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Power Efficient, Reliable & Secure Body Area Network using Clustering

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ABSTRACT

Healthcare systems use a medical text mining which have been increasingly facilitating health condition monitoring and disease modelling. System works on the Personal Health Information (PHI) of the user. and analysis, which can hardly afford the dynamic health condition fluctuation Healthcare system grant users access to range of health information and medical knowledge. In proposed system I basically created the database of 150 to 200 diseases with their precaution suggestions. System will output the next highly probable disease by narrowing down the number of diseases from the list of diseases according to the related symptoms either entered by the users or captured by the different sensors nodes. Benefit of the system is all the information about disease, precautions and healthcare are store at one place. Unfortunately, delegating both storage and computation to the untreated entity would bring a series of security and privacy issues. One of the controversial issues for PHI is how the technology could threaten the privacy of patient health information. The proposed system focused on fine-grained privacy-preserving static medical text access.

Keywords: WBAN, WSN, Cloud Computing, K-Mean Clustering Algorithm, Rijndeal AES algorithm

I. INTRODUCTION

Progressing in medical concern such as the aging population in developed countries and the skyrocketing cost of healthcare have told the emergence of technology-driven improvements of present healthcare practice. For instance, recent advances in electronics have enabled the progress of bio-medical sensors that can be worn or put in the human body. These sensors have the capability to gathered important data about the body's health condition and thus facilitating the introduction of various types of networks among which are Wireless Body Area Networks (WBANs) [1]-[11]. WBANs are networks of nodes with the capability of original time monitoring of patient's vital signs such as pulse rate, body temperature, blood pressure, and etc. The information gathered is wirelessly relayed to the physician or caregiver in a timely fashion. Essentially, the data gathered by the sensors is sent to an external server for analysis and storage. As it turns out, using a wired connection for this issue will be cumbersome and will involve high deployment and maintenance cost. While the use of a wireless interface permit an easier application and is additional cost efficient [1]. With the current traditional medical care system, there are limitations in diseases diagnosis in addition to difficulties experienced in previous detection of diseases and long term patients monitoring. WBANs constitute an powerful and efficient result to the formerly mentioned issues [2]. WBAN can monitor single or multiple vital signs at the same time and can include implantable or wearable bio-sensors. The data transmission in WBANs can include ZigBee, Bluetooth, and Wi-Fi. Data access points in a WBAN where the data is gathered, save or displayed can

include laptop computers, smart phones and personal digital assistants etc.

II. LITERATURE REVIEW

Basically, here we can say that the medical diagnosis process can be interpreted as a decision making process, throughout which the physician induces the analysis of a new &unknown case from an available set of medical data from her/his clinical experience. At the University of Calabria in Italy, the medical decision making process has been computerized, Physicians at the Cosenza General Hospital currently are using the diagnostic decision support system to help them with the timely identification of breast Cancer in patients through The application of a well-defined set of classification data. Dr. MirnmoConforti presented the system in Year 1999 & he explained the architecture from this particular point of view emphasizing the powerful efficiency and effectiveness of Mathematical Programming approaches as the basic tools for the design of the or Computer Aided Medical Diagnosis system. MimmoCnnforti addresses our attention to previous detection of cancer on the basis of minimum amount of clinical information [3].

Hubert Kordylewski[5], Daniel Graupe[6] in 2001 describes the application & principal of a large memory storage and retrieval (LAMSTAR) neural network. The LAMSTAR was specifically useful for application to problems having very large memory that contains various different categories or attributes, like where some of the data is exact while other data are fuzzy and where, for a given problem, there may be some data categories are totally missing. The LAMSTAR network is fast, speedy and can shrink/grow in dimensionality without any reprogramming. LAMESTER network is a self-organized also having features of forgetting and of interpolation & extrapolation, thus being able to handle map (SOM) with link weight between two neurons of this SOM module. The network partial data sets. Applications of the network to 3 specific medical diagnosis problems are described: two from nephrology and one related to an emergency-room drug identification problem.

