Monitoring Of Pulse-Rate And Temperature Of Patient With Comparative Analysis Using Weka Library

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Abstract- *Advances in recent technologies and innovations have led to unfolding of Internet of things (IOT). IOT has enabled developing health monitoring systems for patient. Most essential health parameter of human is pulse rate which reveals the soundness of human cardiovascular system. Here our aim is to monitor patient's health using sensors like pulse rate sensor, temperature sensor (DS18B20) which are connected over network. If the system detects any abrupt changes in patient's health data, which is collected through the sensors, the system sends an alert message to the patient's relative.. This system also facilitates the relative to set a reminder for his/her patient's appointment. Data mining is the process of extraction of useful and meaningful information from huge amount of data, here we have applied machine learning algorithm on this previously mined data. Through this paper we also attempt to show comparative analysis of Random forest and J48 classification algorithm using WEKA tool. Comparative analysis of both the algorithm is done by analyzing the performance measures like Error rate, Precision, Recall etc.*

Keywords- IOT, Android, Ardiuno UNO, Data Mining, Random forest, J48, WEKA.

I. INTRODUCTION

There many people around the globe suffering various health issues due to environmental changes. Ever increasing pollution is the main cause of the changes observed. Also there's been increase in population which has led to less doctor-to-patient ratio which is as low as 1:2000. The specialist doctor to patient ratio is 1:1568 which is lower than W.H.O standard of 1:1000. It's not always possible for a doctor to check patient's body parameter such as heart rate and temperature all the time.Pragmatically, we need to consult a doctor for basic check-ups, so we felt a need to build up a system which can be used for monitoring a patient and to predict whether the monitored data matches the threshold values and if so then send the alert messages to the concerned people. We have used Arduino which is a microcontroller, which is connected to sensors, basically useful for collecting the body parameters such as pulse rate, temperature. This is a device that helps in collecting the data in either of analog or digital form. Data mining is process of extracting useful data amongst the available data. WEKA is suite for machine learning that provides us with various machine learning algorithms like classification ,clustering etc which can be used for analysis of the data and predictive modeling. WEKA is used for comparing various machine learning techniques on real-time data. It is a sturdy tool that provides us with supervised and unsupervised learning algorithms. Comparison is done on the basis of various performance measures such as precision call, error rate, execution time ,etc.

Modeling of the data set is done by making predictions on the available data set, that is classification algorithms are used. For fine tuning the data model, we would be using the Cross-Validation techniques that would make the system more efficient. The data set is sampled into sub parts where in $1/10^{th}$ of each part of the data set is used as testing model and remaining $9/10^{th}$ is used as training set.

II. LITERATURE SURVEY

Now a days many people do not have access to quality healthcare services, thus remote patient monitoring becomes a need. Presently in Healthcare system there is the lack of communication between the patients and the doctors. Thus to address this problem information technology becomes a need. Healthcare services can be improved a lot with IoT-enabled healthcare devices.

Various catastrophic diseases are the leading causes of death worldwide.Thus Munaza Ramzan et el[1] focused on Weka Classifiers for Classification and Characterization for the treatment strategies are essential for these critical diseases. It is highly used for better predictions and supports in decision making in medical domain.

Y.Jeya Sheela et al [2] focused on extracting models for describing classes and predicts target class for data instances. They also referred different datasets from University of California, Irvine(UCI) are classified using Weka Explorer with different classification trees like Decision Stump, Hoeffding tree, J48,LMT,Random forest and REP tree. Then finally results are compared using the performance measures like Accuracy and execution time.

Narander Kumar et al [4] worked on different techniques used for early disease prediction in healthcare sector. In their paper , different data classification techniques and their prediction accuracy for chronic kidney disease are compared. The algorithms used are J48, Naïve Bayes, Random Forest, SVM and k-NN classifiers using performance measures like ROC, kappa statistics, RMSE and MAE using WEKA tool.

Arulananth.T.S et al [5] paper describes use of sensor and Arduino for measuring heart rate which is very vital health parameter that is directly related to the soundness of the human cardiovascular system. Sensing the rhythmic contraction and expansion of an artery and measuring the ECG waveform are useful in this process. This fluctuation of blood can be detected through an optical sensing mechanism placed around the fingertip. Amplified signal can be sent to Arduino with the help of serial port communication. With the help of processing software heart rate monitoring and counting is performed.

Himadri Nath Saha et al [6] focused on the development and implementation of an effective healthcare monitoring system based on IoT.The proposed system monitors the vital health parameters and transmits the data through a wireless communication, which is further transferred to a network via a Wi-Fi module. The data can be accessed anytime promoting the reception of the current status of the patient. In case any abnormal behavior or any vital signs are recognized,the caretaker,as well as the doctors are notified immediately through a message service or an audio signaling device (buzzer).

