar cells
4) next-generation solar cells.

Theoretical maximum efficiency of homojunction solar cells can reach approximately 29% under ideal conditions, namely when exposed to AM 1.5 global radiation with an intensity of 1000 W/m^2 and a band gap energy ranging from 1.1eV to 1.7eV. Several semiconductors, such as silicon (Si), gallium arsenide (GaAs), and cadmium telluride (CdTe), exhibit band gaps within this range [5]. Despite ongoing research and development efforts, the reported maximum values achieved in laboratories for solar cells and photovoltaic modules are only able to approach the theoretical maximum values.

Silicon is a cheap and non-toxic material that can be used in a range of applications. Despite its lower efficiency, multicrystalline silicon is employed in commercial modules due to the increasing output of solar PV cells and the need to reduce their cost. However, because to the costly cost of producing crystalline silicon, thin film cells based on a hydrogenated alloy of amorphous silicon (abbreviated as Si:H) have become widely used [6].

The levels of efficiency that some solar cells from the first and second generations were able to reach in the laboratory. Measuring the cell under the global AM1.5 spectrum at a temperature of 250 degrees Celsius and 1000 watts per square meter has resulted in a cost reduction in comparison to Silicon wafer-based technology [7-8]. Other benefits of thin film modules include the fact that they may be manufactured in extremely large sizes and installed on curved surfaces by making use of the appropriate substrates. On the other hand, the efficiency of solar cells based on thin films is lower than that of those based on wafers.

The efficiency of devices based on amorphous silicon as well as compound semiconductors derived from elements in groups III and V of the periodic table has shown significant improvement. However, the costs associated with their production are high. It has been claimed that a three-junction GaInP GaIn AsGe cell may achieve an efficiency of 40.7% when subjected to the standard spectrum for terrestrial concentrator solar cells at 240 suns (24.0W/cm2, AM1.5D, low aerosol optical depth, and 25°C). Solar concentrators, which are the most common use for multijunction cells based on III-V compounds, are the primary means by which power is generated for use in space-based applications[9-10].Because of its higher efficiency than silicon, the compound semiconductor known as gallium arsenide, or GaAs, has begun to displace silicon in numerous applications [11]. GaAs solar cells can be manufactured in a variety of different shapes, including thin film, single crystal, multicrystalline, and multijunction. In the laboratory, the efficiency of the thin film GaAs single junction solar cells was measured at 28.8%, whereas the efficiency of the multicrystalline GaAs solar cells was measured at 18.4%. In a laboratory setting, thin film GaAs solar cell modules have demonstrated an efficiency of 24.1%. multijunction solar cells containing GaAs have demonstrated an efficiency of 31.6%. In addition to these benefits, GaAs has a bandgap of 1.42 eV, which is close to the optimal value for photovoltaic applications; it also has a good performance level in environments with high temperatures; and it has improved resistance to radiation. Because of all of these qualities, it is well-suited for use in solar concentrators and other uses in space.

A few cells that are part of the future generation of solar technology are the perovskite solar cell, the organic solar cell, the dye-sensitized solar cell, the kesterite solar cell, and the quantum dot solar cell.

Perovskites Solar Cell

Perovskites solar cell are a class of compounds that have a crystal structure that is like that of the perovskite mineral, which is composed of calcium titanate. Perovskites are also named after the perovskite mineral. Perovskites are also known by the name calcium titanate, which is another name for perovskites [12-13]. Perovskite solar cells are built on a base that is established using organometallic halides. Recent research has shown that single-junction designs have an efficiency of 25.5%, whereas silicon-based tandem cells have an efficiency of 29.1%. These results were obtained by comparing the two types of designs. Perovskite solar cells are the solar technology that is advancing at the fastest rate now, and they have the potential to achieve even higher levels of efficiency while simultaneously lowering the costs of production. However, the commercialization of this technology faces several challenges, such as photo-unstability, mechanical fragility, stability against moisture and oxygen, heating under applied voltage, photo-unstability, and environmental concerns due to the toxicity of lead halides used in perovskite solar cells. These challenges must be overcome before this technology can be successfully brought to market.

Organic Solar Cells

Organic solar cells, often known as plastic solar cells, are another name for thin-film cells that make use of organic semiconductors. This form of cell has several useful properties, some of which include the fact that it does the processing of solutions, the fact that it is flexible and lightweight, and the fact that it does not cost too much [14]. On the other hand, the efficiency of these cells is just slightly below average. Organic solar cells

have been built with a diverse range of topologies utilizing a broad spectrum of materials. Recently, an efficiency of 17.3 percent for organic photovoltaics was accomplished by utilizing a tandem structure.

Photosensitized Solar Cells

Two varieties of photoelectrochemical cells are known as photosensitized solar cells. These cells may also be referred to as Gratzel cells or Dye sensitized solar cells. The various components that make up the cell are referred to by their respective names as follows: photoanode, sensitizer, electrolyte, and counter electrode. It is possible to carry out the function of the sensitizer using either a metal-organic dye, an organic dye, or an inorganic dye. All three of these alternatives are valid[15-16]. The Dye sensitized solar cells has garnered a significant amount of interest, partly because of the ease with which it can be manufactured using traditional roll-printing methods and the comparatively affordable nature of most of the components used in its construction. Experiments conducted in the lab have demonstrated that tandem cells and single junction cells, respectively, can attain conversion efficiencies of around 11% and 15%, respectively.

Kesterite Solar Cells

Copper zinc tin sulphide and copper zinc tin selenide (are the two synthetic chemicals that form the foundation of kesterite solar cells. The optical and electrical characteristics of copper zinc tin sulphide and copper zinc tin selenide are comparable to those of CdTe and CIGS. copper zinc tin sulphide and copper zinc tin selenide on the other hand, have the benefit of not containing any rare earth elements or hazardous metals, such as cadmium or indium, respectively [17]. This is a significant advantage. It has been stated that the efficiency of a copper zinc tin sulphide cell is 7.6%, whereas the efficiency of a copper zinc tin selenide cell is 9.8%. The performance of these cells is hindered by several loss processes, including dominating interface recombination, high series resistance, and low minority carrier lifetime.

Quantum Dot Solar Cell

The semiconductors known as quantum dots belong to a specialized subgroup known as nanocrystals [18-19]. These nanocrystals are made of periodic groups of materials numbered II-VI, III-V, or IV-VI. Quantum dot solar cells, also known as quantum dots solar cells, are structures that have a bandgap that can be tuned to fit the spectral distribution of the sun's spectrum. This results in a decrease in the cost per watt ratio of solar electricity. They can be processed to create junctions on inexpensive substrates such as plastics, glass, or metal sheets; they can easily be combined with organic polymers and dyes; they can be moulded into a variety of different types; they can be two-dimensional (sheets) or three-dimensional arrays. quantum dots offer several advantages, including the following: they can be moulded into a variety of different types; they can be two-dimensional (sheets) or three-dimensional arrays. Recently, researchers at the University of Queensland successfully synthesised a quantum dot solar cell from a halide perovskite, which resulted in an efficiency of 16.6%.

Future Trends

Future Trends Innovative materials that allow for the effective collection of solar energy are being produced because of ongoing research and development activities in the field of solar photovoltaics [20]. The design of the products, in addition to the materials that are utilized, is a factor that has an impact on the commercial application of technology. Numerous fascinating applications have already been realized, and it is predicted that further breakthroughs will be made in the not-too-distant future. For instance, the idea of floating solar farms involves the installation of photovoltaic panels in such locations as reservoirs, dams, and other bodies of water. These panels are then used to generate electricity for the farm [21]. This method has the advantage of preserving a sizeable portion of land that would otherwise be used to install traditional solar

panels. Another significant advancement is the incorporation of photovoltaics into the architectural design of buildings.

Conclusion

To efficiently capture solar energy, researchers are developing new solar photovoltaic materials. Commercial technology adoption is influenced by material selection and product design. Numerous promising applications have materialized, and further progress is imminent. For instance, photovoltaic panels can be installed on reservoirs, dams, and other bodies of water to power "floating solar farms." Using this technology, less land is needed for solar panels. Another significant development is the incorporation of photovoltaics into building design.

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Exploring Microbial Activity of Quinazoline Derivatives Through Experimental Investigation

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ABSTRACT

This introduction offers an overview of antimicrobial agents and their crucial role in combating infectious diseases. Antimicrobial medicines are classified based on the microorganisms they target, with antibiotics designed for bacteria and antifungals for fungi. They can also be categorized as microbicidal, which directly kill microbes, or biostatic, which inhibit their growth. The use of these medicines for treatment is referred to as antimicrobial, while their preventive use is called antimicrobial prophylaxis. The primary classes of antimicrobial agents include disinfectants, antiseptics, and antibiotics, each serving distinct purposes in controlling microbial growth.

However, the introduction of new antimicrobial agents has significantly declined since 1980, partly due to the high costs and rigorous testing required for drug development. In parallel, a concerning rise in antimicrobial resistance has been observed among various microorganisms, posing a severe global health threat. Widespread misuse of antibiotics, including in viral infections, has expedited the emergence of antibiotic-resistant pathogens.

Addressing this resistance problem demands renewed efforts to discover and develop effective antibacterial agents, especially against those that have developed resistance. Potential strategies include exploring diverse environments for bioactive compounds produced by uncultured microorganisms and the development of customized small-molecule libraries for bacterial targets.

This introduction sets the stage for a comprehensive exploration of antimicrobial agents, their historical significance, and the critical need for innovative solutions to combat antibiotic resistance, emphasizing the importance of responsible antimicrobial use to safeguard public health.

I. INTRODUCTION

Antimicrobial agents, which either kill microorganisms or inhibit their growth, are crucial in combating infections. These agents can be categorized based on the microorganisms they target, such as antibiotics for bacteria and antifungals for fungi [1].They can also be classified by function, with microbicidal agents killing microbes and biostatic agents inhibiting their growth. Antimicrobial medicines are used in both

infection treatment, known as antimicrobial chemotherapy, and infection prevention, referred to as antimicrobial prophylaxis [2,3].

The primary classes of antimicrobial agents include disinfectants, which are nonselective and eliminate a wide range of microbes on surfaces to prevent the spread of disease. Antiseptics, on the other hand, are applied to living tissues to reduce infection risks, especially during surgical procedures. The term "antibiotic" originally pertained to formulations derived from living microorganisms but now encompasses synthetic antimicrobials like sulphonamides and fluoroquinolones [4]. While historically limited to antibacterial agents, "antibiotic" now encompasses all antimicrobial substances. Antibacterial agents can be further divided into bactericidal agents, which kill bacteria, and bacteriostatic agents, which slow bacterial growth. Recent advancements have even led to solutions that go beyond inhibiting microbial growth, including certain types of porous media that can kill microbes upon contact [5,6].

Antimicrobial use has a rich history, dating back at least 2000 years, with ancient Egyptians and Greeks using molds and plant extracts for infection treatment. In the 19th century, microbiologists like Louis Pasteur and Jules Francois Joubert observed antagonistic interactions between bacteria and explored their medical applications. In 1928, Alexander Fleming's discovery of penicillin, a natural antimicrobial from Penicillium rubens, marked a turning point in medicine when it was successfully used to treat Streptococcus infections in 1942 [7,8].

Antibacterials are vital for treating bacterial infections, generally having low toxicity to humans and animals. Prolonged use of certain antibacterials can disrupt gut flora, potentially impacting health. Strategies to replenish gut flora include probiotics and a balanced diet, while stool transplants may be considered for patients recovering from extended antibiotic treatment, especially in cases of recurrent Clostridium difficile infections [9].

The discovery, development, and use of antibacterials in the 20th century substantially reduced mortality from bacterial infections. The antibiotic era began with the pneumatic application of nitroglycerine drugs, followed by a "golden" period from approximately 1945 to 1970 when a diverse range of highly effective antimicrobial agents were discovered and developed. However, since 1980, the introduction of new antimicrobial agents has declined due to the substantial costs associated with their development and testing. Simultaneously, antimicrobial resistance has surged among bacteria, fungi, parasites, and some viruses, rendering multiple existing agents ineffective [10].

Notably, antibacterials are among the most frequently used drugs, often misused by physicians in treating viral respiratory tract infections. This widespread and injudicious use has accelerated the emergence of antibiotic-resistant pathogens, posing a severe threat to global public health. Addressing this resistance problem requires renewed efforts to seek effective antibacterial agents against pathogenic bacteria that are resistant to current treatments. Strategies to achieve this goal include increased sampling from diverse environments and applying metagenomics to identify bioactive compounds produced by unknown and uncultured microorganisms, along with the development of small-molecule libraries customized for bacterial targets

Result and Discussion:-

These compounds were assayed for their antifungal activities against the test fungus Fusarium udum (at room temperature).

Potato dextrose (PDA) was used as a basal medium to evaluate the effiency of different synthesized products. The medium was prepared by dissolving 200 gm of peeled potato slices and 20 gm dextrose powder in 1 liter distilled water. In this mixture 20 gram agar powder was added for solidification of sample. The prepared medium was sterilized in an autoclave at 121^0C temperature and 20 lbp/ pressure for near about 15 min. After sterilization medium was cooled to about 50 ^{o}C and poured into sterile petriplates. The test compounds were then added to these petriplates containing PDA media. The petriplates were rotated for uniform mixing of the media and the test compounds. The plats were then allowed to solidify.

A chemical fungicide was used as a standard for this process. Calculated amount of each product and chemical fungicide was added to an autoclaved warm PDA and shaken well and poured into each sterilized petriplates. 5 mm discs from seven days old culture of Fusarium udam were cut and discs was placed in the center of each plates. Plates were in cubed at room temperature. The colony diameter of fungal growth was recorded after seven days of incubation.

These inhibitions of mycelia growth was calculated by following formula,

$$I = \frac{C - T}{C} \text{ x } 100$$

Where,
I = Inhibition
C= Growth in control
T = Growth in treatment

Observation Table:-

Entry	Compound	Colony Diameter (mm)				% Inhibition
		RI	RII	RIII	Average	
1	4-(2,4-dichlorophenyl)-8-(2,4-dichlorophenyl-1-enyl)-1,3,5,6,7 pentahydroquinazolin-2-one.	17.5	16.5	22.5	18.83	63.31
2	4-phenyl-8-(1-benzenyl)-1,3,5,6,7 pentahydroquinazolin-2-one.	23.5	24.5	20.7	22.9	50.88
3	4-(2-nitrophenyl)-8-(2-nitrophenyl-1-enyl)-1,3,5,6,7 pentahydroquinazolin-2-one.	39.5	41.5	38.0	39.66	22.59
4	4-(4-methoxyphenyl)-8-(4-methoxyl-1-enyl)-1,3,5,6,7pentahydroquinazolin-2-one.	23.6	24.5	28.4	25.5	50.32
5	4-(2-chlorophenyl)-8-(2-chlorophenyl-1enyl)-2-thiocarbonyl-1,3,5,6,7	24.6	27.5	23.5	25.2	50.90

	pentahydraquinazoline.					
6	4-phenyl-8-(1-benzenyl)-2-thiocorbonyl-1,3,5,6,7 pentahydroquinazoline.	27.5	29.5	30.7	29.23	34.05
7	4-(4-nitrophenyl)-8-(4-nitrophenyl-1-enyl)-2-thiocarbonyl-1,3,5,6,7pentahydroquinazoline.	34.5	30.5	31.7	32.23	37.21
8	4-(4-methoxyphenyl)-8-(4-methoxylphenyl-1-enyl)-2-thiocarbonyl-1,3,5,6,7 pentahydroquinazoline.	25.5	29.5	30.6	28.53	44.41
9	Control	50.0	52.0	52.0	51.33	-
10	Standard (copper oxychloride)	13.7	12.0	15.0	13.5	73.41

Conclusion:-

"In the context of our exploration into the microbial activity of quinazoline derivatives, we conducted assays on compounds listed in Table entries 1 through 8 against the fungus Fusarium udam. The results of these assays revealed a range of antifungal activities, varying from high to low.

Notably, compounds corresponding to Table entry 1 exhibited exceptionally high antifungal activity. Compounds 2 and 5, in particular, demonstrated inhibition percentages exceeding 50%. Surprisingly, when compared to the standard synthesized compound, these derivatives surpassed it with inhibition percentages ranging from 34% to 63%.

These findings point to the potential for further research and the development of additional derivatives to enhance and optimize antifungal activity. As our research continues, we aim to identify compounds with even more potent antifungal properties to contribute to the field of antimicrobial agents and address the growing concern of antibiotic resistance."

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Leveraging AI and Machine Learning for Enhanced Construction Risk Management

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ABSTRACT

The construction industry is undergoing a revolutionary transformation with the integration of Artificial Intelligence (AI) and Machine Learning (ML) into smart building and construction practices. While the past decade witnessed the adoption of software solutions for planning, scheduling, and execution in construction, the current era is marked by the unprecedented power of AI and ML. These technologies are bringing forth a new wave of advancements, delivering heightened accuracy, precision, efficiency, safety, and cost-effectiveness. In essence, AI and ML are not just incremental improvements but catalysts for transformative capabilities that are reshaping the entire landscape of the construction industry.

The utilization of Artificial Intelligence (AI) and Machine Learning (ML) empowers the automation of construction processes, diminishing the need for extensive human intervention. Robots, adept at executing repetitive tasks with efficiency and precision, contribute to heightened productivity and optimal resource management. Additionally, the fusion of AI and ML with the Internet of Things (IoT) facilitates the instantaneous monitoring and analysis of data from building systems, enabling proactive maintenance and continuous optimization.

Despite the manifold advantages that arise from incorporating AI and ML in construction, the journey is not devoid of challenges and limitations. Nevertheless, even in the face of these obstacles, the trajectory of AI and ML in the construction industry is set to revolutionize the processes involved in designing, constructing, and operating buildings in the years to come.

This research paper delves into the applications, benefits, obstacles, and prospective developments related to the integration of AI and ML in the construction sector. It underscores their capability to redefine the future of construction through the augmentation of efficiency, precision, and safety.

Keywords : Artificial Intelligence, Machine Learning, Internet of Things, construction industry

I. INTRODUCTION

The construction industry plays a pivotal role in shaping the infrastructure of societies, contributing to economic development and enhancing the quality of life for communities. However, this dynamic sector is not without its challenges, and construction projects are often associated with inherent risks that can impact timelines, budgets, and overall project success. As the industry continues to evolve, there is a growing

recognition of the transformative potential of artificial intelligence (AI) and machine learning (ML) in mitigating risks and optimizing construction processes.

In recent years, the integration of AI and ML technologies into construction management has opened up new avenues for addressing and managing risks effectively. These advanced technologies empower construction professionals to analyze vast amounts of data, identify patterns, and make informed decisions that lead to improved project outcomes. From early-stage planning to project execution and post-construction monitoring, AI and ML are revolutionizing the way risks are assessed and mitigated in the construction industry.

One of the key areas where AI and ML are making a significant impact is in risk assessment. Traditional risk assessment methods often rely on historical data and expert judgment, which may fall short in capturing the complexity and dynamic nature of construction projects. AI and ML algorithms, on the other hand, can process real-time data from various sources, including project management software, sensors, and environmental data, to provide a more accurate and timely assessment of potential risks.

This paper explores the role of AI and ML in revolutionizing construction risk assessment and mitigation strategies. We will delve into specific applications and case studies that highlight how these technologies are being leveraged to enhance project management, improve safety measures, and ultimately contribute to a smarter and more resilient future for the construction industry. As we navigate through the potential benefits and challenges, it becomes evident that the integration of AI and ML is not merely a technological advancement but a paradigm shift that has the power to reshape the construction landscape.

II. ARTIFICIAL INTELLIGENCE IN CONSTRUCTION ENGINEERING

The field of civil engineering stands at the cusp of a technological revolution, with Artificial Intelligence (AI) emerging as a transformative force that is reshaping traditional practices and unlocking unprecedented opportunities. AI, characterized by machine learning algorithms, predictive analytics, and advanced data processing capabilities, has the potential to revolutionize how civil engineering projects are planned, designed, executed, and maintained.

AI algorithms are revolutionizing the design phase of civil engineering projects. Through generative design, AI systems analyze vast datasets and simulate various design possibilities, optimizing for factors such as cost, materials, and environmental impact. This not only accelerates the design process but also leads to more innovative and resource-efficient solutions.

AI is enhancing project management in civil engineering by providing sophisticated tools for planning and scheduling. Machine learning algorithms can analyze historical project data, weather patterns, and other variables to predict potential delays or bottlenecks, enabling proactive decision-making and ensuring project timelines are met.

The maintenance and monitoring of infrastructure are critical aspects of civil engineering. AI-based structural health monitoring systems leverage sensors and data analytics to continuously assess the condition of buildings, bridges, and other structures. This proactive approach allows for early detection of potential issues, reducing the risk of catastrophic failures and enabling cost-effective maintenance strategies.

In the realm of transportation engineering, AI is being employed to optimize traffic flow, reduce congestion, and enhance overall urban planning. Intelligent traffic management systems use real-time data from cameras, sensors, and mobile devices to dynamically adjust traffic signal timings, reroute vehicles, and improve overall traffic efficiency.

AI contributes significantly to risk assessment in civil engineering projects. By analyzing historical data and considering a myriad of variables, AI systems can predict potential risks and propose risk mitigation strategies.

This enables engineers and project managers to make informed decisions that minimize uncertainties and enhance project success rates.

With a growing emphasis on sustainable development, AI is playing a crucial role in assessing and mitigating the environmental impact of civil engineering projects. Machine learning algorithms can analyze complex environmental data to optimize designs for energy efficiency, reduce waste, and minimize the ecological footprint of infrastructure projects.

III. ADVANTAGES OF AI AND ML IN CONSTRUCTION INDUSTRY

The integration of Artificial Intelligence (AI) and Machine Learning (ML) in the construction industry brings forth a myriad of advantages, revolutionizing traditional practices and enhancing overall project efficiency. Here are some key advantages of employing AI and ML in construction:

3.1. Risk Mitigation

AI and ML algorithms can analyze vast datasets to identify and assess potential risks in construction projects. This includes predicting delays, cost overruns, and safety hazards. By providing proactive risk assessments, these technologies enable project managers to implement effective mitigation strategies, improving overall project outcomes.AI-driven tools can optimize project planning and scheduling by analyzing historical data, weather patterns, and other relevant variables. This leads to more accurate and realistic timelines, helping in the efficient allocation of resources and reducing the likelihood of delays.

3.2. Cost Estimation and Management

AI and ML enable more precise cost estimation by considering a multitude of factors, such as material prices, labor costs, and project complexities. This results in more accurate budgeting and cost management, reducing the risk of financial overruns during construction projects.

3.3.Generative Design and Optimization

Generative design, powered by AI, allows for the exploration of numerous design possibilities based on specified constraints. ML algorithms learn from past designs and iteratively generate optimized solutions, leading to innovative designs that are both efficient and cost-effective.

3.4. Equipment Monitoring and Maintenance

AI-driven sensors and monitoring systems can assess the health and performance of construction equipment in real-time. Predictive maintenance models can anticipate equipment failures, enabling timely repairs and minimizing downtime, ultimately increasing overall project productivity.

3.5.Quality Control and Defect Detection

AI and ML technologies facilitate advanced quality control processes by analyzing images, sensor data, and other inputs to detect defects and deviations from design specifications. This ensures that construction projects meet the highest quality standards.

3.6. Safety Enhancement

AI plays a crucial role in enhancing construction site safety. Smart cameras and sensors powered by ML can monitor construction sites in real-time, identifying potential safety hazards and alerting workers or supervisors. This proactive approach reduces the risk of accidents and enhances overall job site safety.

3.7. Supply Chain Optimization

AI and ML contribute to optimizing the construction supply chain by predicting material requirements, managing inventory efficiently, and identifying potential disruptions. This results in streamlined procurement processes and cost savings.

The adoption of AI and ML in the construction industry brings forth a paradigm shift, offering numerous advantages that range from enhanced risk management to improved project planning, cost control, and sustainability. As these technologies continue to evolve, their impact on the construction sector is poised to drive innovation and efficiency across various facets of the industry.

IV. CHALLENGES OF AI AND ML IN CONSTRUCTION INDUSTRY

While Artificial Intelligence (AI) and Machine Learning (ML) offer numerous advantages to the construction industry, their implementation is not without challenges. Addressing these challenges is crucial for maximizing the potential benefits of these technologies. Here are some of the key challenges faced by AI and ML in the construction industry.

4.1. Data Quality and Availability

AI and ML algorithms heavily rely on high-quality, diverse, and large datasets for training and accurate predictions. In the construction industry, obtaining comprehensive and reliable data can be challenging, particularly in cases where historical project data is limited or fragmented.

4.2. Integration with Existing Systems

Integrating AI and ML systems with the existing software and workflows in the construction industry can be complex. Legacy systems may not be designed to seamlessly incorporate these advanced technologies, leading to issues with compatibility and workflow disruption.

4.3. Lack of Standardization

The construction industry often lacks standardized data formats and protocols. This lack of standardization makes it difficult to develop universally applicable AI and ML solutions, hindering interoperability and collaboration between different stakeholders and projects.

4.4. Cost of Implementation

Implementing AI and ML technologies in construction requires a significant initial investment in infrastructure, software, and training. Small and medium-sized enterprises may find it challenging to bear these costs, limiting the widespread adoption of these technologies across the industry.

4.5. Skill Shortages

The successful deployment and management of AI and ML systems require a workforce with specialized skills. The construction industry may face a shortage of professionals who possess the expertise to develop, implement, and maintain these technologies.

4.6. Ethical and Legal Concerns

AI and ML systems in construction can raise ethical and legal concerns, particularly regarding data privacy, security, and accountability. Questions about who owns the data, how it is used, and the potential biases in algorithms need careful consideration and regulation.

4.7. Interpretability

The "black box" nature of some AI and ML algorithms can be a challenge in industries where decision-makers need to understand the reasoning behind recommendations. Ensuring transparency and interpretability of algorithms is crucial for gaining trust and acceptance.

4.8. Limited Generalization

ML models trained on specific datasets may struggle to generalize well to diverse or unforeseen situations. Construction projects vary widely, and ensuring that AI and ML models can adapt to different contexts is an ongoing challenge.

4.9.Resistance to Change

The construction industry has historically been slow to adopt new technologies. Resistance to change, both from leadership and frontline workers, can impede the successful implementation of AI and ML systems.

4.10. Security Risks

As construction projects become more interconnected through the Internet of Things (IoT) and other technologies, there is an increased risk of cyber security threats. AI and ML systems, if not properly secured, can become targets for malicious activities.

Addressing these challenges requires a collaborative effort from industry stakeholders, policymakers, and technology providers. As the construction sector continues to navigate the integration of AI and ML, proactive measures and strategic planning will be essential to unlock the full potential of these transformative technologies.

V. FUTURE PROSPECTS OF IMPLEMENTING AI AND ML IN THE CONSTRUCTION INDUSTRY

The implementation of Artificial Intelligence (AI) and Machine Learning (ML) in the construction industry holds significant promise for revolutionizing various aspects of the sector. As technology continues to advance, the future prospects for AI and ML in construction are highly optimistic, bringing about improved efficiency, safety, and overall project success.

The construction industry can expect to see increased productivity, reduced costs, and improved project outcomes with application of AI and ML. However, challenges such as data privacy, integration with existing systems, and workforce readiness need to be addressed to fully realize the potential of AI and ML in construction. As industry stakeholders embrace and invest in these technologies, the future holds a transformative journey towards a more efficient, sustainable, and technologically advanced construction sector.

VI. CONCLUSION

The integration of AI into civil engineering practices is ushering in a new era of efficiency, sustainability, and innovation. As these technologies continue to evolve, civil engineers are empowered to tackle complex challenges with unprecedented precision and foresight. The symbiotic relationship between artificial intelligence and civil engineering holds the promise of not only optimizing current processes but also fostering the development of smarter, more resilient, and sustainable infrastructure for the future.

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International Marketing: Future With Blockchain

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ABSTRACT

Technology has played a significant role in the continuous revolution in the internationalization of products. The Internet with emails, social media and e-commerce platforms made the world a smaller place where every small, medium business or individuals can easily market their product or service in any foreign country. While its possibility today, International marketing has many challenges yet to be addressed. Like the Internet, the advent of B.T. is likely to disrupt international marketing forte with its capabilities of distributed ledger technology, Smart Contracts and bringing Authenticity in untrusted environments. Objective of this paper is to draft the applications of Blockchain in the future of international marketing. By what method Blockchain can help the global business environment to cope with diverse parameters. To evaluate if the said technology has potential to disrupt the current marketing methodologies by bringing trust in untrusted global business ecosystems.
In this study we will explore the literature concerning the research done across the international business cut with B.T. and try to accomplish the objective with explorative study.

Keywords: Internet of things (IoT), Blockchain Technology (B.T.), Bit coin, hyper ledger, distributed network, database security, Public Key Management (PKI).

I. INTRODUCTION

American Marketing Association (AMA) defines International marketing as the multinational process of planning and executing the conception, pricing, promotion and distribution of ideas, goods, and services to create exchanges that satisfy individual and organizational objectives. Although there is a lot more to do in international marketing at a high level we will stick to this definition through this paper. As said, we divide the study in four processes as conception, pricing, promotion, and distribution and define the challenges that persist even after so much evolution in the business processes at present. Majority of business process evolutions have traditionally been driven by technologies. Specifically talking about the marketing arena [1]. Marketing in all dimensions has seen the era of analog processes. This domain has precisely adapted to the changing environment and technologies. Openness to changing needs and continuously diversifying scope has been key for businesses to survive and be competitive to in time disruption. Foreseeing the trend, the

challenges ahead are more aggressive as the pace of technological evolutions and market behaviour is growing faster than expected business transformations [2]. One of these technological disruptions is Blockchain. Blockchain gained limelight with Bit coin first followed by similar other crypto currency. It has become popular in the past few years due to its unique characteristics and relevant use cases in the International business environment. Despite strong potential across a wide range of business domains, most of the research and development with Blockchain through this time has been focused on crypto currencies, finance and banking [3]. Now that awareness and understanding of the Blockchain as technology beyond crypto currencies is crude, many researchers and technologists claim that Blockchain will significantly disrupt the way businesses function today. This gap in mapping Blockchain with international marketing encourages serious efforts towards evaluating the Blockchain as a tool for International marketing and its application [4].

II. CONTRIBUTION OF THE SURVEY

What is Blockchain?

IBM, B.T. evangelist and promoter define Blockchain as "It is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network. An asset can be tangible (a house, car, cash, and land) or intangible (intellectual property, patents, copyrights, branding). Virtually anything of value can be tracked and traded on a Blockchain network, reducing risk and cutting costs for all involved."

Timeline of Blockchain

2018 • Blockchain potential got revamped by more investments in wide range of use cases

2017 • Seven European banks, announced their program to develop a Blockchain -based trade finance platform in collaboration with IBM

2016 • Ethereum DAO code was compromised and hacked, Emergence of permissioned Blockchain solutions

2015 • Blockchain trial was initiated by NASDAQ, Hyper ledger project was started

2014 • with crowd funding the Ethereum Project was started, Ethereum genesis block was created

2013 • Ethereum, a Blockchain -based distributed computing platform was

2012 • Coin base, started as brokerage for Bit coin

2011 • Silk Road launched with Bit coin as payment method , Bit Pay first Blockchain -based wallet, Emergence of other crypto currencies like Swift coin, Lit coin

2010 • First Bit coin crypto currency exchange Mt. Gox started working

2009 • First Bit coin block was created

2008 • Bit coin's whitepaper was published by Satoshi

Blockchain was first brought to the public by a person (or group of people) using the name Satoshi Nakamoto in 2008 to serve as the public transaction ledger of the crypto currency bit coin [1]. Transparency, Immutability and Security are major. It is seen as researcher industries and while there are now researcher and it's unique. At a high level the service or products are classified in terms of its scope of reception. Some of these are made for local, domestic purposes while most of the services or products can be promoted globally [6]. Blockchain is challenging the status quo of the central trust infrastructure currently prevalent in the Internet towards a design principle that is underscored by decentralization, transparency, and trusted auditability [7]. In ideal terms, Blockchain advocates a decentralized, transparent, and more democratic version of the Internet. Essentially being a trusted and decentralized database, Blockchain finds its applications in fields as varied as the energy sector, forestry, fisheries, mining, material recycling, air pollution monitoring, supply chain management, and their associated operations. [1]. In this paper we provide a broad ranging survey of the

implications of Blockchain on the future of the Internet with a comprehensive take on their legal and regulatory ramifications as well. We cover a wide range of use cases and try to observe the common patterns, differences, and technical limitations so that a more informed decision can be made by someone interested in deploying a use case from ground up or translating one's use case to a Blockchain -based solution [8],[9]. We provide a comparison of our paper with other recent Blockchain -based survey. most of the issues covered by recent survey literature, a clear distinguishing feature of this paper is that we also discuss a few of the most important legal and regulatory challenges and ramifications of deploying a Blockchain -based solution [10]. This is particularly important given the development of new data protection regulations.

Papers/Books (Author)	Year	Blockchain Fundamentals	Challenges	Smart Contracts	Blockchain Applications	Future Trends	IoT	Blockchain Types	Blockchain Characteristics	Consensus Algorithms	Regulatory Issues
Zheng et al. [10]	2016	✓				✓			✓	✓	X
Ye et al. [11]	2016	X		X		X	X	✓	X	X	✓
Yli-Huumo et al. [12]	2016	X				✓	X	X	X	X	X
Pilkington [13]	2016					X	X	X	X	✓	X
Nofer et al. [14]	2017						X	X	X	X	X
Zheng et al. [15]	2017			X	X		X	✓			X
Lin et al. [16]	2017			✓		X	X	X			X
Miraz et al. [17]	2018		X	X		✓	✓	✓	X	X	X
Yuan et al. [18]	2018		X	X		X	X	X	X	X	X
Ali et al. [8]	2018		X		X	✓				✓	X
Wust et al. [19]	2018	X	X			X				X	X
Salah et al. [20]	2019	X					X			✓	X
Xie et al. [21]	2019						✓	X	X	X	✓
Wang et al. [22]	2019		X	X		X	X	X	X		X
Yang et al. [23]	2019			✓		✓	X	X	X		X

Yang et al. [24]	2019			X		X		X	✓	X	X
Belotti et al. [25]	2019	X		✓		X		X	X		X
Dai et al. [26]	2019			X		✓		X			X
Wu et al. [27]	2019			X		X		X		X	X
Viriyasitavat et al. [28]	2019	X		X		X		X	X	X	X
Mollah et al. [29]	2020			X			X	X		✓	✓
Liu. [30]	2020			✓	X		X	X		X	X
Neudecker et al. [31]	2019			X	X		X	X	X	X	X
Lao et al. [32]	2020			X		X	✓	X			X
Kolb et al. [33]	2020			✓		X	X	X			X
Monrat et al. [34]	2019			X		✓	X	X			✓
Zhang et al. [35]	2019			✓	X	X	X	✓			X
Xiao et al. [36]	2020	X		X	X	X	X	X			X
Bodkhe et al. [37]	2020	✓		X			✓	X	X		X
Al-Jaroodi et al. [38]	2019	X					X	X	X	X	

Background

The original premise of Blockchain is to establish trust in a peer-to-peer (P2P) network circumventing the need for any sort of third managing parties. As an example, Bit coin introduced a P2P monetary value transfer system where no bank or any other financial institution is required to make a value-transfer transaction with anyone else on Bit coin's Blockchain network [39]. The provision of this trust mechanism allows peers of a P2P network to transact with each other without necessarily trusting one another. Sometimes this is referred to as the trust less property of Blockchain. This restlessness further implies that a party interested in transacting with another entity on Blockchain does not necessarily have to know the real identity of it. Further, a record of transactions among the peers are stored in a chain of a series of a data structure called blocks, hence the name Blockchain. Each peer of a Blockchain network maintains a copy of this record [40]. Additionally, a consensus, taking into consideration the majority of the network peers, is also established on the state of the Blockchain that all the peers of the network store. That is why, at times, Blockchain is also referred to as the distributed

ledger technology (DLT). Each instance of such a DLT, stored at each peer of the network, gets updated at the same time with no provision for retroactive mutations in the records.

Use of hashing

We now take a closer look at how hashing is used to chain the blocks containing transaction records together and how such records are rendered immutable[41]. A hash is defined as a unidirectional cryptographic function. A hash function usually takes an arbitrary input of an arbitrary length and outputs a seemingly random but fixed-length string of characters. Each such output is unique to the input given to this function and can be considered as the footprint for the input. If the input is even so slightly changed then the output of the hash function almost always changes completely and seemingly in a random fashion (there are, however, rare occasions where a collision occurs when two distinct inputs to a hash function map to the same output) [15]. This way hash of a piece of data can be used to verify the integrity of it. As an example, Secure Hash Algorithm 256 (SHA256) is a member of the family of SHA2 hash functions which is currently being deployed by many Blockchain -based systems such as Bit coin [16].

Transaction chain

A transaction chain is a difference between a transaction chain and a Blockchain. Each block in a Blockchain can contain multiple transaction chains. Each transaction chain in turn shows the value transferred from one peer of the network to another [16]. Each such transaction chain is also sometimes referred to as a digital coin or more generally as a token a transaction chain makes use of digital signatures, in addition to hashing like the way it is described above, to track the provenance of digital funds.

