An android application for health monitoring using IoT

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Abstract: Android operating systems are being developed since last 20 years and that too for smartphones, mobile operating system has greatly evolved from Palm OS to windows pocket PC. Internet of things (IoT) is a system of computing devices which are interrelated. In this paper, we leverage about the health care using IoT and android application using smart gloves. It uses a different kind of sensors to collect the data from user's body and a machine to machine communication to transferring the data to the server. The cloud server carries out the decision about the data, whether it in a normal range or user is in a critical situation. All the results will be displayed on the user's android mobile application and if there is any critical situation as the collected data is very low or high compared to the normal condition then the mobile application will notify about the nearby doctors for further treatment.

Keywords: Android, Health, Smart Gloves, IOT, Cloud

I INTRODUCTION

The use of wearable technologies in healthcare is shifting the focus from treatment to prevention, from general to personalised medical care and from hospitalisation to at home monitoring. The main objective is to help every individual to get the basic health check-up by themselves using an android application through smart gloves. In some of the rural areas consulting the doctors every time even for the basic body check-up will be difficult. This smart glove will help them knowing their pulse rate, body temperature and the amount of glucose in the body. It will inform about the readings of the users through an android application because a major part of our country's population is using Android mobile. According to Wikipedia since 2011 Android has been the best-selling operating system worldwide on smart phones and it has more than two billion monthly active users. In an unconditional situations (i.e. if the readings increase or decrease than the normal range) this mobile application will suggest the near-by doctors. This prevents in causing diseases, for example bradycardia, tachycardia, high fever, hypothermia and diabetes. With the help of sensors used (connected with Arduino). Doctor can reply to any specific user or a group of users through push notifications who belongs to the rural area and suggest them about the medicines and precautions.

The readings are fetched from the users and sent to the global server[1][8].Here an android app place vital role by storing the readings of a particular user through their unique id and password. As mentioned in the above the statement the patients can interact with the doctors through the android application the user has to operate with the pro mode i.e. there will be do mode of operation in the android one is basic

and other is pro mode in basic mode the user no. need to pay any money but in the pro mode one has to activate through some monthly or yearly plan by paying some amount. In order to fetch the readings from the user we use some hardware parts and sensors are connected to Arduino and blue tooth module is established between android application and the hardware parts. Because the Arduino will be able to sense the environment by taking the input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators[6] so Arduino also plays a main part in this project along with an android application[17], since all the reading and data are stored in the android application itself[2][9]. The Arduino coding is needed for sensing heart rate and body temperature by using arduino software. Through this project we are going to both the software and hardware combined implementation in the health sector which can be easily used by number of users without further risk.

II LITERATURE SURVEY

For measuring heart rate there are some existing approaches designed and developed. The recent technologies for getting heart rate are consist of various methods which uses optical as well as electrical methods. Electrical method provides a bulky strap around user's chest [13]. But the another method which is optical method doesn't require this kind of strap and it can be used more effectively. Using optical technology low cost heart rate measuring devices were developed. In optical method powerful ED and Light Dependent Resister (LDR) are used to sense pulses [14]. The pulse signals are then amplified by an amplifier circuit and filtered through a band pass filter. Another approach is there where infrared Tx and Rx are used. In that system it senses pulses, pulses will be amplified and filtered by a low pass filter. Finally, the pulse signal is sent to a microcontroller [15], [16]. After comparison with a reference voltage the microcontroller gives output comparing with a reference voltage. Both the approaches give inaccurate result in many cases because analog signal of pulse varies from person to person and the approaches fail to calibrate analog signal of pulses for each person. It uses wireless terminal to send data and wireless receiver to receive the data. The data are then sent to the computer using serial port. The main drawback of this approach is that it needs a computer to send data to the web server through the internet. A telemedicine system is presented and the aim of our study is to develop a device which is interfaced with an Android application so that the heart rate and body temperature are monitored easily. At the same time, doctor can realize the current situation of the patient accessing the server. The exiting remote health monitoring system described above are fully dependent on proper communication between the server and client. So it may arise severe condition that server connection gets congested and patient's situation is serious then it creates a problem to recognize the present situation of the patient. For this reason the goal of our project is to design a portable Android assistant heart rate and body temperature monitoring device which is affordable and user friendly, at the same time inexpensive, accurate, and durable.