Himadri Nath Saha et al [7] paper objective is to trace patient's health with the assistance of sensors and internet. Internet is employed to tell their beloved if there is a drag. The health observation system can keep track of patient's pulse rate, eco rate of heart, pressure level rate, temperature etc. If system detects any abrupt changes in patient heartbeat or temperature, the system mechanically alerts the user concerning the patients standing over IOT and additionally shows details of heartbeat and temperature of patient live over the internet.

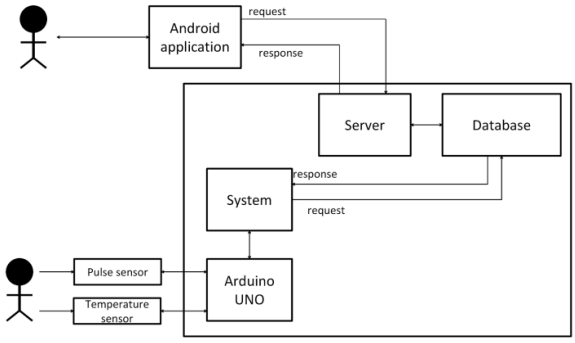
S Pradeep Kumar et al [8] paper objective is to monitor the health state of the patient and screen it to doctors or paramedical staff through the IoT, as it is challenging to screen the patient for 24 hours. So here the patient health condition or status (Pulse rate, Respiratory rate, Body Temperature, Position of the body, Blood glucose, ECG) can be measured by utilizing the Non-invasive sensors. The "Thingspeak" named new cloud is utilized here to place the detected information into the server. The information in the server can be used by the specialist and paramedicals and medical staff by Thingspeak android app.

Nur Hidayah Binti Abu Bakar et al [9] focused on health monitoring system which useful in checking the condition of the patient and easily monitored by doctor as well as patient via mobile phone. Alerting the patient as and when required for the treatment. Arduino Uno and GSM together with temperature and pulse rate sensors are used for this research.

Hasmah Mansor et al [10] paper presents a design of portable heart rate monitoring system which is part of a project called Home-smart Clinic. Connecting patient with medical personnel is possible using this project. It would be beneficial as it would save hospital bill, waiting time and reduce traffics in the hospital. The prime objective of this paper is to design and develop heart rate measurement device for which real time data could be observed by the doctor via internet. Patient condition can be identified and using the collected data and identify the condition.

III. WORKING

In this system we have three modules out of which one is used for recording the data, while the other is used for analyzing the previously mined data and the last module is used for showing the real-time data which is recorded by the first module. The Registration procedure is obligatory process. The registration of patient is useful for storing the recorded values in the database as well as for viewing the record of the patient in android device. The patient is supposed to fill in the registration detail once and only one profile can be created for a particular email-id of a patient. After registration is done successfully, it generates a password that is sent to email id of the relatives. They can view the record of the patient by using that password and their respective email id. Thus they can keep a track of the patient health record.



(i) Architecture

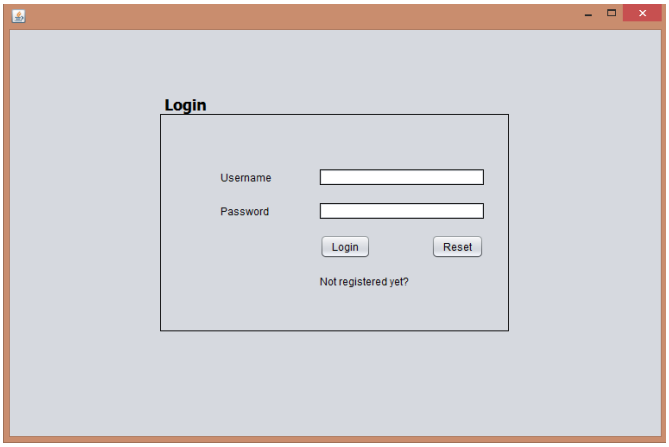
Monitoring is the first module wherein we would be recording the real time data of the patient which would be stored and thus can be used for analysis later on. Arduino is a microcontroller which is connected with the sensors through the jumpers Ds18B20 and Pulse rate sensor. These sensors are connected to the body of the patient so as to record the body parameters. This encompasses the first module.