DejanDinevski, Peter Kokol, GregorStiglic, Petra Povalej [7] elaborates the use of self-organization to combine different specialist opinions generated by different intelligent classifier systems with a purpose to raise the classification accuracy. Early and accurate diagnosing of various diseases has proved to be of vital importance in many health care processes. In recent years intelligent systems have been often used for decision support & classification in many scientific and engineering disciplines including health care. However, in many cases the proposed treatment or the prediction or diagnose can vary from one intelligent system to another system similar to the real world where various specialists may have different opinions. The main aim here is to imitate this situation in the manner to combine different opinions generated by diverse intelligent systems using the self-organizing abilities of cellular automata because most ensembles are construct using definite machine learning method or a combination of that method, but the drawback being this is that the selection of the appropriate method or the combination of that method for a specific issue must be made by the user. So, to overcome this issue an ensemble of classifiers is constructed by a self-organizing system applying cellular automata (CA).

III. PROPOSED WORK

Wireless Body Area Network

WBAN is a technology that is very helpful in monitoring the health conditions overcome the wired line limitations of conventional signals from the body[1]. As it is played in Fig.1, WBAN can be considered as a sensor network used for personal

matter. This network is in hybrid form which is formed by using a group of sensor nodes that uses wireless transmissions for forwarding the data which they collect from the body sensors. The nodes which are found in WBAN have very much higher speeds and they are affected by regularly occurring topological changes. The topology of WBAN is similar to topology of MANETs, but they are having a movement that is based on the groups, when compared to that of node-based movement. Also reliability becomes a difficult task due to the power and mobility issues which is caused by frequent changes in network topology. In cost of the existing literature works of WBAN the security and reliability are handled individually. The node sensing the data wants to transmit the data to BAN coordinator, it either sends directly or via relay node based on its battery power and SNR[1].

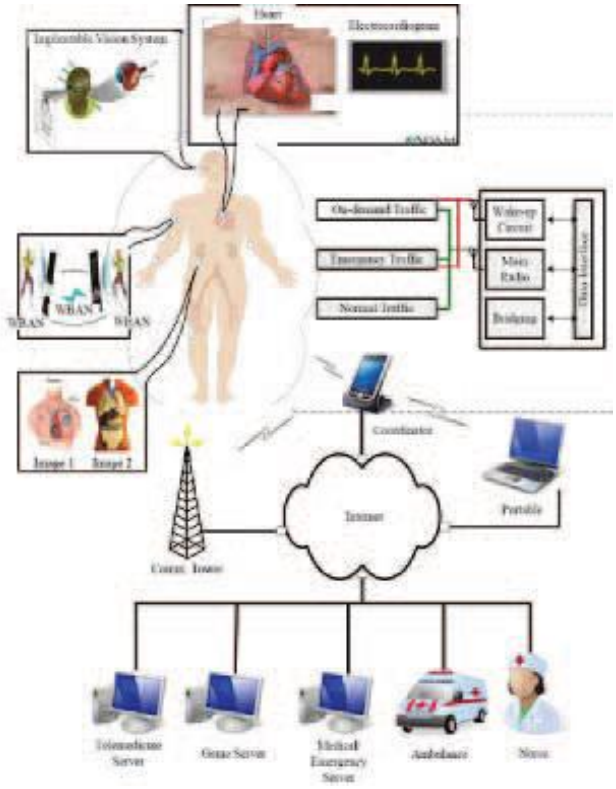

Figure 1 Wireless Body Area Network

Proposed System

Developments in microcircuits & medical field are to help in long term health monitoring. These sensors are battery supported & are very small devices which are deployed along the body of human [1]. The collected data from the sensors is sent to a data hub by using wireless channels. The sink may be device which may portable (PDA) or a smart phone. The device which collects all the necessary data sends it to a health agency using a cellular or wireless network or internet etc. This helps to forward the real time information which is collected from the sensors to the human who are specialists in that, by using this data they can deliver the required treatment to the patients who are under the monitoring in short period of time. WBANs are efficient, it aims to help in monitoring people who are suffering from unique diseases and problems which are chronic or those who are working and living in adverse environment conditions or far from care givers. In a spatial region WBANs are deployed (around the body of human being) instead of single hop communication they tend to follow multi-hop communication as their main communication pattern. Previous research states [2] that since the body of human will be having much physical absorption, the channels in WBAN will undergo higher path loss when the same are compared with the WBAN network which deployed in free space. In WBANs using of high power RF along the human body is not recommended as the RF waves can generate some heat which might cause damage to body tissue. For determining the required transmission power for each and every wireless link for which we use dynamic power assignment [3]. In the solution the information of transmission power used by the sender to transmit the packet exists. By measuring the received signal strength at the receiver the decision is taken if power of transmissions is more or less, or is informed to the client for adjusting the power of transmissions depending on the observations done, which will improve the trusting ability of the communication. Researchers mainly point on efficient

routing algorithm, which helps in creation of communicating the data [4].