Smart contracts

One important aspect of Blockchain s is its use in enabling smart contracts [17]. Smart contracts can simply be viewed as algorithmic enforcement of an agreement among, often, mutually non-trusting entities. More technically, a smart contract is a program that executes on Blockchain in a distributed manner and possesses unique identification. It contains functions and state variables. These functions receive input parameters of the contract and get invoked when relevant transactions are made. The values of state variables are dependent on the logic contained in the functions [18].

Public and private Blockchain

The underlying Blockchain s of Bit coin, Ethereum and, in general, of most crypto currencies are open and public. This implies that anyone can join the Blockchain network and transact with any other peer of the network [22]. Moreover, such networks also encourage peers to stay anonymous. As an example in Bit coin's network, peers are assigned addresses based on the hash of their public keys instead of based on their actual identities. On the other hand, there are permissioned and private variants of Blockchain s as well. This concept was particularly popularized by Linux Foundation's hyper ledger Fabric (HLF) platform [28]. This platform is proposed for business use cases where, in addition to data immutability and P2P consensus, transaction confidentiality is also required. Permissioned and private Blockchain platforms such as HLF usually deploy a cryptographic membership service on top of their Block chain's immutable record keeping [32]. Each peer in

such a network can be uniquely identified based on its real-world identity. Proof-of- Authority functions on the same principle of permissioned and private Blockchain.

Internet of value

The value addition in businesses by Blockchain technology is expected to grow to $176 billion by 2025, according to Gartner [17] Inc. Based on this technology, innovative payment channels are being introduced. One such example is Ripple net [18] that facilitates quick and lower-cost payments globally through its network of more than 300 financial institutions located in different geographical parts of the world.

Digital assets

A digital asset can be considered as the digital representation of a tradeable valuable that can be owned and used in a digital-value transfer system such as Blockchain -based crypto currency networks. The use of digital assets is rising and evolving wave in the Blockchain space [37]. The potency to represent assets within a digitized system and carry out transactions via an open source B.T. is inspiring the creation of a whole new marketplace. The aim is to reduce the cost, risk, constraints, and fraud associated with the traditional trading systems [43]. Digital asset tokens and the associated set of smart contracts can exemplify an arbitrary agreement among parties interested in a trade related to a digital asset.

Blockchain -Based Network Applications

Other than crypto currencies, Blockchain finds its applications in various other fields, particularly those that require more transparency and trust in their record-keeping.

Software-Defined Networks

Software-Defined Networking (SDN) is an evolving networking technology that detaches data plane from control traffic. In such a technology, networking resources are managed by a centralized controller acting as the networking operating system (NOS) [19]. However, scalability is a major constraint in the single SDN-enabled networking environments, and thus the adoption of B.T. with SDN can help with facilitation of multi-domain SDNs interconnection and based upon integration of SDN-enabled edge computing and B.T., where the fog nodes are placed at the network edge. The architecture is distributed as three layers, cloud, device, and fog. Blockchain in this solution is mainly used to record the QoS, service pool, and payments, while the proof-of-service plays the role of a consensus mechanism to control the service usage. However, this solution has not been implemented yet and security of fog nodes enabling communication across IoT entities remains an open research problem.

The Decentralized Internet

The Internet has enabled the evolution of a number of applications such as mobile health, education, e-commerce, online social systems, and digital financial services. However many parts of the world are still deprived of the Internet's boons due to the existence of a digital divide [21],[22]. Moreover, the existing Internet infrastructure is predominantly centralized creating monopolies in the provision of services to its users [23], [24].

Decentralized Email

Today, electronic mail (email) is a common form of communication among many that usually consists of a mail client and an associated server. There are various protocols such as SMTP, ESMTP, POP, and IMAP for formatting, processing, delivering, and displaying email messages by ensuring interoperability among different mail clients and servers. These email messages, without appropriate security safeguards, can potentially be read, modified, and copied at any point along their path [25]. Melissa, Sasser worm and other embedded hyperlinks and viruses have damaged millions of computers and their data [26]. Email solutions (such as Yahoo) have suffered from data breaches in the past and have resultantly urged their users to change their password keys [27].

Blockchain for the Internet-of-Things (IoT)

The Internet of Things (IoT) broadly speaking is a network of everyday objects in which the IoT devices capture or generate enormous amounts of data and send it over the network [28]. This interconnection of a large number of IoT devices is known to cause many privacy and security issues [29] [30], including, but not limited to, authentication, privacy preserving, and data tampering/false data injection. In such systems, Blockchain based solutions can help in addressing the issues related to security and privacy. Besides the by-design existence of some implementation constraints of energy, delay, and computation overhead in IoT devices, businesses have started initiatives to use Blockchain into their various domains such as in production and supply chain management [31], [32].

Blockchain -based Content Distribution

Content distribution networks (CDNs) are an effective approach to improve Internet service quality by replicating the content at different strategic geographic locations in the form of data centres. Users can request and access data from the closest replica server instead of always fetching it from the data-originating server. Generally, large companies such as Netflix and Google's YouTube service, have their own dedicated CDNs, while smaller organizations can rent CDN space from other companies like Akamai. Bit Torrent is a P2P content distribution protocol that enables the propagation of data using networks of computers for downloading and uploading simultaneously without a central server [33].

Distributed Cloud Storage

Today, consumers and enterprises face the storage and management problems caused by an ever-increasing volume of data on non-volatile data storage systems. Despite the popularity of cloud storage solutions (such as Dropbox and Google Drive), the control, security, and privacy of data remain major concerns [34]. It is largely due to the current model being adopted by the cloud storage systems that often puts them under a centralized institutional authority. In this model, data is transferred over TCP/IP from a client to the host servers in the legacy client-server model [35].

Applications in Online Social Networks

The engagement of people with online social networks (OSNs) has increased greatly in recent years [36]. Users often put trust in these OSNs and share their personal details with their online social community. Privacy and security concerns however still remain an issue with many OSNs. Any breach of trust has the potential to detriment a user's virtual and, often in turn, real-world identities [37].

Cyber security

A study on cybercrime [38] conducted on some organizations, says that information loss remained the major cost component and increased from 35% in 2015 to 43% in 2017. Blockchain s in particular can be a costly target for cyber-attacks [39], [40]. As an example, DDoS attacks on a Blockchain system can take the form of flooding the network with small transactions. Still such transactions must be paid for (in the units of gas) in order for them to be confirmed by the network [39]. Public Key Infrastructure (PKI): Certificate Authority (CA) Public Key Infrastructure (PKI) establishes a link between identities like domain names to a cryptographic public key with help of certificates [41], [42]. Among traditional approaches to PKIs, the most common choice is the use of Certificate Authority (CA) that serves as a trusted third party and manages the distribution digital certificates over the network. This creates a single point of failure in such PKIs in practice [43]. There have been many incidents when these centralized CA's have been compromised—e.g., the Digi Notar attack: 531 fraudulent certificates issued [44] [45]

Other Applications

Using the B.T., a company named Factom has started a land registration project with the Government of Honduras to ensure integrity and correctness of the information. Using the same technology, they have engaged in projects related to smart cities, document verification, and the finance

Industry [40]. In another application, a Blockchain -based start-up Ever ledger is working on bringing transparency to the supply chain of diamonds, which was previously perceived as complex, risky and prone to carrying false and incomplete information. Ever ledger has been designed to reduce fraudulent Modifications in the records to help financial institutions, businesses, and insurance companies with actual details of information [42]. A bit coin-based start-up Abra for transferring money to anyone with minimal charges of transaction. No intermediate party gets involved in this transaction [42]. Blockchain is being considered as a novel software connector, which can provide a decentralized alternative to existing centralized systems resulting in quality attributes. For example, Xu et al. [43] found that Blockchain can improve information transparency and traceability as a software connector.

Scope	Example(s)	Description
Smart Contract	Ripple [4]	Occurrence of certain events triggers transfers of different things, i.e., security deposit payment, saving wallets, decentralized gambling, wills etc.
Cloud Services	Abuse Prevention [34]	Defence to stop attacks and service abuses in cloud computing applications.
Message Exchange	Bit message [35]	Secure system to send and receive messages.
Identity and Privacy	Chain Anchor [36]	Trusted, privacy-preserving, identity management system.
Digital Content	Content Distribution [37]	Decentralized and peer-to-peer digital content management system with rights management mechanism.
Voting System	Electronic Vote [35]	Electronic vote transaction system for a voter to spend the vote in favor of one or more candidate recipients.

Health	Patient Data [36]	Patient data sharing system based on Blockchain technology.
Transportation	Vehicle Communication [37]	Secure vehicle to vehicle communication system.
Agriculture	ICT E-Agriculture[38]	Distributed ledger system to safeguarded transparent data management.
Software	Software Connector [38]	Software components states sharing system without trusting a central integration point.
Micro Finance	Stellar [39]	Creates services and financial products using Blockchain architecture.
E-Commerce	OpenBazaar [40]	Provides trading platform for users where they can make free transactions among themselves.
Mobile Banking	Atlas [41]	Atlas provides platform for mobile banking and connects world communities through it.
Storage	Sia [42]	A cloud storage platforms, enables anyone to make money.
Document Management	Blockcerts [43]	Issue and verify certificates for academic, professional, workforce and civic records.

TABLE : Examples of Blockchain -based applications

Scope	Startups	Description
IoT and Economics	Chronicled [8]	Provides trusted data, ensures data provenence of IoT devices and helps in business process automation
Security and Intelligence	Elliptic [9]	Necessary intelligence information to security agencies and financial departments.
Data Security	LuxTrust [10]	Provides security to customer's electronic data and digital identity.
Regulatory Compliance	GuardTime [11]	Data protection regulatory compliance software.
Financial	Augur [12]	A market forecasting tool to increase profitability.
Transportation	Lazooz [13]	Real-time ridesharing services.
Property Records	Ubiquity [14]	Provide service for secure ownership record of property.
Process Compliance	Startumn [15]	Ensures process integrity and improves regulatory compliance.
Music	Mycelia [16]	Music industry online services.
Asset Management	Gem [17]	Secure identification of assets.
Data Security	Tieriom [18]	Data protection service.
Smart Contracts	SkuChain [20]	Offers services like: Smart contracts, provenance of things, Inventory Management.
Storage	Storj [21]	A distributed storage platform.
E-commerce	Gyft [22]	An online gift transfer platform.
Health and	BitGive [23]	By using B.T. it works for the improvement of public health

Environment		and environment worldwide.

TABLE: Examples of Blockchain -based start-ups

Platform	Description
Swarm [9]	An open Infrastructure for Digital Securities
Inter Planetary File System (IPFS) [4]	A protocol and peer-to-peer network for storing and sharing data in a distributed file system
Sia [9]	A platform for securing storage transactions with smart contracts
MaidSafe [22]	A decentralized platform for application development via a proof-of-resources protocol
Storj [23]	A decentralized file storage solution over P2P network using Blockchain hash table
Filecoin [21]	A digital payment system and Blockchain -based cooperative digital storage
BlockScores/NextCloud [35]	An application for Blockchain and smart contract interacting via secure leader boards

TABLE: Examples of Blockchain platforms for distributed cloud storage

III.RESULTS AND DISCUSSION

Challenges

The Blockchain is expected to drive economic changes on a global scale by revolutionizing industry and commerce by redefining how digital trust mechanisms through distributed consensus mechanisms and transparent tamper-evident recordkeeping. The disruption of Blockchain is evident, and people are beginning to adopt this distributed ledger technology. There are, however, various hurdles that are slowing down the rate of block chain's adoption. Some of these challenges are listed below and with pointers to how these challenges might find a solution in the future.

Governance, Operational & Regulatory Issues

Blockchain has great potential to enable efficient and secure real-time transactions across a large number of industries by providing financial services visibility along a supply chain and streamlining government authorities and consumers. B.T. is still far from being adopted en masse due to some unsolved challenges of standards and regulation. Although it's hard to regulate the development of the B.T. itself, Blockchain-based activities (such as financial services, smart contract, etc.) should be regulated. To support its emergence and commercial implementation, the development of standards and regulations are required to establish market confidence and trust. These regulations can also be used for law enforcement to monitor fraudulent activities e.g., money laundering.

Scalability Issues

Scalability is one of the major concerns in the way of wide spread adoption of Blockchain-based technological solutions. We discuss this concern with following three different perspectives.

Security and Privacy Concerns

Besides security being in the system by design of the Blockchain-based transactions, privacy remains a concern in applications and platforms. The B.T. has been considered as privacy-preserver and rated well in this context.

Sustainability Issues

Blockchain has attained an extraordinary amount of interest and attention and a large number of industries are adopting this virtual digital ledger. However, it is still unclear that any particular solution of Blockchain can attain a certain level of adoption for their sustainability.

Anonymity

In a Blockchain system, the users utilize generated addresses, which are mostly in the form of public keys, for their unique identification over the Blockchain network. The Blockchain users can generate their multiple addresses in order to avoid the revelation of their real identities. These addresses are generated in the form of cryptographic keys. The said keys are then used to send and receive Blockchain based transactions.

Use of Artificial Intelligence and Machine Learning

Recent advancements in B.T. are making new ways for the involvement of AI and machine learning (ML) that can help to solve many challenges of Blockchain with several important future applications.

Usability and Key Management

One of the primary challenges that any new technology faces is the usability. This issue is more acute in Blockchain because of new architecture and high stakes. The transaction flow should be visible to users to analyze the whole transaction flows.

B.T. current market trend

Current B.T. Market (By Type: Public, Private, Hybrid Cloud; By Component: Applications & the solution, Middleware, as well Infra & Protocols; By Activity: Digital Identity, The payments, Exchanges, Logistics Management, Smart Contracts, Other; Large Enterprises, Small and Medium Enterprises; End-Use) - Global Industry Research, Scopes, Share, Development, Trends, Region Attitude, and Forecast for 2023-2032. The international B.T. market was valued at USD 4.8 billion in 2022 and is predicted to grow to around USD 2,334.46 billion by 2032. [46].

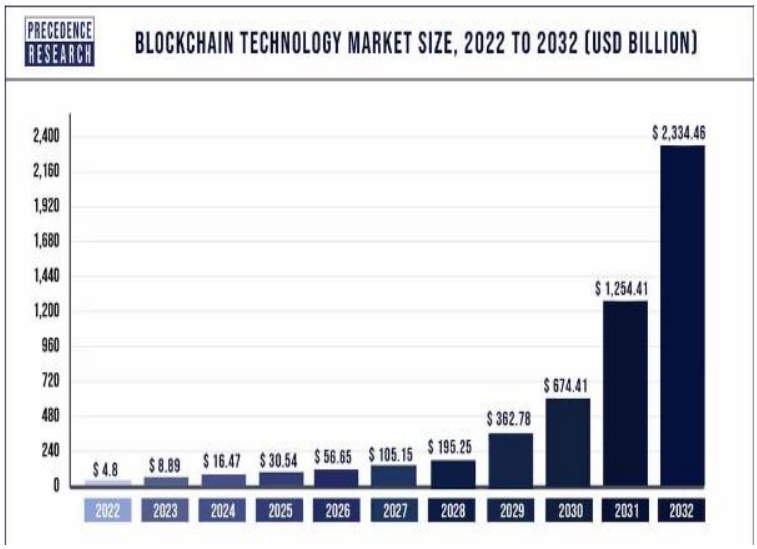

Fig: B.T. current market trend forecast

IV. CONCLUSION

In this paper, we provide a study on Blockchain-based network applications, discuss their applicability, sustainability and scalability challenges. We also discuss some of the most prevalent and important legal ramifications of working with Blockchain-based solutions. Additionally, this paper suggests some future directions that will be helpful to support sustainable Blockchain-based solutions. The worldwide B.T. market was valued at USD 4.8 billion in 2022, with a projected value of USD 2,334.46 billion by 2032. From 2023 to 2032, the worldwide B.T. industry is expected to develop at an 85.7% CAGR. IBM Corp. (US), Microsoft Corp. (US), The Linux Foundation (US), BTL Group Ltd. (UK), Chain, Inc. (US), and Circle Internet Financial Ltd. (US), etc. are the leading companies in the B.T. sector. The widespread usage of Blockchain-based solutions in finance and cyber security is propelling the B.T. industry forward. During the projection period of 2023 to 2032, the North American territory will be dominant in the worldwide B.T. market. Blockchain is still in its infancy implying there will be sometime spent before it gets ubiquitous and widely adopted. However, the aim of this study is to provide a guiding reference manual in a generic form to both the researches and practitioners of the filed so that a more informed decision can be made either for conducting similar research or designing a Blockchain-based solution.

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Electrical Parameters of Soil with Organic Matter at J Band

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ABSTRACT

Soil is a dielectric material with electrical conductivity that depends on number of factors. Estimating the electrical property of matter with the help of microwaves is an important tool for analyzing the composition of that matter. It forms the important aspect of remote sensing and exploring the nature of the matter. With variations in structure and chemical composition, the dielectric properties of the material vary. The present paper represents the electrical properties of cultivated soil with different concentration of organic matter, vermicompost in different concentrations. Organic fertilizers vermicompost is added to the wet soil in varying concentration of 0-10 %. Microwaves of frequency 7.2 GHz with dominant TE10 mode is used and infinite sample method is employed for calculating the dielectric properties. The findings of the work showed that, with the addition of fertilizers, the dielectric properties of the soil increases progressively.

Keywords: Dielectric Constant, Dielectric Loss, Relaxation Time, Ac Conductivity, Vermicompost

I. INTRODUCTION

Response of material to the applied electrical field is influenced by various conditions of the matter like frequency of the applied field, physical and chemical composition of the material, temperature, etc. The measure of the reaction of the dipoles of the material to the applied external field is the dielectric property of the material. Dielectric properties of the material are like dielectric constant, dielectric loss, ac conductivity, relaxation time, tangent loss, etc. Dielectric constant is measure of the amount of energy stored per cycle of the applied electric field. Dielectric loss is the amount of energy lost in aligning the dipoles. Displacement of centers of positive and negative charges gives rise to ac conductivity. The time taken by the dipoles to align in the direction of applied field is the relaxation time. The ratio of energy stored to the energy lost per cycle is called the tangent loss [1].

Dielectric properties of soil changes as the structure of its constituent particle change [2]. The moisture content of the soil is easily found out by analyzing the dielectric constant of the soil [3]. Correlation is seen between the physical and chemical properties of soil with electrical properties of the soil is noted [4]. The dielectric properties show a significant difference, with the impurities present in it [5]. Chemicals present in the soil can be correlated with the dielectric properties of the material [6].

Vermicompost: Vermicompost is an organic fertilizer containing water soluble nutrients that are high in organic matter and helps the soil as a conditioner. Plants treated with vermicompost have higher nutrient intake as compared with other fertilizers. Vermi means "worms" in Latin. In Vermicomposting, earthworms are nurtured on the organic waste. These earthworms digest the organic matter and excrete nutrient rich byproduct. When the organic matter, as a food passes through the digestive track of the worms, it breaks down into sustainable nutrients with the help of the enzymes secreted in it. This together with chemicals is given out as waste by the worms. The waste is rich in nutrients that improve the soil texture, aeration and structure. The advantages are like: It enriches the quality of the soil. The soil is high in the percentage of macro nutrients like nitrogen, phosphorus and potassium. It is a soil conditioner. It also increases the water holding capacity of the soil. Worm excreta contains about all micronutrients and also trace elements. The humus from the excreta absorbs the harmful fungi and toxins from the soil. It suppresses the diseases caused by seed borne pathogens. It acts like a buffer and maintains the pH level of the soil such that the plants can absorb nutrients from it. It breakdowns the heavy metals in the soil and forms its compounds that are later absorbed by the plants. It increases the plant growth and also gives high yield of the crop.

The soil samples are first analyzed for their physical and available chemical properties from the agricultural office. For dielectric measurements, the microwave bench with J band along with other components like isolator, attenuator, frequency meter, slotted line and sample holder with matched termination are aligned sequentially. The slotted line is mounted with probe having crystal detector that reads the power of the VSWR. The power is measured by the micrometer connected in line with the detector. Both the soil samples are dried, sieved and mixed with different concentration of the organic matter vermicompost varying from 0 to 10%. These soil samples with vermicompost are carefully inserted in the sample holder and connected in line with the slotted line and matched termination. The forward and the reflected wave from the surface of soil within the waveguide forms a standing wave pattern. Shift in the minima and voltage of these VSWR gives the information of the dielectric parameters of the soil in the sample holder. Further calculations are done by infinite sample method to determine the variables. Graphs show the variation of
parameters with the concentration of the fertilizer.

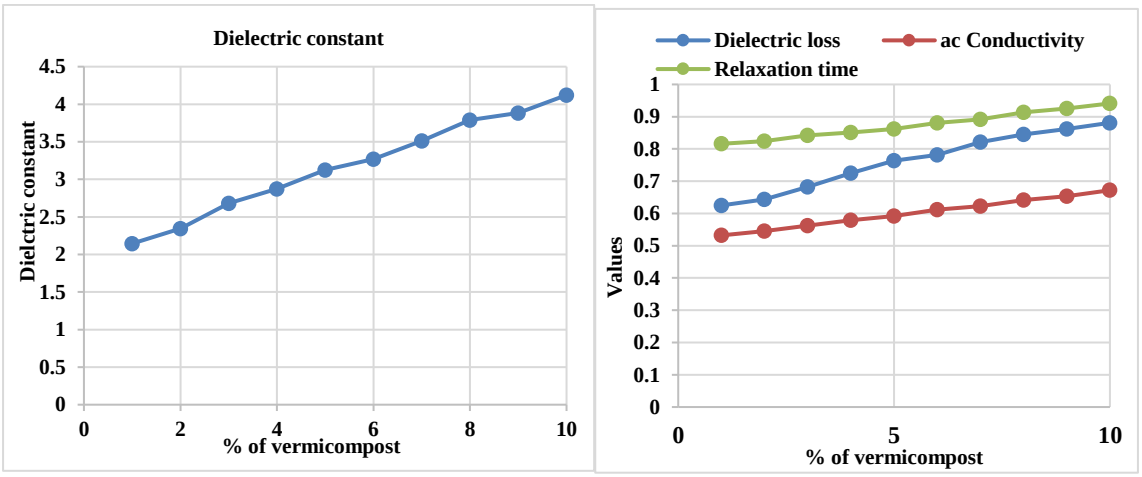

Fig 1.1 (a) & (b) Graphical representation of variation of dielectrical parameters with vermicompost

Table 1: values of dielectric parameters with different concentration of vermicompost

% of vermicompost	Dielectrical Parameters			
	Dielectric constant	Dielectric loss	ac conductivity mho/cm	Relaxation time psec
1	2.145	0.625	0.532	0.816
2	2.345	0.644	0.545	0.824
3	2.682	0.682	0.562	0.842
4	2.874	0.725	0.579	0.851
5	3.124	0.764	0.592	0.862
6	3.268	0.782	0.612	0.881
7	3.514	0.821	0.623	0.892
8	3.789	0.845	0.642	0.913
9	3.882	0.862	0.654	0.925
10	4.122	0.881	0.672	0.941

Result:

The value of dielectric constant of the dry soil varies from region to region. It is greatly influenced by the geographical parameters pertaining during rock formation like weathering, temperature, climatic conditions, moisture content. Considering all other factors as constant at the time of observation, impact of vermicompost on soil,s electrical properties is studied. The table above shows that the dielectric parameters of the soil increases with the increase in the concentration of the organic matter i.e. vermicompost. The results are in accordance with the literature survey [7]. Addition of any impurity or other matter has a great influence on the values of the dielectric parameters [8 & 9]. Thus constituents of the soil influences the electrical behavior of the matter to the applied electromagnetic waves.

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Deformation of Soil and Its Correlation With Characteristics of Soil – An Over View

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ABSTRACT

Consolidation settlement of soil due to load coming from structure takes place in longer time hence there is a need to develop an economical easy and less time consuming method to predict the consolidation settlement. some researcher have developed correlation in between index properties of soil and consolidation parameter of soil, like coefficient of consolidation, volume change (mv),and compression index (Cc). Consolidation settlement of soil by one dimensional consolidation settlement by obtaining coefficient of consolidation of soil from time compression data by different time fitting curves, consume much time as well as it is not satisfactory .presently as the population is growing there is tremendous need of fast construction activities which is not possible over poor fine grain soil due to its shrinkage and swelling properties , hence before construction we need to find out deformation behavior of soil through index properties in laboratory which is costly and time consuming . Hence study of different correlation with deformation characteristic of soil may give quick estimation of settlement . As computation of magnitude of settlement and rate of settlement is critical here are finding different factor responsible for prediction of settlement in correlation with index properties of soil which will save time and energy in predicting settlement in future.

Keywords: Volume change, Compression Index ,Coefficient of Consolidation

I. INTRODUCTION

The soil strata often need number of years to get fully consolidated. As computation of settlement from laboratory experiments and from time fitting curve is time consuming and not satisfactory , it is associated by some errors ,therefore different parameters such as coefficient of volume change (mv) , compression index (Cc) ,coefficient of consolidation are an important parameter in design consideration. Estimation of magnitude and rate of consolidation settlement is critical in many civil engineering projects. Consolidation settlement of soil can be find out by one dimensional consolidation and obtained coefficient of consolidation of soil from time compression data by using different available time fitting curves. It is reported that it consumes much time. Later on investigators have correlated deformation settlement with plastic limit, Liquid limit,shirinkage limit , density and clay mineralogy ,coefficient of consolidation and coefficient of compressibility individually or in group to develop co-relation in between them to predict probable settlement. Here are some works of the researcher are being presented and index properties of Aurangabad soil is studies particularly cc and cv values has find

out to develop correlation among them to find out settlement and its prediction it is observe that it is observed that

.Generally fine grained clayey soils are expansive in nature which in association of engineering structure either swell or heave depending upon the stress level and soil swelling pressure. Therefore construction of structure over such problematic soil becomes challenging task for geotechnical engineer. Now a days the structures are constructed over poor soil as well as on the coastal areas where the soil is experiencing much settlement when critical stresses exceeding over the soil or in form of earthquakes. Hence, it is not economical to go for construction before knowing the soil deformation behavior against loading. This deformation or settlement is related with properties of soil and minerology. Therefore computation of settlement in laboratory after experimentation is costly. Hence, study of different co-relation and deformation with index properties.of soil may give a quick estimation of settlement to decide whether the site should be selected or not.

II. INDEX PROPERTIES AND CORRELATIONS

2.1 General .

Geotechnical properties of soil and its correlation with other properties are likely to give good predictive method for consolidation settlement. The development of correlation and proper method for prediction of settlement will solve the problem of structural settlement over soil. Many investigators have given different

correlation in between liquid limit, plastic limit, shrinkage limit voids ratio, density, C_v and C_c, along with settlement of soil. They have also reported the effect of mineralogy and temperature over soil.

2.2.Geotechnical Properties of Soil

2.2.1 Different correlation in properties of soil .Landris T Lee [1], has studied" the index properties of fine grained dredged materials based on the detailed studies carried out by him he Concluded that slump test method is useful in rapidly estimating index properties of soil. He also gave Positive correlation between Liquid limit, and vertical deformation slump test.The empirical correlation developed is.

1)e = 0.028w – 0.055 N - 0.065,

N = Normalized Slump. (2.1)

2) LI = 1.601 $\left(\frac{W}{LL}\right)$ - 0.612 (2.2)

3) Shear strength = 8.7 $\exp^{-2.37\left(\frac{W}{LL}\right)}$, exp= 2.7

(2.3)

4) $6^1 = 6.21 \left(\frac{W}{LL}\right)^{-4.8573,}$

6^1 = effective stress in KP_a (2.4)

K.M Neaupane *et.al.*[2] have carried out studies on "effects of temperature on one –dimensional characteristics of clayey soil" They have selected Bangkok clay for study and reported as:

i) Normally consolidated clay contracted on heating.

ii)Over consolidated clay after heating show less contraction.

iii) Due to heating, rate of seepage increases and viscosity of water decreases.

iv) Prolong heating in soil resembles secondary consolidation.

v) Due to thermal unloading voids ratio up to certain extend increases then starts decreasing. It is observed that in case of clayey soil which is under high normal stress of 300 KPa heated up to 70C & subsequently cooled up to 35 C i.e. at room temperature shows a continuous deformation or decrease in voids ratio even after cooling when temperature is cut off.

Mark .R *et.al.* [3] carried studies on "Geotechnical characteristics of soft Lake Marl with preload test result." In this experiment they have performed odeometer test and find out characteristics of marl. The values of different parameter are found to be coefficient of consolidation --1.2 x 10^{-2} cm^2/s, Compression = 0.31

Recompression = 0.03,OCR--2.2, cα /cc--0.039 and After performing preload test they have predicted settlement as 2.5 cm to 5 cm and reported that its

reliability is not exceeding 30 to 40 %. They have also reported that as the depth decreases and OCR value becomes unity due to the effect of ground water fluctuations, chemical changes, post loading. Therefore to reduce the settlement they have preloaded the soil and achieved desirable strength.

A Sridharan, .H.B. Nagaraj, [4] have studied the hydraulic conductivity of remoulded fine grained soils verses index properties" They have developed a predictive method of finding hydraulic conductivity (K) in terms of voids ratio and shrinkage index.

$$K = C\left[\frac{e^x}{1+e}\right] \quad , x = c \log K\ (1+e) \text{ vs } \log e \qquad (2.5)$$

C = Slope of line. K VS $\frac{e^x}{1+e}$, Where the value of C is

$$C = 2.5x10^{-4}\,(I_s)^{-3.69} \qquad (2.6)$$

It is reported that K-e has much variations even at same liquid limit.

2.2.2. Effect of minerology on Geotechnical properties of soil

Shridharan [5] hase studied "H volume change behavior of fine grained soil," and reported that undisturbed bonded expansive soil can even show compression upon wetting even under very light stresses. Where as the remolded sample can show large swelling. He has carried out studies on kaolinite and mantnorillimite clay soil and reported that shear resistance plays a vital role in koalinite soil. Where as diffusive double layer repulsion parameter plays a vital role in volume change behavior of montmorillonite soil. Kaolinite soil can withstand external pressure at higher voids ratio where as montmorillonite soil can with stand external pressure by pore water when the diffusive double decreases & water escapes from the pores and soil collapses in saturated condition. In kaolinite soil due to negative pore pressure development. shear resistance decreases and soil collapse. He has also stated that due to saturation in expansive soil double diffusive layer modified, if the external pressure is less than the soil, Soil will swell and it stabilizes when swelling pressure and external pressure became equal. It is also reported that soil in remolded state swell and in undisturbed state compresses and behave like non expansive soil.

K Prakash and A. Shridharan [6], have studied "Free swell ratio and clay mineralogy of fine grained soil." They have presented a simple method to find out clay minerals by free swell ratio (FSR) which is as follow

FSR =Equilibrium sedimentsvolume10 gm oven dried soil/(Volume of distilled water/ Carbon tetra Chloride/ Kerosene) = Vd/Vk and given FSR as follows

Table 2.1: Free swell ratio and clay minerals

FSR	*Title Case*		
< 1	Kaolinite	non swelling	Negligible
1 –1.5	Kaoliniti c and Montmo rillonite	mixture of swelling and non swelling	low
1.5 –2	Montmo rillonitic	swelling	Moderate
2 – 4	Montmo rillonitic	swelling	high
> 4	Montmo rillonitic	Swellin g	very High

Further they have correlated liquid limit to find out dominant clay minerals existing in soil by finding LL by carbon tetra chloride and LL by water, If

$LL(_{Ccl4}) > LL(_{H20})$, then soil is having Kaolinitic types of clay minerals.

Masami.Ohtsubo*et.al.* [7], have studied "mineralogy and chemistry and their correlation with the

geotechnical index properties of Bangkok clay,: and comparison with Ariak clay." They reported that mineral is found to be responsible for swelling in Bangkok clay and less in Ariake clay. The liquid limit in Ariake soil changes with the increase in salt concentration in soil, where as the liquid limit of sodium saturated Bangkok clay have no change if salt concentration increases in it by substituting Ca for Na and no reason for constant liquid limit is reported.

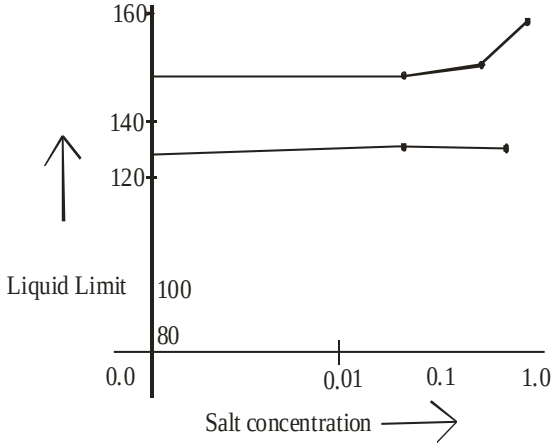

Fig.2.1:Effect of salt concentrationon liquid limit.

2.2.3.Determination of Pre consolidation stress of soil:

R. Krishnamohan [8], has carried out "comparison of e - log p and log e- log p methods. Based on the studies he concluded that, i)By intersection of two lines one can get easily p_c value in log e – log p method. ii) By considering known P_c value the difference in between two methods was found to be 9%. iii) He has considered known value of preconsolidation stress and found that difference in between two method is 9% and he concluded by inter section of two lines preconsolidation stress can be calculated easily,. They have also reported that Log e – log p method can be used as a good alternative method to check p Log p results.

Gandhi N J, *et.al.* [9], carried out studies on "preconsolidation pressure for varying compressible soils." And collected 50 samples of alluvial soil from in and around Surat and find out preconsolidation pressure from four methods and concluded that, Strain energy – Log stress (1997) method give high values of preconsolidation pressure, .. Casagrandemethod having less deviation in its values & give high value in CL & MI soil, Pachco Silva (1970) method give better result for CI, CH & MI soil, where as Jose (1989) method give better result for CH Soil. Therefore they concluded that casagrande (1936) &Pachco Silva (1970) methods are very useful in alluvial soil.

M.M. Allam *et.al.*[10], have carried out studies on" Estimation of preconsolidation pressure using n-log p plot", They have reported that Previous method uses e-log p plot and log (1+e) – log p plot but in this, paper they have presented data of 12 soils in form of n-log p plot and concluded that a bilinear relationship exist for soils of known stress history, desiccated and undisturbed soil which give preconsolidation value at the intersection of bilinear line, and reported settlement equation as follows

$$\Delta_s = \Delta H \frac{C_{nr}\log_{10}\left(\frac{PC}{PO}\right)}{1-n_o+C_{nr}\log_{10}\left(\frac{PC}{PO}\right)} + \Delta H \frac{C_{nc}\log_{10}\left(\frac{P1}{PC}\right)}{1-NC+C_{nc}\log_{10}\left(\frac{P1}{PC}\right)} \quad (2.8)$$

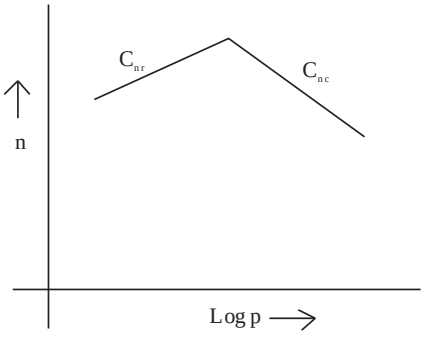

Fig.2.2. Effect of pressure on porosity of soil.

JLH Grozic*et.al.* [11] carried out "An oedometer test study on the pre consolidation stress of glaciomarine clays.". They reported that oedometer test on over consolidated clay of low plasticity are difficult to interpret. Traditional methods for determining 'P_c proposed by casagrande (1936) and Janbu (1969) are

difficult to apply these soils where as Becker et.al. (1987), Burland (1990) Jacobsen (1992) &Onitsuka (1995) have given alternative methods,. For accuracy they have carried out oedometer verification test & reported that Becker et.al. (1987), Incremental work method, and bilogarithmic method proposed by Onitsuka*et.al.* (1995), have provided the most accurate results. Becker *et.al.*has given work method eq^{n}as follow

$$\Delta_{woed} = \left(\frac{6i+1+6i}{2}\right)\left[\sum i+1+\sum i\right] \quad (2.9)$$

,

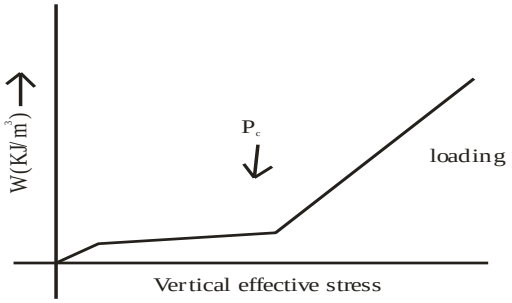

Fig.2.3. graph for 'Pc' calculation in between vertical effective stress

and work.

Bilogarithmic method has adopted the following plot s.(a) (1+e) – in p^{1}. (Buther field 1979) (b) & log (1+e) – log p^{1} (Oikawa 1987) (c) in (1+e) – log p^{1} plot (Onitsuka et.al. 1995).