In second module we have used the concept of machine learning which would be applied on previously mined data. Mined data is the result of data mining. Acquiring the information from entire data set that would satisfy the condition is Data mining. We have used WEKA tool for the exact purpose. WEKA is released under G.N.U General Public Licensing and contains various packages with variety of methods of machine learning that would be used to apply on the mined data which is available in various formats like arff(attribute relation file format), CSV(comma separated values) etc. We used the concept of supervised learning problem in our system. Here the idea is to predict how many people from given dataset suffer from Arrhythmia, which could be done with many algorithms here we have used j48 and random forest which are the subtypes of classification algorithm. For which we have given certain data for training purpose and this is possible by giving data as an external file input. Here we have used '.arff' extension file format for data input to the WEKA. Attribute Relation File format(arff) is file describing a list of instances that share the attributes. It's in ASCII text format.

In third module we have created an android application which is developed by considering the perspective of patient's relative. This module can be accessed only by the authorized people i.e. patient's relative, giving them the facility of monitoring the patient's data, getting the notification (alert message) if the data is crossing some threshold value and an option to set a reminder of the appointment.

3.1 App

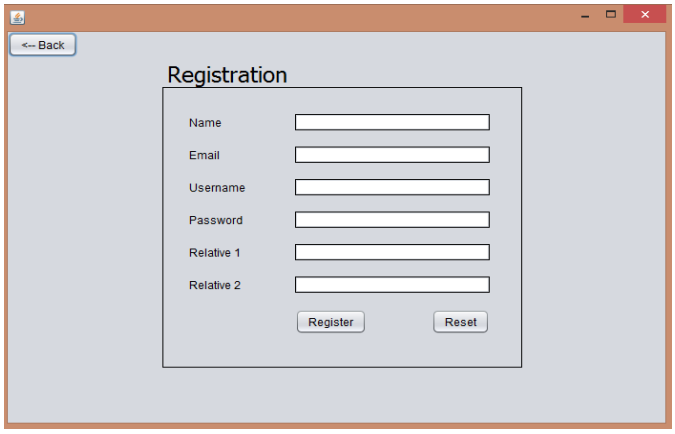
3.1.1 Login Tab



(ii) Login Tab

Username and password are must to enter the profile that would be further used for recording the body parameters. Login button would be used to open the profile provided the credentials match the data in the database. Reset is used to clear all the fields. Not Registered yet? Would be useful in registering new patient.

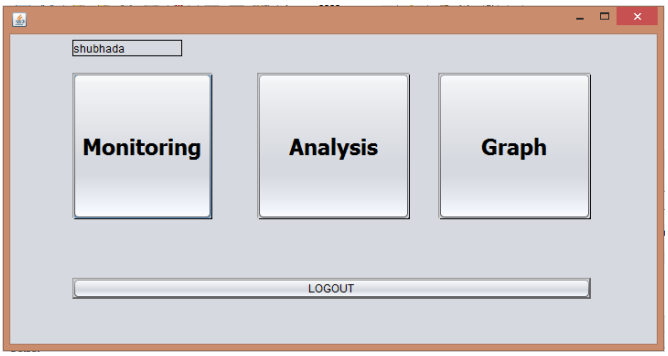
1.2 Registration Tab



(iii) Registration Tab

The patient is supposed to fill in the registration form before using the app provided his email id has to be unique. He is supposed to fill in all the fields during registration. Register button would be used in creating the profile of the patient where as Reset button would clear all the fields. Back Button would be used to go back to login page

1.3 Options Tab



(iv) Option Tab

The user is leaded to this tab once he log's in successfully. The user name of user is mentioned in upper left left side of tab and the logout button is provided if the user want to logout. This tab provides user with options which he/she want to perform. The options are:

1) Monitoring:

The monitoring option lead to other tab which is used for displaying the monitoring parameters to the user and storing this parameter in the database. More detailed information of this tab is mentioned in the following tabs to me described .

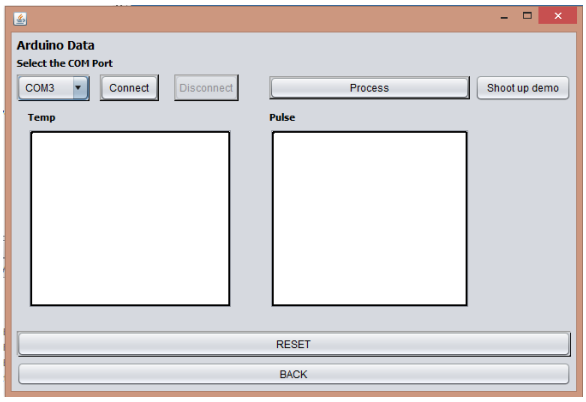
2) Analysis:

The analysis option leads to analysis tab which gives analysis information about the monitored data which is obtained. Here some algorithms are used . More detailed information of this tab is mentioned in the following tabs to me described .