Normally experienced doctors classify diseases based on the different diagnosis [2] method. This involves narrowing down the diseases to the root disease out of the list of diseases which shows similar symptoms. This is done using their knowledge & experience, and it is then confirmed by performing various tests. Especially in some area, the problem of lack of trained and experienced doctors leads to intensification of this problem [3]. So we are trying to build this process of differential diagnosis to make this rather tough task a lot easy.

The system, using various techniques mentioned, will in twist display the root disease along with the set of most likely diseases which have similar symptoms. This system will give the list of diseases that the patient has maximum or more probability of suffering from. This, in turn, will help to recommend specific tests corresponding to diseases in the list, thus reducing the number of non-consequential tests and thus resulting in saving time and money for both the doctor & the patient [14].

System Design

System design is the process or art of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. One could see it as the application of systems theory to product development. There is some overlap & synergy with the disciplines of systems analysis, systems architecture and systems engineering.

System Architecture

The Fig. 2 will works as the user of the system enter the input symptoms to the system and their level of occurrences or gravity then clustered the entered data by providing the aquiline distance by performing the subtraction of symptom weight from the users symptoms weight to the expert symptoms weight. the closest distance considered the next highly probable disease, then system provide the prescription and Google data related to particular disease and doctor appointment through mail

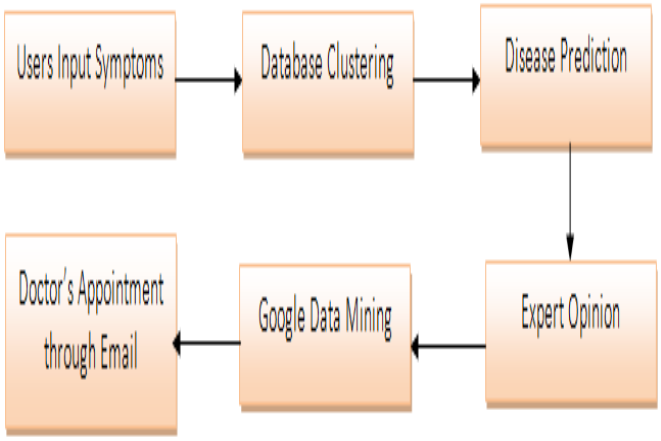

Fig. 2 System architecture block diagram

Data Flow Diagram

The DFD is a simple graphical structure that can be used to system representation in terms of input data to the system, various processing carried out on this data, & the output data is generated by this system. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. Those components are the process the system; this process used the data, an exterior entity that cooperate with the system & the flows of information in the system.

DFD shows way of the information moves during the process of system & it is adapted by a transformations series. It is a graphical method which represents information flow & the transformations so as to apply as data moves from input to output,