Madhira R *et.al.* [12]," carried out studies on," "Phase Transition Effects on Pre consolidation stress of soil." In this study they have considered the effect of phase change in over consolidation soil from over consolidation phase to normal consolidation phase. They have Tested, Araike clay having OCR ranging from 1 to 4 and reported that following four parameters are effecting the soil.

i) OCR- over consolidation ratio $\left(\frac{6c^{1}}{60}\right)$,

ii) SIR- Stress increment ratio $\left(\frac{\Delta 6}{60}\right)$ and

3) μ - Compression Indices ratio $\left(\frac{cr}{cc}\right)$ and plotted different graphs pore pressure vs. Time, degree of settlement vs time and voides ratio vs. log $\left(\frac{6av}{60}\right)$ and Depth of nc/oc with time and, concluded that early settlement can be achieved by more OCR, and voides ratio is observed to be decreasing more with lesser OCR, values. Hence more settlement is observed at lesser value of OCR. It is also reported that coefficient of consolidation for two bilinear phases are inversely proportional to the respective values of compression Indices. i.e. C_r & C_c

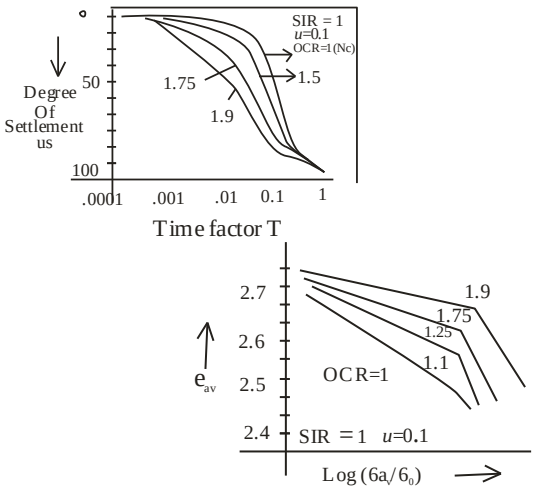

Fig.2.4.Effect 0f time factor on Degree of Settlement

Fig.2.5. Effect of stress on Average voids ratio

2.2.4 Coefficient of consolidation & its correlation with characteristic of soil:

Shridharanetal [13] have carried out studies on" coefficient consolidation and its correlation with index properties of remolded soils," and reported that the coefficient of consolidation depends upon many factors, the behavior of soil in one dimensional consolidation does not completely satisfy the theoretical relationship of consolidation as reported by Terazeghis equation with the use of curve fitting procedure. Many researcher in the past predicted the coefficient of consolidation. He reported (a) Carriers (1985) conducted studies on Cv and given the following equation.

$$C_v = \frac{9.09x10^{-7}(1.192+ACT^{-1})^{6.993}(4.135\,I_p+1)^{4.29}}{I_p(2.03I_L+1.192+ACT^{-1})^{7.993}} \quad (2.10)$$

ACT = Activity, IL = Liquidity Index, IP = Plasticity Index.He reported Cv is immensely proportional to plasticity Index.(b) Raj*etal.* (1995) proposed an

equation to predict Cv (cm^2/s) for clayey soil in term of voids ration at liquid limit (e_L) considering over burden pressure $6^{l}v$(Kpa) as follows.

$$C_v = \frac{1+e_L(1.23-0.276\ \text{Log}\ 6_v)}{e_L} \times \frac{1}{6_v^{1(0.353)}} \times 10^{-3} \quad (2.11)$$

In this study only a particular range of LL & PL is considered Hence generalization of this equation became questionable.

(c) Lambe& Whiteman (1979) have given a typical range of values of coefficient of consolidation for soils of varying liquid limits as shown in table:

Table 2.2 Liquid limit and values of Cv.

Liquid limit	Lower Limit for recompression (m^2/s)	Undisturbed virgin Compression (m^2/s)	Upper Limit remolded (m^2/s)
30	$3.5x10^{-6}$	$5x10^{-7}$	$1.2x10^{-7}$
60	$3.5x10^{-7}$	$1x10^{-7}$	$3x10^{-8}$
100	$4x10^{-8}$	$2x10^{-8}$	$1x10^{-8}$

(d) Terazaghi and Peck (1967) indicated that with decreasing voids ratio i.e. due to increasing effective vertical pressure (6^{i}_v) both K and mv decreases rapidly, $Cv = \frac{K}{mv\ rw}$ Therefore, less $\frac{K}{mv} C_v$ is fairly constant over a wide range of effective vertical pressure. But Robinson &Allam (1998) have shown that C_v-6_v^1 relationship is effected by mineralogy. (e) Recently A Shridharan and HB Nagraj (2004) have developed co-relation between coefficient of consolidation and shrinkage index and reported that it has better relation with coefficient of consolidation by the following equation.

$$Cv = \frac{3}{100(I_s)^{3.54}} \quad (2.12)$$

Emad Akawwi *et.al.* [14], have studied "consolidation coefficient and swelling potential for the expansive soils in Jordan." They have collected samples from different places in Jordan and performed odeometer test in wet & dry condition and find out Cv values.

They reported that cv are in the range of 0.1 – 0.2 & 0.4 – 1.6 m^2/y^2 for dry soil & 0.2 – 0.4 m^2/y^2 for wet soil. Later on they compaired these values with the Cv values in other countries of the world and found that. Swedish sensitive clay & Mexico City clay are having same Cv as the Jordan Amman clay, but these values are some what less if compared to Boston blue clay and Chicago silty clay.

N	Soil Type	Cv(m^2/y
1	Boston blue clay (Cl)(Load and Lurcher 1965)	12-6
2	Organic silt (OH) (Lowe, Zacheo and Fildman 1964)	2-2.7
3	Glacial lake clay (Cl) (Wallace and Otto1964)	2.7
4	Chicgo silty clay (Cl Terzagi and Peck 1967).	. 1-.2
5	Swedish Medium sensitive clays(CL-CH) (Holts and Broms 1972)	0.6-1.2
6	Swedish Medium sensitive clays(CL-CH) (Holts and Broms 1972)San Francisco Bay Mnd (CL)(Leonards and Giranlt 1961)	0.6-1.2
7	Mexico City clay (MH) Leonard sand Girault 1961).	0.3-0.5
8	Jordan (Amman city clay) CHIn wet soil-,Dry soil-	0.1-0.4 . 1-.2,.4

Table No:2.3 Typical values of Cv in the world

A H C. Chan [15] have studied, "Determination of co efficient of consolidation using a least square method,." He concluded that usual casagrande and Taylor's method for calculation of time factor Tv are associated

with error, hence according to Hasen (Hispa 2003) He has given time factor as follows:

$$Tv = \cong^{3} \sqrt{\frac{U6}{2(1-U6)}} \qquad (2.13)$$

In this experiment by using above said equation a simple and practical least square procedure is provided to determine the value of "Cv" which is having more accurate value.

Giampaolo Cortellazzo [16], carried out studies on "Laboratory and insitu values of the coefficient of Primary consolidation 'Cv,' he reported that 'Cv' values obtained from four different methods are compared with insitu values and concluded that: i) Casagrande method in some cases not usable. ii) Taylor's method gives maximum Cv value. iii) Shridharan method Log $\left(\frac{H^2}{t}\right)-U$ also give high value which is also a very true value. Where as Log δ – log t method give less Cv value at U = 88.3%.They have also studied effect of layer thickness on Cv values and shown that shallower layer have higher Cv where as for deeper layer it is lower. For thick layer i.e. > 10 m having silty-clayee layers the drainage condition changes and hence coefficient of consolidation values for such samples are not good for computation of settlement

Koji Suzuki] have carried out studies on two cases of consolidation settlement analysis using constant rate of strain consolidation test are impotant to analyse the consolidation in over consolidated state .

MSS Almedia et.al (), studied on "consolidation of very soft clay with vertical drain they have reported the coefficient of consolidation value cv is 0.52 m2 /y,also cv doesn't remain constant during process.

2.2.5 Compression index and its correlation with characteristic of soil:

A.Shridharan and YesimGurtug [17] have studied "compressibility characteristics of soil" and performed odeometer test on four samples of soil collected from North of Cyprus and reported that, ,e– log p curve does not show a linear relationship in most cases, it is found as concave curve. , with log (1+e) vs log p (Butherfield 1979) method gave concave curve at start and become linear as the pressure increases. Hence these two methods does not arrive at a unique value and concluded that: ,Compression Index. Of soils cannot be represented by compression index- alone. and Compressibility behavior $\frac{\Delta h}{hi}$ vs pressure shows rectangular parabola. They have also reported a relationship for settlement as follows.

Settlement (S = $H\left[\frac{a(P_2+P_1)}{(a+bp_1)(a+bp_2)}\right]$ (2.15)

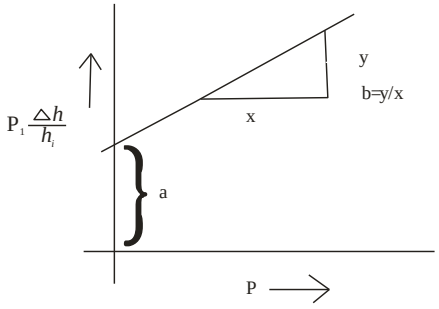

Fig. 2.6. : pressure effect of stress over $P_1\frac{\triangle h}{h_i}$

The above said methods give more accurate value other then conventional method here.,In P/ $\frac{\Delta h}{hi}$ vsp Compressibility behavior is represented by 'a' and 'b' parameter where a-is intercept on y-axis &'b' is the slope of the line. It is important to note that here pre consolidation pressure knowledge is not required.

V.K. Stalin, [18] has studied" consolidation behavior of soils with wide range of compressibility. "They have ,Tested low compressible soil i.e. sand and high compressible soil i.e. Bentonite clay with liquid limit ranging from 20 to 286 %. Due to liquid limit which varies from 20% to 286% it was not possible to generalize compression index equation. Hence compression index equations are proposed and reported individually for low and high compressible soils, as follows.

Table 2.4. Effect of liquid limit on compressibility of soil.

Sr. No	Properties of low compressible soil	High compressible soil
1 2 3	i.e W2 < 75% 1) cc = 0.009 (WL-9) 2)cc = 0.0073 (WL-3)	i.e. WL > 75% cc = 0.013 (WL – 26)

Chu Sudha Rani *et.al.* [19] studied "proper parameters for prediction of compression index." They have developed 15, Regression model with LL,PI, mc and γd or In various combination. Performance of all these models have verified by comparing observed and predicted Cc by comparing data of 180 soil samples. Here Three of these models were found to be effective in predicting cc. To qualify One way Annova and Dunnetls test were carried out to further find out the which is the best model. They have reported that model relating cc with LL, γd mc & PI are found to be the best among all

Table 2.5 Regression Models of soil showing relation in between Index properties all of soil and compression Index.

1	Cc=0.461+(0.003*LL)
2	Cc=0.168+(0.0048*Mc)
3	Cc=(0.556-0.16*yd)
4	Cc=(0.130+(0.0347*PI)
5	Cc=0.070+(0.003*LL) (0.002*MC)
6	Cc=0.087+(0.003*LL(+0.007*yd)
7	Cc=(0.09+(0.001*LL)+(0.002*PI)
8	Cc=1.25-(0.009*MC)-(0.045*yd)
9	Cc=0.16(0.002*MC)+(0.004*PI)
10	Cc=0.014+(0.006*yd)+(0.0001*PI)
11	Cc1.02+(0.003*LL)+(0.12*MC)+(0.04*yd
12	Cc=(0.20+(0.003*MC)-(0.01*yd)+(0.003*PI)
13	Cc=1.27-(0.001*LL)-0.002*MC)+(0.002*PI)
14	Cc=0.038+(0.001*LL)-(0.007*yd)-(0.002*PI)
15	Cc=0.991(0.629+(0.0017*LL)+(0.007*MC)+(0.031*yd+0.002*PI)

V.K. Stalin, [20] has carried out, "Analysis of compressibility and swelling equations". He has collected data on cc and LL and found that there is no cc equation available in the literature for over consolidation soils except Hough (1986) equation i.e. $C_c = 0.3 (e_o-0.27)$ Hence he has given a Cc equation for over consolidated soil as follows:

$C_c = 0.0053$ (LL-18.5). 2.15)

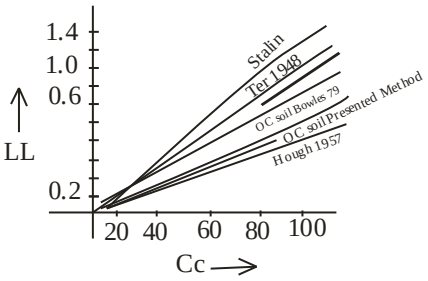

Fig.2.7. Liquid limit vs compression index

M. Aysen LAV *et.al.* [21], have studied "Regression Analysis of soil compressibility." collected data base consisting of 300 dataset record of 40 years from different parts of turkey which contains index properties and consolidation parameters and conducted a statistical study to determine suitable co-relation for estimating consolidation response. For this purpose they adapted various linear regression models were adopted and a parametric study was carried out in order to obtain the most suitable and practically applicable relationships. They have divided data in ten groups and compared its reliability with the Test data of 700 samples of Azzons (1976) They have observed that the void ratio, water content, liquid limit and dry unit weight yielded sufficiently reliable co-relation.

Table 1. List of expression for Compression Index

Proposed Equation	Applicability	Reference
$C_c = 1.15(e_0 - 0.35)$	All clays	Nishida, 1956
$C_c = 0.30(e_0 -$	Silty clays	Hough, 1957

0.27)		
C_c = 0.75(e_0 – 0.50)	Soils of very low plasticity	Sowers, 1970
C_c = 0.40(e_0 – 0.25)	All natural soils	Azzous.et al., 1976
C_c = 0.01w_n	Chicago clays	Osterberg, 1972
C_c = 0.01(w_n –5)	All natural soils	Azzous.et al., 1976
C_c = 0.07 (w_L – 7)	Remoulded clays	Skempton, 1944
C_c= 0.009(w_L – 10)	Normally consolidated clays	Terzaghi & Peck, 1967
C_c= 0.006(w_L–9)	All natural soils	Azzous et al., 1976

No	Subgroup Property	Data Sets
1	Low plastic soils	139
2	Highly plastic soils	161
3	Normally consolidated	141
4	Over consolidated	159
5	Dry density < 1.3 tcm	118
6	1.3<Dry density is < 1.6 tcm	130
7	Dry density < 1.6 tcm	52
8	Liquidity index <0.2	152
9	Liquidity index >0.2	148

Table No. 2 Summary of Relationship Developed to Evaluate Compression Index for Subgroup

Independent variable	Correlation coefficient	Regression equation
Water contain, w_n	0.803	1n Cc = 1.235 1n w_n – 5.65
	0.784	Cc = 0.479 1n w_n – 1.367
	0.758	Cc = 0.012 w_n –0.1
Liquid limit, w_L	0.509	Cc = 0.006 (w_L +1)
Void ratio, e_o	0.765	Cc = 0.40 e_o –0.10
	0.785	Cc = 0.485 1n e_o +0.329
	0.817	1n Cc = 1.272 1n e_o – 1.282
Dry unit weight, γk	-0.817	Cc = 0.618 – 0.975 γk

Table No. 3 Summary of Relationship Developed to Evaluate Compression Index for Subgroup

Subgroup	Correlation coefficient	Regression equation
Low plastic	0.762	Cc = 0.32 1n w_n – 0.838
	0.820	1n Cc = 1.43 e_o – 1.19
	0.744	Cc = 0.012 w_n – 0.086
	0.800	Cc = 0.407 e_o – 0.094
	0.814	Cc = 0.317 +0.338 1n e_o
	0.812	Cc = 0.556-0.769 1n γk
Over consolidated	0.721	Cc = 0.481 1n w_n – 1.376
Normally consolidated	0.877	Cc = 0.012 w_n – 0.098
	0.890	Cc = 0.43 e_o – 0.122
	0.661	Cc = 0.007 w_L – 0.029
Liquidity Index > 0.2	0.716	Cc = 0.012 w_n – 0.085
	0.736	Cc = 0.405 e_o – 0.064

Sudhakar M Rao [22], has studied "correlation between plasticity angle and engineering properties of volcanic ash soils,". He examine the effect of allophone and Hallosytic mineral on Index properties of soil and has given correlation coefficient as 0.73 and a linear regression equation in between Modified compression Index and plasticity angle of volcanic soil as follows:

$$\frac{Cc}{(1+e_o)} = 0.016\alpha - 0.091 \qquad (2.16)$$

Where, plasticity angle $\alpha = \tan^{-1}$ x Plasticity Index/Liquid Limit - 20

He concluded that decrease in allophane minerals decreases shearing resistance and increases compressibility

Moshleh. A, AL-Shamrani, [23], have studied "Application of the C_α/c_c concept to secondary compression of Sabkha soils". They have studied coastal saline deposits of Saudia Arabia, containing some organic matter. They have tested it for one dimensional consolidation test and developed a correlation in between C_α/c_c = 0.037, This ratio can also be used for prediction of secondary compression by using Buisman's equation, as follows.

$$S_b = \frac{C_\alpha}{1+e_p} Hp \log \frac{t_f}{t_p} \qquad (2.17)$$

2.2.6. Settlement of soil and its prediction

J.C. Chai *et.al.* (24). They have studied "compression and consolidation characteristica of structured natural clay." They have reported that voides ratio (e) and effective stress (p^1) is more linear in ($e+e_c$) – in p^1 plot then e – in p^1 plot where e_c – is a soil parameter Hence they concluded that in structural clay the linear ($e+e_c$) – in p^1 relation can simulate the load settlement curve much better than the linear e – in (p^1) relation.

Jennifer Mc phail, [25], have studied "Evaluation of consolidation settlement using the sub layer Method." They have concluded that one point conventional method for consolidation settlement can be represented by the following equation

$$S = \left[\frac{cc}{1+e}\right] H \log\left(\frac{P_{new}}{P_{old}}\right) \qquad (2.18)$$

This equation is associated with error ranging from 100-300% They have divided soil into no. of sub layers and calculated stress in each layer by Boussinesq equation or Newmarks Integration with the help of constle computer program and find out total consolidation. It is reported that in 30 m deep layer the consolidation settlement find out by conventional method is only 1.8 cm where as by sublayer method it is 37.6 cm. It is important to note that, in conventional method settlement decreases with the increase in thickness of layers, where as in sub layer method it is increases.

Luc Morissetlle *et.al.* [26], have "studied empirical settlement prediction in over consolidated marine champlain sea clays," They reported an empirical model by using several published settlements records obtained at embankments on overconsolidated champlain clay,

They have considered $\frac{\Delta 6_v}{(\Delta p^1 - 6_{vo})}$ average value for settlement calculation and plotted. A graph OCR vs compression % by the following equation.

$$\text{Comp \%} = 34.3 \log \frac{\Delta 6_v}{(\Delta p^1 - 6_{v0})} + 21.4 \log \text{OCR} - 9.04 \qquad (2.19)$$

The settlement for 7 years are calculated and for next 15 years were estimated by simply projecting the available data on arithmetic time scale plot. Having error range of in between $\pm$ 33%. The model is validated after performing consolidation test from different sites and finding c_c values which ranges in between 1.5 to 2.8. Here they adopted a correlation factor 3 if C_c value is more than 3.

N Sivakugan & K Johnson [27] have studied "settlement predictions in granular soils : a probabilistic approach" They have presented state of the art settlement predictions and reported that following are the four important methods for predicting settlements in granular soil. Tera zaghi and

Pech (1967), Burland and Burbidge (1985), Schemertmann (1978), and Beradi and Lacellotta (1994).

Here they have used extensive database of settlement records and reported settlement ratio which is the ratio of predicted to measured settlement and follows a reverse J shape beta distribution with a strong skew to the right. Using Beta distribution parameters, separate design charts were developed for the four methods which enable designer to estimate the probability where the actual settlement in the field will exceed a certain limiting value. For Traditional value if 25 mm it gives range from 15 to 40 mm values for unconventional structure Therefore it becomes a very useful tool for designer of shallow foundations. The probabilistic approach proposed here can be extended to include other settlement prediction methods as well.

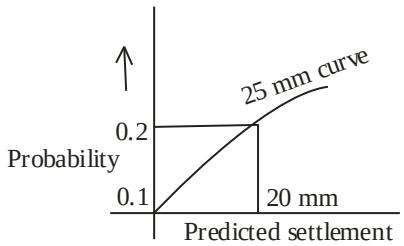

Fig. 2.8. Probability vs predicted settlement

They reported that Settlement obtained by terrazaghi method show that 20% probability is for settlement exceeding 20 mm, Hence 80 % , accuracy is reported as compaired to other method.

M.A. Shahin *et.al.* [28] have studied "Neural Network stochastic design chats for settlement prediction." They have reported that by using Artificial Neural Networks model (Shahin 2002 a) and Monte Carlo Technique, stochastic charts can be prepared which will give more accurate settlement predictions.

These stochastic approach incorporate parametric uncertainty or Model uncertainty and quantified it in term of probability distribution function which given the risk level associated with exceeding predicted settlement. They have also examined the effect of varying the uncertainty on the settlement affecting factor i.e. coefficient of variations for q (load) & M (Compression). As the value of q & M increases settlement values from 29.2 mm increases to 42.6 mm for a non exceeding probability of 95% Hence effect of q & M can not be neglected in predicting the settlement. Ex. Graph shows that prediction 22mm settlement is having only 5% risk to exceed beyond 34 mm settlement.

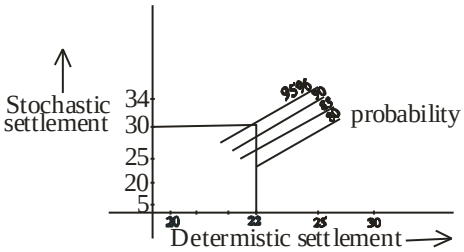

Fig.2.9. Stochastic settlement and relation in between deterministic settlement

2.6.1.State of the Art settlement prediction Methods:

Following are the methods for predicting settlement in soil.

1) Asaokas Method (1978) based on observation.

$S_n = \beta_0+\beta_1 S_{n-1}$ ($_n$-time,β_0 β_1-parameters.$_s$-Settlement.)

(2.20

2) Janbu (1991,1994) based on settlement potential 'R' method.

$$R=s.t = \frac{\triangle s}{\triangle t}$$

(2.21)

Researchers a constant value and after it long term settlement is found out:

Based on approximate soil of consolidation equation. It can be modified as:

$$R = \begin{cases} R_o \sqrt{\dfrac{t}{t_{50}}} & t \le t_{50} \\ R_o & t < t_{50} \end{cases}$$

(2.22)

R_o – is constant value of settlement potential

Longer settlement can be found on as

$$R=\begin{cases} = S_o \dfrac{2R_o(\sqrt{t}-\sqrt{t_0})}{\sqrt{t_{50}}} & t \le t_{50} \\ = S_o + 2R_o\left(1-\dfrac{\sqrt{t_0}}{\sqrt{t_{50}}}\right)+R_0 \text{ in}\left(\dfrac{t}{t_{50}}\right), & t \le t_{50} \end{cases}$$

(2.23)

Where t_o is initial time for S_o settlement.

Koronen (1977) has given eqn

$$S = \frac{t}{a+b.t}$$

(2.24)

Where a and b are parameters can be find from graph

Hee Lassrivaara substituted this equation with Junbus equation which is as follows:

$$R_0 = t \xrightarrow{\text{limit}} \infty \quad \frac{t}{a+b.t}$$

2.25)

$$R_0 = \frac{1}{b}$$

4) Taylor's (1948) has given a well known square root of time fitting method to find C_v where curve plotted is straight upto 60% primary consolidation.

$S = a\sqrt{t}$ [a-is slope coefficient]. (2.26),Good results can be obtained if it is replaced by exponent 0.5 with b variable. $S = at^b$ (2.27)

The b exponent is ranging betn 0.4-0.6m and co-relation factor is close to one.

For example, a clay is tested which gave 70% consolidation at 0.5 h hence. Power Function we get is S=0.668 t 0.5334 with correlation factor R^2=0.9992, Here 'b' is calculated from formula and plotted 'b' verses time minimum number of observation 3 needed with two previous added & all previous taken also and predicted settlement for above is obtained plot graph 0.5 hrs. Settlement after (0.5h) which will show a straight line. Therefore against observed value 0.477 mm we are getting same value after prediction.

O Ravaska," [29] "has develop "A simple Method to predict settlement from previous measurements and given a power function y = a x_b which suits very well to the settlement observations, and easily compared to other available methods like Janba (1991) Asaoka (1978) and Karhomem hyperbola methods (1977).They have conclude that Initial observation of settlement are useful for predicting the future settlement with the help of above said model. It is an extension of square root of tunic fitting method in which square root is replaced by power function. In this experiment they have considered test data of two embankment in Finland and compared it with four methods & reported that There is no difference in between power Function method and Jan bus method and they are better than Asanka's & hyperbola method.

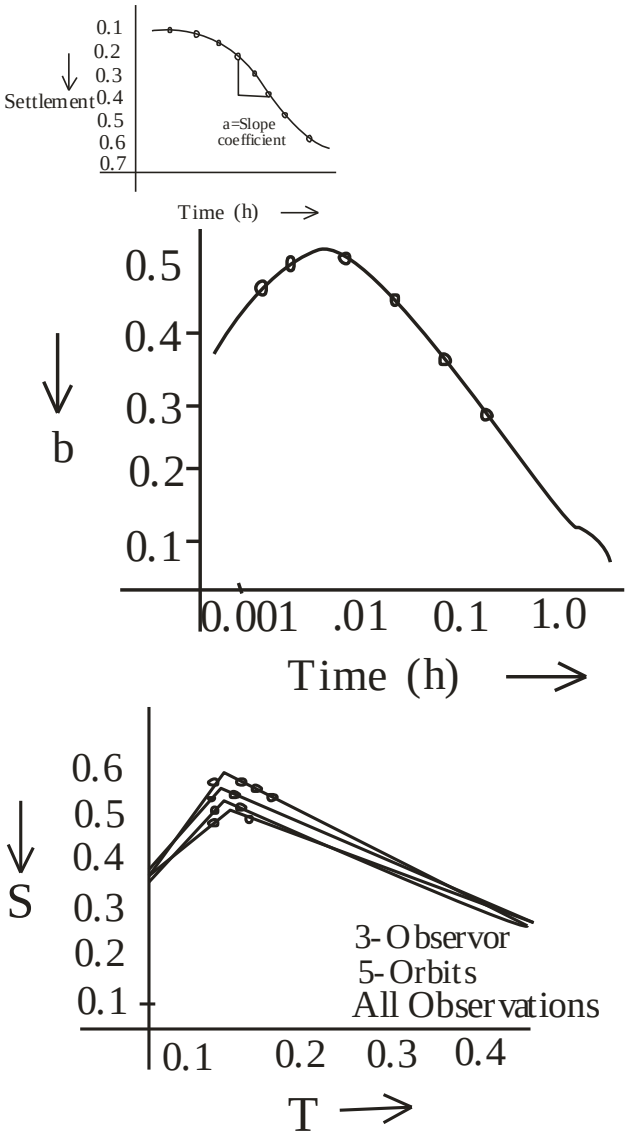

Fig.2.10. a) Relation in between b) Effect of time on settlement c) Relation in between time Time and Predicted settlement.In this experiment they have used 189 Determistic settlement (mm) data points, which can be increased for more applicability of this model in future.

III EXPERIMENTATION AND RESULT

3.1 To develop settlement model

one dimentionalconsolidation is carried out for analysis and development of proper method for predicting settlement of soil .For the present study soil samples are collected from Himayat Bagh Mohammadi Bagh from the depth of 1.5 m,1.8 m,2.1 m, 2.4 m and 2.7 m. and different properties of soil is find out . The sample is tested for finding different properties of soil like specific gravity, density, liquid limit, plastic limit, shrinkage limit etc.soil classification ,coefficient of compressibility ,coefficient of consolidation , The result of this as follows :

S. NO	SAMPLETAKEN AT DEPTH	WC %	SP. GRAVITY	LL	PL	PI	MDD	OMC
1	1.5 m	14.	3.33	42	32	10	1.50	24.3
2	1.8 m	11.	3.22	31	24	7.	1.62	21.2
3	2.1 m	10.	2.47	29	23	5.	1.73	22
4	2.4 m	15.	3.91	30	23	7.	1.66	22.3
5	2.7 m	14.	3.56	29	21	7.	1.62	22.5

The soil is classified as per USCS classifications as CL–ML i.e. inorganic silty clay with low to medium compressibility which are having low plasticity.

3.2 One dimensional consolidation

sample is tested in a consolidation cell having sample ring demension as 2cm height and 6cm diameter. The loading sequence adopted is 0.5,1,2,4,8 kg/cm2 and elapse time sequance is taken as 0.25,1,2.25,4,6.25,9,12.25,16,20.25,25,36,49,64,81,10,121,144,169,225,256,289,324,361,400,500,600,1440 minutes and so on for atleast for each load increment and decrement. samples at natural water contain is loaded upto 8kg/cm2 and then unloaded upto 0.5kg/cm2From the available data of dial gauge and elapse time graph are plotted by Taylor's square root method to find coefficient of consolidation.Cv is important parameter having combined effect of permeability and compressibility. Its is used to find the time rate of consolidation. here the less value of Cv represent the more settlement and vice-versa.

3.3 Compression Index

From the graph obtained in coefficient of consolidation we will find out compression index by taking slope of virgin compression curve. Compression index is the ratio of change in voids ratio to the change in stress is being calculated from the following formula.

$$cc = \frac{\Delta e}{log\left(\frac{6_f}{6_o}\right)}$$

SN	SOIL AT DEPT	CV AT 0.5 KG	CV AT 1.0 KG	CV AT 2.0 KG	CV AT 2.0 KG	CV AT 8.0 KG	AVG CV CM2 /Y
1	1.5 m	0.36	0.38	0.40	0.28	0.27	0.338
2	1.8m	0.45	0.134	0.133	0.20	0.152	0.213
3	2.1m	0.17	0.24	0.182	0.40	0.183	0.235
4	2.4 m	0.085	0.169	0.086	0.12	0.25	0.142
5	2.7 m	0.095	0.163	0.137	0.239	0.126	0.152

Soil	A	B	C	D	E
AT DEPTH	1.5 m	1.8 m	2.1 m	2.4 m	2.7m
Cc for 0.5kg	0.28	0.20	0.21	0.19	0.19
Cc for 0.5kg	0.15	0.19	0.15	0.12	0.13
Cc for 0.5kg	0.13	0.12	0.13	0.13	0.12
Cc for 0.5kg	0.11	0.11	0.12	0.15	0.12
Cc for 0.5kg	0.11	0.11	0.11	0.12	0.11
Cc avg	0.152	0.148	0.144	0.142	0.135

3.4 Computation of Settlement

Computation of settlement is being carried out from the available data of voids ratio and change in height of soil sample. Change in height is nothing but settlement (Sc) and will be calculated as follows:

From the available data of compression index obtained from log6 vs e graph computation of settlement is being calculated from the following equation

$Sc = \frac{\Delta e}{(1+e_o)} H \Delta H = \frac{\Delta e}{(1+e_o)} H$

$$Cc \frac{H}{(1+e_o)} \times log\left(\frac{60+\Delta 6}{60}\right)$$

Sc=

Soil sample	Settlement Observed	Predicted Settlement
A	13.25mm	13.20mm
B	13.10mm	13.05mm
C	12.93mm	12.88mm
D	12.86mm	12.80mm
E	12.40mm	12.35mm

Here settlement value are getting correlation factor R2 as 0.9991 with taylors modified equation .Here observed values are very closed to predicted value .

III CONCLUSION

1) From the above works it is clear that index properties are very important factor which are controlling the consolidation settlement of soil. Particularly shrinkage limit as reported by Shridharan (2004). Hence, there is a need for further analysis and research to elaborate shrinkage limit along with density of soil for the prediction of consolidation settlement of soil.

2) From the literature survey it reveals that very less work has been carried out in combination, in co-relating coefficient of compression and voids ratio with index properties of soil. Further investigation can be carried out in this direction.

3) From the literature survey it is also clear that many researchers have tried to co-relate plastic limit with concern on the similar line some derived parameter like plasticity angle can be studied to develop correlation in between plasticity angle with C_c or Cv of the soil.

4) Very few researchers have studied the co-relation of mineralogy of soil with properties of soil for prediction of settlement. Hence further studies can be done in this direction.

5) After these studies i.e. Cv C_c m_v and mineralogy. It is proposed to co-relate these with settlement of the soil to find out and develop proper parameter, or method that will influence the consolidation settlement of soil.

6) Experimental result and studies on Aurangabad soil shows that observed and predicted settlement values are similar .

7) State of Art settlement prediction method reveals that much work has been carried out by researcher to develop the suitable less time consuming method to find out accurate settlement prediction but no one is unanimously agreed by the researcher on any one method therefore there is a scope for further development for modifying the existing settlement prediction method based on some correlation with index properties of soil. Though their validation and generalization is problematic due to complex nature of soil.

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Preparation, Characterization and Catalytic Applications of Al-SBA-15 type Mesoporous Zeolite for One Pot Efficient Synthesis of Tetrahydrobenzo[c] acridine-8(7H)-one

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ABSTRACT

A clean and efficient method have been developed for the one pot synthesis tetrahydrobenzo [c] acridine derivatives, by three component, cyclocondensation of 1-napthlylamine, dimidone, and variety of substituted aldehydes using Al-SBA-15 as solid heterogeneous reusable catalyst. The catalyst was synthesized by hydrothermal method under autogenous pressure. The prepared catalyst was characterized by Powder-X ray diffraction, Scanning electron microscopy, Energy dispersive spectroscopy, Fourier transform infrared spectroscopy. Brunauer-Emmer-Teller surface area analysis. The present method offers significant advantages over the reported methods like easy separation of catalyst, simple work-up procedure, non chromatographic isolation and purification desired product and excellent yield. Furthermore catalyst could be reused without significant loose in activity.

Keywords: one pot synthesis, tetrahydrobenzo[c]acridine, Al-SBA-15, 1-naphthylamine, dimidone, benzaldehyde.

I. INTRODUCTION

Nowadays one pot synthesis methods has played significant role in organic synthesis because of its advantages such as, minimum steps, short reaction time, high yield, selectivity, and fewer byproducts as compared to classical synthetic methods.1 Nitrogen containing heterocyclic compounds like 1,4, dihydropyridine, acridine are the building blocks of alkaloids and such natural products2 which have been found to possess biological and pharmaceutical activity such as anticancer, antibacterial and antitubercular 3-5some polycyclic acridine derivatives posses DNA binding activity. 6 Beside these 5, 6-dihydrobenzo [c] acridine forms electroluminescent complexes with Iridium and these complexes are used to design organic light emitting devices.7 Therefore, by considering importance of benzo [c] acridine derivatives several methods have been developed using homogenous and heterogeneous catalysts like, heteropolyacids, L-proline, succinnimide-N-sulfonic acid, oxalic acid, ionic liquid, sulphonic acid functionalized SBA-15. 8-13 However, some of them

suffered from some problems like acid fictionalization of catalyst, harsh reaction condition, maximum reaction time, low yield, harsh reaction condition, use of non recoverable homogenous catalyst which generates acidic effluent. Some methods required special conditions such as microwave and/or sonication homogenous Nitrogen containing organic bases like piperidine.14, 15 Hence in order to overcome these limitations it is necessary to find sustainable, efficient and ecofriendly protocol for synthesis of tetrahydrobenzo [c] acridine derivatives.

Heterogeneous solid acids such as metal oxides, supported clays, mesoporous silica, zeolites are playing important role in organic synthesis in order to develop cleaner and eco friendly green process, especially mesoporous silica which offered significant advantages such as non corrosive, reusability, high surface area and better catalytic activity. During past decades, many efforts have been made to synthesize the mesoporous ordered silica (SBA-15, MCM-41, MCM-22) due to their tuneable properties and applications in the field of advanced drug delivery, fluid catalytic cracking16, 17 and supports for active transition oxide nanoparticals which shows superior catalytic activity.18-21 Furthermore Co-Fe-SBA-15 was utilized for degradation of rhodamine dye in water, recently Zn-SBA-15 is reported as effective sorbent for removal of hydrogen sulphide (H2S) gas.22, 23 Structurally SBA-15 is two dimensional ordered hexagonal siliceous materials with mesopores and possess better hydrothermal stability as compared to MCM-41-zeolites. However, such material shows weak Lewis acidity. Several reports were available for tailoring acidity of SBA-15 by isomorphous substitution of trivalent metal ion in SBA-15, which generates strong Lewis acidity in his framework.24 Trivalent Al+3 cation can be incorporated in framework of SBA-15 either by co-precipitation (direct) method or post synthetic grafting to improve the acidity of SBA-15. In continuation of our research work, on development of heterogeneous catalysts and their utilization for synthesis of heterocyclic organic compounds, 25-27 herein we report direct hydrothermal synthesis of Al-SBA-15 zeolite catalyst which is characterized by powder-X ray diffraction, scanning electron microscopy, energy dispersive spectroscopy, fourier transform infrared spectroscopy, Brunauer-Emmer-Teller surface area analysis. The catalytic activity of Al-SBA-15 is tested for one pot synthesis of tetrahydrobenzo [c] acridine-8(7H)-one derivative.

II. Experimental

2.1 Chemicals and instruments

All solvents and chemicals were of analytical grade and purchased from Merck, Avra and Spectrochem chemicals and used as such. Melting points were taken in an open capillary and are uncorrected. FT-IR spectrum was recorded on Perkin Elmer thin layer chromatography was performed on Merck pre-coated silica plates. ^{1}H NMR and ^{13}C spectra were recorded on Bruker Avance 400 MHz FT-NMR spectrometer in $CDCl_3$ as solvent and chemical shifts values are recorded δ (ppm) relative to tetramethylsilane (Me_4Si) as an internal standard. The X-ray diffraction patterns were recorded on Bruker 8-D advance X-ray diffractometer using monochromatic Cu-Kα radiation (λ=1.5405Å). Scanning electron microscope image with energy dispersive X-ray spectroscopy was obtained on JSM - 6390LV6330 LA operated at 30.0 kV. The Surface area was calculated by using Brunauer-Emmer-Teller N_2 adsorption desorption method on Quantachrome CHEMBET 3000 instrument.