III MATERIALS USED

Arduino Uno Rev3: Arduino can sense the environment by receiving input from various sensors. It can be connected to the android application through the Wi-Fi module or through the Bluetooth

Jumper Wire: Wire is the component used to connect the entire component through the bread

board. Wires are must for the connection in the bread board.

Bread board: For all the connectivity of sensors we are using this as a base of our device.

Temperature sensor: LM35 sensor(fig-2) is used to detect the body temperature. It is selected because this is the only sensor which is used to measure the body temperature accurately.

Heart beat sensor: This sensor(fig-1) used to sense the heart rate i.e. the pulse rate of the user accurately in each and every second.

Android: The output of the result that means the readings will be displayed on the android screen.

IV Sensing Mechanism

A. Heart beat sensing

The pulse rate beat sensing is sense by the heart beat pulse sensor in which we can measure the heart rate per minute[3][4].

Fig.1 Heart beat sensor

We connect the pulse sensor to the Arduino as following[12]:

+5v of Arduino-> '+' of pulse sensor

GND of Arduino->'-'of pulse sensor

A0 of Arduino->S of pulse sensor

B. Body temperature sensing

We can measure the temperature in Fahrenheit. Body temperature depends upon the place in the body at which the measurement is made, and the time of day and level of activity of the person. Different parts of the body have different temperatures. It is great medical importance to measure body temperature. Many diseases are accompanied by characteristic changes in body temperature.

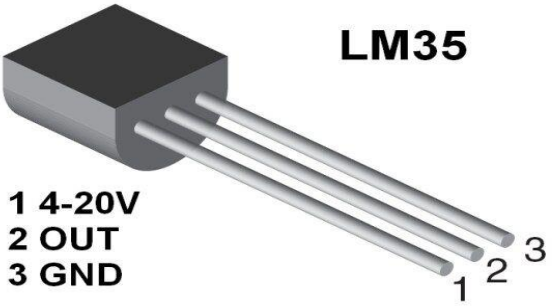

Fig.2 Body temperature sensor

Arduino: The Arduino Uno(fig-3) is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It Normal contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC[11] adapter or battery to get started. The Uno differs from all preceding boards, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

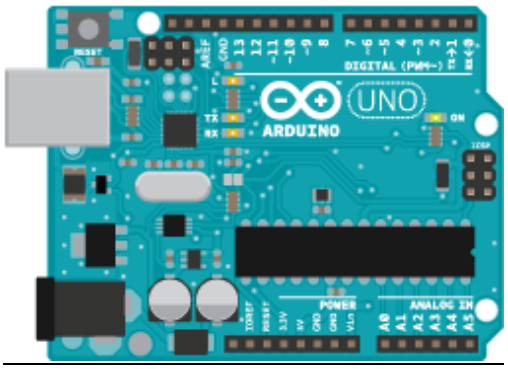

Fig.3 Arduino board

V GENERAL ANALYSIS

The heart rate is measured mainly by using 2 types, the first type is called systolic heart rate which measures the pressure in our blood vessels when your heart beats. The second type is called diastolic heart rate this measures thee pressure in our blood vessels when our heart rests between the beats. If the measurement reads [4]120 systolic and 80 diastolic we will say that as "120/80 mmHg". If the heart rate is less than 120/80 mmHg then it is normal. A heart rate of 140/90 mmHg or more is too high. The peoples level in between these rates i.e., 120/80 and 140/90 have a condition called prehypertension [12].

Body temperature	
Normal :	The average normal Temperature is 98.6° F (37° C). The normal temperature varies from person to person
Abnormal:	Oral, temporal artery temperature Fever: 100.4°F (38°C) to 103.9°F (39.9°C) High fever: 104°F (40°C) and higher Armpit (auxiliary) temperature Fever: 99.4°F (37.4°C) to 102.9°F (39.4°C) High fever: 103°F (39.5°C) and higher A rectal or ear temperature of less than 97°F (36.1°C) means a low body

Heart rate	
Normal:	Systolic rate is lesser than 120 mmHg and diastolic rate is lesser than 80mmHg
At risk	Systolic rate is higher than 120–139 mmHg and diastolic rate is higher than 80–89 mmHg
High	Systolic rate is 140 mmHg or higher diastolic rate is 90 mmHg or higher

VI SYSTEM FLOW

The following figure shows the proposed smart glove system architecture. In this the sensors which will be connected through the Arduino, and both Arduino and sensors will be mounted on the smart sloves. Sensors will take the the readings as body temperature, pulse rate from the user's body and send to the Arduino. Arduino is having wifi module it will transfer the data to the server. Data will be stored in the database of server.Afterwards Mobile application will fetch the data from server and display on the mobile screen. In case of any critical situation the application will notify the user through push notification about the nerby doctor. The data will be stored in the database, it will be helpful to compare in case of future readings.

