International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 06 | June - 2021 ISSN: 2582-3930

Detection of Cardiac Abnormalities and Prognostic Health Diagnosis

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Abstract - Public healthcare has been paid an increasing attention given the exponential growth human population and medical expenses. It is well known that an effective health monitoring system can detect abnormalities of health conditions in time and make diagnoses according to the gleaned data. As a vital approach to diagnose heart diseases, ECG monitoring is widely studied and applied. However, nearly all existing portable ECG monitoring systems cannot work without a mobile application, which is responsible for data collection and display. In this paper, we propose a new method for ECG monitoring based on Internet of-Things (IoT) techniques. Experiments are carried out on healthy volunteers in order to verify the reliability of the entire system. Experimental results reveal that the proposed system is reliable in collecting and displaying real-time ECG data, which can aid in the primary diagnosis of certain heart diseases.

Key Words: Arduino uno, Heart rate sensor, Pulse rate sensor, Bluetooth module, Mobile devices, Arduino IDE, Android Studio.

1.INTRODUCTION

As we are well aware that death and disability due to heart attacks is increasing day by day in India. With a rapid growth in human population and medical expenditure, healthcare has become one of most significant issues for both individuals and governments. Meanwhile, according to a report from the World Health Organization (WHO) , the problem of population aging is becoming more serious. Health conditions of aged people usually need to be checked more frequently, which poses a greater challenge to existing medical systems. Therefore, how to identify human diseases in a timely and accurate manner with low costs has been paid an increasing attention. Due to the dominance in the diagnosis of heart-related diseases, electrocardiogram (ECG) monitoring has been widely applied in both hospitals and medical research. Traditionally, the ECG is detected through large and stationary equipment in professional medical institutions. The kind of equipment usually employs twelve electrodes to collect ECG data due to their good performance in short-term measuring. However, the equipment is unlikely to be portable, which means that patients' activities are severely limited during the period of data collection. Moreover, as these devices are usually too expensive for home use, patients have to go to hospital frequently, which will inevitably increase the burden of hospitals. Therefore, a portable system for a long-term ECG signal detection with low costs is highly desired. Existing approaches ECG bio-signal faulted due to high noise signal interference, electronic and software fault, mechanical fault like sensor contacts failures, wear and tear of equipment. In this Project segregation of the actual fault-free signal and extract the abnormality of the vital feature for prognostic diagnostics is done.

2.INTERFACE REQUIREMENTS

a) Hardware requirements

- Arduino Uno
- ECG Sensor
- Pulse rate Sensor
- Mobile Device
- Jumping Wires

b) Software requirements

- Android Studio
- Arduino IDE

Hardware Design:

Hardware of this project can be considered as integration of three units: the data acquisition, the values comparison, Disease prediction.

Software Design:

Several software tools were used throughout the entire development procedures of this project in order to program the Arduino board which is considered the core of this project besides developing the android application which will detect Disease.

Arduino IDE:

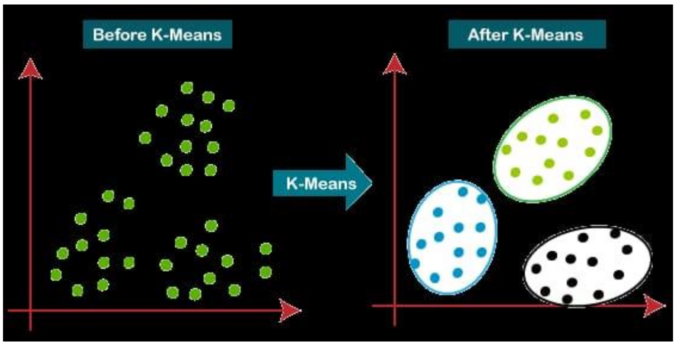
Is the required software environment to program the Arduino by writing a code and upload it to the Arduino. It also outputs the results for analysis using both serial monitor and serial plotter. The version used in this project is 1.8.3 (Genuino) which supports both serial monitor to print the HR wave while the serial monitor to print the temperature values. The Arduino IDE used to write a code to the Arduino. The digital output values were printed to the Serial Monitor of the Arduino IDE to validate the algorithm before sending the data over Bluetooth.