2.2 Synthesis of Al-SBA-15 catalyst.

Tetrapropyl ammonium bromide (4 g) was dissolved in 50 ml of deionised water, to this tetraetylorthosilicate (20.8 g 100 mmol) was added dropwise with vigorous stirring, resulting mixture was stirred for 50 min at room temperature to obtain silica sole. Aluminum nitrate $Al(NO_3).3\ H_2O$. 1.2498 g, (3.33 mmol) was dissolved in minimum quantity of deionisd water and added droopwsise to stirred solution of tetraetylorthosilicate. The pH of the solution was maintained to about 12 by adding 0.1 M aqueous solution of NaOH. A white precipitate was formed which was vigorously stirred for 2 hours at room temperature. The homogeneous gel was transferred in Teflon lined stainless steel autoclave and treated hydrothermally under static condition and autogenous pressure at 150 °C for 12 hours. The solid product was filtered, dried in an oven at 100 °C for 5 hours and calcined in muffle furnace at 550 °C for 5 hours under air atmosphere. The resulting material was naturally cooled and named as Al-SBA-15

2.3 Typical reaction procedure for the synthesis of tetrahydrobenzo[c]acridine-8(7H)-one

A mixture of aromatic aldehyde (1 mmol), napthylamine (1 mmol), dimidone (1 mmol), and catalytic amount of Al-SBA-15 (0.1g) was refluxed in ethanol (20 ml) for the time shown in (Table. 3). The progress of the reaction was monitored by TLC (petroleum ether: ethyl acetate=7:3 as eluent). After completion of the reaction, the reaction mixture was filtered and the filtrate was poured on crushed ice. The crude product obtained was collected, recrystallized from ethanol to afford pure product (Table 2 entry 2a-2i). All the derivates are reported and confirmed by melting point.

2.4 Spectroscopic data of representative sample

10, 10-Dimethyl-7-(4-hydroxy)-9, 10, 11, 12-tetrhydrobenzo [c] acridine-8 (7H)-one (2e): White solid IR : (KBr, cm^{-1}) 3422, 3323, 3060, 1670, 816, ^1H NMR 1.01 (s, 3H, CH_3), 1.06-108 (s, 3H, CH_3) 2.03-2.07 (dd, C_9-H), 2.20-2.24 (dd, 2H, C_{11}-H), 5.10 (s, 1H, C_7-H), 7.39-7.55 (m, 9H, Ar-H), 8.43-8.45 (d, 1H C6-H), 8.99 (s 1H, NH) 9.15 (s, 1H, OH) ^{13}C NMR : 26.75, 29.36, 32.05, 38.90-40.36, 50.36, 78.51-79.17, 101.75, 114, 121, 130.49, 139.31, 151.37, 155.30, 193.48. LCMS: M^{+1} = 370

III.Result and discussion

3.1 Powder X-ray diffraction analysis

X-ray diffraction patters of uncalcined and calcined SBA-15 are given in Fig. 1. Which shows intense peaks at 2θ° = 6.834, 7.180, 21.052, 29.324, 43.402, 45.171 with corresponding planes (100), (100), (111), (400) (600), (430) respectively, the plane (100) indicate the presence of ordered hexagonal structure of Al-SBA-15 type material. A broad peak between 20-25° is due to presence of amorphous mesopours silica.[28] The reflection plane (400) is due to the formation of nanocrystalline Al_2O_3.[29]

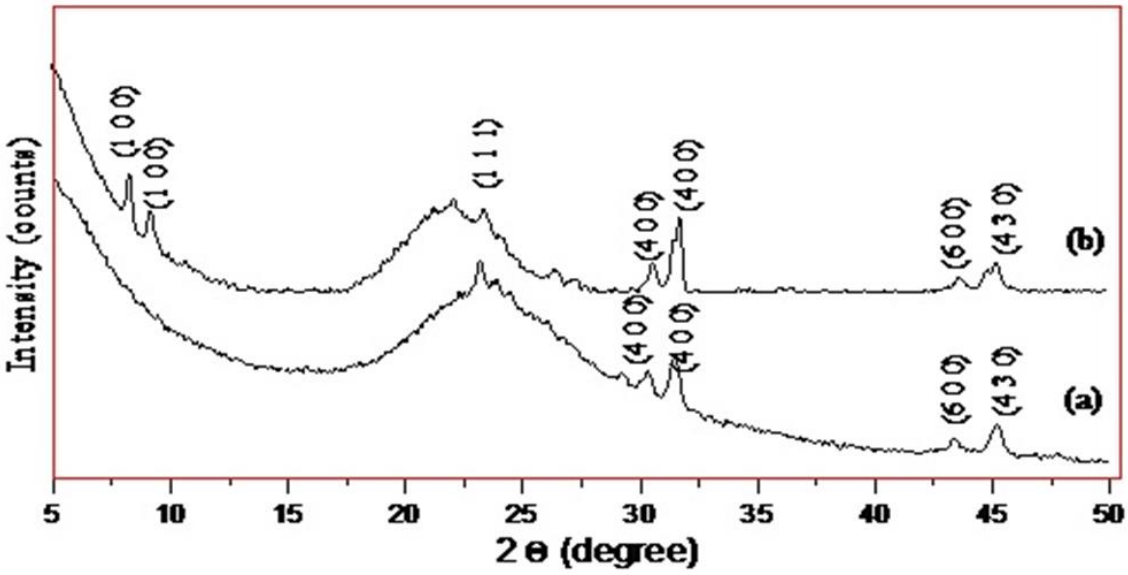


Figure-1 Powder XRD pattern of (a) Al-SBA-15 uncalcined (b) Al-SBA-15 calcined at 550°C

3.2 Scanning electron microscopy-Energy dispersive Spectrometry analysis

In order to study the surface morphology and chemical composition of synthesized catalyst it was analyzed by SEM-EDS spectroscopy. The Fig.2 (a) shows sponge like morphology for uncalcined Al-SBA-15. This may be due to presence of surfactant inside the pores or channels of Al-SBA-15 framework. The same catalyst was calcined at 550°C and it shows nano rod shaped crystals with size 170.88 - 226.27 nm along with mesoporous silica (Fig.2 (b) the Al-SBA-15). These rod shaped crystals may be grows during calcinations process. The elemental composition of calcined Al-SBA-15 is shown in Fig 3 which confirms the presence of Si, Al, O and Na on the basis of atomic wt% 43.17, 3.82, 50.16 and 2.86 respectively.

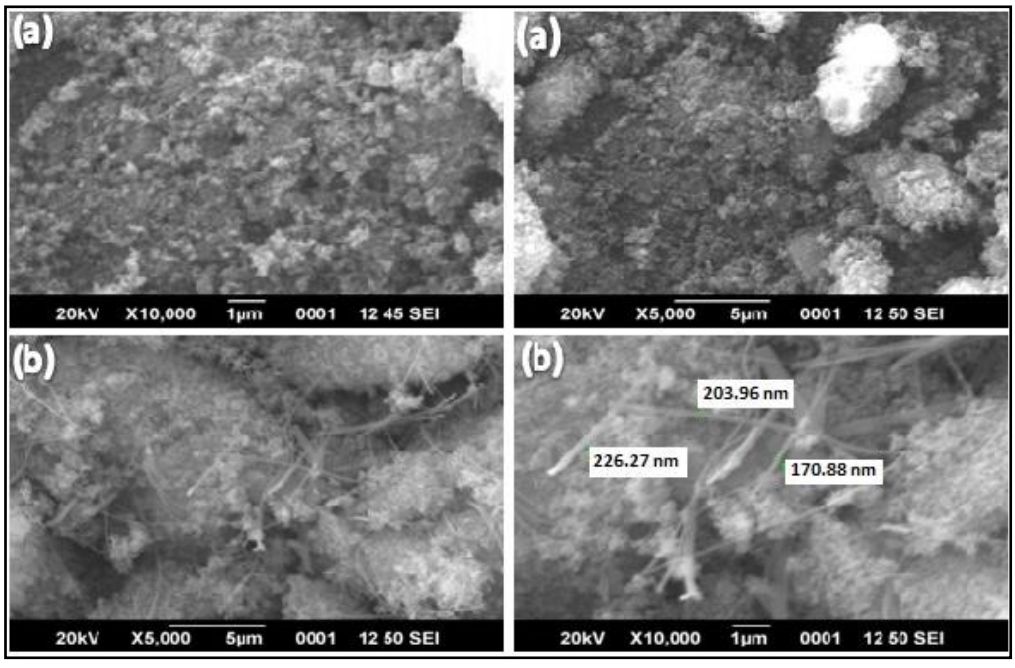


Figure-2. (a) SEM image of Al-SBA-15 unclcined (b) SEM image of Al-SBA-15 calcined at 550°C

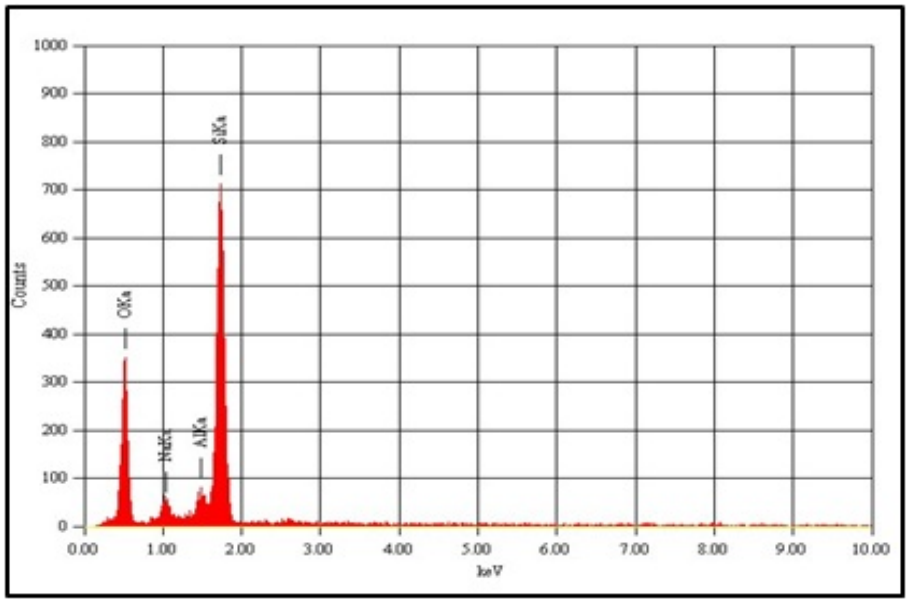


Figure-3 EDS-Spectrum of Al-SBA-15 calcined at 550°C.

3.3 Brunauer-Emmer-Teller surface area analysis

Surface area, average pore diameter and pore volumes were calculated by N_2 adsorption and desorption isotherm method. The BET surface area, average pore diameter and pore volume of calcined Al-SBA-15 was found to be 31.792 m^2/g, 51.1753 Å and 0.04047 cm^3/g.

3.4 Fourier transform infrared spectroscopy analysis

Figure 3 (a-b) shows peak at 468-471, 795-802, 1099-1103 cm^{-1} is due to the symmetric starching of Si-O-Si bond form SiO_2 tetrahedron inside the framework, the stretching vibration of O-Si-O bond is observed in the range 1099-1103 cm^{-1} in present work confirm formation of characteristic ordered Al-SBA-15 framework.[30] The peak at 1689 cm^{-1} is attributed to deformation mode of Si-OH bond. The broad band appear between 3437-3442 cm^{-1} confirms presence of bridged hydroxyl group.[31]

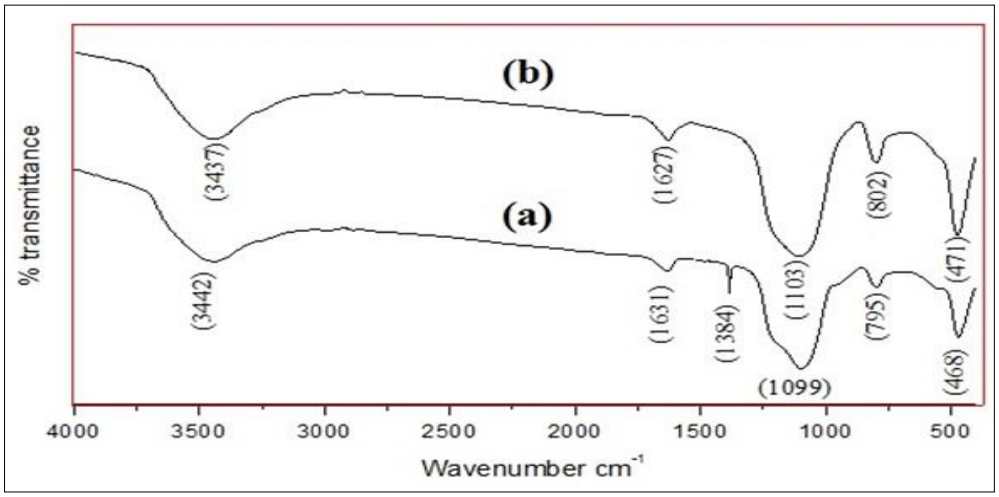


Figure-3 (a) FT-IR Spectrum of (a) Al-SBA-15 uncalcined (b) Al-SBA-15 calcined at 550°C

3.5 Optimization of reaction conditions

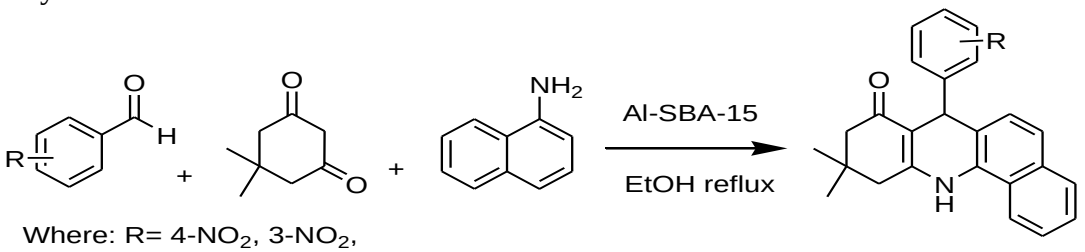
In order to investigate optimum loading of catalyst amount and suitable reaction condition, 4-OH-benzaldehyde (1mmol), 1-Napthylamine (1mmol) were allowed to react with dimidone (1mmol) as model reaction with different amount of calcined Al-SBA-15 as catalyst and various solvents at reflux condition the results are summarized in (Table 1). In the absence of catalyst the reaction did not give desired product (2e), which indicate important role of catalyst. It has been found that the 0.1 gm of calcined Al-SBA-15 is suitable to catalyze reaction smoothly. The same reaction was carried out under different protic and aprotic solvents and it is observed that the reaction proceeds faster in protic solvent such as water and ethanol with maximum yield in reduced time as compare to non protic solvents such as terahydrofuran and actonitrile which gave lower yield (Table 1)

Table 1. Optimization of catalyst loading with different solvents for the synthesis of (2e).

Entry	Solvent	Catalyst amount (g)	Time (min)	Yield(%)[a]
1	Ethanol	-	120	30
2	Methanol	-	120	25
3	Acetonitrile	-	120	23
4	1,4-dioxane	-	120	27
5	Tetrahydrofuran	-	120	21
6	Water	-	120	40
7	Ethanol	0.05	45	80
8	Ethanol	0.10	45	92
9	Ethanol	0.15	45	92
10	Ethanol	0.20	45	92

Reaction conditions 4-OH-benzaldehyde (1mmol), 1-Napthylaine (1mmol), and dimidone (1mmol), different solvents (15 ml) under reflux

[a] Isolated yields.



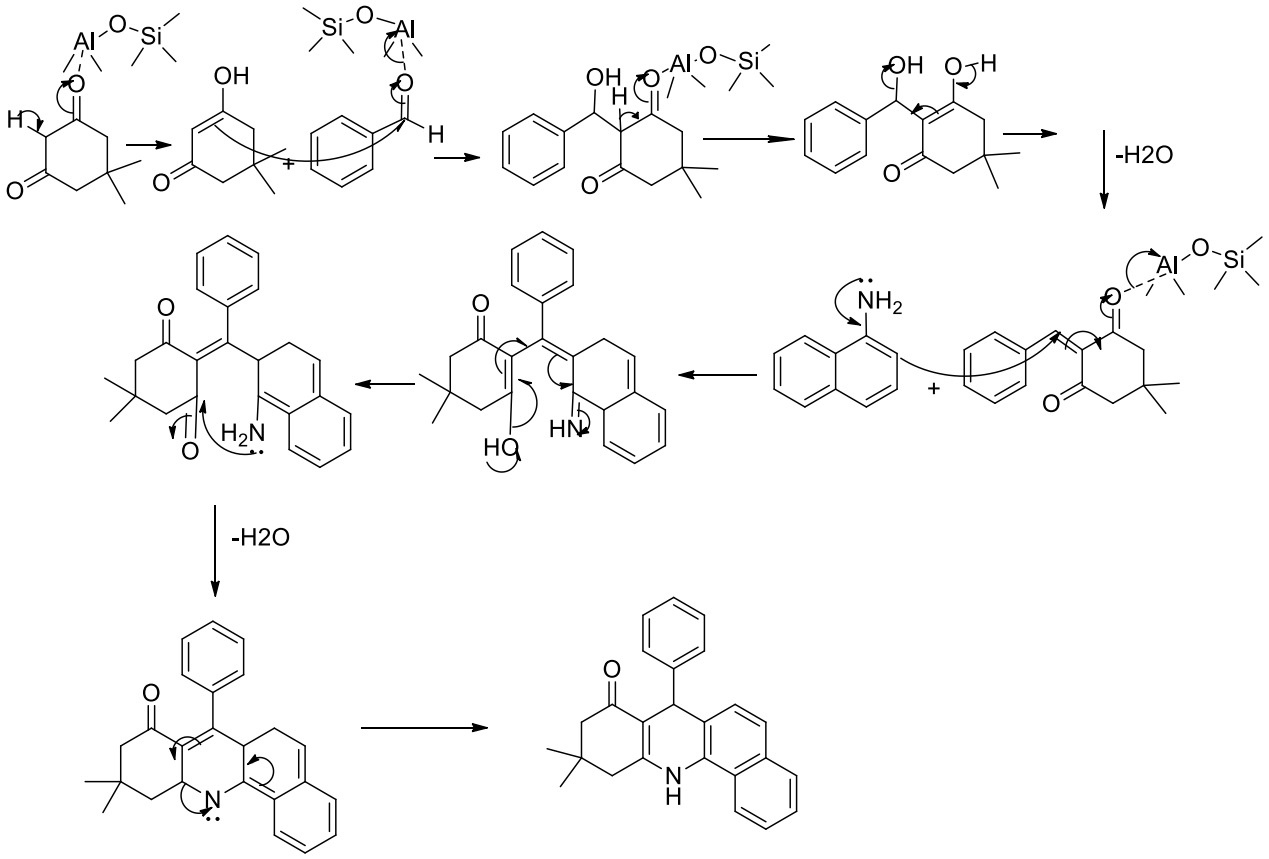
Where: R= 4-NO_2, 3-NO_2, 4-OCH_3, 4-OH, 4-Cl, 2-Cl, N,N-CH_3, 4-Br.

Scheme 1. Synthesis of tetrahydrobenzo [c] acridine-8-(7H)-one derivatives

In order to investigate the scope and importance of the present method, different aromatic aldehydes were tested under optimum reaction conditions and it is observed that there is no significant effect on the yield

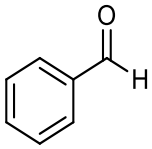
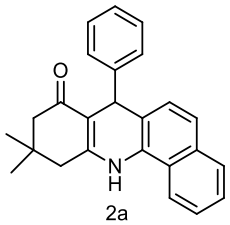
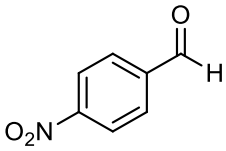
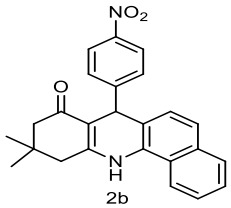
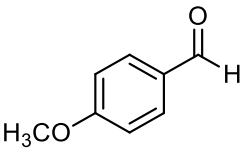
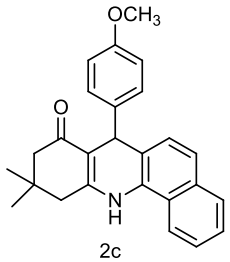
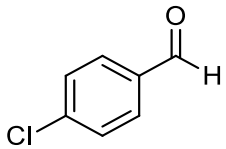
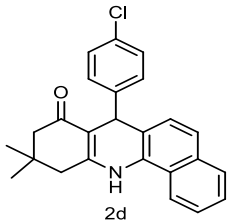
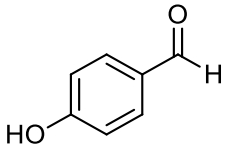
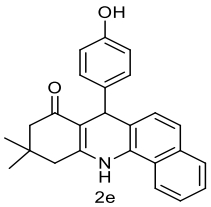
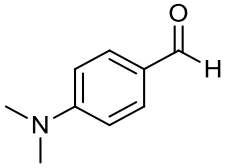
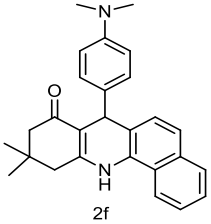
of corresponding tetrahydrobenzo [c] acridine-8(7H)-one derivatives in stipulated time (Table 2). The efforts have been made towards the recovery and reusability of the catalyst. After completion of reaction, Al-SBA-15 catalyst was recovered by filtration and washed with acetone and activated by drying at 150°C for 3 h before the next catalytic run. Reusability of the catalyst was investigated for two times and it was found that the catalyst has retained almost consistent activity (Table 2, entry 5). The plausible reaction mechanism is depicted in sheme-2. The reaction proceeds via Knoevenagel condensation between benzaldehyde and dimidone followed by Michael addition of 1-Napthylamine on intermediate adduct.

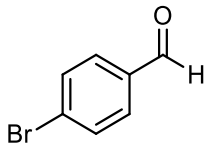
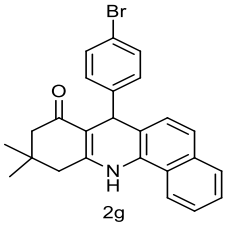
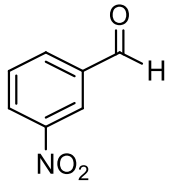
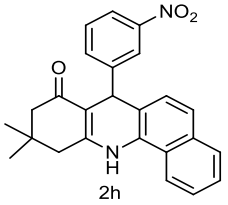
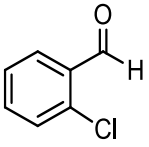
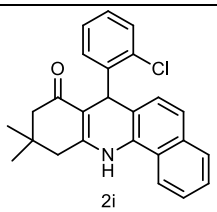
The tri-coordinated aluminum in the framework of SBA-15 act as Lewis acidic center which binds to the carbonyl oxygen of benzaldehyde thereby increasing electrophilicity of carbonyl carbon.



Scheme 2. Plausible reaction mechanism for Al-SBA-15 catalyzed one pot synthesis of tetrahydrobenzo [c] acridine-8-(7H)-one derivatives

Table 2. Al-SBA-15 catalyzed cyclocondensation of aromatic aldehyde, dimidone and 1-napthylamine.

Entry	Aldehydes (R)	Product	Time (min)	Yield (%)[a]	R_f value	Melting point (°C) (Observed)	Melting point (°C) (Literature)
1		 2a	45	93	0.65	260	258-259 [13]
2		 2b	45	92	0.70	280	283-285 [13]
3		 2c	45	92	0.78	260	259-261 [13]
4		 2d	45	90	0.76	262	264-266 [10]
5		 2e	45	92 (92,90)[c]	0.60	280	278-280 [10]
6		 2f	45	90	0.76	270	275-277 [10]

7		 2g	45	89	0.60	281	280-282 [13]
8		 2h	45	91	0.68	266	266-268 [10]
9		 2i	45	93	0.66	243	244-246 [13]

Reaction conditions benzaldehyde (1mmol), 1-Napthylamine (1mmol), dimidone (1mmol) and (0.1 g) calcined Al-SBA-15 catalyst in ethanol 20 ml. [a] Isolated yields. [c]Yield after consecutive cycle

To specify the advantages of proposed method, results of different reported methods are compared with our results and are summarized in Table 3. It is found from tabulated results that, Al-SBA-15 promotes reaction more effectively than other reported methods.

Table 3. Catalytic performance of different catalysts for the synthesis of tetrahydrobenzo [c] acridine-8(7H)-one derivatives.

Entry	Catalyst	Condition	Time (min)	Yield (%)	References
1	$H_6P_2W_{18}O_{62}18H_2O$	reflux , ethanol	110	70	[07]
2	Succinimide-N-sulfonic acid	Ethanol, 60°C	60	88	[10]
3	Oxalic acid	Water, reflux	60	96	[11]
4	Ionic Liquid	60°C	35	93	[12]
5	Sulphonic acid functionlized SBA-15	Solvent free , 140°C	10	90	[13]
6	Piperidine	Piperidine, 75°C	60	93	[14]
7	Al-SBA-15.	reflux in ethanol	45	92	Our results

IV. CONCLUSION

In summary, we have synthesized Al-SBA-15 zeolite by hydrothermal method. The Powder X-ray diffraction analysis confirmed hexagonal phase. SEM images show nano road ranging from 170.88 to

226.27 nm. The FT-IR analysis shows presence of bridge and surface hydroxyl group (Bronsted acidity). The catalytic activity of Al-SBA-15 was tested for one post synthesis of tetrahydrobenzo [c] acridine-8(7H)-one derivatives via cyclocondensation of 1-nathylamine, dimidone, and variety of substituted aldehydes Present method offers remarkable advantages such as non-toxic, non-corrosive and an inexpensive reaction conditions. Simple recovery and reusability of the catalyst, non chromatographic purification and isolation of tetrahydrobenzo [c] acridine-8(7H)-one derivatives makes the reaction more successful under environmental benign conditions.

V. ACKNOWLEDGEMENT

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Soil Carbon Recognition using Hyper Spectral Image Remote Sensing

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ABSTRACT

Soil carbon is a crucial component of the Earth's climate system, and its recognition is essential for understanding and managing the carbon cycle. Hyperspectral image remote sensing is a promising technique for soil carbon recognition, as it can provide high dimensional spectral data that can be used to characterize the spectral signatures of different soil carbon contents.

Soil carbon content is crucial in assessing soil health, fertility, and its role in mitigating climate change through carbon sequestration. Traditional methods for soil carbon measurement are often laborious, time-consuming, and limited in spatial coverage. In response to these challenges, this project aims to develop a novel approach for soil carbon recognition using hyperspectral image remote sensing, providing an efficient and accurate method for soil carbon estimation.

The project begins with a comprehensive literature review on soil carbon estimation and remote sensing techniques. It explores traditional soil carbon measurement methods, including soil sampling and laboratory analysis, as well as the emerging field of remote sensing and its applications in soil carbon estimation. Hyperspectral remote sensing is thoroughly examined to understand the principles of hyperspectral imaging and various data analysis techniques used to extract meaningful information from hyperspectral data.

The necessity for a remote sensing-based soil carbon recognition system is highlighted, focusing on the limitations of conventional methods and the advantages of hyperspectral image analysis. The problem definition clearly emphasizes the need for an accurate and efficient system to estimate soil carbon content across large areas.

The objectives of the project are outlined, which include the development of a robust soil carbon recognition system, the evaluation of its accuracy and reliability, and the exploration of potential applications in agriculture, land-use planning, and environmental monitoring. The scope of the project is discussed, detailing the specific components of the proposed system and the limitations that may arise due to environmental factors and spectral data noise.

The abstract also emphasizes the diverse applications of the proposed system. It highlights how the system's successful implementation can contribute to precision agriculture by optimizing fertilization and irrigation strategies based on soil carbon content. Additionally, it explains how the system can assist in land-use planning by assessing soil quality for suitable land utilization and zoning. Furthermore, the abstract emphasizes the importance of environmental monitoring by tracking changes in soil carbon levels to support carbon sequestration initiatives.

The project's organization and plan are briefly outlined, with a step-by-step explanation of the phases involved in the project's execution. This includes the literature survey, data collection, system development, performance analysis, and conclusion.

Throughout the project report, various methodologies and techniques are described in detail. This includes data collection processes for acquiring hyperspectral images and ground truth soil carbon data, as well as preprocessing steps to remove noise and atmospheric corrections. The feature extraction and selection methods used to extract relevant spectral information from the hyperspectral data are also elaborated upon.

A major focus of the project is on the development of a robust machine learning model for soil carbon prediction. The abstract outlines the key steps in model development, including model selection, hyperparameter tuning, and validation using cross-validation techniques. The performance evaluation parameters are also mentioned, which include mean absolute error (MAE), root mean squared error (RMSE), and R-squared (R^2) to assess the model's accuracy.

The implementation details of the proposed system are provided, including the programming environment and libraries used for data processing, analysis, and model implementation. The database specification, consisting of hyperspectral images and corresponding ground truth soil carbon data, is also explained in detail.

The abstract includes an overview of the results obtained from the performance analysis. It briefly discusses the evaluation metrics, the comparative analysis with existing methods, and the sensitivity analysis to understand the system's performance in different scenarios.

Finally, the abstract concludes with a summary of the findings, achievements, and contributions of the project. It highlights the limitations and challenges faced during the project's execution and suggests future scope and recommendations for further research and improvements.

This project report presents a study of the use of hyperspectral image remote sensing for soil carbon recognition. The report begins with an introduction to the necessity, problem definition, objectives, scope and limitations, applications, organization, and project plan of the study. The literature review section provides an overview of the state of the art in soil carbon recognition using hyperspectral image remote sensing. The system development section describes the proposed system, database specification, algorithms/techniques/procedures used, performance evaluation parameters, and implementation details. The performance analysis section presents the accuracy/testing results of the proposed system. The conclusion section summarizes the findings of the study and discusses the future scope of research.

Keywords : Mean Absolute Error, Root Mean Squared Error, Hyperspectral Data

I. INTRODUCTION

1.1 Background:

Soil carbon is a critical component of the Earth's terrestrial ecosystem and plays a crucial role in maintaining soil health and fertility. It acts as a reservoir for carbon storage, contributing to climate change mitigation by sequestering carbon dioxide from the atmosphere. Soil carbon content is directly linked to soil quality, agricultural productivity, and overall ecosystem sustainability. Therefore, accurate and efficient methods for

soil carbon measurement and estimation are essential for sustainable land management and environmental conservation.

Traditionally, soil carbon measurement has been carried out through labor-intensive and time-consuming laboratory analysis of soil samples collected from various locations. This approach, though accurate, is limited in spatial coverage and becomes impractical when dealing with large areas or remote regions. In recent years, advances in remote sensing technology have offered promising alternatives for soil carbon estimation over large spatial scales. Hyperspectral image remote sensing, in particular, provides an opportunity to analyze soil properties based on the unique spectral signatures emitted or reflected by different soil components.

1.2 Motivation:

The motivation behind this project is to develop a robust and efficient soil carbon recognition system using hyperspectral image remote sensing. By leveraging the power of remote sensing technology, this project aims to overcome the limitations of traditional soil carbon measurement methods and provide a comprehensive solution for estimating soil carbon content across vast regions.

The key motivations driving this project are as follows:

1. **Improved Efficiency:** Hyperspectral remote sensing enables rapid and non-destructive data acquisition over large areas, significantly reducing the time and effort required for soil carbon estimation.
2. **Enhanced Spatial Coverage:** By using satellite or aerial platforms, the proposed system can cover expansive regions that are otherwise difficult to access with ground-based sampling methods, allowing for a more comprehensive assessment of soil carbon distribution.
3. **Precision Agriculture:** Accurate soil carbon estimation can lead to improved precision agriculture practices, optimizing fertilization and irrigation strategies based on soil carbon content and improving overall crop yield and resource utilization.

Environmental Monitoring: Continuous monitoring of soil carbon levels facilitates effective environmental management, allowing for the evaluation of carbon sequestration initiatives and assessing the impact of land-use changes on carbon stocks

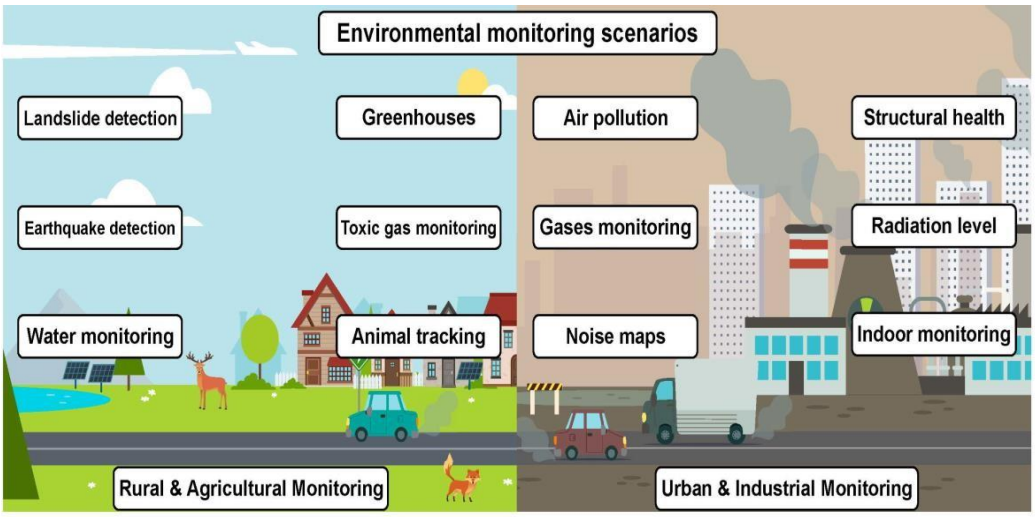


Figure 1 : An environmental monitoring application.

This figure shows an environmental monitoring application where soil carbon content is used to track the impact of climate change. The different colors in the plot represent different soil carbon content levels over time. This information can be used to track the rate of soil carbon loss and to identify areas that are most vulnerable to climate change.

Climate Change Mitigation: Understanding soil carbon dynamics is vital for studying the role of soils as carbon sinks and sources, contributing to global efforts to combat climate change.

2. METHODS AND MATERIAL

Through hyperspectral imaging, remote sensing techniques provide a non-destructive method of evaluating soil organic matter content. Hyperspectral picture data contains highdimensional information about reflectance spectra throughout hundreds or thousands of small spectral bands spanning the visible-near infrared wavelength range of 400-2500nm. Several studies have found strong relationships between soil organic matter concentration and specific spectral features extracted from reflectance spectra (i.e., absorption peaks at specific wavelengths) using statistical analysis tools such as principal component analysis (PCA), independent component analysis (ICA), and others.

Another option is to create predictive models based on machine learning algorithms such as random forest, support vector machines, artificial neural networks, and so on, with specified spectral bands as input variables, to forecast soil organic matter concentrations across wide areas.

Hyperspectral Remote Sensing

Hyperspectral remote sensing is a technique that involves obtaining high-resolution photographs of an area or object in hundreds or thousands of small spectral bands spanning the visible-near infrared wavelength range of 400-2500nm. Hyperspectral sensors can detect the distinctive spectral signatures of various elements such as plants, minerals, and water bodies.

The advantage of hyperspectral remote sensing over regular multispectral imaging (which normally covers only a few broad bands) is that it delivers significantly more comprehensive information about object reflectance spectra. This allows for the identification of specific features within an image, such as individual plant species or mineral types.

Hyperspectral remote sensing has been utilised for a variety of purposes, including: Agriculture: By detecting changes in chlorophyll concentration and leaf structure, the device can be used to evaluate crop health and growth rates.

Environmental Monitoring: It can be used to track changes in land-use patterns, deforestation rates, and levels of air pollution, among other things.

Geology and mineral exploration: Using their unique spectral signatures, hyperspectral data has been utilised to map geological formations and discover mineral reserves.

Forestry Management: It enables forest managers to examine the composition of tree species over wide areas.

What Is the Process of Hyperspectral Remote Sensing?

A hyperspectral sensor takes data over a wide range of narrow continuous bands with extremely small bandwidths (usually 10 nm). These observations are then merged into a single image called a hypercube, in which each pixel contains reflectance values from all wavelengths acquired by the sensors.
Before further analysis, the raw data from these sensors must be preprocessed with techniques such as atmospheric adjustment and radiometric calibration.
For feature extraction, statistical techniques such as principal component analysis (PCA), independent component analysis (ICA), and support vector machine algorithms are commonly used, followed by classification tasks such as supervised learning methods, which involve training models with labelled samples collected from ground-truth observations to help classify each pixel into specific categories.

The Benefits of Hyperspectral Remote Sensing

In comparison to typical multispectral imaging, hyperspectral remote sensing has various advantages:
Exceptional spectral resolution: It delivers far more detailed information about an object's reflectance spectra than other sorts of sensors.
Ability to discern tiny differences: Hyperspectral data can identify things such as distinct flora species or mineral types that may not be visible in normal RGB imagery.
Data acquisition that is both efficient and cost-effective: When compared to manual sampling, hyperspectral images cover huge areas quickly, allowing for continuous monitoring over long periods of time.
Non-destructive: Because the hyperspectral sensor is non-contact, it does not need to come into physical touch with the thing being measured.

Hyperspectral Remote Sensing is the acquisition of images with high spectral resolution that capture a wide variety of contiguous spectral bands.