Mainly in the android app for the registration of the user we are creating a loggin page or if he is a new user the registration page should be selected. User has to enter the current phone number and in

order to ensure the security this will generates OTP (one time password) whichwill be sent to the respective phone number. This registred number will be stored in the firebase which will be used as primary key in further steps. This successfully complets the registration prosess[7].

When once the user loggined he/she will get to options fileld 1.Basic mode 2.Pro mode[10][11]. After the selection of basic mode the generated hardware part i.e. the smart gloves will be connected automitacally. The user can select either temperature or the pulse rate to check the reading this can be calculated by refering:

Offset = Measured voltage – threshold voltage (eq-1)

the reading will be taken and stored in the separate database of every user.along with the body temperature and pulse rate the user will also be provied with the basic health related information such as consumption of water every day based on the age and the neutrition food system chart.

The application will suggest doctors to the user based on their location. Using GPRS the near by doctors will be suggested. Even the doctors can see the users reading. All the features that are in basic mode that will be present in pro mode also. Each users respective records will be stored in the firebase.

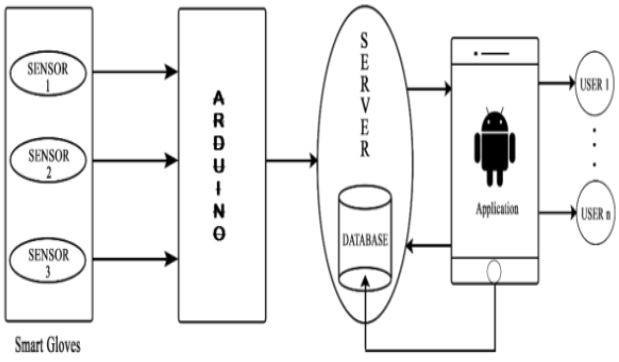

Fig-4 Architectural diagram

All the above sensors are connected to the hardware component called Arduino. Arduino is a small single-board computer. It is a dynamic microcontroller has capable of just like anything a computer is. It runs with python programming language. Arduino is like little computer it is used for many electronic projects. Since the data which are measured through those sensors are cannot be directly sent to android application so inorder to connect the sensors and the cellular phone we use Arduino. The Arduino is a credit card sized. Cheap portable robust connects to real world objects. Computer that has a several ports such as audio jack, Wi-Fi, mouse and all the sensors are connected through wires and readings are sent to the Arduino. Since the android application is connected through Wi-Fi model all the readings which are measured by the sensors are noted in the android application and stored in a separate database. From the Arduino it is sent to the server. The server is of global server any one can fetch the data through android application and the readings are displayed in their smart phones. All the records are stored in the database. Since it is global server the user can view it where ever and whenever he/she wants through android application.Recently many authors proposed different schemes for ensuring security in patients monitoring system. Current scenario is that even in the smart generation, for basic body check-ups we need to consult the doctors. Records are stored in the form of hard copy. Even in the hospitals daily readings has been taken by the nurse manually by using different instruments. Sometimes this reading may have the chance of losing the data or mismatching the data. If there are aged people in home and who are suffering from BP they have to be taken care daily like they have to be taken for check-ups daily. Instead of this if a user selects the Pro mode in our app the with some money paid the

doctor will be consulted and through online and insisting about the health care.

Here, Mobile phones play an important role in patient monitoring to receive process and transmit patient details. The readings are collected from the sensors and transmit the readings to the central hub and communicate with mobile phone through Wi-Fi module or the Bluetooth.Body sensors are used in health monitoring for acquiring body parameters and physiological signals and transmit them to the central node (here the central node will be smart phone) continuously. Before all the data sent to the central the signs are converted into digital form if they are in analogue form (since the digital form will be easier for the further calculation) as mentioned above, these sensors are used to record the data of the human and store these data to the database which can be accessible through anywhere by the users.