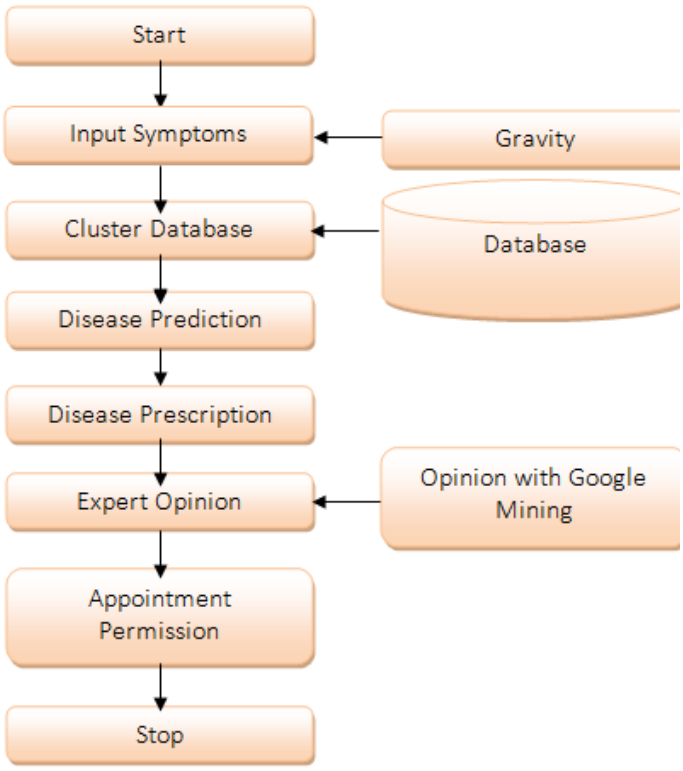

Fig. 3 Data flow diagram

UML Diagram

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, & was created by, the Object Management Group. The goal is for UML to become a common language for creating models of object oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML. The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.

The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems. The UML is a very important part of developing objects oriented software & the software development process. The UML uses mostly graphical notations to express the design of software projects.

Use case Diagram

A use case diagram at its simplest is a representation of a user's interaction with the system and depicting the specifications of use case. A use case diagram can portray the different types of users of a system and the various ways that they interact with the system. Use case diagrams describe the interaction of any parson or external device with the system which is under design process. Use cases are often developed in collaborations between software developer & other users of the proposed system. The main purpose of the use case diagram is to help developing teams to visualize the functional requirements of the system. Use case diagram shows the relationship between actors & use cases. It consists of two elements: Use cases Actor The actor characterizes the interacting person or a thing. The use case describes the specific interaction of an actor.

The purpose of use case diagram is to capture the dynamic aspect of a system. But this definition is too generic to describe the purpose. Because other 4 diagrams (activity, sequence, collaboration and State chart) are also having the similar purpose. So it will look into some specific purpose which will distinguish it from other 4 diagrams. Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements.

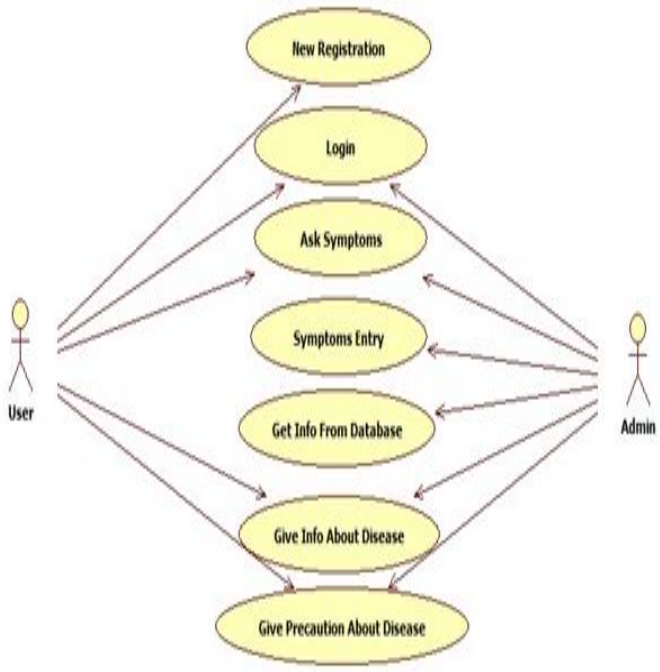

Fig. 4 Use case Diagram

Class Diagram

The class diagram is a static diagram. It's represents the static view of an application. Class diagram is not only used for visualizing, describing & documenting different aspects of a system but also for constructing executable code of the software application. The class diagram describes the attributes and operations of a class & also the constraints imposed on the system. The class diagrams are widely used in the modelling of object oriented systems because they are the only UML diagrams which can be mapped directly with object oriented languages. The class diagram shows a collection of classes, interfaces, associations, collaborations& constraints. It is also known as a structural diagram.