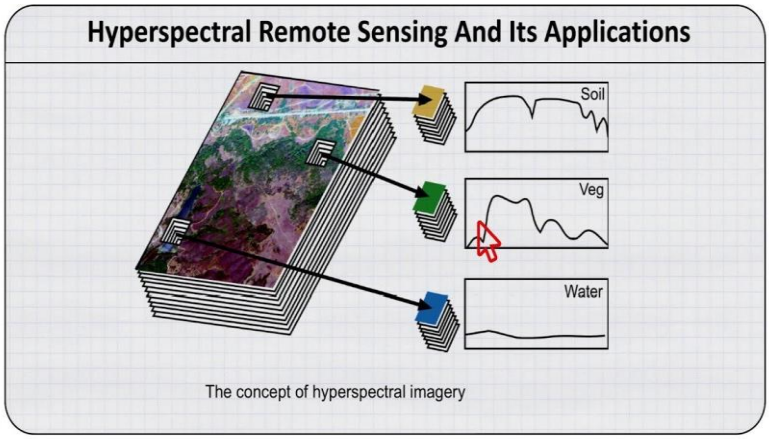
This technology allows for the characterization of surface materials based on their spectral signatures, such as organic matter and carbon concentration in soil. The ability to distinguish small spectrum differences, assess spatial patterns, and provide synoptic coverage of huge areas are all advantages of hyperspectral remote sensing. strategies for Estimating Soil Carbon Content: Several strategies for estimating soil carbon content using hyperspectral remote sensing have been developed.

These techniques can be divided into two categories:

Spectral Indices: Spectral indices are calculated from certain combinations of spectral bands and are used to indirectly assess soil carbon. These indices take advantage of the link between soil reflectance and carbon content by utilising organic matter's absorption and reflectance capabilities. The normalised difference vegetation index (NDVI) and the cellulose index are two examples.

a) The modified triangular vegetation index (MTVI) and the absorption index (CAI). In complicated landscapes, spectral indices may lack accuracy due to their simplicity and computational efficiency.
b) Multivariate Analysis: Techniques for establishing quantitative connections between soil carbon content and the complete hyperspectral dataset are used in multivariate analysis. Principal component analysis

(PCA), linear regression, partial least squares regression (PLSR), and support vector machines (SVM) are examples of these techniques. Multivariate analysis approaches take into account all spectrum information, allowing for more accurate and robust assessment of soil carbon. They do, however, necessitate larger calibration datasets and additional computational resources.



Applications of Hyperspectral Remote Sensing in Soil Carbon Recognition:

Hyperspectral remote sensing has demonstrated significant potential in soil carbon recognition and mapping. By analyzing the spectral reflectance patterns of soils, researchers can infer important soil properties, including organic matter content and carbon stocks. The following are some key applications of hyperspectral remote sensing in soil carbon recognition:

Soil Carbon Mapping: Hyperspectral remote sensing enables the spatial mapping of soil carbon content over large areas. By analyzing the unique spectral signatures associated with different levels of soil carbon, models can be developed to estimate carbon content and create high-resolution carbon distribution maps.

Soil Property Analysis: Hyperspectral data can be used to derive various soil properties related to carbon content, such as soil organic matter content, texture, moisture, and mineral composition. These properties provide valuable insights into soil health, fertility, and nutrient cycling.

Land Management and Agricultural Practices: Hyperspectral remote sensing helps optimize land management and agricultural practices by providing detailed information about soil carbon variability. This information can guide precision agriculture techniques, including variable rate nutrient applications, site-specific irrigation, and land-use planning to maximize carbon sequestration potential.

Climate Change Studies: Hyperspectral remote sensing contributes to climate change studies by providing essential data for carbon stock assessments, carbon cycle modeling, and monitoring changes in soil carbon over time. It helps quantify the effectiveness of carbon sequestration initiatives and evaluate the impacts of land management practices on soil carbon dynamics.

Challenges and Future Directions:

While hyperspectral remote sensing holds great promise in soil carbon recognition, several challenges and future research directions need to be addressed:

Spectral Unmixing: Spectral unmixing techniques are necessary to separate the spectral signatures of different materials present within a pixel. Unmixing techniques need to be improved to accurately identify and quantify the contributions of soil organic matter to the overall spectral response.

Scale and Resolution: Addressing the scale dependency of soil carbon estimation using hyperspectral data is crucial. Research is needed to develop scalable approaches that can capture soil carbon variability at different spatial scales, from field-level assessments to regional and global carbon mapping.

Sensor Calibration and Validation: Accurate calibration and validation of hyperspectral sensors are critical for reliable soil carbon estimation. This includes careful calibration of sensor radiometric and geometric properties, as well as robust validation against ground truth measurements.

Data Integration: Integrating hyperspectral data with other remote sensing datasets, such as LiDAR or thermal imagery, can provide additional information to improve soil carbon estimation. Research is needed to develop integrated models and fusion techniques that leverage the complementary nature of different remote sensing data sources.

Machine Learning and AI: Advancements in machine learning and artificial intelligence algorithms offer opportunities to improve the accuracy and efficiency of soil carbon estimation using hyperspectral data. Developing advanced models that can effectively handle high-dimensional hyperspectral data and extract relevant features is a promising avenue for future research.

Influencing Factors in Carbon Estimation:

Several factors influence the accuracy and reliability of hyperspectral remote sensing-based soil carbon estimation:

Soil Heterogeneity: At many scales, soil characteristics, particularly carbon content, exhibit significant geographic variability. Soil variability makes accurate soil carbon assessment difficult, necessitating careful consideration of sampling strategy, spatial scale, and data preprocessing procedures.

Spectral Interference: In addition to soil reflectance, hyperspectral photographs record contributions from vegetation, water, and other surface elements. Because spectrum interference can impair the accuracy of soil carbon estimation, careful spectral unmixing techniques and atmospheric correction algorithms are required.

Sensor Characteristics: The hyperspectral sensor's spectral resolution, signal-to-noise ratio, and spatial resolution all have an impact on the quality and accuracy of the recorded data. Understanding sensor features and how they affect soil carbon estimate is critical for choosing appropriate datasets and preprocessing procedures.

Here are some key factors that can affect carbon estimation:

Vegetation Type and Coverage: The carbon content of different forms of vegetation varies, and the amount and density of vegetation cover can affect carbon estimation. The carbon stocks in ecosystems are heavily influenced by the leaf area index, canopy structure, and biomass distribution.

Soil Properties: Soil properties such as soil type, texture, organic matter content, and moisture content all have an impact on carbon estimation. Carbon reserves are often higher in soils with a larger organic matter level. Furthermore, soil moisture can influence spectral reflectance qualities, which can impair the accuracy of carbon quantification using remote sensing techniques.

Land Use and Management Practises: Land use and management practises such as agriculture, forestry, and land cover changes can all have a large impact on carbon stores. The conversion of natural habitats to croplands or forests can alter carbon storage. Tillage, crop rotation, and afforestation are all examples of land management practises that can have an impact on carbon content.

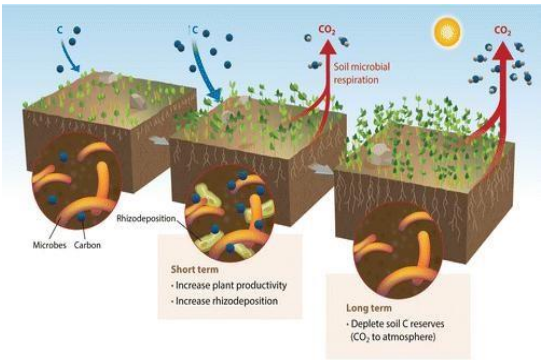
Climate and environmental conditions influence primary productivity and carbon sequestration rates. Climatic variables such as temperature, precipitation, and solar radiation all have an impact on these rates. Carbon stores differ between ecosystems in different climatic zones. Environmental circumstances, such as fire, drought, or flooding, can have an impact on carbon dynamics and quantification.

Spatial Heterogeneity: Within ecosystems, spatial heterogeneity, such as changes in topography, vegetation mix, and soil qualities, can add inaccuracies in carbon assessment.

Data Quality and Resolution: The accuracy of results can be influenced by the quality and resolution of data used for carbon estimation, such as remote sensing photography and ground data. High-resolution data can catch finer-scale changes in carbon stocks, but lowresolution data may smooth out local variations.

Modelling Approaches and Assumptions: The modelling approaches used, such as empirical models or process-based models, as well as the assumptions made throughout the modelling process, can add uncertainty in carbon assessment. Models must take specific ecological aspects into consideration and address potential biases. Scale and Sampling Design: The scale at which carbon estimation is performed, which can range from individual plots to regional or global dimensions, can have an impact on the results. For representative carbon estimation, proper sampling design, including sample size, spatial dispersion, and randomization, is critical.

Sensor Characteristics and Calibration: Sensor characteristics such as spectral resolution, radiometric calibration, and sensor geometry can have an impact on the accuracy of the resulting carbon estimations in remote sensing-based carbon estimation. For trustworthy results, proper calibration techniques and sensor-specific factors are required.



Data Preprocessing and Analysis Methods: Before carbon estimation, remote sensing data undergoes various preprocessing stages such as atmospheric correction, spectral unmixing, and feature selection. The accuracy of carbon estimation might be influenced by the preprocessing processes and analytic algorithms used.

Progression and Difficulties:

Among the most recent advances in soil carbon recognition using hyperspectral images and remote sensing are: Researchers have investigated sophisticated feature selection strategies and dimensionality reduction algorithms to increase the efficiency and accuracy of soil carbon estimation models. These methods seek to discover the most informative spectral features while reducing the computational burden associated with large datasets.

Integrating Hyperspectral pictures with Other Data Sources: Integrating hyperspectral pictures with other data sources, such as LiDAR (Light Detection and Ranging) and thermal photography, has showed promise for improved soil carbon quantification. These integrated approaches make use of complementary data to increase accuracy and capture additional soil features relevant to carbon cycles.

Machine Learning and Deep Learning Methodologies: For soil carbon assessment using hyperspectral pictures, machine learning and deep learning methods such as random forests, artificial neural networks, and convolutional neural networks have gained traction. These techniques provide the promise of more sophisticated pattern recognition and higher accuracy.

The following challenges remain in soil carbon detection using hyperspectral pictures and remote sensing:

a. Availability of Ground Truth Data: Obtaining reliable and representative ground truth data for soil carbon concentration remains a challenge. Creating robust calibration and validation datasets is critical for model development and accuracy evaluation.
b. Scale Dependency: Scale-dependent phenomena, such as spatial heterogeneity and data resolution, can influence soil carbon estimation using hyperspectral remote sensing.

Addressing scale-related difficulties is critical for consistent and trustworthy results.

Transferability:

Due to changes in soil types, land use practises, and climate conditions, models created for soil carbon assessment in one location or ecosystem may not be directly transferrable to other places. Model transferability necessitates careful consideration of site-specific variables as well as proper validation.

4. SYSTEM DEVELOPMENT

4.1 Architecture of the Proposed System

The architecture of the proposed system for soil carbon recognition using hyperspectral image remote sensing involves a series of interconnected components and processes designed to accurately estimate soil carbon content over large spatial scales. The proposed system integrates data acquisition, preprocessing, feature extraction, machine learning model development, and validation stages to achieve its objectives. Here is the detailed architecture of the proposed system:

1. **Data Acquisition:** The first step in the proposed system is data acquisition, where hyperspectral images are collected over the study area using remote sensing platforms, such as satellites or airborne sensors. The

hyperspectral data consists of hundreds to thousands of narrow and contiguous spectral bands, capturing the reflected or emitted electromagnetic radiation from the Earth's surface. The data acquisition process ensures comprehensive coverage of the study area to obtain a representative dataset.

2. **Data Preprocessing:** Once the hyperspectral data is acquired, it undergoes preprocessing to ensure data quality and consistency. The preprocessing steps include radiometric calibration to convert raw digital numbers to reflectance values, atmospheric correction to remove atmospheric effects, and spectral resampling to ensure consistent spectral intervals across all bands. Preprocessing also involves noise removal and outlier handling to improve the overall quality of the hyperspectral data.

3. **Spectral Feature Extraction:** After preprocessing, relevant spectral features are extracted from the hyperspectral data. Spectral feature extraction techniques, such as Spectral Angle Mapper (SAM), Spectral Feature Fitting (SFF), or Principal Component Analysis (PCA), are applied to identify the unique spectral signatures associated with soil carbon content. The extracted spectral features serve as inputs to the machine learning model for soil carbon estimation.

4. **Ground Truth Data Collection:** Ground truth soil carbon data is collected from various locations within the study area through traditional soil sampling and laboratory analysis. This ground truth data is essential for model training, validation, and accuracy assessment. The ground truth data points are georeferenced to match the spatial resolution of the hyperspectral data.

5. **Model Development:** The core component of the proposed system is the development of the machine learning model for soil carbon recognition. Various machine learning algorithms, such as Support Vector Machines (SVM), Random Forest, Neural Networks, or their ensemble variants, are considered. The model is trained using the extracted spectral features and the corresponding ground truth soil carbon data. The training process involves optimizing model parameters to minimize the error between the predicted and actual soil carbon content.

6. **Model Validation and Performance Evaluation:** Once the model is trained, it is validated using an independent validation dataset. The validation dataset contains ground truth soil carbon data not used during model training. The model's predictive performance is assessed using various performance metrics, such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and coefficient of determination (R-squared). The validation process ensures the reliability and generalization ability of the model.

7. **Soil Carbon Estimation:** After successful validation, the trained machine learning model is applied to the entire hyperspectral dataset to estimate soil carbon content across the study area. The model leverages the spectral information from the hyperspectral data to predict soil carbon levels for each pixel, generating a continuous map of soil carbon distribution.

8. **Result Visualization and Interpretation:** The final step involves visualizing and interpreting the results of soil carbon estimation. The continuous soil carbon map is visualized using appropriate visualization techniques, such as color mapping or contour plots. The results provide valuable insights into soil carbon content variations across the study area, aiding decision-making processes for sustainable land management, agriculture, and environmental conservation.

4.2 Data Flow Diagram:

A Data Flow Diagram (DFD) for the proposed system represents the flow of data and processes involved in soil carbon recognition using hyperspectral image remote sensing. It illustrates how data is collected, processed, and utilized to estimate soil carbon content. The DFD typically consists of the following components:

1. **Data Sources:** This includes the hyperspectral image data collected from remote sensing platforms, ground truth soil carbon data obtained through traditional soil sampling and laboratory analysis, and any ancillary data sources, such as topographical information or climate data.
2. **Data Preprocessing:** Data preprocessing steps, such as radiometric calibration, atmospheric correction, spectral resampling, noise removal, and outlier handling, are represented in the DFD as processes that transform and clean the raw data.
3. **Feature Extraction:** The DFD includes processes for extracting relevant spectral features from the preprocessed hyperspectral data, using techniques like Spectral Angle Mapper (SAM), Spectral Feature Fitting (SFF), or Principal Component Analysis (PCA).
4. **Model Training and Validation:** The machine learning model development, training, and validation stages are depicted as separate processes in the DFD. The training process involves optimizing model parameters using the training dataset, while the validation process assesses the model's accuracy using the validation dataset.
5. **Soil Carbon Estimation:** This process represents the application of the trained machine learning model to the entire hyperspectral dataset to estimate soil carbon content across the study area.
6. **Result Visualization:** The DFD includes processes for visualizing the soil carbon estimation results, generating continuous soil carbon maps, and presenting the findings.

4.3 Implementation Details - Software and Tools Used:

The implementation of the proposed system for soil carbon recognition using hyperspectral image remote sensing requires the utilization of various software and tools. The following software and tools are commonly used in the implementation:

1. **Hyperspectral Image Processing Software:** Specialized hyperspectral image processing software, such as ENVI (Environment for Visualizing Images) or MATLAB with Hyperspectral Toolbox, is utilized for data preprocessing, including radiometric calibration, atmospheric correction, and spectral resampling. These software packages offer a wide range of image processing algorithms tailored for hyperspectral data.

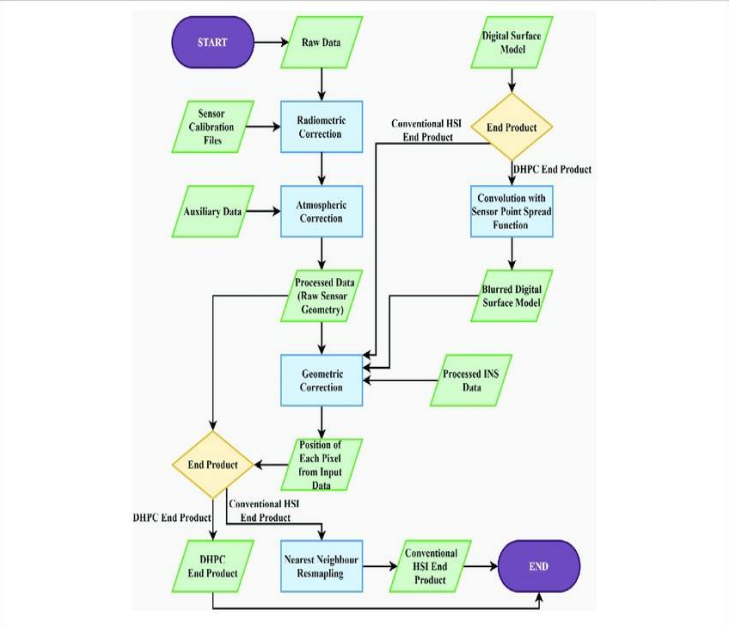


Figure 8 : A hyperspectral image processing workflow.

This figure shows a workflow for processing hyperspectral images. The first step is to atmospherically correct the images, which removes the effects of the atmosphere from the images. The second step is to extract spectral features from the images, which are the different wavelengths of light that are reflected by the ground. The third step is to select the most important features, which are the features that are most correlated with soil carbon content. The fourth step is to train a machine learning model to predict soil carbon content from the selected features.

2. **Machine Learning Libraries:** Popular machine learning libraries, such as scikit-learn (for Python), TensorFlow, or PyTorch, are employed for model development, training, and validation. These libraries provide a comprehensive set of tools for implementing machine learning algorithms, including Support Vector Machines (SVM), Random Forest, Neural Networks, and ensemble methods.
3. **Geospatial Information Systems (GIS) Software:** GIS software, such as ArcGIS or QGIS, may be used to handle geospatial data, visualize ground truth data points, and generate soil carbon maps with spatial interpolation techniques.
4. **Programming Languages:** Python or R are commonly used programming languages in soil carbon recognition implementations. Python offers extensive machine learning libraries and is well-suited for data manipulation, while R provides statistical analysis and visualization capabilities.
5. **Data Visualization Tools:** Data visualization tools, like Matplotlib, Seaborn (for Python), or ggplot2 (for R), are used to visualize the extracted spectral features, ground truth data, and soil carbon estimation results.
6. **Version Control Systems:** Version control systems, such as Git, are beneficial for collaborative development and version tracking of the codebase and project files.
7. **Integrated Development Environment (IDE):** An IDE, such as Jupyter Notebook or Visual Studio Code, provides a development environment with interactive capabilities for code testing, debugging, and documentation.
8. **Data Management Tools:** Database management systems or data storage solutions may be used to organize and store hyperspectral data, ground truth data, and intermediate results efficiently.

4.4 PROGRAMMING ENVIRONMENT:

The programming environment for implementing the proposed system for soil carbon recognition using hyperspectral image remote sensing typically includes the following components:

Programming Language: Python is chosen as the primary programming language due to its extensive support for machine learning libraries, data manipulation, and visualization capabilities. Python provides a robust ecosystem for scientific computing and machine learning, making it well-suited for processing hyperspectral data and developing machine learning models.
Integrated Development Environment (IDE): Jupyter Notebook is used as the IDE for interactive development and documentation. Jupyter Notebook allows the integration of code, visualizations, and explanatory text in a single notebook, facilitating clear and concise communication of the implementation steps.

Machine Learning Libraries: The implementation relies on popular machine learning libraries such as scikit-learn, TensorFlow, and Keras. Scikit-learn provides a wide range of machine learning algorithms and tools for model development, evaluation, and preprocessing. TensorFlow and Keras offer deep learning capabilities, enabling the use of neural networks for more complex pattern recognition tasks.
Data Visualization Libraries: Data visualization is crucial for understanding the data and presenting the results. Matplotlib and Seaborn are used for creating static and interactive visualizations of the spectral data, ground truth data, and soil carbon estimation results.

4.5 CODE STRUCTURE:

The code structure for the implementation of the proposed system follows a modular and organized approach, consisting of the following main components:
Data Preprocessing: This module handles the radiometric calibration, atmospheric correction, and spectral resampling of the hyperspectral data to ensure consistent and high-quality data.

Feature Extraction: The feature extraction module implements techniques such as
Spectral Angle Mapper (SAM), Spectral Feature Fitting (SFF), or Principal Component Analysis (PCA) to extract relevant spectral features from the preprocessed hyperspectral data.

Model Development: The model development module focuses on building machine learning models, including Support Vector Machines (SVM), Random Forest, or Neural Networks, using scikit-learn and TensorFlow/Keras libraries.

Model Training and Validation: This module encompasses the training and validation of the machine learning models using the ground truth soil carbon data. Cross-validation techniques are employed to evaluate the model's performance.

Soil Carbon Estimation: The soil carbon estimation module applies the trained machine learning model to the entire hyperspectral dataset to generate continuous soil carbon maps across the study area.

Data Visualization: Data visualization is integrated throughout the implementation to present the extracted spectral features, ground truth data, and soil carbon estimation results in a visually appealing and informative manner.

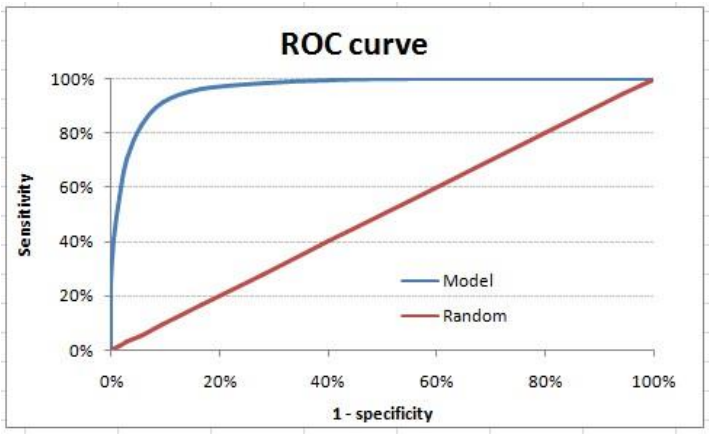


Figure 9 : A machine learning model performance evaluation plot.

This figure shows a plot of the performance of a machine-learning model on a validation dataset. The x-axis shows the different values of the model's hyperparameters, and the yaxis shows the model's accuracy. This plot shows that the model's accuracy is highest when the hyperparameters are set to a specific value.

5. PERFORMANCE ANALYSIS:

The performance analysis aims to evaluate the accuracy and effectiveness of the proposed soil carbon recognition system using hyperspectral image remote sensing. Various evaluation metrics are employed to assess the model's predictive performance, and the results are presented and analyzed to gain insights into the system's capabilities. The performance analysis involves the following steps:

5.1 Evaluation Metrics Results:

The evaluation metrics are selected to quantify the accuracy and precision of the soil carbon predictions obtained from the machine learning models. Commonly used evaluation metrics for regression tasks include:

1. **Mean Absolute Error (MAE):** MAE measures the average absolute difference between the predicted soil carbon values and the corresponding ground truth values. It provides a measure of the model's accuracy, with lower MAE indicating better performance.

2. **Root Mean Squared Error (RMSE):** RMSE calculates the square root of the mean of the squared differences between the predicted and ground truth soil carbon values. Like MAE, RMSE provides an indication of the model's accuracy, with lower RMSE indicating better performance. It penalizes larger errors more heavily than MAE.

3. **Coefficient of Determination (R-squared or R2):** R-squared measures the proportion of the variance in the ground truth soil carbon values that is explained by the model's predictions. It ranges from 0 to 1, with higher values indicating better model fit. An Rsquared value close to 1 indicates a good fit, while a value close to 0 suggests poor model performance.

4. **Mean Percentage Error (MPE):** MPE calculates the average percentage difference between the predicted and ground truth soil carbon values. Positive MPE indicates overestimation, while negative MPE indicates underestimation. A value close to zero indicates balanced predictions.

5. **Coefficient of Correlation (Pearson's r):** Pearson's correlation coefficient measures the linear correlation between the predicted and ground truth soil carbon values. It ranges from -1 to +1, where +1 indicates perfect positive correlation, -1 indicates perfect negative correlation, and 0 indicates no correlation.
6. **Bias:** Bias measures the systematic deviation of the model's predictions from the ground truth values. A bias close to zero indicates unbiased predictions.

5.2 Presentation and Analysis of Results:

The results of the evaluation metrics are presented in tabular format, with each evaluation metric calculated for different machine learning algorithms or model configurations used during the training process. Graphical visualizations, such as bar plots or scatter plots, may also be employed to compare the performance of different models.

The analysis of the results involves interpreting the values of the evaluation metrics and drawing conclusions about the effectiveness of the proposed soil carbon recognition system. The following points are considered during the analysis:

1. **Model Comparison:** The evaluation metrics are used to compare the performance of different machine learning algorithms, such as Support Vector Machines (SVM), Random Forest, and Neural Networks, used for soil carbon prediction. The model with the lowest MAE and RMSE and the highest R-squared and correlation coefficient is considered the best-performing model.
2. **Overfitting and Underfitting:** The analysis also checks for signs of overfitting or underfitting in the models. Overfitting occurs when the model performs well on the training data but poorly on new, unseen data, while underfitting occurs when the model fails to capture the underlying patterns in the data. Proper cross-validation techniques are used to mitigate these issues.
3. **Data Quality and Model Robustness:** The analysis examines the impact of data quality, including noise and outliers, on model performance. Robustness of the model is evaluated by considering how well it generalizes to new, unseen data.
4. **Interpretation of R-squared and Correlation Coefficient:** The interpretation of Rsquared and correlation coefficient values provides insights into how well the model's predictions match the ground truth soil carbon values. High R-squared and correlation coefficient values indicate strong relationships between the predicted and actual soil carbon content.
5. **Practical Implications:** The analysis considers the practical implications of the model's performance in real-world scenarios, such as precision agriculture, land-use planning, and environmental monitoring. The accuracy of soil carbon predictions has implications for decision-making processes in these domains.

The performance analysis concludes with a summary of the results, emphasizing the strengths and limitations of the proposed soil carbon recognition system. Recommendations for further improvements, such as data augmentation, hyperparameter tuning, or incorporating additional data sources, may also be provided based on the insights gained from the analysis.

Conclusion:

In conclusion, using hyperspectral images remote sensing techniques for measuring soil organic matter content offers enormous potential in developing sustainable land-use policies that support climate change mitigation efforts while improving agricultural practices. However, more research needs to be conducted on standardizing sampling and laboratory analysis procedures, accounting for environmental variations, and understanding the relationship between land-use types and CO2 fluxes. The development of predictive models based on hyperspectral data using machine learning algorithms will be a significant contribution to this field of research.

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Structural Investigation of Li^+ doped Cobalt ferrite Nanoparticles

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ABSTRACT

Now a day spinel ferrite nonmaterial's are studied more due to their widespread applications in the electronics industry and energy storage devices. The Li^+ doped Cobalt ferrites with the general formula $Co_{1+x}Li_xFe_{2-x}O_4$ (x =0.0, 0.1, 0.2, 0.3, 0.4) were prepared using wet chemical method i.e. sol-gel auto combustion method. Structural characterization of the samples was carried out using X-ray powder diffraction technique. The XRD confirmed the cubic phase of $Co_{1+x}Li_xFe_{2-x}O_4$ ferrite with the crystallite size. The crystallite size and other structural parameters such as lattice constant, volume of a cubic unit cell, X-ray density, and porosity of the samples are calculated. The lattice parameter of the sample was found to be increases with increasing Li^+ content (x). The porosity is increased with increasing Li^+ content as evident from XRD. Crystallite size is calculated by using Debye Scherrer method. The sol–gel auto-combustion method was used for synthesize substituted Cobalt spinel ferrite. This is a novel method as it is combination of the chemical sol–gel process and the combustion process. The present work was to synthesize Li^+ doped Cobalt ferrite using citrate assisted sol-gel auto combustion and to understand

Keywords :X-ray diffraction, spinel ferrite, Nanoparticles, Sol-gel auto combustion, Bulk density, Porosity

I. INTRODUCTION

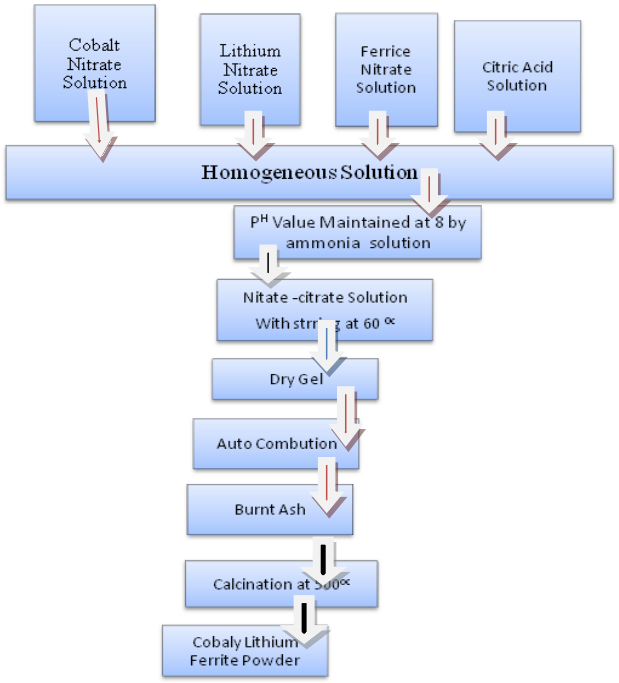
The cubic spinel structured cobalt ferrite nanoparticles have been the subject of current interest because of their applications in electric devices and telecommunication which often differs from their bulk counterpart [1]. The properties such as high saturation magnetization, high coercivity, strong anisotropy as well as chemical stability are not observed in the bulk sample. Spinel ferrite has general formula $(A^{2+})[B_2{}^{3+}]O_4{}^{2-}$ where A^{2+} and B^{3+} are the divalent and trivalent cations occupying tetrahedral (A) and octahedral [B] sites[2]. Ferrite has Face-centered cubic structure and cations and oxygen anions formulation. When divalent cation occupies both tetrahedral as well as octahedral sites, inverse spinal is formed [3]. Similarly, a mixed structure can also be formed when divalent cations is distributed in both sites. The $CoFe_2O_4$ is a partially inverse spinel with Co^{2+} ions, occupy the octahedral [B] site and Fe^{3+} ions occupy both tetrahedral (A) site and octahedral [B] site [4]. Substituted cobalt ferrites are widely used as magnetic materials due to their low dielectric losses. Large number of researchers have been carried out work on the structural, morphological, magnetic, electrical, dielectric, optical etc. properties of spinel cobalt ferrites with a view to improve these properties for the desired

applications [5].It is excepted that doping of mono-valent metal ions Li^+ in Cobalt ferrite may show the fascinating properties which can be employed for different applications.

II. METHODS AND MATERIAL

II.1 Materials

Cobalt nitrate [$Co(NO_3)_2 \cdot 6H_2O$], Nickel nitrate [$Ni(NO_3)_2 \cdot 6H_2O$], ferric nitrate [$Fe(NO_3)_2 \cdot 9H_2O$], lithium nitrate [$LiNO_3.6H2O$] and citric acid [$C_6H_8O_7 \cdot H_2O$], ammonia solution [$NH_3.H_2O$] acetone, distilled water were used. All chemicals used were of analytical grade and the solutions were prepared with distilled water.



Flow chart for the synthesis of cobalt-Lithium ferrite using citrate-gel auto combustion technique

II.2 Synthesis of Li^+ doped Cobalt ferrite nanoparticles.

Ferric nitrate [$Fe(NO_3)_3 \cdot 9H_2O$], lithium nitrate [$Li(NO_3).6H_2O$], Cobalt nitrate [$Co(NO_3)_2 \cdot 9H_2O$] were dissolved together in a minimum amount of distilled water to get clear solution. The citric acid was used as a fuel. The citric acid to nitrate ratio was considered to be 1:3. An aqueous solution of citric acid was mixed with metal nitrate solution. The mixed solution was kept on magnetic stirrer and constantly stirred at 300rpm by maintaining the temperature at 60°C.to form a homogeneous solution. The solution was transformed into a sol and then a gel is formed by evaporation of the water. The ammonia solution was slowly added to maintain the pH at 8 of the mixed homogeneous solution. The temperature after the gel formation is increased to 120°C. At this temperature the gel get burnt converting into fine loose powder of $Co_{1+x}Li_xFe_{2-x}O_4$ (x = 0.0, 0.1, 0.2, 0.3, 0.4) nanoparticles. This sample was then manually grinded and kept for calcinations at 500^{oC} in furnace for 4 hours to remove the moisture and impurity if any present in the sample. Pellets were prepared with KBr hydraulic press in 2–3 mm thickness and 10 mm diameter size. The samples in powder form were used to characterize the material

II.3 Characterizations

X-ray diffractometer (XRD) with Cu-Kα radiation(λ=1.5405 *A*°) and 2Θscanning ranges from 20° to 80°, at a scanning speed of ~ 2° /min, were characterized to verify the phase purity and structure of prepared material.

III.RESULTS AND DISCUSSION

4.1 X-ray diffraction analysis

The X-ray diffraction (XRD) pattern of all $Co_{1+x}Li_xFe_{2-x}O_4$ (x = 0.0, 0.1, 0.2, 0.3,0.4) nanoparticles were recorded using X-ray diffractometer at room temperature in the 2θ range of 20° to 80°. **Fig. 1** displays the XRD patterns of all the samples. Using Bragg's law, all the peaks in the XRD pattern were indexed. All the peaks belonging to the cubic spinel structure are verified by the XRD patterns, indicating that the prepared specimens have a single-phase existence. XRD pattern is compared with JCPDS card number 00-0022-1086 in order to identify the crystalline phases present [7]. In the XRD patterns, all the peaks observed are extreme and slightly wider, indicating the nanocrystalline nature. Using XRD data, the different parameters such as lattice constant, crystallite size, X-ray density, Bulk density, % porosity etc. were determined and their variation with Li^+ is discussed.

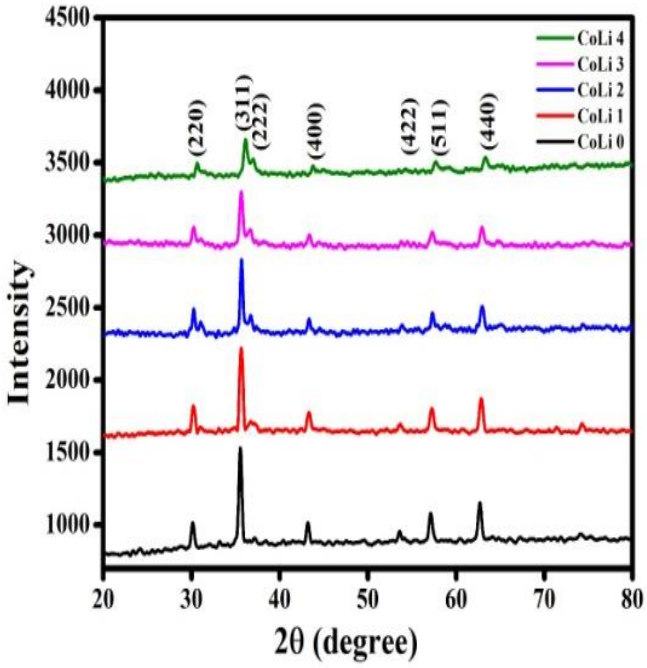


Fig. 1 *X-ray diffraction patterns of (a) $Co_{1+x}Li_xFe_{2-x}O_4$ (x = 0.0, 0.1, 0.2, 0.3, 0.4) nanoparticles.*

The lattice constant was determined from X-ray data analysis with an accuracy of ± 0.002 Å using the formula, $\frac{\lambda^2}{4a^2} = \frac{sin^2\theta}{h^2+k^2+l^2}$ g/cm^3 … 1

Where, 'a' is lattice constant, (h k l) represents the Miller indices and λ is the wavelength of X-rays used and 'θ' is the glancing angle. The unit cell volume is given by equation $V=a^3$ ….. (2). It is a cube of lattice constant [8]. The crystallite size was determined from the full width at half maximum β (FWHM) of the strongest reflection (311) and by using the Scherrer's formula

$D=\frac{0.9\lambda}{\beta cos\theta}$ …….. (3)

Where, D is the crystallite size (nm), λ is wavelength of the X-ray radiation. (CuKα = 0.154 nm), θ is the diffraction angle. The crystallite size obtained from Scherrer's formula.The values of lattice constant, unit cell volume and the crystallite size are given in Table 1. The X-ray density was calculated from lattice parameter (a) using the formula

$\rho_{XRD} = \frac{8M}{N_A a^3}$ g/cm^3 …….. (4)

where, M is molecular weight and N_A is the Avogadro's number [8]. Its value is given in Table1 .The bulk density is determined by the relation.

Table 1. Variation of lattice constant, volume of a cubic unit cell, X-ray density, Bulk density and % porosity with Li^+ Content in Cobalt ferrite.

