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E-Health Care and Patient Monitoring System Using Body Area Network

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***Abstract*— A better healthcare system should give better healthcare services to users anywhere in an affordable and comfortably manner. The new patient centered approach is completely different from the old traditional way. In the old way the doctors perform the main role. Patient always needs to visit the doctor for necessary diagnosis and advice. This approach has two problems, first the doctors compulsory should present at place of the patient for 24 hours and second, in the hospital. The patient remains admitted with wired connected biomedical instruments to bedside, for long period of time. The patient friendly approach has received to solve these two problems. To overcome this problem, the patients should be aware of symptoms, disease, diagnosis and precaution. This proposed system reduces the regular visits to doctors, until the patient is critical. This system provides readily available patient monitoring system and disease prediction.**

Keyword : Patient Monitoring, IoT, Health Care, Disease Prediction, Biomedical Sensors, Raspberry Pi.

I. INTRODUCTION

Health is not a static it is a dynamic process which needs to be monitored continuously. Due to continuously increasing population, patients are increasing which increases number of patients admission in hospital. This increases number of patients per doctor day by day. To overcome this situation, E-Health care system is proposed for human health care. This provides 24/7 patient condition monitoring and disease detection. Because of increase in number of sudden deaths caused by chronic heart disease or high blood pressure and high pulse rate, it is necessary to monitor patient at home. It is done with the handy and compact computing system along with medical sensors. Doctors can receive the patient's medical information through the internet, so doctor can give the appropriate advice. Recently, the patient monitoring system is one of the major advancements because of its improvement in Internet of Things (IoT) technology. In this system we are measuring patient's medical parameters like ECG, Pulse rate, Blood Pressure, Temperature using respective medical sensor.

Then the collected data from the sensors are transferred to Raspberry pi for display purpose and disease prediction purpose.

Wearable medical IoT sensors have more demand in the market recently, due to easy availability of Internet in affordable price. Following are some important objective of proposed healthcare monitoring system. To get the real time patient health information via wearable IoT devices. Analysis and prediction of chronic disease/disorders in primary stage through the data mining techniques, which is useful for decision making. To bring IoT based healthcare monitoring system anywhere anytime. We implement a semi supervised approach for learning as well as disease prediction. Use of Fuzzy classification approach for prediction. Implement a system on mobile and web based platforms.

In the proposed research work to design and implement a system that can provide the patient health monitoring and disease recommendation using fuzzy classification approach. We collect a data from patient wearable devices using IoT framework. In general, most of the hospitals and medical clinics, medical parameters of patients are inspected manually. Continuous and regular monitoring of patients is required based on their health status. This has some limitations like

1. Longer measurement time
2. Lower precision
3 .Complexity in automatic patient monitoring
4. Connection of many wired instruments is tedious process
5. Heart beat is measured manually

To remove all such drawback current Body sensor network has been implementing which provides a fully automated and wireless patient body monitoring.

II. SYSTEM ARCHITECTURE

Basically proposed system has divided into two different phases, training and testing.

A. Training

- Collect data from Collect data from internet like synthetic data as well as patient real time data
- Preprocessing, leaning, data acquisition, outlier detection and data conversion.
- This processed and cleaned data has to save into the database called as background knowledge, which is used at the time of testing.

Age	Range	Average
New Born	120-160	140
1-12 Months	80-140	120
1-2 Years	80-130	110
3-6 Years	75-120	100
7-12 Years	75-110	95
Adolescence	60-100	80
Adulthood	60-100	80

Table No 1 : Pulse Rate

Blood Pressure Data	Action
BP<120	No Action
BP>130	Inform Family Members
BP>160	Inform Local Physician

Table No 2 : Blood Pressure

B. Testing

- First system creates the IoT- based healthcare system hardware where we used minimum 4 sensors as wearable devices.
- Then we have connected all sensors to Raspberry Pi, and collect data from sensor using batch processing approach.
- All collected data has to store in connection oriented architecture data base which is global
- In testing we read all testing as well as training data simultaneously.
- Apply Fuzzy classifier and predict the possible using decision making system
- Finally provide the analysis accuracy with True positive and false negative of system.

First system collects all the health raw data using different sensors, with the help of Raspberry PI. Then whole generated data from sensor it is collect by Raspberry PI, and process all data mining task on such data like data cleaning, data acquisition, outlier detection and store into MySQL cloud DB. In third section system introduce the GUI with the help of android base application as well as python webpage, where user can see the whole data interpretation as well. In the fourth phase system also recommend some possibilities like possible disease, survival time of patient etc.

