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Cloud Computing –Analysing Healthcare and ECG Monitoring system

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Abstract:

At present, more number of services are extended on the edge of the network from cloud considering knowledge transformation at the edge can reduce feedback time and sink bandwidth cost for operations. In this paper, We explain Monitoring of Wireless ECG using Android phone as a hub which is used to connect cloud server. Also we present the design, development and implementation.

The built system meets the basic requirement of our design. It has fortunately documented the ECG signal by recording from the user, transferring it to the smartphone which is used as a hub, storing it locally, uploading to the server, and lastly displaying.

Keywords **—ECG, Android, Cloud.**

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I. INTRODUCTION

Cardiovascular diseases (CVD) are the dominant cause of worldwide death. The World Health Organization (WHO) estimates that 17.9 million people die each year from CVD. Bio-signals are signals that are turn out by living beings that are frequently monitored,measured and used to analyze the health of its producer. Monitoring and evaluating thecardiac health conditions by the use of low-cost and easily approachable user-friendly devices can benefit public health significantly. The most familiar and common electrical bio-signals are Electroenchepalogram(EEG),Electrocardiogram(ECG),Electromyogram(EMG),andElectrooculography(EOG).Among other electrical bio-signals, ECG is one of the familiar and popular field of research among other electrical bio-signals as it is very closely related to cardiovascular diseases.Many related studies have been conducted to develop an ECG instrument, both in hardware and software development. One of the most recent is the expansionof monitoring the ECG signal remotely using wireless technology.

IoT constitute the future of the Internet,Where it is not just about the computers connected to the network, but also other devices will be interconnected.Despite being connected with Local computer,ECG devices could be connected with cloud server via internet.Hence it will be able to serve better and extensive viewers.Here,we have developed a wireless ECG monitoring system connected to the cloud server via Android phone which is used as a Hub.

II.METHODOLOGY

This paper is focussed on two points,system Development and Signal processing.Signal processing consists of all the steps which are essential to identify the pattern that occurs in the ECG signal. In thisstage, we investigate the procedure which is effective and coherent to

classify the ECG signal.Here we focus on discussing the System Development of the RemoteMonitoring.That is the design and implementation of the system which captures the signal from patients,transmitting the data,storing and displaying the data.The model used for development in this project is Agile model as shown in fig 1.

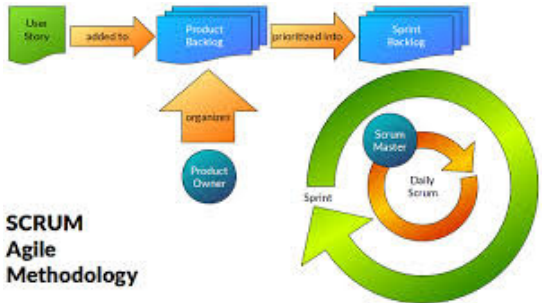

Fig 1 Agile Scrum Methodology

III. SYSTEM DESIGN

Users are provided with portable medical device to monitor and note the ECG signal and store it in the cloud .Hence this reduces the waiting time of the patients queuing up in the hospitals just to get their ECG test done.On the other hand, the respective Doctors could check the ECG reports online and advice the patients online by using short message services or chat services.

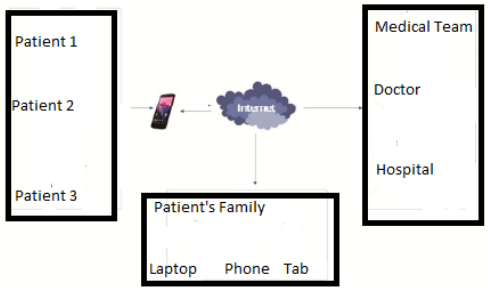

Fig 2 System Overview

A.System Architecture

System architecture depicts the components that are required to form the system and how they are inter-communicated. Thesystem architecture of the wireless ECG monitoring system can be seen in fig. 3.

There are mainly three components in this architecture:

a)Sensor component

b) Hub and Transmission component

c) Server component.