Android Studio:

An IDE as well but it is an environment for applications development that will run on Android OS. It's an alternative for the Eclipse Android Development Tools. Android Studio has been used to develop an android application that is compatible with the project's components. The developed application has a type of account. The account receives measured data via Bluetooth module, track patient's heart and pulse rate values and keeps records uploaded in the database. Following figures show the interfaces of the application accounts: The first interface enables users (patients and doctors) to login to their accounts using username and password in case they have already created accounts.

3.Algorithm:

kMeans clustering algorithm is an unsupervised learning algorithm.Given a data set of items,with certain features,and values for these features,the algorithm will categories the items into k groups or clusters of similarity.Using the distance mesurements we can calculate the similarities between data points and categories them into different clusters



Step Wise Procedure:

1.Select the data where the K-Heart rate value, K-Pulse rate value. Let X = {x1,x2,x3,……..,xn} be the set of data points and Y= {y1,y2,…….,yc} be the set of centres.

2.Select the random K-points.

3.alculate the distance between each data point and cluster centres i. e. distance between x and y.

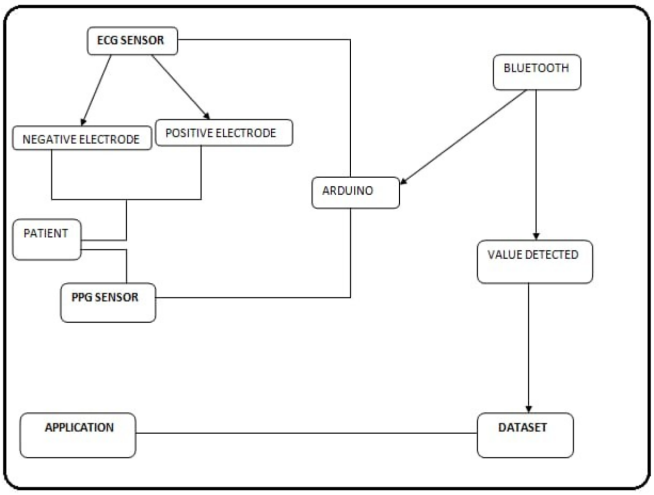
4.Assign the data point to the cluster centre whose distance from the cluster centre is minimum of all the cluster centres..

5.Calculate the variance and place a new centroid of each cluster.

6.Recalculate the value between each data point and new obtained cluster centres.

7.If no data point was reassigned then stop, otherwise repeat from step 3.

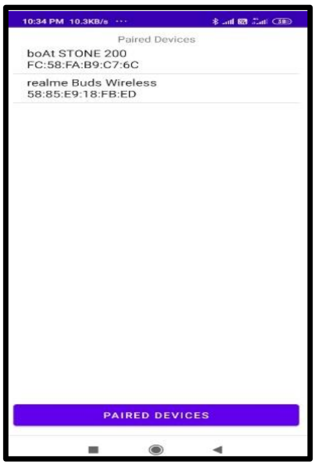
4. ARCHITECTURE:



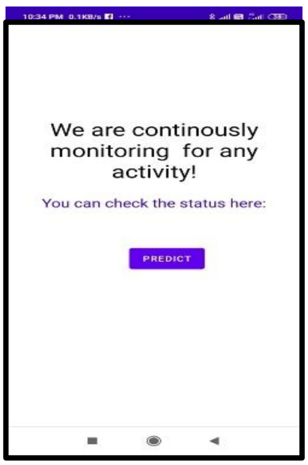
5. Development:

Login Page

Registration page



Device list



Detection activity

6. Database requirements:

PHP:

PHP is a scripting language used in order to develop and create web pages and often internet applications. PHP files are files written using PHP language for usage by remote servers. A Web Hosting service is a type of internet hosting service that allows individuals and organizations to make their website accessible via the www. This service has been used to store and retrieve the required data to and from the application using PHP files .The web service implemented here is an online free webhosting website known as www.webhost.com.