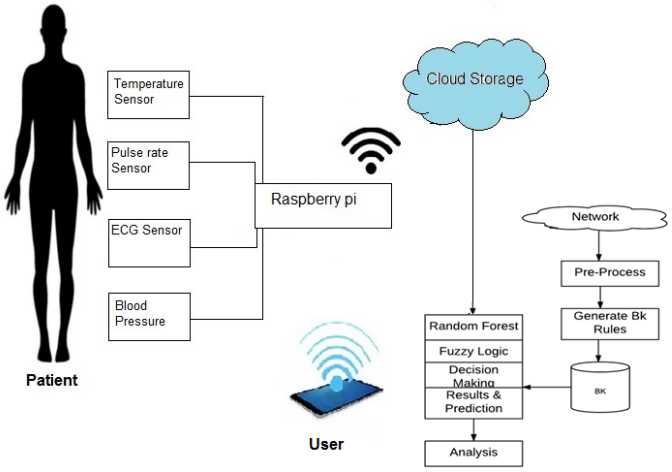

Fig. 1 Block diagram of System Architecture

III. IMPLEMENTATION METHODOLOGY

The interconnection between different components is explained using the architecture of system. Architecture diagram is shown in figure 1. The patients connect the sensors to their body and the other end of the sensors is connected to Raspberry Pi. The data acquired by sensors is stored in the Raspberry Pi Zero. The values stored are sent to server with the help of internet. All the values are stored on the server and the most recent value is displayed on web page. The doctor along with their login credentials can login and see the patient data. Doctors can see all previous records of a patient and suggest medicines and changes in prescription. Also patients are given unique user id and password to view their records.

A. Hardware Used :

1) Temperature sensor (LM35) :It is a very small size sensor in IC package. It is three terminal IC with Supply, GND and output. Its output is linearly proportional to its surrounding temperature which can be calibrated to show values in Degree Celsius.

2) ECG sensor : ECG electrode sticks to chest to gather Electro Cardio Gram (ECG) signals. Then wires of the ECG sensor are connected to AD8232. This is an instrumentation amplifier based sensor. ECGs can be extremely noisy. It filter out noise and gives clear signals.

3) Pulse Rate sensor : This is IR based Pulse rate sensor which uses detector to collect light reflected from blood. Further this signal is converted into digital pulse. It corresponds to BPM (Beats per Minute).

4) Raspberry Pi Zero/W : The Raspberry Pi/W Zero is a low cost and tiny computer. Which can be plugged into a monitor or TV, and uses a USB keyboard and mouse. The Raspberry Pi Model Zero/W has single core 1GHz processor with 512MB SDRAM and powers through Micro USB port of 5V.

B. Software Used :

1) Raspbian OS : It is debian based computer operating system for Raspberry Pi.

2) Apache HTTP Server : It is a free and open source cross platform web server.

3) MySQL database : It Open source database management system.

IV. ALGORITHM

Preprocessing Algorithm
Input: Disease name and URL and DB size
Output: Dataset DB with disease wise
Step 1: Initialize the disease list as D[ ].
Step 2: Provide disease D[i] with URL to server admin
Step 3: For each D[i] create one chunk for raw data.
Step 4: Convert XML to text
Step 5: Read each concept from text DB and build a taxonomy for DB
Step 6: End for.
Step 7: Return DB

Fuzzy Classifier

Input :Training Dataset DB, testing instance T(i), threshold T,
Output : Each training node with score (0.0 to 0.99)

Step 1: For (each instance from T upto NULL)
Step 2: For (each instance from DB up to NULL)
Step 3: Forest construction is an iterative process. Here we have to find similarity of two Nodes a=(a1…..an) and b(b1…bn) where a(n) and b(n) are the components of the nodes (features of the train node, or values for each features of the node) and the is the dimension of the node:
Weight = CalcSim(a,b)
Step 4: Save each tree node with disease into the databases.
end for

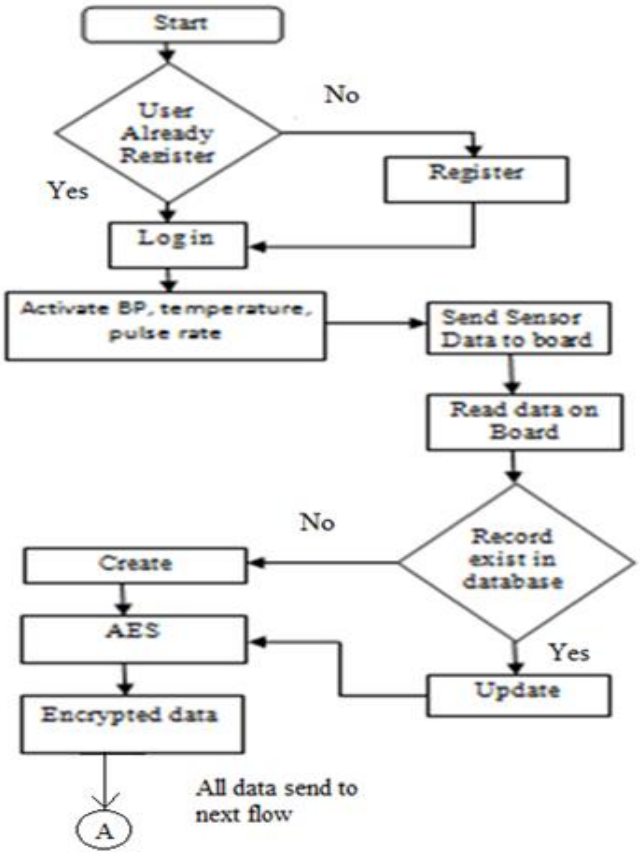

Fig. 2 Flowchart

V. CONCLUSION

System provides real time health monitoring as well as disease prediction. It can work base on synthetic as well as real time training data. Accuracy of prediction is good than other learning approaches. System also has a capability to provide the alert when any criticalness 24*7.

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