Compositions	Lattice constant(Å)	Cell Volume V(Å^3)	Crystallite Size (nm)	X-ray density (ρ_{xRD}) (gcm^{-3})	Bulk densityρ_B gm/cm^3)	Porosity P %
$CoFe_2O_4$ (CoLi0)	8.451	603.565	35.701	5.456	3.343	38.7280
$Co_{1.1}Li_{0.1}Fe_{1.9}O_4$ (CoLi1)	8.441	601.425	35.653	5.477	3.358	38.6896
$Co_{1.2}Li_{0.2}Fe_{1.8}O_4$ (CoLi2)	8.436	600.357	35.611	5.483	3.384	38.2819
$Co_{1.3}Li_{0.3}Fe_{1.7}O_4$ (CoLi3)	8.437	600.570	35.543	5.492	3.388	38.3102
$Co_{1.4}Li_{0.4}Fe_{1.6}O_4$ (CoLi4)	8.423	597.585	35.365	5.498	3.390	38.2730

$$D=\frac{m}{\pi r^2 h} \quad \ldots\ldots\ldots (5)$$

Where m is pellets mass, h is thickness and r is radius of pellet. Bulk densities show inhomogeneous behaviour due to pallets variable thickness and mass.
From the X-ray density and bulk density values, porosity (P %) was calculated using the relation

$$P= 1- \frac{\rho_B}{\rho_X} \% \quad \ldots\ldots\ldots (6)$$

Where ρ_B is the physical density, ρ_x is the x-ray density [9]. The value of porosity is also listed in Table 1. It is observed from Table 1 that porosity shows higher value which is attributed to synthesis conditions. The structural parameters obtained for the present cobalt ferrite nano-particles are in good agreement with those reported in the literature. The smaller Li^+ ions (0.60˚A) successively replace the largerFe^{3+} ions (0.64˚A) on B sites due to the site preference. This results in an expansion of unit cell. The X-ray density increases as Li^+ substitution increases. The X-ray density is in the range 5.456- 5.498g/cm^3. The data on lattice constant (a), unit cell volume, X-ray density, crystallite size, porosity (P) and for the samples for substituted lithium ferrites are given in Table 1. Fig 2 represents variation of X-Ray density with porosity. X-ray density increases while porosity decreases as Li^+ content increases.

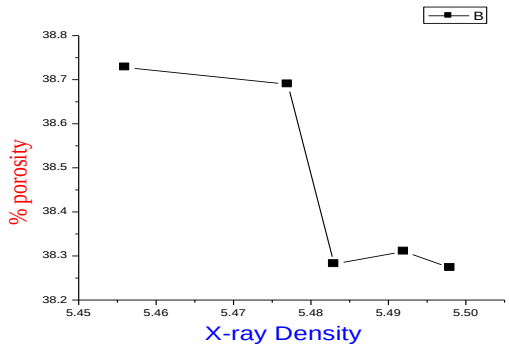


Fig 2 Variation of X-ray density Vs Porosity

IV. CONCLUSION

Monovalent Li^+ doped cobalt ferrite nanoparticles with composition $Co_{1+x}Li_xFe_{2-x}O_4$ (x = 0.0, 0.1, 0.2, 0.3 , 0.4) nanoparticles were successfully synthesized via citric acid assisted sol-gel auto combustion route. X-ray diffraction study revealed the single phase formation and nanocrystalline nature of all the prepared nanoparticles. The lattice parameter, crystallite size, and Unit cell volume of crystalline phase reduced systematically with the increase in Li^+ mole, concentration. As Li^+ content in cobalt ferrite increases X-ray density increases. The decrease in porosity was possibly due to systematic decrease in bulk density of prepared materials.

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Floristic studies in three species of Scleria Bergius (Cyperaceae)

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ABSTRACT

The genus is represented by over 200 species distributed throughout the world of which about 50 are known from the India. Almost all Cyperologists regard Scleria (s.l.) a somewhat homogenous assemblage of species. The members of Scleria exhibit high degree of variations in vegetative and floral structures as well. The useful ones help in specific and even infrageneric separation. The subdivision of genus into two subgenera by Clarke (1894) namely Hypoporum (Nees) Clarke and Scleria proper could not get wider acceptance. The genus is distinguished from the other members of Cyperaceae by its unisexual flowers disposed in unisexual or bisexual spikelets and the peculiar bony nuts with crustaceous pericarp subtended by a disc pesistent at base and falling off with the nuts. The present report is hoped to provide basic material for further research in Cyperaceae.

Keywords : Scleria, floristic, unisexual Flowers, bony nuts, Cyperaceae.

I. INTRODUCTION

The genus *Scleria* was erected by Bergius, P. (1765) based on *Scleria flagellum-nigrorum* as its type. The genus is distinguished from the other members of Cyperaceae by its unisexual flowers disposed in unisexual or bisexual spikelets and the peculiar bony nuts with crustaceous pericarp subtended by a disc pesistent at base and falling off with the nuts. The disc, however, is either 3-lobed, cup-like (not lobed) or at times reduced or oboslete. The fruit bearing spikelets are usually provided with 2, 3 or more glumes.

The genus is represented by over 200 species distributed throughout the world of which about 50 are known from the India. Almost all Cyperologists regard *Scleria* (s.l.) a somewhat homogenous assemblage of species. The members of *Scleria* exhibit high degree of variations in vegetative and floral structures as well. The useful ones help in specific and even infrageneric separation. The subdivision of genus into two subgenera by Clarke (1894) namely *Hypoporum* (Nees) Clarke and *Scleria* proper could not get wider acceptance. The genus is distinguished from the other members of Cyperaceae by its unisexual flowers disposed in unisexual or bisexual spikelets and the peculiar bony nuts with crustaceous pericarp subtended by a disc pesistent at base and falling off with the nuts.

There has been conflict in opinions among the Cyperologists about the generic delimitation of *Scleria* and the small genus *Diplacrum*. Relevant to this, it is the first attempt to focus on some of the facts neglected as regard to the Indian Scleriae. Supportive evidence are based on the morphological observations of plants from the regions of present exploration.

Bentham (1878) for the frist time merged *Diplacrum* (s.l.) under *Scleria*, pointing that there is no longer any reason to uphold *Diplacrum* as a separate genus. Goebel (1888) opposed this congenerity and again regarded *Diplacrum* as distinct. In his treatment he never considered the latter to be the member of *Scleria*. Kern (1961, 1974) strongly opposed Goebles argument and treatment in favour of *Diplacrum*.Two groups of Cyperologists of the world have divided opinions in accepting generic and infrageneric delimitation. Most of the authors take *Scleria* and *Diplacrum* as two distinct genera Gobel 1888; Clarke 1902, 1909; Blake 1954; Koyama 1961, 1971, 1985; Napper 1971; Hooper 1976; Goetghebeur 1986; Bruhl. J. 1995; Simpson & Koyama 1998 and others. Some of the authors accept broad generic limit of *Scleria* treating *Diplacrum* infragenerically including Bentham 1878; Clarke 1894, 1898; Pfeffer 1927; Hutchinson 1959; Kern 1961, 1976; Rao & Verma 1982; W. Khan 1997, 1998 and few others.

Floristic Account:

Scleria africana Benth. in Benth & Hook. f. Gen. Pl.3:1071.1883. Jain & Raghwan Bull. Bot. Surv. India 9(1-4):301. f. 1-4.1967. *S. pygmaea* auct. non R. Br.1810. *Diplacrum africanum* (Benth.) Clarke in Th. Dyer Fl. Trop. Afr. 7:510.1902. Ill. Cypr. t. 134-1-2. 1908. Blake in J. Arn. Arb. 35:233-34.1954. Prasad & Singh Sedg. Karnataka (Fam. Cypr.): 133.2002. *D. pygmaeum* sensu Boeck. Linnaea 38: 434.1874. *D. caricinum* sensu Fischer in Gamble Fl. Pres. Madras (1931) 3:1678.(repr.ed.) 1994. pro parte. Brahman & Saxena Fl. Orissa: 4.2213.1996. W. Khan et al. J. Eco. Taxon. Bot. 31 (3): 603.2007.

Annual, small tufted. Stems slender, trigonous, 2-12 cm long *ca* 0.5 mm thick, glabrous. Leaves: basal as well as cauline, short-linear, abruptly narrowed to an acute or acuminate apex, 1-3 cm long, 1.5-2.5 mm wide, very minutely scabrous on the margins towards apex; sheaths trigonous, not winged, slightly dilated upward, truncate at mouth. Inflorescence: axillary and terminal clusters of spikelets, almost throughout the length of the stem; clusters scarcely exserted from the subtending leaf-sheaths; bracts leaf-like; male spikelets always basal, liner-oblong, *ca* 1.5 mm long; glumes usually 3, linear, oblong-lanceolate, *ca* 1.5 mm long; female spikelets with glumes spreading in the upper half, 2-2.5 mm long, single flowered; glumes paired, fused at base, oblong-lanceolate, acuminate at apex, 2-3 mm long, with 2 lateral lobes near the middle portion, with 3 prominent nerves. Nut broadly ellipsoid or oblong-ellipsoid, shortly beaked at apex, *ca* 0.8 mm long, with 3

prominent, longitudinal ribs and 5-7 faint ribs in between the prominent ribs; ribs not interveined. Disk obsolete, adnate to the nut base, obtusely triangular in outline.

Occasional in rice-field, open grasslands.

Flowers Fruits: September to October.

Specimens examined: A.P. Vishakhapatnam Dist. Areku Valley, *Shaikh R. I.* 1252.

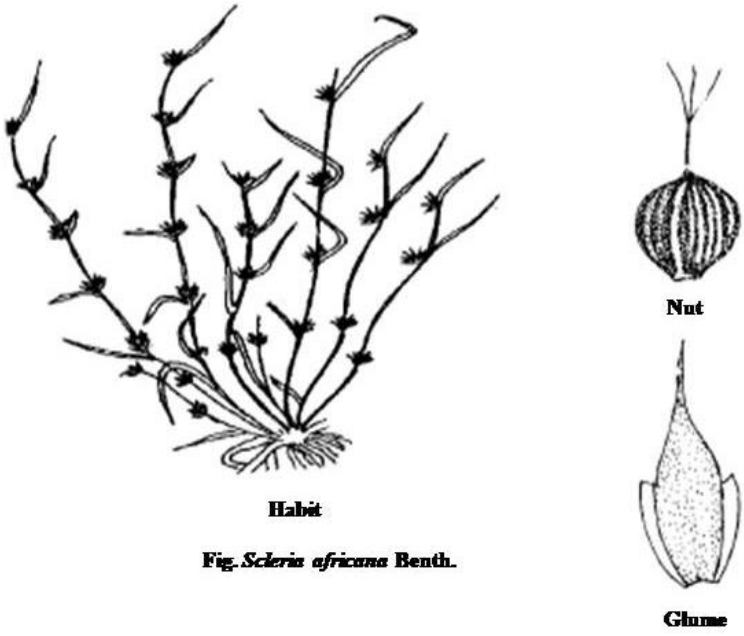

Fig. *Scleria africana* Benth.

Notes: This and other two species of the section **Diplacrum** are so similar that they are seldom distinguished apparantly from one another. First Jain & Raghwan (l.c.) have overlooked the features of behaviour of nut and glumes on which *S. africana* stands distinct. A sole species (out of three in the World) distinguishes from very closely allied Malesian *S. pygmaeopsis* Kern (section **Sphaeropus**) in which the glumes are smaller, 1-1.5 mm long, entire (not lobed) at apex and rather larger spongy peduncle. Benthum (l.c.) named African plant as above. According to him, earlier Boeckeler (1874) wrongly named it as *Diplacrum pygmaeum* (or *S. pymaea* of R. Brown) which is distinct from *S. africana* Benth. on account of entire or minutely 3-lobed glumes, rather larger and tuberculate nuts, not vertically ridged and shallowly or obscurely lobed basal disc and somewhat larger habit. *S. pygmaea* R. Br. also fall under section **Sphaeropus**.

Scleria biflora Roxb. Fl. Ind. Ed. 2.3:573.1832; Clarke in Hook f. Fl. Brit India 6:687.1894; T. Cooke, Fl. Pres.Bombay 2:419.1958(repr.ed.); Kern in Steenis Fl. Malesiana. 1, 7(3):743.1974; L'narsimhn in Sharma et al Fl. Maharashtra: 371.1996; Brahman & Saxena Fl. Orissa: 4. 2214.1996. Pullaiah & Hanumanth.Cypr. in Fl. Andhra Pradesh 3:1112.1997. Prasad & Singh Sedg. Karanataka (Fam. Cypr.): 314. 2002. W. Khan et al. J. Eco. Taxon. Bot. 31 (3): 604. 2007.

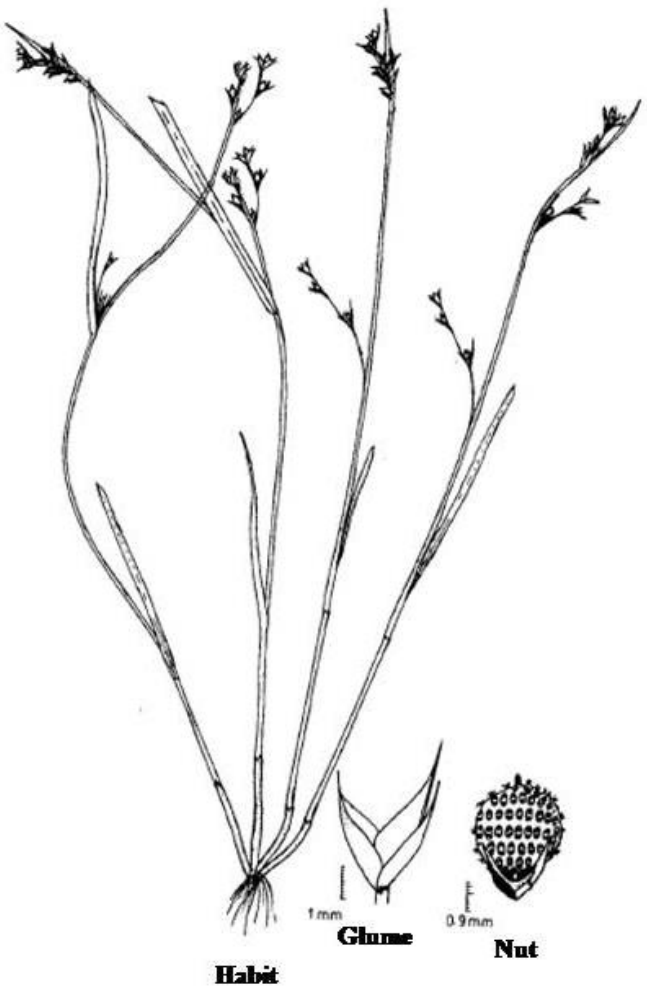

Fig. *Scleria biflora* Roxb.

Annual, 15-30 (-45) cm high; stems slender, smooth, 1-2 mm thick. Leaves: linear, narrowed to an obtuse tip, 6-16 cm long, 2-4 mm wide, minutely scabrous on the margins towards apex; sheaths trigonous, narrowly winged; contraligule very short, much broader than long, obtuse. Inflorescence: of 2-4 panicles, terminal one larger; primary bract usually overtopping the panicle. Sipkelets solitary or paired; male spikelets lanceolate, short-pedicellate, *ca* 3 mm long; pedicels 2-2.5 mm long. Glumes lanceolate, 2-3 mm long. Stamens 2-3 to each glume; anthers linear-oblong, apiculate, *ca* 1 mm long. Nut bearing spikelet obovoid, 3-4 mm long. Glumes broadly ovate-lanceolate, acuminate at apex, 3-4 mm long. Nut globose or slightly depressed-globose, with a dark brown beak of style base at apex, 1.5-1.8 mm across, cancellate with regular vertical rows of pits on the surface, ferrugineous-pubescent on ridges between pits, whitish. Disk deeply 3-lobed; lobes narrowly-lanceolate, acute at apex, up to half the length of the nut.

Occasional in wet open grasslands, rice-fields.

Flowers and Fruits: September to November.

Specimen examined: A.P. Vishakhapatnam Dist. Chintapalli forest, *Shaikh R. I.* 895, Chintaru forest, *Shaikh R. I.* 891, Narsipatnam, *Shaikh R. I.* 908.

Notes: Subsp. *ferruginea* (Ohwi) Kern (l.c. 744) with its narrow leaves, 1-2 mm wide, shorter, suddenly caudate-mucronate disc lobes, densely ferrugineous tomentose nuts are distinguishable from the typical variety.

Scleria multilocunosa Koyama in Bull. Nat. Sci Mus. 17(1):71.f.3. 1974 et. in Dassan. & Fosb. Rev. Handb. Fl. Ceylon 5:361.f. A & B 1985. Pullaiah & Hanumanth.Cypr. in Fl. Andhra Pradesh 3:1114.1997. W. Khan et al. J. Eco. Taxon. Bot. 31 (3): 606. 2007.

Annual. Stems 25-55 cm tall, 1.2-1.8 mm thick, sharply triquetrous, glabrous, smooth or weakly scabrid on angles, remotely 3-4 nodes, herbaceous or membranous, sharply triquetrous without wings, pale green and stained with purple, obliquely truncate. Leaves: shorter than the stem; blades linear, 17-26 cm long, 3.5-5 mm

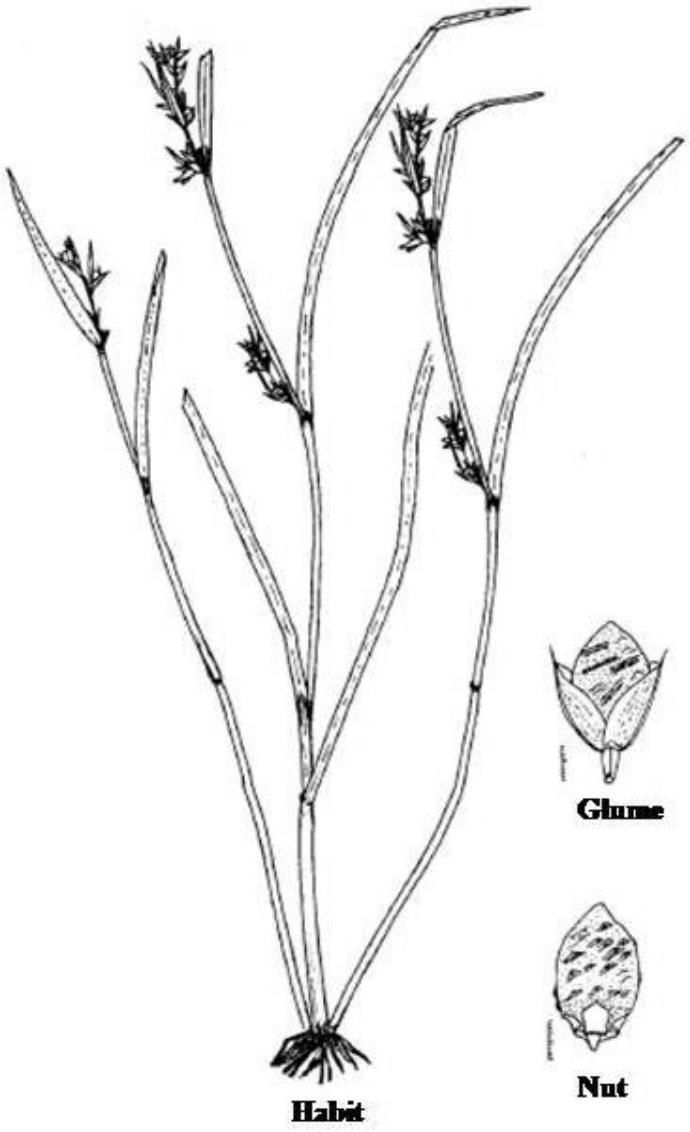

Fig. *Scleria multilocunosa* Koyama

wide, flattish, tricostate, herbaceous, fresh green, glabrous, scabrous on margins and abaxial costa, gradually tapering to acute apex; sheaths 3-6 cm long, glabrous or sparsely pubescent on ventral side towards the orifice, greenish, sharply triquetrous, the angles scabrous, often narrowly winged; contraligule rounded-truncate, *ca* 1/2 mm long, ciliate with short rusty-brown hairs. Inflorescence : with 2-4 partial panicles, the lowest one distant from the remainder and on a long-exserted peduncle, the lowest one distant from the remaindar and on a long-exserted peduncle, the remaindar and on a long-exserted peduncle, the remainder contriguous at the stem apex; partial panicles subspiciform, 1-2 cm long, 0.8-1.2 cm wide, the branches short, flattened with narrowly winged edges, bearing 3-5 pistillate spikelets and 1-3 staminate spikelets, those intermingled; lowest leafy bract sheathing for 2-3 cm, the blade 10-13 cm long, not surpassing the stem; other bracts not sheathing, the blade of the second bract 3-6 cm longer than its subtending partial panicle, ciliate at base, the third and the fourth bracts much shorter; bracteoles setaceous. Staminate spikelets 3-3.5 mm long, lanceolate, short-peduncled. Pistillate spikelets 3-4 mm long, obdeltoid; glumes usually 3, ovate to lance-ovate, 3.8-4.2 mm long,1.2-2.3 mm wide, acuminate at apex, membranous, pale green and stained with straw-brown, boat-shaped with green prominent keel ending in a straight cusp at apex. Nut globose, 2-2.25 mm long, 1.9-2 mm across, rounded at mucronate apex, the white-ceramic surface irregularly lacunose with many shallow depressions of varying shape and size; style 1 mm long, filiform; stigmas 3, *ca* 1 mm long, Disk 1/2 mm wide, deeply 3-lobed; lobes obovate-oblong, 0.8 mm long, 0.5 mm wide, subcoriaceous, yellowish, rather suddenly contracted at cuspidate apex.

Occasional in shady, moist areas

Flowers and Fruits: October to December.

Specimens examined: T.N. Tirunelveli Dist. (on the way), *Shaikh R. I.* 803.

Notes: Apparently very similar to *S. benthamii* Clarke and *S. tessellata* Willd., but differs in its irregularly locunose and rugulose nuts (not tessellated) and the characteristic obovate disc lobes often appressed at base.

Acknowledgements

The author is thankful to Dr. M. A. Wadoodkhan ex Reder and Head, Dept. of Botany, Herbarium of Cyperaceae, Majalgaon College Majalgaon (HCMCM) for the confirmation of identity of taxa and going through the manuscript. Dr. Mohammad Ilyas Fazil, the Principal of the College for his constant support and the Principal, Majalgaon College Majalgaon for laboratory and library facilities.

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Experimental and Analytical Study of Doubly Reinforced Beam

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ABSTRACT

Plain cement concrete has high compressive strength and low tensile strength. Normally tensile strength is about 10 to 15 % of its compressive strength. Hence if beam is made up of plain cement concrete, it has a very low load carrying capacity since its low tensile strength limits its overall strength. It is therefore, reinforced by placing steel bars in tensile zone of concrete beam so that the compressive bending stress is carried by concrete and tensile bending stress is carried entirely steel reinforcing bars. The concrete reinforced by steel bars is called reinforced cement concrete (RCC). If the steel reinforcement is provided in tension zone only it is known as singly reinforced beam. However, if steel is provided in compression zone also it is known as doubly reinforced beam.

In present thesis, effect on young's modulus will be studied by varying compression reinforcement of doubly reinforced beam, grade of concrete, area of steel. The experimental program includes testing of beams to its failure for M20 grade of concrete and its validation in Ansys Benchwork software. Also, deflection analysis is done for M40 and M60 grade of concrete using Ansys Benchwork software. Also, area of steel is going to vary according to the design as per IS456-2000

Keywords : Reinforced concrete, elastic properties of concrete, doubly reinforced beam, grade of concrete, shear reinforcement, modulus of elasticity.

I. INTRODUCTION

This document Concrete has a very high compressive strength but relatively little tensile strength. As a result, the singly reinforced beam, which is the tensile side of concrete, uses steel reinforcement. Because they are strengthened on the tensile face, singly reinforced beams are good in both compression and tension. However, the precise width, depth, and steel and concrete grades used in each of these beams defines their own limiting moments of resistance. A issue arises when a section is bent at a moment larger than its limiting moment of resistance while being used as a single reinforced section. The problem can be resolved in two different ways. First, we can increase the beam's depth, which might not always be possible. By adding steel reinforcement to the compression face and extra reinforcement to the tension face of the beam in such situations—a process known as doubly reinforcing beams—the compressive and tensile forces of the beam can be increased.

When a beam's cross-section is constrained due to architectural or other concerns, the doubly reinforced concrete beam design is necessary. Because of this, the concrete is unable o generate the compression force

necessary to withstand the current bending moment. In such a case, steel bars are added to the beam's compression zone to improve it at compression. Therefore, a beam reinforced on both the faces i.e., with tension steel and compression steel is called a doubly reinforced concrete beam. For the same cross-section, steel grade, and concrete, the moment of resistance (MR) of a doubly reinforced concrete beam is higher than that of a singly reinforced concrete beam. However, since the strength approach of design, which takes into consideration the complete strength-potential of concrete in the compression zone, has become more widely used, the use of compression reinforcement has significantly dropped. Compression reinforcement can, however, be utilized for purposes other than strength, such as reducing long-term beam deflection, accounting for minimum-moment loads, and maintaining stirrup positions. In structural analysis, especially in indeterminate structures, (S K Kulkarni et al 2014) it becomes essential to know material and geometrical properties of members. The codal provisions recommend elastic properties of concrete and steel and these are fairly accurate enough. Another method of determining modulus of elasticity of concrete is by flexural test of a beam specimen. The modulus of elasticity most commonly used for concrete is secant modulus. The modulus of elasticity of steel is obtained by performing a tension test of steel bar. Two important stiffness properties such as AE and EI play important role in analysis of high rise RCC building idealized as plane frame. The shear behavior of doubly reinforced concrete beams, (Ionut Ovidiu Toma et al 2007) with or without steel fibers, affected by distributed cracks. For this purpose, monotonic loading tests were carried out on a series of eight RC beams. Prior to testing, the surface of the beams was inspected the presence of distributed cracks. The crack density parameter introduced in the earlier research work was used to mathematically quantify the influence of the distributed cracks on the shear carrying capacity of the beams. The beams exhibited a mixed mode of failure between both diagonal tension and diagonal compression failures. A companion paper was also published (Khuntia & Ghosh b) emphasizing the applicability of the proposed stiffness expressions for all levels of applied loading, both service and ultimate loads. The parameters of interest were reinforcement ratio, concrete compressive strength, magnitude of axial load and the eccentricity ratio. The authors investigated effective parameters and the results were compared with the available experimental data. The parameters considered were bar size and the effective concrete area surrounding the reinforcement. In addition to these parameters, the additional parameter considered in the present study is variation in compression reinforcement. The minimum compression steel in doubly reinforced beams is not specified in IS 456:2000. However, the creep and shrinkage of concrete may require hangers and other bars that provided up to 0.2% of the total area of the cross section. In light of this, these bars are not regarded as compression reinforcement Therefore, in order for the doubly reinforced beam to handle the additional loads in addition to resisting the effects of concrete creep and shrinkage, the minimum amount of steel used as compression reinforcement should be at least 0.4% of the area of concrete in compression or 0.2% of the entire cross-sectional area of the beam. According to IS 456 clause number 26.5.1.2, the maximum amount of compression steel cannot be more than 4% of the entire area of the beam's cross-section. As stipulated in clause 26.5.1.1(a)and (b) (IS 456: 2000), the minimum amount of tensile reinforcement shall be at least (0.85 bd/fy) and the maximum area of tension reinforcement shall not exceed (0.04 bD). The singly reinforced beams shall have Ast normally not exceeding 75 to 80% of Ast, lim so that xu remains less than xu, max with a view to ensuring ductile failure. Nonetheless, the presence of compression steel in the case of doubly reinforced beams ensures the ductile failure. Thus, the depth of the neutral axis may be taken as xu, max if the beam is over-reinforced. Accordingly, the Ast1 part of the tension steel can go up to Ast, lim and the additional tension steel Ast2 is provided for the additional moment Mu - Mu, limit. The quantities of Ast1 and Ast2 together form the total Ast, which shall not exceed

0.04 bD.is a template. An electronic copy can be downloaded from the conference website. For questions on paper guidelines, please contact the conference publications committee as indicated on the conference website. Information about final paper submission is available from the conference website.

II.EXPERIMENTAL PROGRAM

An easy This section provides information about combinations of compression and tension reinforcement with different beam cross sections. Additionally, experimental setup arrangements described in brief. After doing the experiment, the beam deflection is recorded.

A. Material Properties

After carefully considering the literature suggestions and conducting an analysis, following material properties were considered for the study as shown in table 1.

Table 1 Materials Specification

Materials	**Specifications**
Cement	
Grade of Cement	OPC, 53 Grade, Birla Super
Specific gravity of cement	3.15
Fineness of Cement	4.28% (IS 4031 Part 2)
Consistency of Cement	39% (IS 4031 Part 4)
Coarse Aggregates (CA)	
Specific Gravity	2.74
Size of Aggregate	20mm
Fine Aggregates (FA)	
Specific Gravity	2.58
Bulk Density	1620 kg/m3
Consumable Water	
pH	7.0-8.0

B. Design Mix

M20 grade of concrete was designed having following properties as shown in table 2.

Table 2 Design Mix for M20 grade of Concrete.

Compressive Strength in MPa	
W/C	0.60
Cement, kg/m^3	319.3
Fine Aggregate, kg/m^3	711.58
Coarse Aggregate, kg/m^3	1182.01
Water, liters	191.58

C. Specimen Details

Total 90 beams were tested for deflection by using Universal Testing machine of 400KN capacity. A doubly reinforced beam is designed as per IS 13920-2016. A minimum width of the beam kept is 150mm. As per IS code depth should not be more than one fourth of clear span accordingly, depth of beam used is 200mm, 300mm, 400mm and length of beam is kept constant as1500mm.

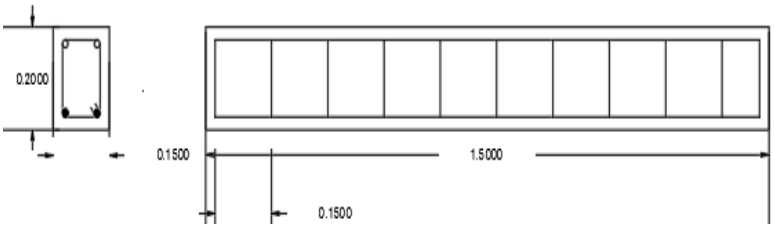


Fig. 1 Sectional View of concrete beam (all dimensions are in meter).

By considering various parameters number of combinations are done by varying tension and compression reinforcement as mentioned in the table 6, table 7, table 8.

In Table 6, three beam models of size 150mmX200mmX1500mm are prepared and by keeping tension reinforcement constant and variations are done in compression reinforcement from minimum to maximum. Similarly for model II, tension reinforcement is kept constant and variations are done in compression reinforcement from minimum to maximum. Similar variations are done for model III. In Table 7, three beam models of size 150mmX300mmX1500mm are prepared and by keeping tension reinforcement constant and variations are done in compression reinforcement from minimum to maximum. Similar variations are done for model II and model III. In Table 8, three beam models of size 150mmX400mmX1500mm are prepared and by keeping tension reinforcement constant and variations are done in compression reinforcement from minimum to maximum. Similar variations are done for model II and model III.

D. Actual Beam Specimen Model

Fig. 2 Actual beam model.

Total 90 beams were casted on site by varying cross section of beam and also, tension and compression reinforcement was considered from minimum to maximum range as mentioned in above table 6, table 7 and table 8. The width of beam used was 150mm and depth of beam used was 200mm, 300mm and 400mm. The length of beam was kept constant i.e., 1500mm.

Table 6 Combination of compression and tension reinforcement of 150mmx200mm c/s.

Model	Tension Reinforcement	Compression Reinforcement	Beam No.	Compression Steel	Tension Steel
Model I	Maximum	Maximum	A1	2 bars of 10mm Ø	2 bars of 10mm Ø
		Minimum	A2	2 bars of 8 mm Ø	
Model II	Moderate	Maximum	A3	2 bars of 10mm Ø	3 bars of 8 mm Ø
		Moderate	A5	3 bars of 8 mm Ø	
		Minimum	A4	2 bars of 8 mm Ø	
Model III	Minimum	Minimum	A6	2 bars of 8 mm Ø	2 bars of 8 mm Ø

Table 7 Combination of compression and tension reinforcement of 150mmx300mm c/s

Model	Tension Reinforcement	Compression Reinforcement	Beam No.	Compression Steel	Tension Steel
Model II	Maximum	Maximum	B9	3 bars of 10 mm Ø	3 bars of 10 mm Ø
		Moderate	B6	2 bars of 10mm Ø	
		Moderate	B8	3 bars of 8 mm Ø	
		Minimum	B7	2 bars of 8 mm Ø	
Model I	Moderate	Maximum	B5	3 bars of 10 mm Ø	2 bars of 12mm Ø
		Moderate	B1	2 bars of 12mm Ø	
		Moderate	B2	2 bars of 10mm Ø	
		Moderate	B4	3 bars of 8 mm Ø	
		Minimum	B3	2 bars of 8 mm Ø	
Model III	Minimum	Maximum	B12	4 bars of 8 mm Ø	4 bars of 8 mm Ø
		Moderate	B11	3 bars of 8 mm Ø	
		Minimum	B10	2 bars of 8 mm Ø	

Table 8 Combination of compression and tension reinforcement of 150x400 c/s

Model	Tension Reinforcement	Compression Reinforcement	Beam No.	Compression Steel	Tension Steel
Model II	Maximum	Maximum	C9	3 bars of 10 mm Ø	3 bars of 10 mm Ø
		Moderate	C6	2 bars of 10mm Ø	
		Moderate	C8	3 bars of 8 mm Ø	
		Minimum	C7	2 bars of 8 mm Ø	
Model I	Moderate	Maximum	C5	3 bars of 10 mm Ø	2 bars of 12mm Ø
		Moderate	C1	2 bars of 12mm Ø	
		Moderate	C2	2 bars of 10mm Ø	
		Moderate	C4	3 bars of 8 mm Ø	
		Minimum	C3	2 bars of 8 mm Ø	
Model III	Minimum	Maximum	C12	4 bars of 8 mm Ø	4 bars of 8 mm Ø
		Moderate	C11	3 bars of 8 mm Ø	
		Minimum	C10	2 bars of 8 mm Ø	

III. EXPERIMENTAL SET-UP

A Universal testing machine (UTM) of 400kN capacity is used to test 90 beams and deflection was measured. UTM can be used to test a wide variety of materials like concrete, steel, cables, springs, steel wires and chains, slings, links, rope, winches, steel ropes, etc.

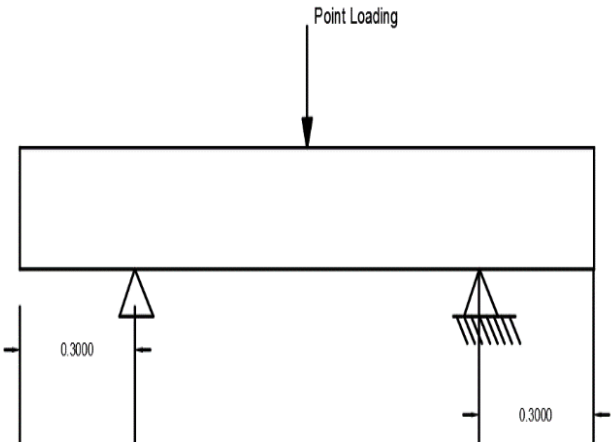


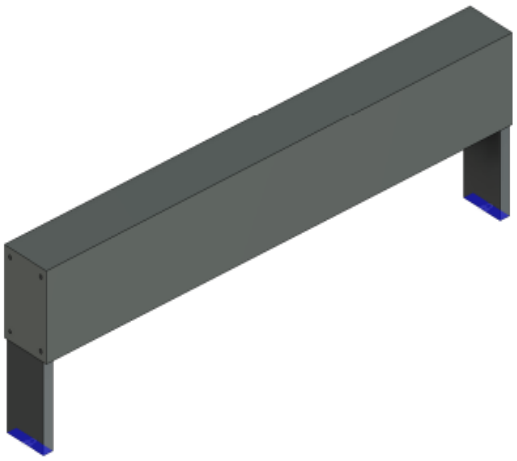
Fig. 3 Test Setup.

A universal testing machine (UTM), of 400kN capacity was used and compressive strength of doubly reinforced beam. The results include the maximum load the specimen can withstand before failure, the deformation or strain at the point of failure, and the modulus of elasticity of the material. Flexural cracks initially developed on the bottom of the beams as the specimens were loaded. The beams exhibited linear behavior up until cracks were noticed at the concrete cover in the middle of the beam, which was subjected to the greatest amount of pure bending. Peak load appeared when the wider flexural fissures and concrete cover in the compression zone began to crumble.

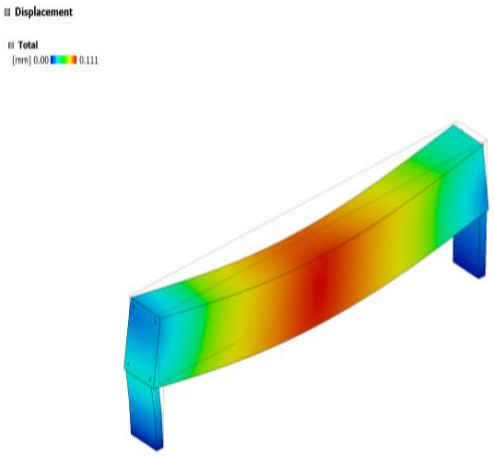
Fig. 4 Failure and cracking pattern of beams.