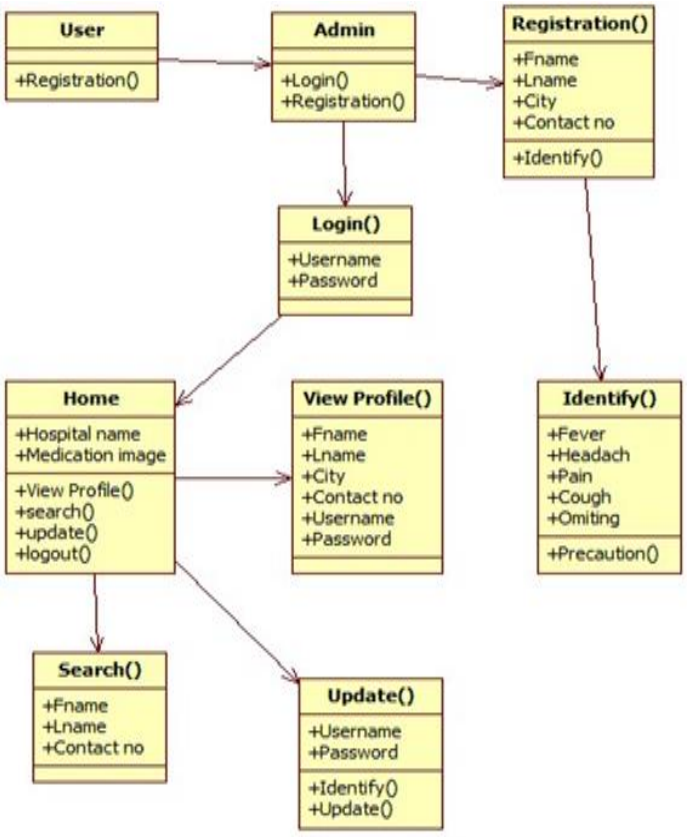

Fig. 5 Class Diagram

Activity Diagram

Activity diagrams are graphical representations of workflows of stepwise activities & actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the Business and operational step-by-step workflows of components in system. An activity diagram shows the overall flow of control.

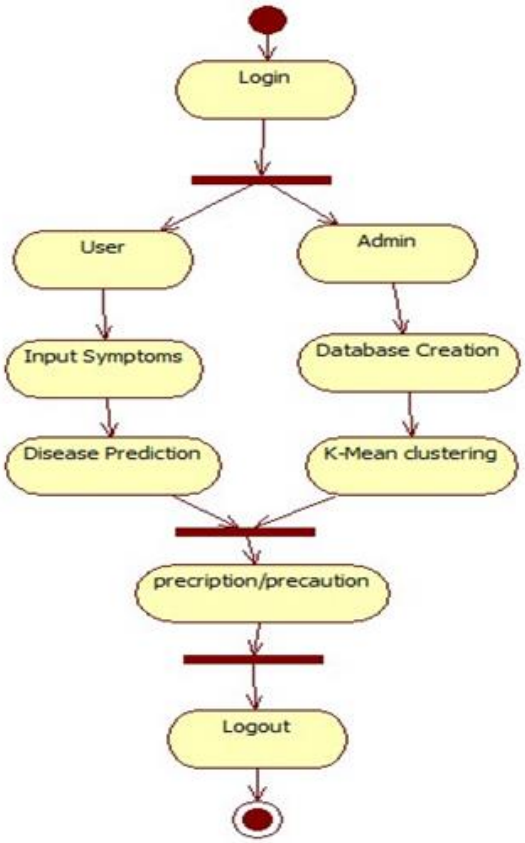

Fig. 6 Activity Diagram

Sequence Diagram

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that show how processes operate with one another & in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, & timing diagrams. The Sequence Diagram models the collaboration of objects based on a time sequence. It shows how the objects interact with each other's in a particular scenario of a use case. With the advanced visual modeling capability, you can also create complex sequence diagram in few clicks. Besides, Visual Paradigm can generate sequence diagram from the flow of events which you have defined in the use case descriptions.

A sequence diagram shows object interactions arranged in time sequence. It depicts the objects & classes involved in the scenario & the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the Logical View of the system under developments.

A sequence diagram shows, as parallel vertical lines (lifelines) different processes or objects that live simultaneously, & as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner.

The purposes of interaction diagrams are to visualize the interactive behaviour of the system. Now visualizing interaction is a hard task. So the result is to use different types of models to capture the different aspects of the interaction. That is why the sequence and collaboration diagrams are used to capture dynamic nature but from a different angle. So the purposes of interaction diagram can be describes as:

- To capture dynamic behaviour of a system.
- To describe the message flow in the system.
- To describe structural organization of the objects.
- To describe interaction among objects.