3) Graph:

The Graph shows a line graph of the pulse rate of the patient which is measured.

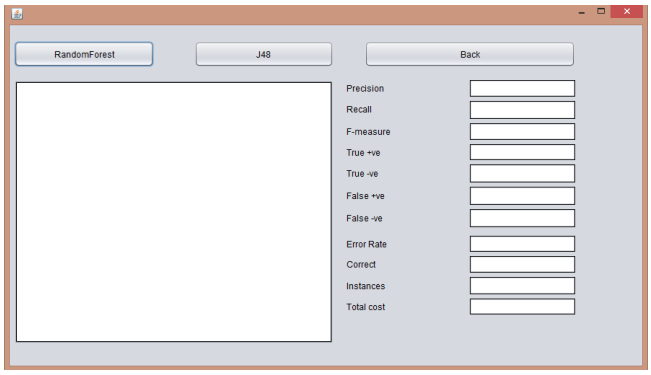
1.4 Monitoring Tab



(v) Monitoring Tab

The above screenshot show the pulse rate and body temperature of the patient. For fetching the data about the patient first we have to connect the sensors to the body and run the code in Ardiuno uno and the selecting the necessary port. After connecting to the port the data which is recorded is show in log area and after using the logic data is segregated into two parameters (body temperature and pulse rate of the body). The reset button here is used to store the recorded data in database and clear the displayed values. The back button takes us to previous part.

1.5 Analysis Tab



(vi) Analysis Tab

In supervised machine learning, training set is given and we are supposed to get a pattern using mapping function. In supervised learning training set is already given. Supervised learning problem is further grouped into classification and regression problems. Here in above picture to algorithms are given random forest and j48 which are used for classification problems. In classification problem the output is categorized. Here an .arff file is given as input on which two algorithms are used for classification to tell how many people are suffering from arrhythmia and how many are not from the given data set in arff. That is we have shown the comparative analysis of 2

classification algorithm using different parameters like precision, recall etc. as shown in above picture.

Precision= TP/(TP+FP)

Precision is the percentage of correctly classified instances for **those instances that have been classified as positive or total retrieved instances**

Recall=TP/(TP+FN)

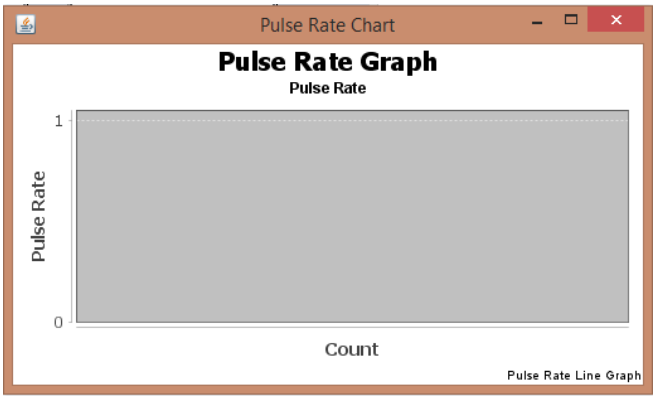
Precision is the percentage of correctly classified instances for **those instances that have been classified as relevant instances.**

F-measure= 2*Precision *Recall/(Precision + Recall)

- **Correctly classified records** = TP + TN
- **Incorrectly classified records** = FP + FN

True +ve(TP) is TRUE POSITIVE number of instances.
False +ve(FP) is FALSE POSITIVE number of instances.
False –ve(FN) is FALSE NEGATIVE number of instances.
True –ve(TN) is TRUE NEGATIVE number of instances.
Error rate is the error rate of the used classifier.
Instances is the total number of instances given as input in the .arff file
Correct is the number of correctly classified instances from the total instances.
Total cost is used for performance evaluation of the classifier algorithm.

1.6 Graph Tab



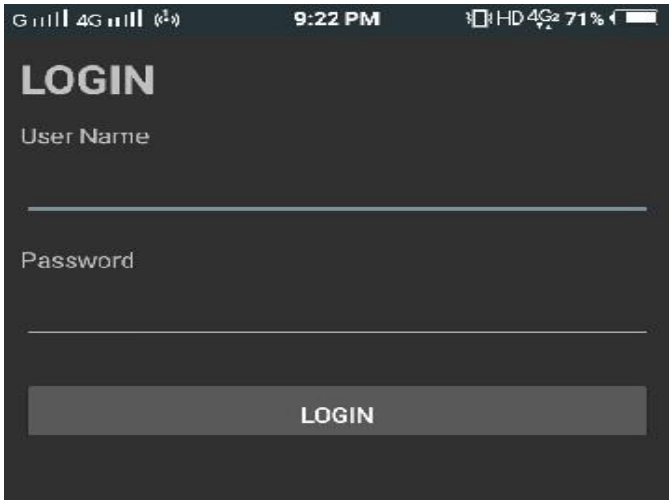
(vii) Pulse-Rate Line Graph

The above picture is used to display a line graph of the pulse rate of the patient which is measured.