IV. FE ANALYSIS

In order to get realistic behavior of RC material analytically various combinations are used using ANSYS Benchwork. The grade of concrete selected for study is M20 with varying depth as 200,300,400.



(a)



(b)

Fig.5 (a) and (b) FE Model for concrete and Deflection Profile.

V. RESULTS AND DISCUSSION

Total 90 beams were tested in UTM machine. Load deflection responses were recorded. The deflection of the beam was recorded with reference to the compression and tension steel for first crack and failure load as shown in table 11.

Table 11 Load and Deflection at first crack and failure load of 150mmx200mm c/s beam.

Model	Experimental Values							Analytical Value
	Beam No.	Load at first Crack	Deflection at first Crack	Average Deflection at first	Failure Load (kN)	Deflection at failure Load (mm)	Average Deflection at failure	Analytical Deflection (mm)

		(kN)	(mm)	Crack (mm)			Load (mm)	
Model I	A1	49	0.5	0.5	54	2	2.17	2.128
		51	0.5		53	2		
		49.5	0.5		55.5	2.5		
	A2	42	0.5	0.5	50	2.5	2.5	2.01
		46	0.5		53.5	2.5		
		41	0.5		50	2.5		
Model II	A3	39	0.5	0.5	47	2.5	2.5	2.46
		37	0.5		48	2.5		
		39	0.5		48	2.5		
	A5	35	0.5	0.5	43	3	3	2.46
		35	0.5		39	3		
		31	0.5		38	3		
	A4	35	0.5	0.5	41	3	3	2.87
		32	0.5		38	3		
		33.5	0.5		42	3		
Model III	A6	29	1	1	34	4	4	4.12
		31.5	1		31	4		
		28	1		33	4		

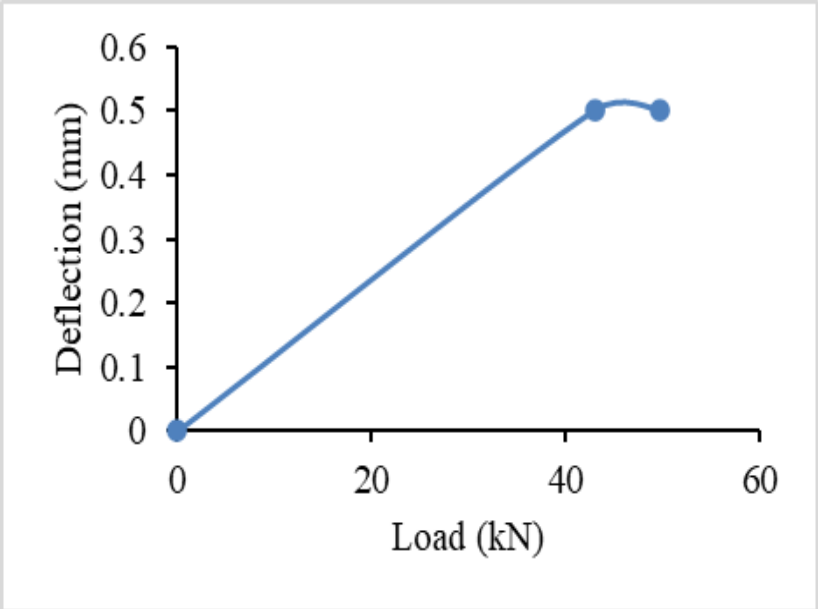


Fig. 8 Graph of Load vs deflection for model I from table 11.

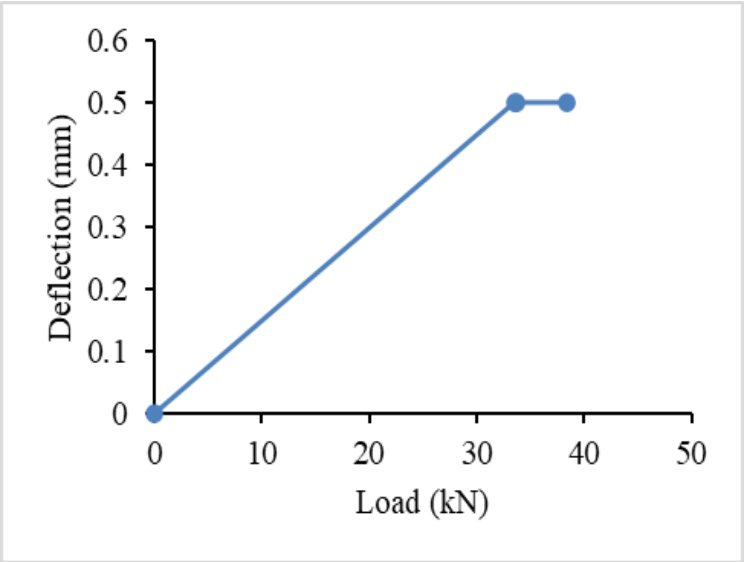


Fig. 9 Graph of Load vs deflection for model II from table 11.

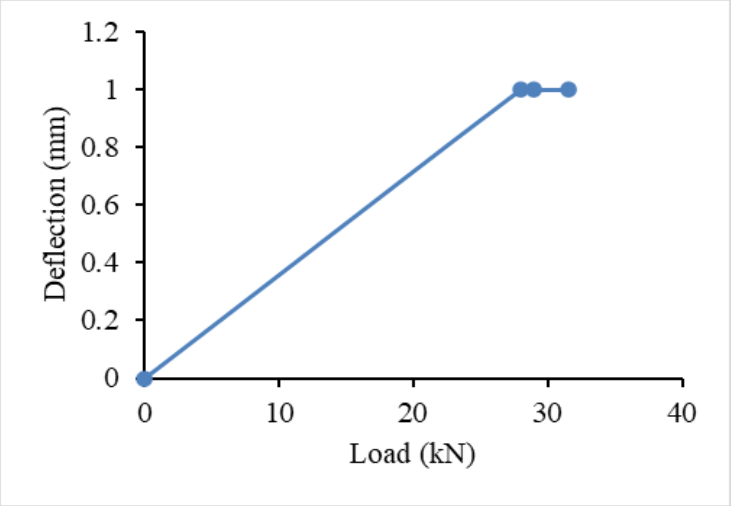


Fig. 10 Graph of Load vs deflection for model III from table 11.

Similar calculations for deflections and load were done for 150mmX300mm and 150mmX400mm size beam.

VI. CONCLUSION

Normal stresses on beams in the longitudinal direction range from the highest tension at one surface to the midplane of the beam being zero to the maximum compression at the opposing surface. Shear stresses are also produced when the length-to-height ratio of the beam is high, but they are typically negligible in comparison to the normal stresses. Flexural fissures can be managed with the appropriate tension reinforcement. Both the curvature and the resisting moments of concrete sections are improved by compression reinforcing. This microcrack has the potential to result in the traditional mass concrete breaking because of the tensile stress pressing on the mass concrete structure. According to the experimental study, cracks were found in the beam's center during testing, and the deflection increased as the cross section of the beam decreased. Shear reinforcement has favorable effect on modulus of elasticity.

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Design of Doubly Reinforced Beam by Varying Percentage of Steel

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ABSTRACT

Plain cement concrete has high compressive strength and low tensile strength. Normally tensile strength is about 10 to 15 % of its compressive strength. Hence if beam is made up of plain cement concrete, it has a very low load carrying capacity since its low tensile strength limits its overall strength. It is therefore, reinforced by placing steel bars in tensile zone of concrete beam so that the compressive bending stress is carried by concrete and tensile bending stress is carried entirely steel reinforcing bars. The concrete reinforced by steel bars is called reinforced cement concrete (RCC). If the steel reinforcement is provided in tension zone only it is known as singly reinforced beam. However, if steel is provided in compression zone also it is known as doubly reinforced beam.

In present thesis, effect on young's modulus will be studied by varying compression reinforcement of doubly reinforced beam, grade of concrete, area of steel and spacing of shear reinforcement. The experimental program includes testing of beams to its failure. Grade of concrete used will be M20, M25, and M30. Also, area of steel is going to vary according to the design as per IS456-2000. Also, simulation will be done by using ANSYS.

Keywords : Reinforced Concrete, Elastic Properties Of Concrete, Doubly Reinforced Beam, Grade Of Concrete, Shear Reinforcement, Modulus Of Elasticity.

I. INTRODUCTION

1.1General

Concrete has a very high compressive strength but relatively little tensile strength. As a result, the singly reinforced beam, which is the tensile side of concrete, uses steel reinforcement. Because they are strengthened on the tensile face, singly reinforced beams are good in both compression and tension. However, the precise width, depth, and steel and concrete grades used in each of these beams defines their own limiting moments of resistance. A issue arises when a section is bent at a moment larger than its limiting moment of resistance while being used as a single reinforced section. The problem can be resolved in two different ways. First, we can increase the beam's depth, which might not always be possible. By adding steel reinforcement to the compression face and extra reinforcement to the tension face of the beam in such situations—a process known as doubly reinforcing beams—the compressive and tensile forces of the beam can be increased.

When a beam's cross-section is constrained due to architectural or other concerns, the doubly reinforced concrete beam design is necessary. Because of this, the concrete is unable to generate the compression force necessary to withstand the current bending moment. In such a case, steel bars are added to the beam's compression zone to improve it at compression. Therefore, a beam reinforced on both the faces i.e., with tension steel and compression steel is called a doubly reinforced concrete beam. For the same cross-section, steel grade, and concrete, the moment of resistance (MR) of a doubly reinforced concrete beam is higher than that of a singly reinforced concrete beam. However, since the strength approach of design, which takes into consideration the complete strength-potential of concrete in the compression zone, has become more widely used, the use of compression reinforcement has significantly dropped. Compression reinforcement can, however, be utilized for purposes other than strength, such as reducing long-term beam deflection, accounting for minimum-moment loads, and maintaining stirrup positions. In structural analysis, especially in indeterminate structures, (S K Kulkarni et al 2014) it becomes essential to know material and geometrical properties of members. The codal provisions recommend elastic properties of concrete and steel and these are fairly accurate enough. Another method of determining modulus of elasticity of concrete is by flexural test of a beam specimen. The modulus of elasticity most commonly used for concrete is secant modulus. The modulus of elasticity of steel is obtained by performing a tension test of steel bar. Two important stiffness properties such as AE and EI play important role in analysis of high rise RCC building idealized as plane frame. The shear behavior of doubly reinforced concrete beams, (Ionut Ovidiu Toma et al 2007) with or without steel fibers, affected by distributed cracks. For this purpose, monotonic loading tests were carried out on a series of eight RC beams. Prior to testing, the surface of the beams was inspected the presence of distributed cracks. The crack density parameter introduced in the earlier research work was used to mathematically quantify the influence of the distributed cracks on the shear carrying capacity of the beams. The beams exhibited a mixed mode of failure between both diagonal tension and diagonal compression failures. A companion paper was also published (Khuntia & Ghosh b) emphasizing the applicability of the proposed stiffness expressions for all levels of applied loading, both service and ultimate loads. The parameters of interest were reinforcement ratio, concrete compressive strength, magnitude of axial load and the eccentricity ratio. The authors investigated effective parameters and the results were compared with the available experimental data. The parameters considered were bar size and the effective concrete area surrounding the reinforcement. In addition to these parameters, the additional parameter considered in the present study is variation in compression reinforcement.

The minimum compression steel in doubly reinforced beams is not specified in IS 456:2000. However, the creep and shrinkage of concrete may require hangers and other bars that provided up to 0.2% of the total area of the cross section. In light of this, these bars are not regarded as compression reinforcement. Therefore, in order for the doubly reinforced beam to handle the additional loads in addition to resisting the effects of concrete creep and shrinkage, the minimum amount of steel used as compression reinforcement should be at least 0.4% of the area of concrete in compression or 0.2% of the entire cross-sectional area of the beam. According to IS 456 clause number 26.5.1.2, the maximum amount of compression steel cannot be more than 4% of the entire area of the beam's cross-section.

As stipulated in clause 26.5.1.1(a) and (b) (IS 456: 2000), the minimum amount of tensile reinforcement shall be at least (0.85 bd/fy) and the maximum area of tension reinforcement shall not exceed (0.04 bD). The singly reinforced beams shall have Ast normally not exceeding 75 to 80% of Ast, lim so that xu remains less than xu,

max with a view to ensuring ductile failure. Nonetheless, the presence of compression steel in the case of doubly reinforced beams ensures the ductile failure. Thus, the depth of the neutral axis may be taken as xu, max if the beam is over-reinforced. Accordingly, the A_{st1} part of the tension steel can go up to A_{st}, lim and the additional tension steel A_{st2} is provided for the additional moment Mu - Mu, limit. The quantities of A_{st1} and A_{st2} together form the total $A_{st,}$ which shall not exceed 0.04 bD.

1.2 Scope of Proposed Research/Choice of topic with reasoning

While most of previous research works focused on the mechanical properties of undamaged RC members, this study investigates the behavior of RC doubly reinforced beams affected by compressive reinforcement. When the applied moment on the beam element is more than the M.R. (moment of resistance) of singly R.C. Beam the M.R. of beam is increased by providing reinforcements in the compression zone. This type of beam is called doubly R.C. Beam. The scope of proposed research is as follows

1. When it is not possible or dimensions (breadth x depth) of the beam are restricted to increase the depth of beam due to architectural purpose.
2. To get more headway in the rooms.
3. When the beam is subjected to reversal of stresses.
4. When subjected to an external load may cause tension on both faces of the member.
5. When subjected to sudden load like in case of earthquakes.
6. For pre-cast beams.
7. When subjected to eccentric loading.

1.3 Objectives of Research

With reference to the previous conclusions of research it is clear that there is need for experimental investigation to study elastic properties of doubly reinforced beams. It is even observed that the codes provisions in IS 456-2000, is insufficient to specify young's modulus of RCC beams. The objectives of research work are as follows

1. Role of compression reinforcement on strength of beam.
2. Analytical and experimental investigation.
3. To arrive at empirical relation for effective EI values in flexural loading based on percentage of tension and compression reinforcement.

II. Literature Review

2.1 General

The main obstacle to finite element analysis of reinforced concrete structures is the difficulty in characterizing the material properties. Much effort has been spent in search of a realistic model to predict the behavior of reinforced concrete structures. Due mainly to the complexity of the composite nature of the material, proper modeling of such structures is a challenging task. Despite the great advances achieved in the fields of plasticity, damage theory and fracture mechanics, among others, a unique and complete constitutive model for reinforced concrete is still lacking.

2.2 Literature Survey

2.2.1 S K kulkarni, M R Shiyekar, S M Shiyekar and B Wagh [2013][1] analyzed structural analysis, especially in indeterminate structures, it becomes essential to know material and geometrical properties of members. The

codal provisions recommend elastic properties of concrete and steel and these are fairly accurate enough. The stress–strain curve for concrete cylinder or a cube specimen is plotted. The slope of this curve is modulus of elasticity of plain concrete. Another method of determining modulus of elasticity of concrete is by flexural test of a beam specimen. The modulus of elasticity most commonly used for concrete is secant modulus. The modulus of elasticity of steel is obtained by performing a tension test of steel bar. While performing analysis by any software for high rise building, cross area of plain concrete is taken into consideration whereas effects of reinforcement bars and concrete confined by stirrups are neglected. The aim of study is to determine elastic properties of reinforced cement concrete material. Two important stiffness properties such as AE and EI play important role in analysis of high rise RCC building idealized as plane frame. The experimental programme consists of testing of beams (model size 150 × 150 × 700 mm) with percentage of reinforcement varying from 0.54 to 1.63%. The experimental results are verified by using 3D finite element techniques. This study refers to the effect of variation of percentage of main longitudinal reinforcement and concrete grade. Effect of confinement is not considered and it appears in a separate study.

2.2.2 Sumant Kulkarni Mukund Ramchandra Shiyekar Sandip Mukund Shiyekar [2014][2] analyzed structural analysis, especially in indeterminate structures, it becomes essential to know the material and geometrical properties of members. The codal provisions recommend elastic properties of concrete and steel and these are fairly accurate enough. The stress–strain curve for concrete cylinder or a cube specimen is plotted. The slope of this curve is modulus of elasticity of plain concrete. Another method of determining modulus of elasticity of concrete is by flexural test of a beam specimen. The modulus of elasticity most commonly used for concrete is secant modulus. The modulus of elasticity of steel is obtained by performing a tension test of steel bar. While performing analysis by any software for high rise building, cross area of plain concrete is taken into consideration whereas effects of reinforcement bars and concrete confined by stirrups are neglected. Present aim of study is to determine elastic properties of reinforced cement concrete beam. Two important stiffness properties such as AE and EI play important role in analysis of high rise RCC building idealized as plane frame. The experimental program consists of testing of beams (model size 150 X 150 X 700 mm) with percentage of reinforcement varying from 0.54 to 1.63% which commensurate with existing Codal provisions of IS: 456-2000 for flexural member. The effect of confinement is considered in this study. The experimental results are verified by using 3D finite element techniques.

2.2.3 Marta Słowik [2018][3] analyzed failure and crack development in beams made of concrete is presented. The analysis was carried out on the basis of the performed experimental investigation and numerical simulations. A fictitious crack model based on nonlinear fracture mechanics was applied to investigate the development of strain softening of tensile concrete in plain concrete and slightly reinforced concrete beams. The role of strain softening was also discussed according to the inclined crack propagation in highly reinforced concrete beams. The analysis has brought the evidence that the mode of failure in flexural beams varies according to a longitudinal reinforcement ratio. A brittle failure due to the formation of a flexural crack takes place in plain and slightly reinforced concrete beams, and strain softening of tensile concrete is of paramount importance at failure crack initiation and propagation. A stable growth of numerous flexural cracks is possible in moderately reinforced concrete beams, and then the load carrying capacity is connected with reaching the yield stress of reinforcing steel or concrete crushing in the compression zone. In higher reinforced concrete beams without transverse reinforcement, brittle failure can take place due to shear forces and the development of diagonal cracks. However, strain softening of tensile concrete is not the only mechanism influencing the

propagation of an inclined crack. Such mechanisms as aggregate interlock and dowel action of steel bars contribute more importantly to the development of failure crack.

2.2.4 Yulita Arni Priastiwi, Iswandi Imranb, Nuroji [2015][4], analyzed experimental study on beams confined in compression zone with different shapes of extra confining reinforcement. The types of extra confining reinforcement considered are hoop reinforcement and cross ties. Three half-scale beam specimens (including the specimen with no extra confining reinforcement in the compression zone) have been tested under increasingly monotonic loading. The test results show that the presence of extra confinement in compression zone of beam section increase the ductility of the beam. However, no substantial increases are observed in the strength capacity of the beam specimens with extra confinement. In addition, more significant increase in ductility is obtained in the beam specimen with extra hoop in the compression zone than that with extra cross ties.

2.2.5 Ionut Ovidiu Toma, Tomohiro Miki and Junichiro Niwa [2007][5] analyzed the shear behavior of reinforced concrete beams with doubly reinforced rectangular cross-section, with and without steel fibers, affected by distributed cracks. The influence of the distributed cracks was mathematically quantified with the help of a crack density parameter. Monotonic loading tests were conducted on the RC beams and their failure indicated a mixed mode between both diagonal tension and diagonal compression failures. Due to the reinforcement layout, the effect of the longitudinal compression reinforcement on the shear carrying capacity should be taken into account. The distributed cracks were shown to have less influence on the peak load of doubly reinforced concrete beams.

2.2.6 Rajkamal M. D., Karthikeyan S, Santosh Velan D, Surendharan N, Vigneshwaran.M.S [2015][6] analyzed deflection of the various beams on analysis of experimental value and the innovation of our project is to bring all types in a single apparatus. We can also find the deflection of both the rectangular and circular cross sectional beams. The objective of our project is to provide a practical knowledge on how a beam gets deflected due to different types of loads acting transversely to the axis of the beam. Here we analysis the experiment by using ANSYS software.

2.2.7 Onur Onat and Burak Yön [2018][7] analyzed failure mode of reinforced concrete (RC) structures are classified according to tension reinforcement ratio of beam elements. To determine effect of tension reinforcement ratio on performance of RC structure, two planar RC structure were selected. One of them is 5 stories other of them is 7 stories. Two different concrete class, C20 and C25, were considered for analysis. Three tension reinforcement combinations were considered, three different tension reinforcement ratios were used. First case is the ratio of the tension reinforcement is lower than that of the compression reinforcement, second case is the ratio of the tension reinforcement is equal to the ratio of the compression reinforcement and third case is the ratio of the tensile reinforcement is higher than the compression reinforcement.

2.2.8 T. Tejaswini, Dr.M.V.Rama Raju [2015][8] analyzed reinforced concrete (RC) which became one of the most important building materials and is widely used in many types of engineering structures. For the efficient use of RCC it is necessary to know the properties and the behavior of RCC elements under various constrains. Within the framework of developing advanced design and analysis methods for modern structures the need for experimental research continues. Experiments provide a firm basis for design equations, which are valuable in the preliminary design stages. Experimental research also supplies the basic information for finite element models. The development of reliable analytical models can reduce the number of required test specimens for the solution of a given problem, recognizing that tests are time-consuming and costly and often do not simulate exactly the loading and support conditions of the actual structure. The aim of the study was to compare

experimental results with the ABAQUS results. Initially laboratory tests are carried out on a beam of 1200 x 200 x100 mm of M30 grade concrete for plain, under, balanced, over reinforced sections. Finite Element Analysis (FEA) has also been performed using ABAQUS for the model geometry considered in the experimental study. The numerical results from the FEA are compared with the experimental results which showed good agreement between the results.

2.2.9 Umer Farooq, Mir Aijaz Ahmad [2014][9] analyzed FEM numerical technique to find approximate solutions for boundary value problems, for partial differential equations and also for integral equations. Finite Element Analysis (FEA) represents a numerical method, which provides solution to problems that would otherwise be difficult to obtain. The numerical analysis investigations were performed with commercial software ANSYS. This software is a suite of powerful engineering simulation programs, based on finite element method, which can solve problems ranging from relatively simpler linear analyses to the most challenging non-linear simulations.

2.3 Conclusion from Literature

It has been observed that the tension steel of doubly reinforced beam has been studied but much focus is not given compressive steel of beam.

III. Methodology

3.1 Problem Statement

A doubly reinforced beam is to be designed as per IS 13920-2016. A minimum width of beam kept is 150mm as mentioned in IS 13920-2016. As per IS code depth should not be more than one fourth of clear span. By considering various parameters number of cases are considered for designing doubly reinforced beam.

3.2 Case I:

Beam cross section = 150mm X 200mm

Length of Beam = 1500mm = 1.5m

Grade of Concrete = M20

Grade of Steel = Fe 415

Design of Doubly Reinforced Beam

Assumptions:

f_{ck} = 20N/mm^2

f_y = 415N/mm^2

Cover = 50mm

Eff. Depth(d) = D - d = 200 - 50 = 150 mm =0.15m

Self-weight of Beam (W_D) = 25 x b x Dx L

= 25x0.15x0.2x1.5

= 2 kN

Factored Load = 1.5x2

= 3kN

Now,

Ultimate Moment (M_u) = W_u x $L^2/8$

= $3x1.5^2/8$

= 1.5 kNm

Vu = W_u x L/2

= 3x1.5/2

= 3kN

Now,

Ultimate Limiting Moment = $0.138f_{ck}bd^2$

$M_{u(lim)}$ = $0.138x20x0.15x0.15^2$

=0.0124kNm

Since, $M_{u(lim)} < M_u$ i.e., 0.0124 < 1.5 kNm

Therefore, It can be designed as doubly reinforced beam.

Compression Reinforcement

$M_u - M_{u(lim)}$ = 1.5 – 0.0124

= 1.48kNm

f_{sc} = $[0.0.35 (x_{umax} – d^/)/ x_{umax}]E_s$

x_{umax} = 0.48 $d^/$ (for fe 415)

=0.48x150

f_{sc} = $\{\{0.035[(0.48x150) -50]\}/ (0.48x150)\}x2x10^5$

= $213.88N/mm^2$

Minimum reinforcement for calculation of Asc = $213.88N/mm^2$

f_{sc} should not be greater than $0.87f_y$

= 0.87x415

= $361N/mm^2$

Take minimum value of f_{sc}

A_{sc} = M_u-M_{ulim} /f_{sc} (d-d')

$= 1.48x10^6 / 213.33(200-50)$

$= 46.13\ mm^2$

Calculation of number of bars

$A_{sc} = \pi/4\ Ø^2\ X$

$46.13 = \pi/4\ 8^2\ X$

$X = 1$

Provide 2 no. of bars of 8mm diameter (Compression Steel)

Therefore,

Actual $A_{sc} = \pi/4\ Ø^2\ X$

$= \pi/4 \times 8^2 \times 2$

$= 100.48\ mm^2$

Tension Reinforcement

$A_{st2} = A_{sc}\ f_{sc} / (0.87f_y)$

$= 46.13x213.88/(0.87x415)$

$= 27.32\ mm^2$

$A_{st1} = 0.36f_{ck}bx_{ulim} / (0.87f_y)$

$= 0.36x20x200x(0.48x150) / (0.87x415)$

$= 287.16\ mm^2$

$A_{st1} = A_{st1} + A_{st2}$

$= 287.16 + 27.32$

$= 314.48\ mm^2$

No. of Bars

$A_{st} = \pi/4\ Ø^2\ X$

$314.48 = \pi/4\ 12^2\ X$

$X = 3$

Therefore, provide 3 bars of 12mm diameter

Actual $A_{st} = \pi/4 \times 12^2 \times 3$

$= 339.12\ mm^2$

Shear Reinforcement

$\tau_v = V_u / bd$

$= (3x10^3) / (150x150)$

$= 0.1\ N/mm^2$

$P_t = 100A_{st} /bd$

$= (100x339.12) / (150x150)$

$= 1.13$

As per IS456 table 19

$\tau_c = 0.646$

As. $\tau_v < \tau_c$

i.e., $0.1 < 0.646$, therefore there is no need of shear reinforcement.

By considering maximum and minimum reinforcement various combinations for compression and tension reinforcement is shown in table no. 1

Table No. 1 Combination of compression and tension reinforcement of 150x200 c/s

Model	Beam No.	Compression Steel	Tension Steel
Model I	A1	2 bars of 10mm Ø	2 bars of 10mm Ø
	A2	2 bars of 8 mm Ø	2 bars of 10mm Ø
Model II	A3	2 bars of 10mm Ø	3 bars of 8 mm Ø
	A4	2 bars of 8 mm Ø	3 bars of 8 mm Ø
	A5	3 bars of 8 mm Ø	3 bars of 8 mm Ø
Model III	A6	2 bars of 8 mm Ø	2 bars of 8 mm Ø

3.3 Case II:

Beam cross section = 150mm X 300mm

Length of Beam = 1500mm = 1.5m

Grade of Concrete = M20

Grade of Steel = Fe 415

Design of Doubly Reinforced Beam

Assumptions:

f_{ck} = 20N/mm²

f_y = 415N/mm²

Cover = 50mm

Eff. Depth(d) = D - d = 300 - 50 = 250 mm =0.25m

Self-weight of Beam (W_D) = 25 x b x Dx L

= 25x0.15x0.3x1.5

= 3 kN

Factored Load = 1.5x3

= 4.5 kN

Now,

Ultimate Moment (M_u) = W_u x L²/8

= 4.5 x1.5²/8

= 2.25 kNm

Vu = W_u x L/2

= 4.5 x1.5 /2

= 4.5 kN

Now,

Ultimate Limiting Moment = $0.138f_{ck}bd^2$

$M_{u(lim)}$ = $0.138x20x0.15x0.25^2$

=0.0345kNm

Since, $M_{u(lim)} < M_u$ i.e., 0.0345 < 2.25 kNm

Therefore, It can be designed as doubly reinforced beam.

Compression Reinforcement

$M_u - M_{u(lim)}$ = 2.25 – 0.0345

= 2.22kNm

f_{sc} = $[0.0035 (x_{umax} – d^/)/ x_{umax}]E_s$

x_{umax} = 0.48 $d^/$ (for fe 415)

=0.48x250

f_{sc} = $\{\{0.0035[(0.48x250) -50]\}/ (0.48x250)\}x2x10^5$

= 408.33 N/mm²

Minimum reinforcement for calculation of Asc = 408.33N/mm²

From SP 16, from effective depth

f_{sc} = 329 N/mm²

Take minimum value of f_{sc}

A_{sc} = M_u-M_{ulim} /f_{sc} (d-d')

= $2.22x10^6$/ 329(250-50)

= 30.17 mm²

Calculation of number of bars

A_{sc} = π/4 Ø² X

30.17 = π/4 8² X

X = 1

Provide 2 no. of bars of 8mm diameter (Compression Steel)

Therefore,

Actual A_{sc} = π/4 Ø² X

= π/4 x 8² x 2

= 100.48 mm²

Tension Reinforcement

A_{st2} $= A_{sc}\, f_{sc} / (0.87 f_y)$

$= 30.17 \times 329/(0.87 \times 415)$

$= 27.49\ mm^2$

A_{st1} $= 0.36 f_{ck} b x_{ulim} / (0.87 f_y)$

$= 0.36 \times 20 \times 150 \times (0.48 \times 250) / (0.87 \times 415)$

$= 478.60\ mm^2$

A_{st1} $= A_{st1} + A_{st2}$

$= 478.60 + 27.49$

$= 506.09\ mm^2$

No. of Bars

A_{st} $= \pi/4\ Ø^2\ X$

$506.09 = \pi/4\ 12^2\ X$

$X = 4.47$

Therefore, provide 4 bars of 12mm diameter

Actual A_{st} $= \pi/4 \times 12^2 \times 4$

$= 565\ mm^2$

Shear Reinforcement

τ_v $= V_u / bd$

$= (4.5 \times 10^3) / (150 \times 250)$

$= 0.09\ N/mm^2$

P_t $= 100 A_{st} / bd$

$= (100 \times 565) / (150 \times 250)$

$= 1.13$

As per IS456 table 19

τ_c $= 0.646$

As. $\tau_v < \tau_c$

i.e., $0.1 < 0.646$, therefore there is no need of shear reinforcement.

By considering maximum and minimum reinforcement various combinations for compression and tension reinforcement is shown in table no. 2.

Table No. 2 Combination of compression and tension reinforcement of 150x300 c/s

Model	Beam No.	Compression Steel	Tension Steel
Model I	B1	2 bars of 12mm Ø	2 bars of 12mm Ø
	B2	2 bars of 10mm Ø	2 bars of 12mm Ø
	B3	2 bars of 8 mm Ø	2 bars of 12mm Ø
	B4	3 bars of 8 mm Ø	2 bars of 12mm Ø
	B5	3 bars of 10 mm Ø	2 bars of 12mm Ø
Model II	B6	2 bars of 10mm Ø	3 bars of 10 mm Ø
	B7	2 bars of 8 mm Ø	3 bars of 10 mm Ø
	B8	3 bars of 8 mm Ø	3 bars of 10 mm Ø

	B9	3 bars of 10 mm Ø	3 bars of 10 mm Ø
Model III	B10	2 bars of 8 mm Ø	4 bars of 8 mm Ø
	B11	3 bars of 8 mm Ø	4 bars of 8 mm Ø
	B12	4 bars of 8 mm Ø	4 bars of 8 mm Ø

3.4 Case III:

Beam cross section = 150mm X 400mm

Length of Beam = 1500mm = 1.5m

Grade of Concrete = M20

Grade of Steel = Fe 415

Design of Doubly Reinforced Beam

Assumptions:

f_{ck} = 20N/mm^2

f_y = 415N/mm^2

Cover = 50mm

Eff. Depth(d) = D - d = 400 - 50 = 350 mm =0.35m

Self-weight of Beam (W_D) = 25 x b x Dx L

= 25x0.15x0.4x1.5

= 4 kN

Factored Load = 1.5x4

= 6 kN

Now,

Ultimate Moment (M_u) = W_u x L^2/8

= 6 x1.5^2/8

= 3 kNm

Vu = W_u x L/2

= 6 x1.5 /2

= 6 kN

Now,

Ultimate Limiting Moment = 0.138f_{ck}bd^2

$M_{u(lim)}$ = 0.138x20x0.15x0.35^2

=0.193kNm

Since, $M_{u(lim)} < M_u$ i.e., 0.193 < 3 kNm

Therefore, It can be designed as doubly reinforced beam.

Compression Reinforcement

$M_u - M_{u(lim)}$ = 3 – 0.193

= 2.807kNm

f_{sc} = $[0.0035 (x_{umax} – d^/)/ x_{umax}]E_s$

x_{umax} = 0.48 $d^/$ (for fe 415)

=0.48x350

f_{sc} = $\{\{0.0035[(0.48x350) -50]\}/ (0.48x350)\}x2x10^5$

= 491 N/mm^2

From SP 16, from effective depth

f_{sc} = 343.54 N/mm^2

Take minimum value of f_{sc}

A_{sc} = M_u-M_{ulim} /f_{sc} (d-d')

= 2.807x10^6/ 343.54(400-50)

= 23.34 mm^2

Calculation of number of bars

A_{sc} = π/4 Ø^2 X

23.34 = π/4 8^2 X

X = 0.46

Provide 2 no. of bars of 8mm diameter (Compression Steel)

Therefore,

Actual A_{sc} = π/4 Ø^2 X

= π/4 x 8^2 x 2

= 100.48 mm^2

Tension Reinforcement

A_{st2} = A_{sc} f_{sc} / (0.87f_y)

= 23.34x343.54/(0.87x415)

= 22.21 mm^2

A_{st1} = 0.36f_{ck}bx_{ulim}/ (0.87f_y)

= 0.36x20x150x(0.48x350) / (0.87x415)

= 670.05 mm^2

A_{st1} =A_{st1} + A_{st2}

= 670.05 + 22.21

$= 692.26 \text{ mm}^2$

No. of Bars

$A_{st} = \pi/4 \, Ø^2 X$

$692.26 = \pi/4 \, 12^2 X$

$X = 6$

Therefore, provide 6 bars of 12mm diameter

Actual $A_{st} = \pi/4 \times 12^2 \times 6$

$= 565 \text{ mm}^2$

Shear Reinforcement

$\tau_v = V_u / bd$

$= (6x10^3) / (150x350)$

$=0.085 \text{ N/mm}^2$

$P_t = 100A_{st} /bd$

$= (100x678.58) / (150x350)$

$= 0.969$

As per IS456 table 19

$\tau_c = 0.646$

As. $\tau_v < \tau_c$

i.e., 0.1 < 0.646, therefore there is no need of shear reinforcement.

By considering maximum and minimum reinforcement various combinations for compression and tension reinforcement is shown in table no. 3

Table No. 3 Combination of compression and tension reinforcement of 150x400 c/s

Model	Beam No.	Compression Steel	Tension Steel
Model I	C1	2 bars of 12mm Ø	2 bars of 12mm Ø
	C2	2 bars of 10mm Ø	2 bars of 12mm Ø
	C3	2 bars of 8 mm Ø	2 bars of 12mm Ø
	C4	3 bars of 8 mm Ø	2 bars of 12mm Ø
	C5	3 bars of 10 mm Ø	2 bars of 12mm Ø
Model II	C6	2 bars of 10mm Ø	3 bars of 10 mm Ø
	C7	2 bars of 8 mm Ø	3 bars of 10 mm Ø
	C8	3 bars of 8 mm Ø	3 bars of 10 mm Ø
	C9	3 bars of 10 mm Ø	3 bars of 10 mm Ø
Model III	C10	2 bars of 8 mm Ø	4 bars of 8 mm Ø
	C11	3 bars of 8 mm Ø	4 bars of 8 mm Ø
	C12	4 bars of 8 mm Ø	4 bars of 8 mm Ø

3.5. Experimental Program

This section provides information about combinations of compression and tension reinforcement with different beam cross sections. Additionally, experimental setup arrangements described in brief. After doing the experiment, the beam deflection is recorded.

3.5.1 Material Properties

After carefully considering the literature suggestions and conducting an analysis, following material properties were considered for the study as shown in table 4.

Table 4 Materials Specification

Materials	Specifications
Cement	
Grade of Cement	OPC, 53 Grade, Birla Super
Specific gravity of cement	3.15
Fineness of Cement	4.28% (IS 4031 Part 2)
Consistency of Cement	39% (IS 4031 Part 4)
Coarse Aggregates (CA)	
Specific Gravity	2.74
Size of Aggregate	20mm
Fine Aggregates (FA)	
Specific Gravity	2.58
Bulk Density	1620 kg/m3
Consumable Water	
pH	7.0-8.0

3.5.2 Design Mix

M20 grade of concrete was designed having following properties as shown in table 5.

Table 5 Design Mix for M20 grade of Concrete.

	Compressive Strength in MPa
	20
W/C	0.60
Cement, kg/m^3	319.3
Fine Aggregate, kg/m^3	711.58
Coarse Aggregate, kg/m^3	1182.01
Water, litres	191.58

3.5.3 Specimen Details

Total 90 beams were tested for deflection by using Universal Testing machine of 400KN capacity. A doubly reinforced beam is designed as per IS 13920-2016. A minimum width of the beam kept is 150mm. As per IS code depth should not be more than one fourth of clear span accordingly, depth of beam used is 200mm, 300mm, 400mm and length of beam is kept constant as1500mm.