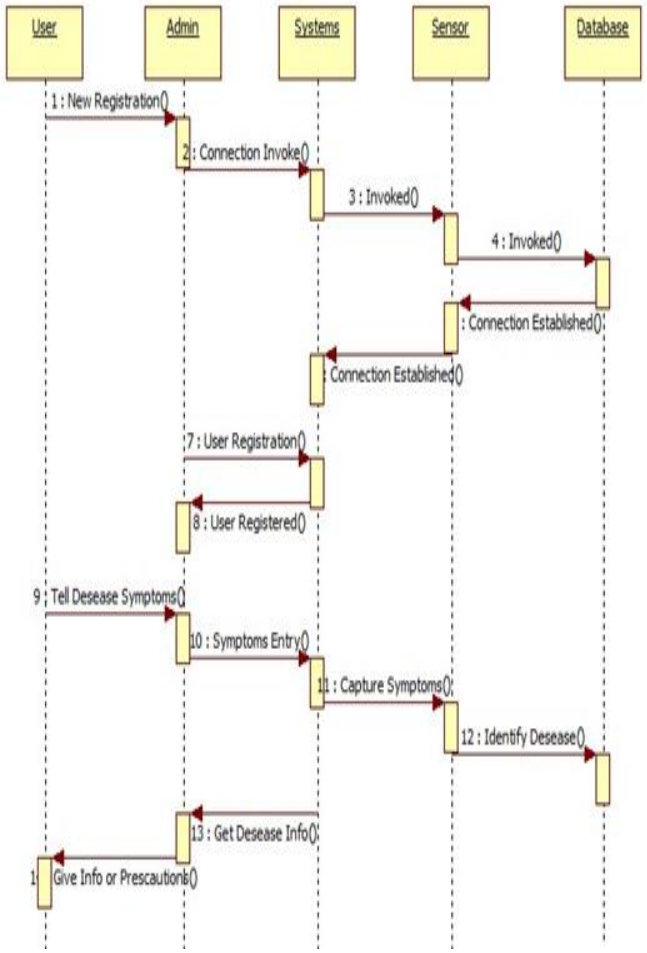

Fig. 7 Sequence Diagram

Component Diagram

Component diagrams are used to model physical aspect so system likes voice, voice processing System, Database server etc. So, component diagrams are used to imagine the organizations and relationships among components in a scheme. These Diagrams are also used to create executable systems.

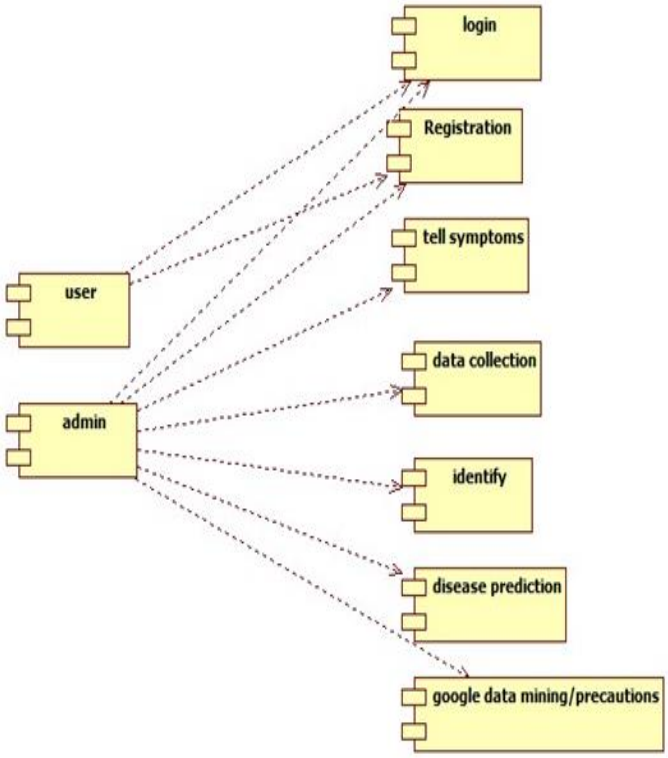

Fig. 8 Component Diagram

Input Design

The input design is the link between the information system & the user. It comprises the developing specification and procedures for data preparation & those steps are necessary to put transaction data in to usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, problem, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things given as below:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.

- Methods for preparing input validations and steps to follow when error occur.

Objectives

- To diagnose correct disease.
- To assist doctors for various diseases associated with symptoms i.e to be a home assistant.
- To assist Medical students working as in pathological labs and to help nurses, nursing student.
- To help military in battle field.