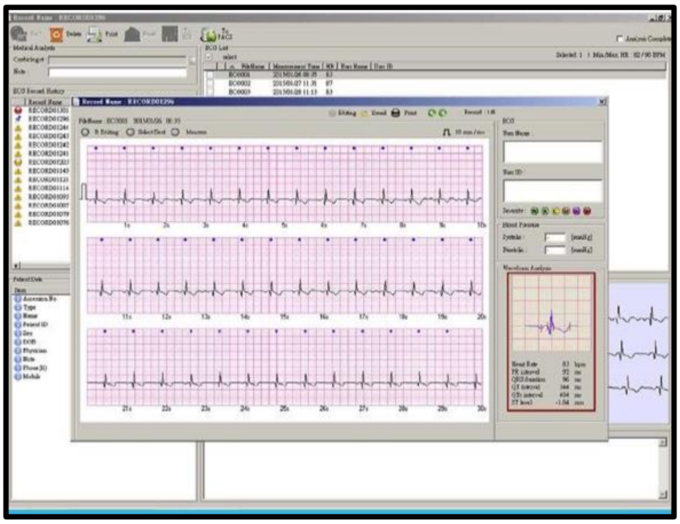
A very easy webserver to deal with, just creating an account using an email and password then you can start creating your tables, upload the PHP files and it is ready to use. The created tables used to record data supplied by doctors and patients when they first create accounts in the Android application.

Table -1:

←T→	id	val	disease
Edit Copy Delete	1	Heart Rate : 678Pulse High : 530	Blood Pressure
Edit Copy Delete	2	Heart Rate : 0Pulse High : 452	Blood Pressure
Edit Copy Delete	3	Heart Rate : 595Pulse High : 436	heartattack
Edit Copy Delete	4	Heart Rate : 674Pulse High : 454	Suger
Edit Copy Delete	5	Heart Rate : 152Pulse High : 446	cancer
Edit Copy Delete	7	Heart Rate : 677Pulse High : 518	Cancer
Edit Copy Delete	8	Heart Rate : 0Pulse High : 454	highbp
Edit Copy Delete	9	Heart Rate : 676Pulse High : 454	Cancer
Edit Copy Delete	10	Heart Rate : 32Pulse High : 442	Cancer
Edit Copy Delete	11	Heart Rate : 54Pulse High : 481	Cancer
Edit Copy Delete	12	Heart Rate : 677Pulse High : 454	Cancer
Edit Copy Delete	13	Heart Rate : 0Pulse High : 673	Cancer
Edit Copy Delete	14	Heart Rate : 0Pulse High : 468	Cancer
Edit Copy Delete	15	Heart Rate : 672Pulse High : 435	cardiac arrest
Edit Copy Delete	16	Heart Rate : 329Pulse High : 465	cardiac arrest
Edit Copy Delete	17	Heart Rate : 0Pulse High : 449	cardiac arrest
Edit Copy Delete	18	Heart Rate : 631Pulse High : 444	Heart attack
Edit Copy Delete	19	Heart Rate : 631Pulse High : 444	Heart attack
Console Copy Delete	20	Heart Rate : 673Pulse High : 458	cancer

Fig -1: Figure

Charts:



7. CONCLUSIONS

An implementation of safety improvement function in the medical system, which segregates the signals for normal with no and abnormal with the fault, is detailed .Further processing of accurate normal with no-fault signals is computed with a fuzzy entropy-based technique to estimate the apt pulse rate of the subject A right combination of accurate samples from PPG, ECG, PCG is necessary along with AI-based data analytics for correct identification of artifacts

ACKNOWLEDGEMENT

We would like to thank our teacher and guide Prof Pritam Ahire who gave us his valuable suggestions and ideas when we were in need of them. We are really grateful to the people for their kind support. Their valuable suggestions were very helpful

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