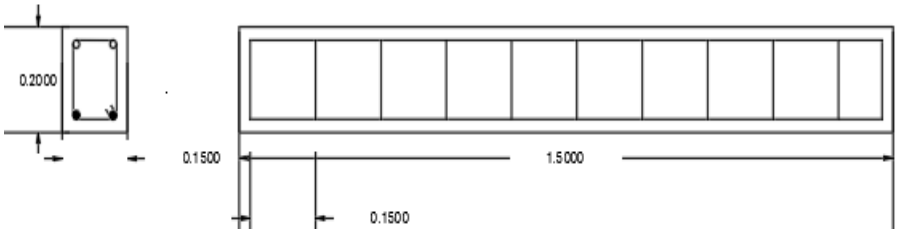


Fig. 1 Sectional View of concrete beam (all dimensions are in meter).

By considering various parameters number of combinations are done by varying tension and compression reinforcement as mentioned in the table 6, table 7, table 8.

Table 6 Combination of compression and tension reinforcement of 150mmx200mm c/s.

Model	Tension Reinforcement	Compression Reinforcement	Beam No.	Compression Steel	Tension Steel
Model I	Maximum	Maximum	A1	2 bars of 10mm Ø	2 bars of 10mm Ø
		Minimum	A2	2 bars of 8 mm Ø	2 bars of 10mm Ø
Model II	Moderate	Maximum	A3	2 bars of 10mm Ø	3 bars of 8 mm Ø
		Moderate	A5	3 bars of 8 mm Ø	3 bars of 8 mm Ø
		Minimum	A4	2 bars of 8 mm Ø	3 bars of 8 mm Ø
Model III	Minimum	Minimum	A6	2 bars of 8 mm Ø	2 bars of 8 mm Ø

In Table 6, three beam models of size 150mmX200mmX1500mm are prepared and by keeping tension reinforcement constant and variations are done in compression reinforcement from minimum to maximum. Similarly for model II, tension reinforcement is kept constant and variations are done in compression reinforcement from minimum to maximum. Similar variations are done for model III.

Table 7 Combination of compression and tension reinforcement of 150mmx300mm c/s

Model	Tension Reinforcement	Compression Reinforcement	Beam No.	Compression Steel	Tension Steel
Model II	Maximum	Maximum	B9	3 bars of 10 mm Ø	3 bars of 10 mm Ø
		Moderate	B6	2 bars of 10mm Ø	3 bars of 10 mm Ø
		Moderate	B8	3 bars of 8 mm Ø	3 bars of 10 mm Ø
		Minimum	B7	2 bars of 8 mm Ø	3 bars of 10 mm Ø
Model I	Moderate	Maximum	B5	3 bars of 10 mm Ø	2 bars of 12mm Ø
		Moderate	B1	2 bars of 12mm Ø	2 bars of 12mm Ø
		Moderate	B2	2 bars of 10mm Ø	2 bars of 12mm Ø
		Moderate	B4	3 bars of 8 mm Ø	2 bars of 12mm Ø
		Minimum	B3	2 bars of 8 mm Ø	2 bars of 12mm Ø
Model III	Minimum	Maximum	B12	4 bars of 8 mm Ø	4 bars of 8 mm Ø
		Moderate	B11	3 bars of 8 mm Ø	4 bars of 8 mm Ø
		Minimum	B10	2 bars of 8 mm Ø	4 bars of 8 mm Ø

In Table 7, three beam models of size 150mmX300mmX1500mm are prepared and by keeping tension reinforcement constant and variations are done in compression reinforcement from minimum to maximum. Similar variations are done for model II and model III.

Table 8 Combination of compression and tension reinforcement of 150x400 c/s

Model	Tension Reinforcement	Compression Reinforcement	Beam No.	Compression Steel	Tension Steel
Model II	Maximum	Maximum	C9	3 bars of 10 mm Ø	3 bars of 10 mm Ø
		Moderate	C6	2 bars of 10mm Ø	3 bars of 10 mm Ø
		Moderate	C8	3 bars of 8 mm Ø	3 bars of 10 mm Ø
		Minimum	C7	2 bars of 8 mm Ø	3 bars of 10 mm Ø
Model I	Moderate	Maximum	C5	3 bars of 10 mm Ø	2 bars of 12mm Ø
		Moderate	C1	2 bars of 12mm Ø	2 bars of 12mm Ø
		Moderate	C2	2 bars of 10mm Ø	2 bars of 12mm Ø
		Moderate	C4	3 bars of 8 mm Ø	2 bars of 12mm Ø
		Minimum	C3	2 bars of 8 mm Ø	2 bars of 12mm Ø
Model III	Minimum	Maximum	C12	4 bars of 8 mm Ø	4 bars of 8 mm Ø
		Moderate	C11	3 bars of 8 mm Ø	4 bars of 8 mm Ø
		Minimum	C10	2 bars of 8 mm Ø	4 bars of 8 mm Ø

In Table 8, three beam models of size 150mmX400mmX1500mm are prepared and by keeping tension reinforcement constant and variations are done in compression reinforcement from minimum to maximum. Similar variations are done for model II and model III.

3.5.4 Actual Beam Specimen Model

Fig. 2 Actual beam model.

Total 90 beams were casted on site by varying cross section of beam and also, tension and compression reinforcement was considered from minimum to maximum range as mentioned in above table 6, table 7 and table 8. The width of beam used was 150mm and depth of beam used was 200mm, 300mm and 400mm. The length of beam was kept constant i.e., 1500mm.

3.5.5 Experimental Set up

A Universal testing machine (UTM) of 400kN capacity is used to test 90 beams and deflection was measured. UTM can be used to test a wide variety of materials like concrete, steel, cables, springs, steel wires and chains, slings, links, rope, winches, steel ropes, etc.

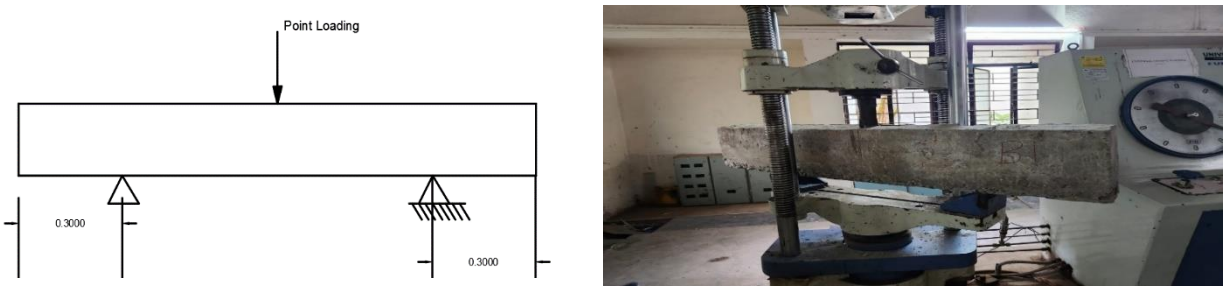


Fig. 3 Test Setup.

3.5.6 Testing of Beams

A universal testing machine (UTM), of 400kN capacity was used and compressive strength of doubly reinforced beam. The results include the maximum load the specimen can withstand before failure, the deformation or strain at the point of failure, and the modulus of elasticity of the material. Flexural cracks initially developed on the bottom of the beams as the specimens were loaded. The beams exhibited linear behavior up until cracks were noticed at the concrete cover in the middle of the beam, which was subjected to the greatest amount of pure bending. Peak load appeared when the wider flexural fissures and concrete cover in the compression zone began to crumble.

Fig. 4 Failure and cracking pattern of beams.

3.6 FE Analysis

In order to get realistic behavior of RC material analytically various combinations are used using ANSYS Benchwork. The grade of concrete selected for study is M20 with varying depth as 200,300,400.

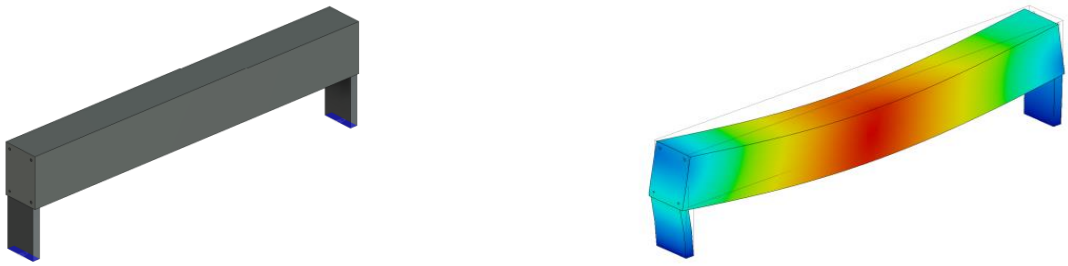


Fig.5 FE Model for concrete and Deflection Profile

4 Results & Discussion

4.1 General

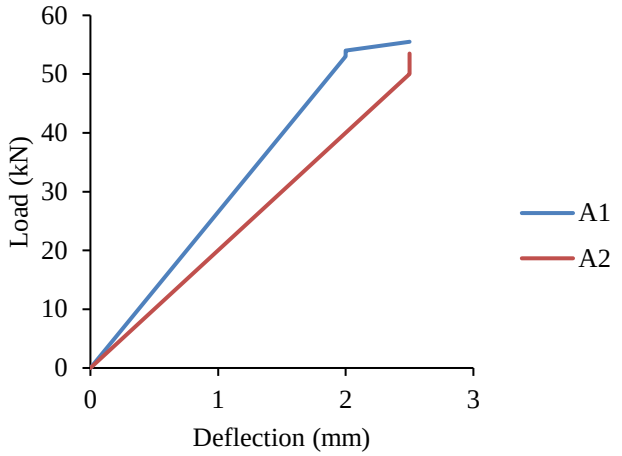
Total 90 beams were tested in UTM machine. Load deflection responses were recorded.

4.2 Results and discussion

The deflection of the beam was recorded with reference to the compression and tension steel for first crack and failure load as shown in table 6, table 7, table 8.

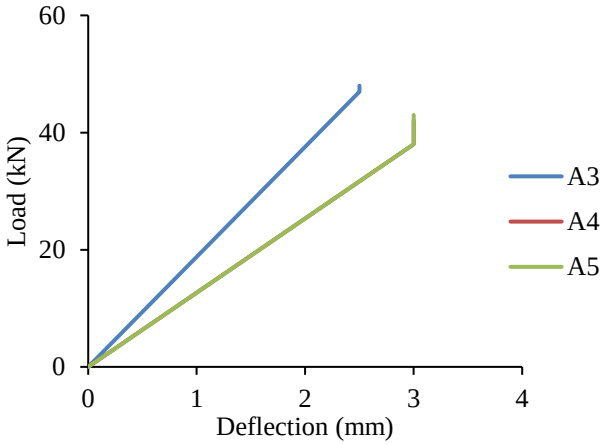
Table 9 Load and Deflection at first crack and failure load of 150mmx200mm c/s beam.

Model	Beam No.	Load at first Crack (kN)	Deflection at first Crack (mm)	Average Deflection at first Crack (mm)	Failure Load (kN)	Deflection at failure Load (mm)	Analytical Deflection (mm)	Average Deflection at failure Load (mm)
Model I	A1	49	0.5	0.5	54	2	2.128	2.17
		51	0.5		53	2		
		49.5	0.5		55.5	2.5		
	A2	42	0.5	0.5	50	2.5	2.01	2.5
		46	0.5		53.5	2.5		
		41	0.5		50	2.5		
Model II	A3	39	0.5	0.5	47	2.5	2.46	2.5
		37	0.5		48	2.5		
		39	0.5		48	2.5		
	A5	35	0.5	0.5	43	3	2.66	3
		35	0.5		39	3		
		31	0.5		38	3		
	A4	35	0.5	0.5	41	3	2.87	3
		32	0.5		38	3		
		33.5	0.5		42	3		
Model III	A6	29	1	1	34	4	4.847	4
		31.5	1		31	4		
		28	1		33	4		



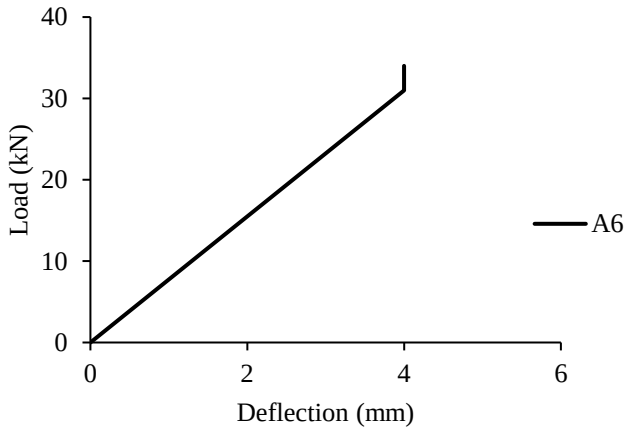
Beam No.	Percentage of Steel	
	Compression steel	Tension steel
A1	0.69	0.69
A2	0.45	0.69

Fig. 6 Graph of Load vs deflection for model I from table 9.



Beam No.	Percentage of Steel	
	Compression steel	Tension steel
A3	0.69	0.67
A5	0.67	0.67
A4	0.45	0.67

Fig. 7 Graph of Load vs deflection for model II from table 9.



Beam No.	Percentage of Steel	
	Compression steel	Tension steel
A6	0.45	0.45

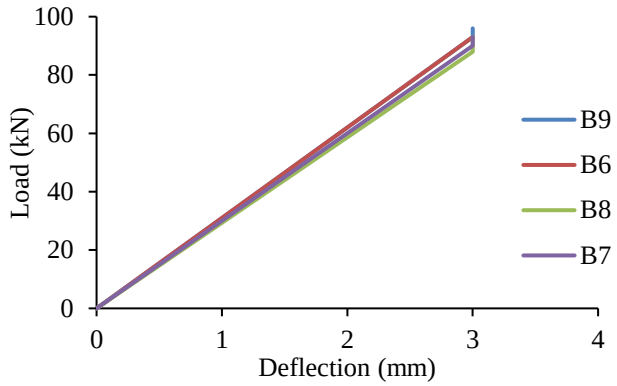
Fig. 8 Graph of Load vs deflection for model III from table 9.

Fig. 6, Fig 7 and Fig. 8 represents deflections of the beam for the failure load as mentioned in table 9. Compression reinforcement varies in each case as mentioned in table 6.

Table 10 Load and Deflection at first crack and failure load of 150mmx300mm c/s beam.

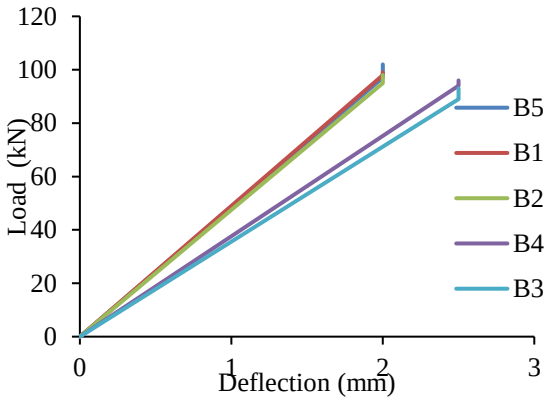
Model	Beam No.	Load at first Crack (kN)	Deflection at first Crack (mm)	Average Deflection at first Crack (mm)	Failure Load (kN)	Deflection at failure Load (mm)	Analytical Deflection (mm)	Average Deflection at failure Load (mm)
Model II	B9	87	0.5	0.5	95	3	2.661	3
		88	0.5		96	3		
		82	0.5		93	3		
	B6	81	0.5	0.5	93	3	2.650	3
		82	0.5		93	3		
		86	0.5		93	3		
	B8	80	0.5	0.5	93	3	2.445	3
		77	0.5		88	3		
		83	0.5		88	3		
	B7	83	0.5	0.5	90	3	2.521	3
		81	0.5		93	3		
		81	0.5		92	3		
Model I	B5	85	0.5	0.5	99	2	2.56	2
		89	0.5		102	2		
		83	0.5		97	2		
	B1	80	0.5	0.5	99	2	2.011	2
		79.5	0.5		98	2		
		78	0.5		99	2		
	B2	82	0.5	0.5	97	2	2.081	2
		84	0.5		95	2		
		79	0.5		98	2		
	B4	81	0.5	0.5	94	2.5	2.481	2.5
		83	0.5		94	2.5		
		83	0.5		96	2.5		
	B3	79	0.5	0.5	93	2.5	2.481	2.5
		77.5	0.5		91	2.5		
		76	0.5		89	2.5		
Model III	B12	73	1	1	83	3.5	3.451	3.5
		74	1		79.5	3.5		
		71	1		82	3.5		
	B11	70	1	1	78	3.5	3.359	3.5
		70	1		76	3.5		
		67	1		77	3.5		

	B10	70	1	1	76	3.5	3.357	3.5
		68	1		75	3.5		
		71.5	1		82	3.5		



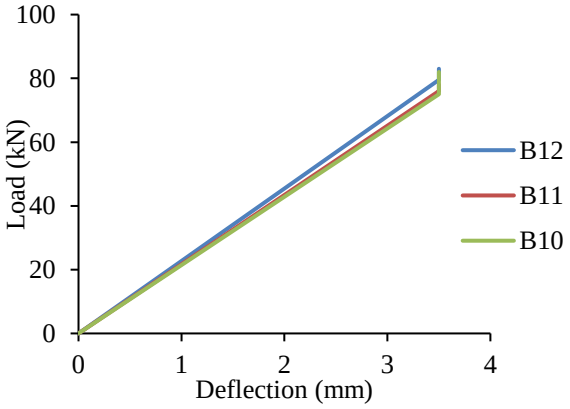
Beam No.	Percentage of Steel	
	Compression steel	Tension steel
B9	0.63	0.63
B6	0.42	0.63
B8	0.4	0.63
B7	0.27	0.63

Fig. 9 Graph of Load vs deflection for model II from table 10.



Beam No.	Percentage of Steel	
	Compression steel	Tension steel
B5	0.63	0.6
B1	0.6	0.6
B2	0.42	0.6
B4	0.4	0.6
B3	0.27	0.6

Fig. 10 Graph of Load vs deflection for model I from table 10.



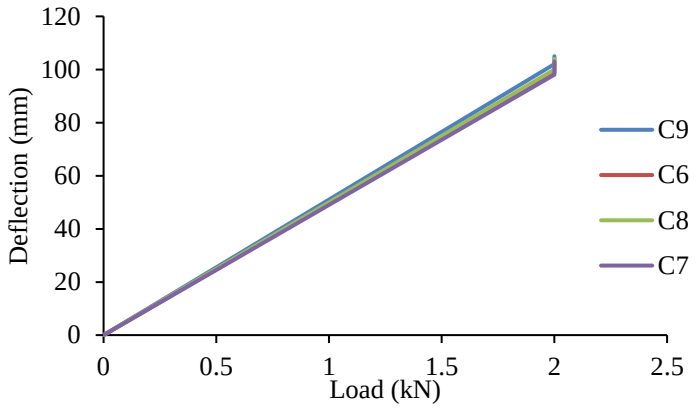
Beam No.	Percentage of Steel	
	Compression steel	Tension steel
B12	0.54	0.54
B11	0.4	0.54
B10	0.27	0.54

Fig. 11 Graph of Load vs deflection for model III from table 10.

Fig. 9, Fig. 10 and Fig. 11 represents deflections of the beam for the failure load as mentioned in table 10. Compression reinforcement varies in each case as mentioned in table 7.

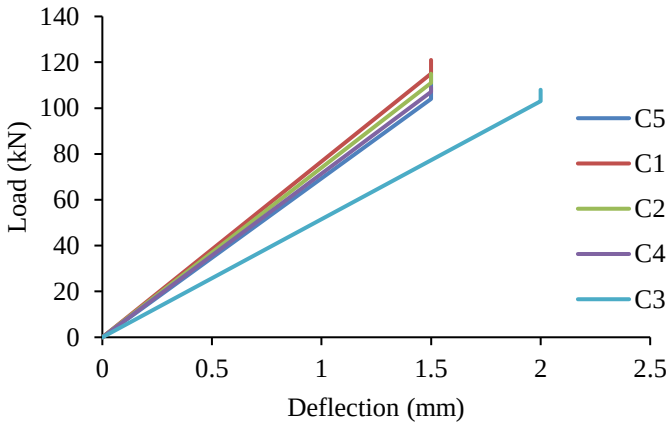
Table 11 Load and Deflection at first crack and failure load of 150mmx300mm c/s beam.

Model	Beam No.	Load at first Crack (kN)	Deflection at first Crack (mm)	Average Deflection at first Crack (mm)	Failure Load (kN)	Deflection at failure Load (mm)	Analytical Deflection (mm)	Average Deflection at failure Load (mm)
Model II	C9	88	0.5	0.5	105	2	2.156	2
		89	0.5		104.5	2		
		86	0.5		102	2		
	C6	93	0.5	0.5	102	2	2.146	2
		95	0.5		101	2		
		94	0.5		99	2		
	C8	89	0.5	0.5	101	2	2.223	2
		91	0.5		104	2		
		89	0.5		100	2		
	C7	90	0.5	0.5	98	2	2.122	2
		89	0.5		98	2		
		89	0.5		103	2		
Model I	C5	100	0.5	0.5	115	1.5	1.446	1.5
		95.5	0.5		104	1.5		
		98	0.5		109	1.5		
	C1	101	0.5	0.5	119	1.5	1.449	1.5
		99	0.5		121	1.5		
		106	0.5		115	1.5		
	C2	98	0.5	0.5	111	1.5	1.445	1.5
		101	0.5		115	1.5		
		96	0.5		112	1.5		
	C4	97	0.5	0.5	109	1.5	1.452	1.5
		96	0.5		109	1.5		
		96	0.5		107	1.5		
	C3	97	0.5	0.5	104	2	2.128	2
		97	0.5		103	2		
		99	0.5		108	2		
Model III	C12	79	1	1	90	3	3.149	3
		81	1		86	3		
		80	1		87	3		
	C11	79	1	1	87	3	3.122	3
		78	1		88	3		
		78	1		85	3		
	C10	76	1	1	83	3	3.125	3
		77	1		90	3		
		79	1		87	3		



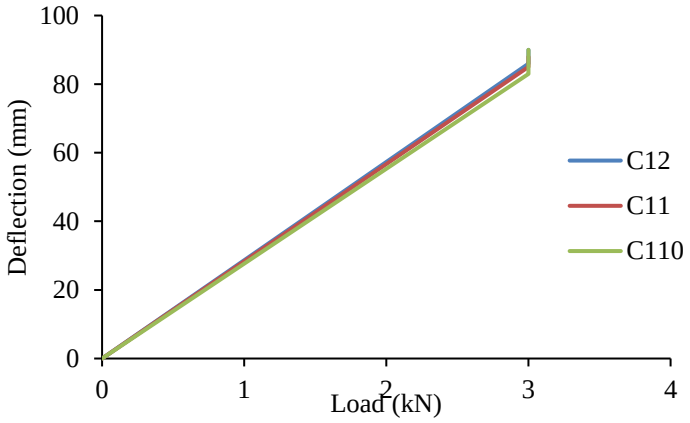
Beam No.	Percentage of Steel	
	Compression steel	Tension steel
C9	0.45	0.45
C6	0.299	0.45
C8	0.287	0.45
C7	0.19	0.45

Fig. 12 Graph of Load vs deflection for model II from table 11.



Beam No.	Percentage of Steel	
	Compression steel	Tension steel
C5	0.45	0.43
C1	0.43	0.43
C2	0.299	0.43
C4	0.287	0.43
C3	0.19	0.43

Fig. 13 Graph of Load vs deflection for model I from table 8.



Beam No.	Percentage of Steel	
	Compression steel	Tension steel
C12	0.38	0.38
C11	0.287	0.38
C10	0.19	0.38

Fig. 14 Graph of Load vs deflection for model III from table 11.

Fig. 12, fig 13 and fig. 14 represents deflections of the beam for the failure load as mentioned in table 11. Compression reinforcement varies in each case as mentioned in table 8.

4.3 Evaluation of E of RCC for M20 grade of Concrete

For a beam subjected to one-point loading the deflection formula is as follows

$$\delta = \frac{5}{384}\frac{wl^4}{EI} + \frac{Pl^3}{48EI} \quad \text{----------} \quad (1)$$

where w is self-weight of beam in N/mm and P is half the load at failure in N. The experimental value of midspan deflection is situated in the above equation for each case. By substituting proper values of w, P, l and I, the remaining value i.e. E is evaluated. The above equation is applicable only for linear behavior. The value of P is substituted corresponding to first crack. Modulus of Elasticity of PCC by IS: 456-2000 formula is $5000\sqrt{f_{ck}}$ = $5000\sqrt{20}$ =22360.68 N/mm^2.

Table 12: Percentage of Steel and corresponding E values of RCC for beam size 150mmX200mm

Model	Beam No.	Load at first Crack (kN)	Deflection at first Crack (mm)	Average Deflection at first Crack (mm)	Failure Load (kN)	Deflection at failure Load (mm)	Average Deflection at failure Load (mm)	E_{RCC} (N/mm^2)	Percentage of Steel (p_t in%)
Model I	A1	49	0.5	0.5	54	2	2.17	69895.02	1.38
		51	0.5		53	2		72707.52	
		49.5	0.5		55.5	2.5		70598.14	
	A2	42	0.5	0.5	50	2.5	2.5	60051.27	1.14
		46	0.5		53.5	2.5		65676.27	
		41	0.5		50	2.5		58645.02	
Model II	A3	39	0.5	0.5	47	2.5	2.5	55832.52	1.36
		37	0.5		48	2.5		53020.02	
		39	0.5		48	2.5		55832.52	
	A5	35	0.5	0.5	43	3	3	50207.52	1.34
		35	0.5		39	3		50207.52	
		31	0.5		38	3		44583.52	
	A4	35	0.5	0.5	41	3	3	50207.52	1.12
		32	0.5		38	3		45988.77	
		33.5	0.5		42	3		48098.14	
Model III	A6	29	1	1	34	4	4	20885.01	0.9
		31.5	1		31	4		20181.88	
		28	1		33	4		22642.82	

Table 13: Percentage of Steel and corresponding E values of RCC for beam size 150mmX300mm

Model	Beam No.	Load at first Crack (kN)	Deflection at first Crack (mm)	Average Deflection at first Crack (mm)	Failure Load (kN)	Deflection at failure Load (mm)	Average Deflection at failure Load (mm)	E_{RCC} (N/mm²)	Percentage of Steel
Model II	B9	87	0.5	0.5	95	3	3	27517.09	1.26
		88	0.5		96	3		27829.59	
		82	0.5		93	3		25954.59	
	B6	81	0.5	0.5	93	3	3	25642.09	1.05
		82	0.5		93	3		25954.59	
		86	0.5		93	3		27204.59	
	B8	80	0.5	0.5	93	3	3	25329.59	1.03
		77	0.5		88	3		24392.09	
		83	0.5		88	3		26267.09	
	B7	83	0.5	0.5	90	3	3	26267.09	0.9
		81	0.5		93	3		25642.09	
		81	0.5		92	3		25642.09	
Model I	B5	85	0.5	0.5	99	2	2	26892.09	1.23
		89	0.5		102	2		28142.09	
		83	0.5		97	2		26267.09	
	B1	80	0.5	0.5	99	2	2	25329.59	1.2
		79.5	0.5		98	2		25173.34	
		78	0.5		99	2		24704.59	
	B2	82	0.5	0.5	97	2	2	25954.59	1.02
		84	0.5		95	2		26579.59	
		79	0.5		98	2		25017.09	
	B4	81	0.5	0.5	94	2.5	2.5	25642.09	1.00
		83	0.5		94	2.5		26267.09	
		83	0.5		96	2.5		26267.09	
	B3	79	0.5	0.5	93	2.5	2.5	25017.09	0.87
		77.5	0.5		91	2.5		24548.34	
		76	0.5		89	2.5		24079.59	
Model III	B12	73	1	1	83	3.5	3.5	11571.04	1.08
		74	1		79.5	3.5		11727.29	
		71	1		82	3.5		11258.54	
	B11	70	1	1	78	3.5	3.5	11102.29	0.94
		70	1		76	3.5		11102.29	
		67	1		77	3.5		10633.54	

	B10	70	1	1	76	3.5	3.5	11102.29	0.81
		68	1		75	3.5		10789.79	
		71.5	1		82	3.5		11336.67	

Table 14: Percentage of Steel and corresponding E values of RCC for beam size 150mmX400mm

Model	Beam No.	Load at first Crack (kN)	Deflection at first Crack (mm)	Average Deflection at first Crack (mm)	Failure Load (kN)	Deflection at failure Load (mm)	Average Deflection at failure Load (mm)	E_{RCC} (N/mm²)	Percentage of Steel
Model II	C9	88	0.5	0.5	105	2	2	15715.94	0.9
		89	0.5		104.5	2		15891.72	
		86	0.5		102	2		15364.38	
	C6	93	0.5	0.5	102	2	2	16594.85	0.75
		95	0.5		101	2		16946.41	
		94	0.5		99	2		16770.63	
	C8	89	0.5	0.5	101	2	2	15891.72	0.74
		91	0.5		104	2		16243.29	
		89	0.5		100	2		15891.72	
	C7	90	0.5	0.5	98	2	2	16067.50	0.64
		89	0.5		98	2		15891.72	
		89	0.5		103	2		15891.72	
Model I	C5	100	0.5	0.5	115	1.5	1.5	17825.32	0.88
		95.5	0.5		104	1.5		17034.30	
		98	0.5		109	1.5		17473.75	
	C1	101	0.5	0.5	119	1.5	1.5	18001.09	0.86
		99	0.5		121	1.5		17649.54	
		106	0.5		115	1.5		18880.00	
	C2	98	0.5	0.5	111	1.5	1.5	17473.75	0.73
		101	0.5		115	1.5		18001.09	
		96	0.5		112	1.5		17122.19	
	C4	97	0.5	0.5	109	1.5	1.5	17297.97	0.72
		96	0.5		109	1.5		17122.19	
		96	0.5		107	1.5		17122.19	
	C3	97	0.5	0.5	104	2	2	17297.97	0.62
		97	0.5		103	2		17297.97	
		99	0.5		108	2		17649.54	
Model III	C12	79	1	1	90	3	3	7066.96	0.76
		81	1		86	3		7242.74	

		80	1		87	3		7154.85	
	C11	79	1	1	87	3	3	7066.96	0.67
		78	1		88	3		6979.06	
		78	1		85	3		6979.06	
	C10	76	1	1	83	3	3	6803.28	0.57
		77	1		90	3		6891.17	
		79	1		87	3		7066.96	

Table 15: Percentage of Steel and corresponding Average E values of RCC for beam size 150mmX200mm

Model	% of steel	Modulus of Elasticity
A6	0.9	21236.57
A5	1.12	48098.14
A2	1.14	61457.52
A4	1.34	48332.52
A3	1.36	54895.02
A1	1.38	71066.893

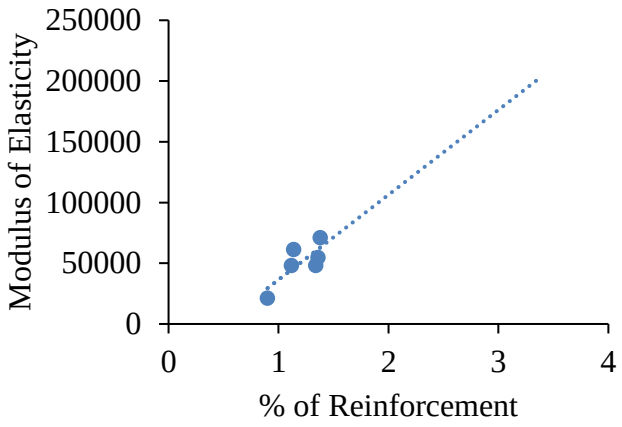


Fig. 14 Modulus of Elasticity against percentage of reinforcement (150mmx200mm)

Graphical representation of the values indicated in table 15, is shown in Fig 14. The equation for E value of RCC from the graph is presented in equation 2 through regression analysis.

$$E_{RCC} = -22840p_t^2 + 597246\,p_t - 330474 \text{ ---------- (2)}$$

Table 16: Percentage of Steel and corresponding Average E values of RCC for beam size 150mmX 300mm

Model	% of steel	Modulus of Elasticity
B9	1.26	27100.42
B6	1.05	26267.09

B8	1.03	230003.25
B7	0.9	25850.42
B5	1.23	27100.42
B1	1.2	25069.17
B2	1.02	25850.42
B4	1	26058.76
B3	0.87	24548.34
B12	1.08	11518.96
B11	0.94	10946.04
B10	0.81	11076.25

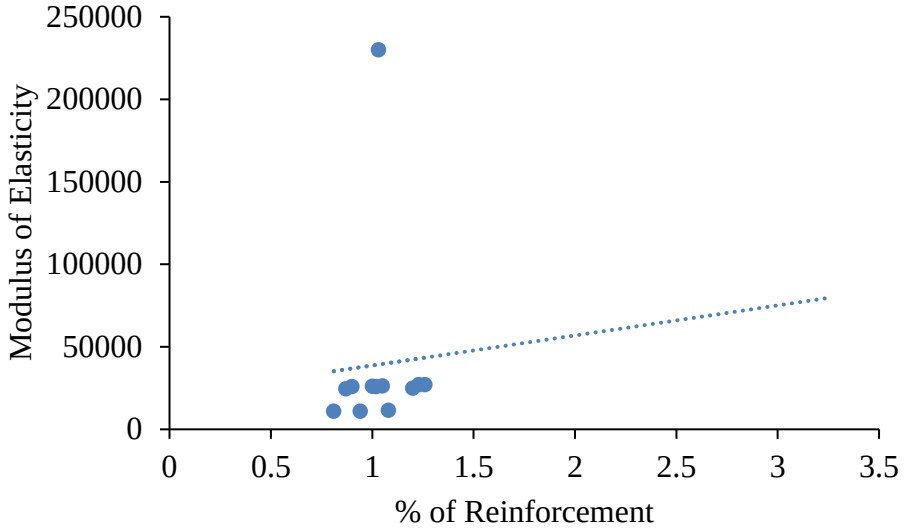


Fig. 15 Modulus of Elasticity against percentage of reinforcement (150mmx300mm)

Graphical representation of the values indicated in table 16, is shown in Fig 15. The equation for E value of RCC from the graph is presented in equation 3 through regression analysis.

$$E_{RCC} = -949250p_t^2 + 2x10^6\, p_t - 999128 \text{ ---------- (3)}$$

Table 17: Percentage of Steel and corresponding Average E values of RCC for beam size 150mmX 400mm

Model	% of steel	Modulus of Elasticity
C9	0.9	15657.35
C6	0.75	16770.63
C8	0.74	16008.91
C7	0.64	15950.31
C5	0.88	17444.46
C1	0.86	18176.88
C2	0.73	17532.34
C4	0.72	17180.78
C3	0.62	17415.16

C12	0.76	7154.85
C11	0.67	7008.36
C10	0.57	6920.47

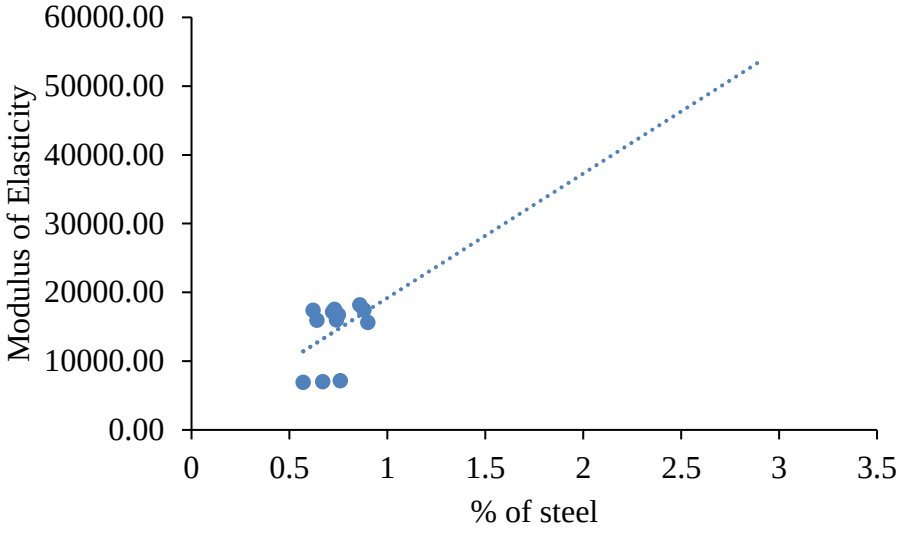


Fig. 16 Modulus of Elasticity against percentage of reinforcement (150mmx400mm)

Graphical representation of the values indicated in table 17, is shown in Fig 16. The equation for E value of RCC from the graph is presented in equation 4 through regression analysis.

$$E_{RCC} = -57198p_t^2 + 103210\ p_t - 29990 \text{ ---------- (4)}$$

IV. Conclusion

Normal stresses on beams in the longitudinal direction range from the highest tension at one surface to the midplane of the beam being zero to the maximum compression at the opposing surface. Shear stresses are also produced when the length-to-height ratio of the beam is high, but they are typically negligible in comparison to the normal stresses. Flexural fissures can be managed with the appropriate tension reinforcement. Both the curvature and the resisting moments of concrete sections are improved by compression reinforcing. This microcrack has the potential to result in the traditional mass concrete breaking because of the tensile stress pressing on the mass concrete structure. According to the experimental study, cracks were found in the beam's center during testing, and the deflection increased as the cross section of the beam decreased. Shear reinforcement has favorable effect on modulus of elasticity.

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