Output Design

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users & to other system through outputs. In output design it is determined how the information is to be displaced for immediate need & also the hard copy output. It is the most important and direct source information to the user.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is design so that people will find the system can use easily and effectively and really. When analysis designs computer output, they should identify the specific output that is needed to meet the requirement.
2. Select methods for presenting information's.
3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action

IV. RESULT

Experimental Result

In this system disease prediction performed on data base of symptoms either manually entered by the users or captured by the sensors, it detects the next highly probable disease. Body Area Network without using clustering & Body Area Network with using clustering, both types of Systems are used for health condition monitoring and timely treatment of patients suffer from chronic disease. The following Table-1 shows the effective experimental result of the proposed system comparing to the existing system considering the parameters Disease prediction, Detection Accuracy & Time. Clustering is more important in disease prediction as well as data transformation in the network from one node to another node with power efficiency.

Table 1: Experimental Result

Parameters	Existing System	Proposed System
Clustering on Database with sensor symptoms	00%	80%
Disease prediction rate	20 %	70 %
Accuracy	30 %	75 %
Time for 1000 samples	48%	72%

Graphical Representation

The statistical data can be represented graphically here. In fact, the graphical representation of statistical data is an essential step during statistical analysis. So

here we have used bar graph for showing graphical representation. As shown below

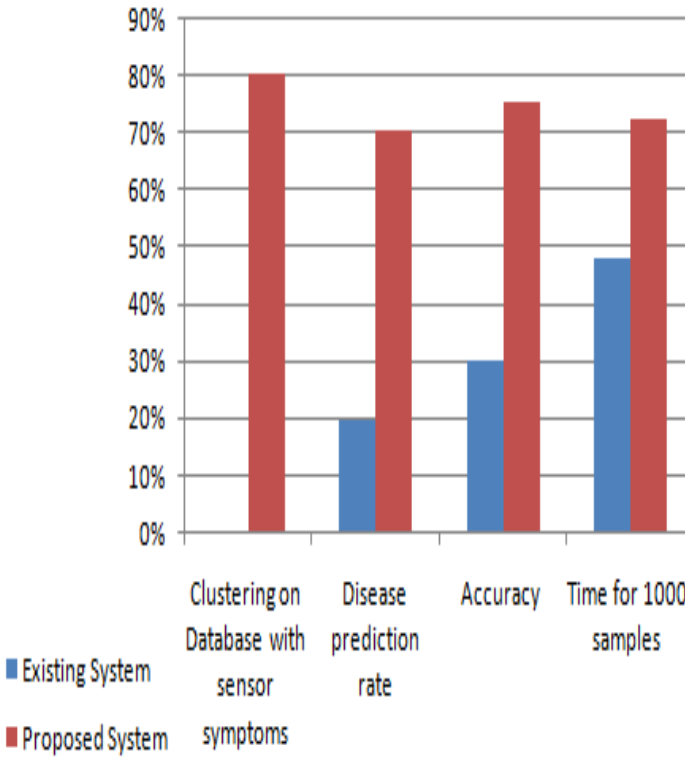

Fig. 9 Graphical representation of result

The Fig. 9 shows the graphical representation of the table 9 for showing the comparison between the BAN using clustering & existing system, considering the parameters Disease prediction, clustering on data base, Accuracy & Time in between proposed system & existing system.

V. CONCLUSION

A low cost Wireless BAN, using off-the-shelf hardware was built & successfully tested in real time where data was successfully captured & displayed on website. The BAN collected the pulse rate, the temperature & the location of the patient. The captured data was made available through graphing application programming interface, where data can be continuously monitored on website. Future enhancements to safeguard the data, including the encryption of the patient data is under investigation. Currently the BAN is powered using a either 9V or 5V battery. In the future we plan to investigate use of body temperature or the physical movement of the patient as means to produce power for the BAN. The captured data was made available through a graphing application programming interface, where data can be continuously monitored on a website.

The proposed system can effectively detect next highly probable disease by applying well clustering on symptoms as well as provide the security to the users old data records, this system most useful for continuous health conditions monitoring but not capable to work on blood samples and cancers tumour prediction this process comes under image processing, this issues can be resolved by applying relevant image processing techniques this will kept as future work of systems further enhancement.

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