VII SYSTEM MODEL

Current scenario is that even for a basic body check-up such as BP, Sugar, Body temperature we need to consult the doctors. Even in the hospitals daily readings has been taken by the nurse manually by using different instruments. In case of manual reading there may be a chance of losing the data or mismatching of data. In this smart glove is that all these check-up can be done wherever the user wants. As the smart gloves are connected to cell phones through an android application which process the data and deliver it to users and caretakers. Since we are using database which will be available in cloud, store all the readings which prevents data inconsistency.

The smart application provides the users with two different modes one is basic mode and the other mode is pro mode. In the basic mode there will be an option given to the patients to get connected with the hardware parts and along the readings of body temperature and pulse rate the user will be provided with additional choices such as BMI (body mass index), amount of water consumption per day and diet chart.

In the pro-mode an interaction between doctor and the patient will be created like the patients can directly communicate with the doctors. Using GPRS Patient can check their nearby doctors. Doctor can send the any kind of information to the individual one to the particular group.

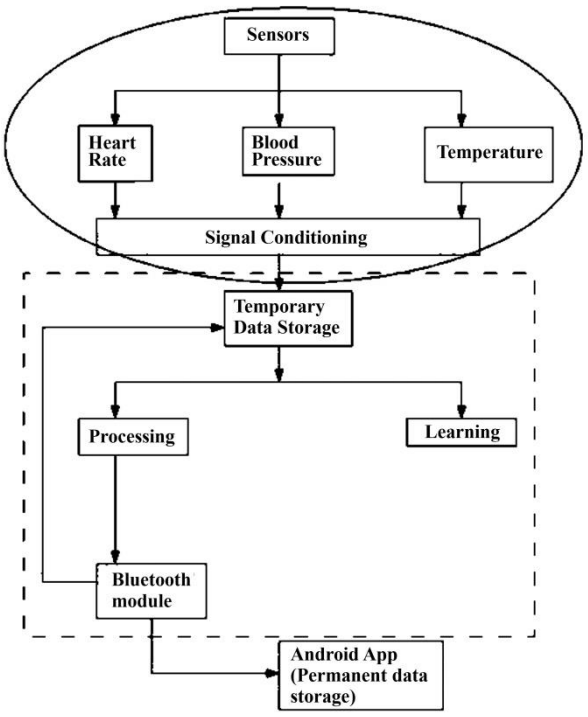

Fig-5 Dataflow diagram

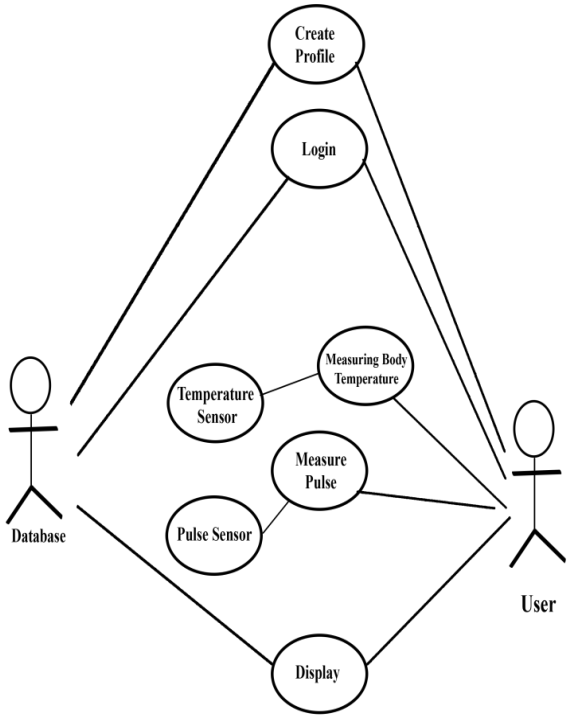

Fig-6 Use case diagram

VIII CONCLUSIONS

This device will able to collect the Pulse rate, Sugar level, Body temperature of the user in-case the readings fluctuated from the actual parameter it will notify the user through push-notification for the doctor consultation.

Since we use an android app and database to store the results which also taking part in Digitalization.User can either be monitored by the app itself or they can choose a particular doctor. Doctor can reply to any specific user or a group of users through push notification.The digital sense body temperature and pulse rate using the sensors can show the accurate results will be displayed on the android screen. Having continuous readings measured accurately without time delay and stored in a separate cloud which can be accessed any time.

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