The sensor component called Arduino, consists of ECG module and Mainboard. The mainboard takes the responsibility of collecting the data and transmitting to the smartphone via Bluetooth.

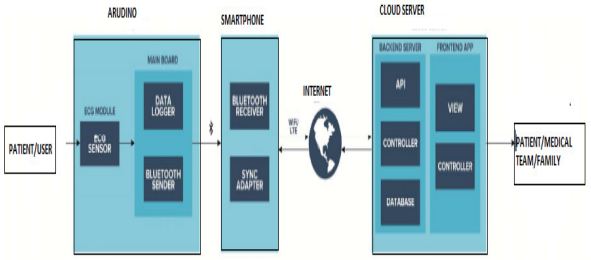

Fig 3 Architecture

Microsoft Azure is used as a the cloud platform in server component.Xampp as Backened server and for front end we have used Php and Codeignitor.

In the below architecture, Smartphone is used as a Hub.Data are collected from Arduino,stores it in the local database and then the data is transmitted to the cloud server using wifi.In case of any emergency, the Patients location can also be sent to the dedicated team on work. The smartphone operating system chosen for this project is Android.

B. Android app

As discussed, in this paper the Smartphone acts as a Hub which collects the data from the sensor and forwards it to the cloud.The flowchart is as shown below.

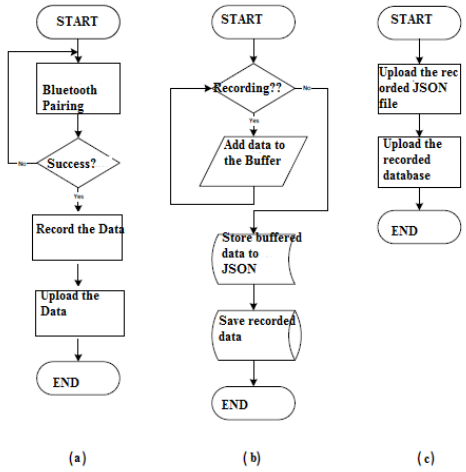

Fig 4General Flowchart of Android app.

a)Main flowchart
b)Showing the process of Data recording
c)Showing the process of Data uploading.

As a part of the Smart system,the app automatically detects the mistakes in the received ECG signal. In future ,the android app is planned to hold on more duties and process. Before the data could reach the server, the app detects the abnormalities or changes which includes pre-processing,feature extraction and classification. Since it consumes lot of computational power,the training will be done in the workstation. The trained model will be passed on to the app.

C. Application Programming Interface(API)

The architectural style used here is Representational State Transfer(REST) which defines set of limitations to be used for creating the Web services.

- User end

a)Register
b)Login
c)Logout

- Recording Functions

a)Get Record
b)Put Record
c)Post Record

- Data File

a)Uploading
b)Parsing.

Whenever the data is noted, two stages of data storages are involved.
a)Data file
b)Database

Data file- The ECG signals are saved in JSON file in form of JSON array. The Sampling rate used here is 100 Hz,For each recorded ECG,100 arrays of data are available for eachsecond.

Database-It includes information such as recording id, date& time, user id, and data file name.

IV.TESTING AND RESULT

Testing is done using Black-box method. The systems functionality is tested using Blackbox test by testing if the input provides the desired results as per the software requirement.According to this project,the initial requirement of the black-box testing is to test whether thesystem is able to receive the data from Arudino(Sensor), store it in smartphone'slocal storage , forward it to the cloud server, and finally display the recording in the front-end web app in the form of graph.

The testing is initiated by installing the Arudino, and connecting with its ECG module. The electrode was placed in right arm-positive electrode, left arm -negative electrode, and ankle-reference / ground electrode as shown in the below figure.