10 values from the database are used to show the line graph of pulse rate.

2 Android App

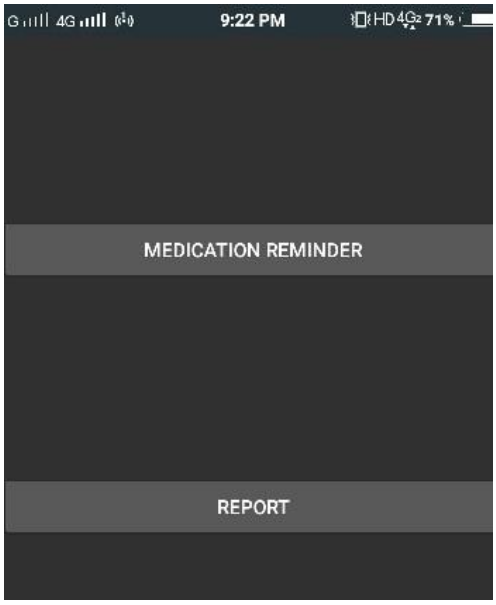
2.1 Login Tab



(viii)Login Tab

When we open this app, the first page will be the login page. Relative has to enter his/her username and password. Password will be provided to relative via email-id which he had entered while the registration. And also email id must be the same.

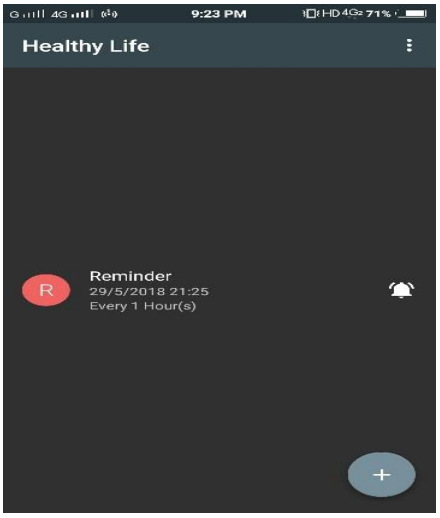
2.2 Options Tab



(ix)Option Tab

After successful login, two options will be there viz. Medication Reminder and Report.In first option i.e medication report,there will be the reminders se by the relative.

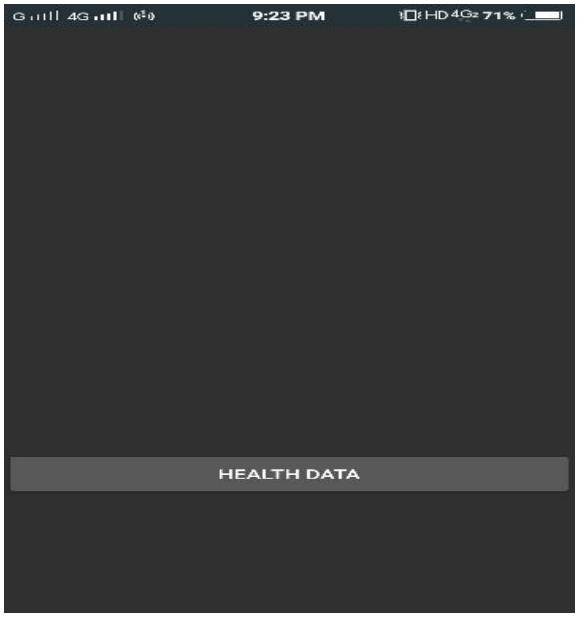
2.3 Reminder Tab



(x) Reminder Tab

The relative will be able to set reminder for himself that patient has an appointment on that day and he has to take patient to the doctor. Reminder can be set by fixing the date and time.Also there is an option to edit the reminder. Relative can add multiple reminders.

2.4 Report Tab



xi) Report Tab

In report by clicking on health data relative can view the pulse rate and temperature report of the patient.The laest parameters will be shown to the relative. Hence he can can keep track of the patients's body parameters.

IV. CONCLUSIONS

By this paper we want to conclude that the project aims to reduce the need of doctor to be present basic checkups. The system records the value that can be used by the relative of patient for monitoring the patient.

This data can be used for alerting the doctor in necessary situation. As machine learning has been implemented doctors can use the data for analytical purpose.

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