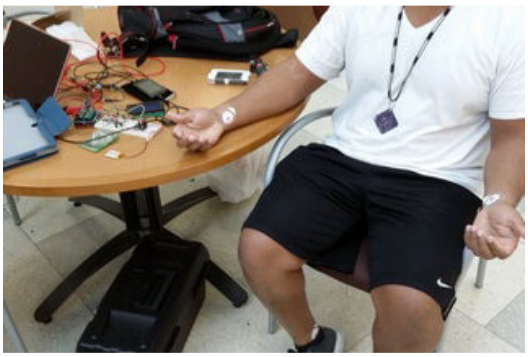

Fig 5 Placement of Electrodes

The operation system used by the Smartphone is Android kit Kat version. Ideally the Bluetooth of both the Phone and Arudino are paired. Upon successful pairing,the recording starts by initializing the Android app that has been developed. The app is shown below.

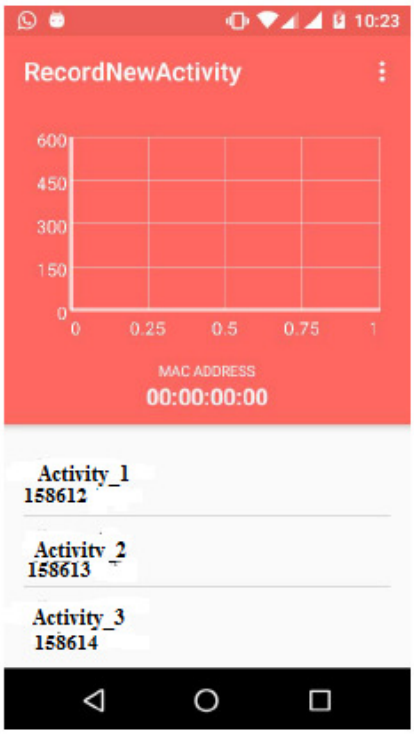

Fig 6 Screenshot of Android app

In this experiment, the recording data was randomized to stimulate the occurring of ECG signal abnormalities.The randomized parameter is start and end time of recording. When the recording is finished, the app will save the recording into JSON file in its local storage, save the recording. information to the local database, then it uploads both of the data to the cloud server by calling provided API. The user needs to logged-in to the system before they could see the data. To display the data, click on the recording row. The recorded ECG signal thendisplayed as seen in fig. 7.

The recorded information is randomized to trigger the abnormalities of ECG signal. The parameter that is randomized is beginning and end of the recording. The app saves the recording automaticallyin the JSON folder which is in local storage and further uploads the data to cloud. The user has to be logged in meanwhile to track the data. The recorded ECG signal will be as shown in the below fig 7.

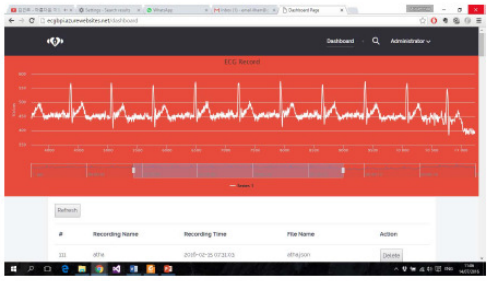

Fig 7Screenshot of Front end app

Table 1 Connection Test

	Success	No Data	No Data and Record
Number	20	4	2
Percentage	90%	16%	4%

The result shows that the success rate is 90%. The 16% of the recording test are the result where the record info was successfully transferred but the signal data is failed to transferred. 4% of the recording is failed both on the record and signal data transfer.

V. CONCLUSION

Here,we have presented design, development, andimplementation of prefatory research about wirelessECG monitoring using android phone as a hub and connecting it tothe cloud server. The system has shown positive results in recording the ECG signal from the user, transferring it to thesmartphone as a hub, storing it locally, upload it to the server,and at the end displaying in the front-end app, with the successrate of 90%. This project has achieved its objectives, but there aresome points that needs to be improved further. Hence,this system can adjust itself to the requirements of various differentenvironments and can be even upgraded with emerging technologies.Drawback is that 10% of the test s failed , due to unstable internet connection to the server. Hence a new mechanism is suggested to

achieve synchronization which handles the network failures.

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