Health Monitoring System Using IoT

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Abstract - **IoT is one of the emerging technologies which is leading to smart health monitoring. IoT helps in connecting the people by empowering their health and wealth in a smart way through wearable gadgets. IoT is the network of physical objects that are embedded with sensors, software and other technologies for exchanging of data over the network. Now a days people are suffering from a lot of acute and chronic diseases, and they do not acknowledge it earlier and due to lack of immediate treatment the death rates among these patients are increasing. This type of problems can be encountered through wearable gadgets that continuously monitor the activity and condition of the patient in a predictable method. The main aim of this work is to provide an extensive research in capturing the sensor data's, analyzing the data and providing a feedback to patients based on different health parameters.**

Index Terms - **Smart watch, IoT, Thingspeak, Android application, IFTTT, Smartphone**

I.INTRODUCTION

In the ever-increasing world population, death rate among the patients is increasing due to lack of patient health monitoring at prior. Internet has grown everywhere to access the services and smart things from anywhere on anytime at anyplace. In this internet of things (IOT) is playing an immense role in the field of automation and wireless technology for a decade. The Internet of Things (IOT) can fully exploit the potential of networking and alter the device of innovative services to over-scale scenarios such as home automation, building automation, intelligent cities and health care [2]. The person who is affected by chronic disease must handle his life properly with at most care and should be treated and monitored by a doctor all the time. The important parameters for the chronic diseases are the heart rate, body temperature. The patient monitoring system allows doctors to supervise many patients at a time. The heart rate indicates the soundness of the heart. Heart rate for adult males on an average is 70bpm and for adult females on an average is 75bpm. With the help of these values, the heart condition can be tracked. The body temperature tells the body condition. The normal human body temperature is 98.6 ° F ± 0.7°F. Any variation in the values of body temperature can risk improper human health [1]. This project continuously monitors the different health parameters of the patient through smart watch which avoids the steward. Different sensors are implemented in smartwatch for measuring different health parameters and these data are sent to cloud for further analysis. The data's sent can be accessed anywhere and if in case of any variability in health data's emergency contact is provided to the locality surgeon or patient's relation [2].

II.LITERATURE REVIEW

Wireless monitoring system is one of the main objectives of the project, so we proposed a system which is connected with smart devices for easy wireless communication and portability which is simple and unique. Getting the raw data from the android application and analyzing the data to ensure the patient's health. Based on the data's collected and analysis of heart rate of patient through their age factor help us to identify the heart abnormalities [2]. It can also be done by other technologies by maintaining a reliable communication between patient and doctor through a mobile application [4].

It can also be implemented by system which is monitoring the body parameter such as pulse rate, ECG, ARM7LPC 2138 processor is used as main interface and data displayed by using GUI [3]. Some other systems are also proposed where a disease prediction and monitoring system for stroke patient can be done using IOT. This can be considered as general prediction model for various diseases by changing the risk factors corresponding to the disease [5].

This paper widely explains about the communication and interaction part of smart watch and how wearables

are connected wirelessly to a gateway and also it explains how this smart watch is connected to smart phone with appropriate android application via BLE (Bluetooth low energy). Monitoring health is one of the complex process by humans. To avoid this condition unconsciously the health has been monitored by the smartwatch and fixing the firmware for particular architecture is another complex task in embedded system [2].

III.PROPOSED WORK

Different sensors are embedded in smartwatch to measure different parameters of patients among those parameters ECG, PPG and Heart Rate (HR) are main aspects to find the abnormal heart rates. To acquire these parameters the smart watch has to be connected with the smart phone via android application [2].We will use IoT cloud(Thingpeak) and web based service provider IFTTT. Fig. 1 shows the block diagram of proposed work
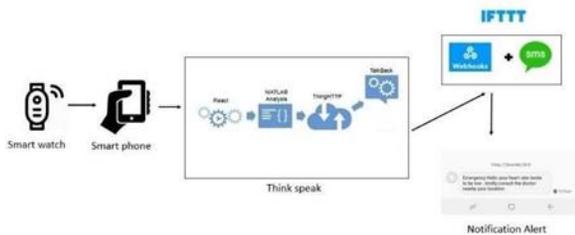

Fig. 1. Block diagram

A. Smart watch

Smart watch is the device which constantly screens our body with accurate Heart rate through ECG and PPG Signal. The results of ECG and PPG signal and their results in thing speak are shown in Fig. 2,3,4,5 respectively. It is Highly efficient and cost effective device which protects human body from vulnerability in human body. It is accumulated with various types of sensors like accelerometer sensor, Bio impedance sensor, temperature sensor, Motion sensor, ECG leads, and capacitive sensor and its applications are shown in Table I.

TABLE I APPLICATION OF VARIOUS SENSORS

Sensors	Application
Accelerometer, Motion	Patient motion detection, Activity and inactivity sensing detects the presence or lack of motion
Optical AFE, ECG	Heart rate monitoring, SpO2 Industrial monitoring
Temperature	Medical equipment, Environment monitoring, HVAC
Bio impedance	Photo plethysmography, Photodiode measurements
Capacitive Sensor	For touch screen displays

visualized in the form of charts. Here we are decoding the ECG, PPG HR data's in that android application by parsing the raw data[10].

TABLE II MODE OF COMMUNICATION FOR VARIOUS CONNECTED DEVICE/SERVICE

Connected device/service	Target device or protocol	Mode of communication
Smart watch	Smart phone	(BLE – Bluetooth Low energy)
Smart phone	Thing Speak	(Router, Mobile data)
Thing Speak	IFTTT	(Web-based service)

Bluetooth Low Energy is considered to be reduced power consumption which can communicate with other Bluetooth low energy devices. Here the smart watch has Bluetooth low energy module which helps in wireless communication between any other Bluetooth Low Energy devices like smartphone, LED TV's, Raspberry Pi 3 for Near Field Communication (NFC). NFC is a protocol which produce communication between two BLE devices. Sensors are connected to Microcontroller for attaining the physical parameter into signals through ADC. Through UART the wireless connection can be achieved through Bluetooth network. Antenna searches for signal commencing from MCU through UART. Power is the mandatory option for standby time of smart watch. The standby time depends on the processing time of smart watch and also depends on display of smart watch. To have power efficiency Display has been removed instead of display ceramic plate is fixed on the top layer of watch for reset and options two pin buttons are allotted. The battery level and applications can be accessed through smartphone. Smartwatch can also connect externally through USB type C cable for testing purpose[9].

B. Smart phone

A device which performs the similar functions to a computer with integrated touch screen, cellular network and also a different operating system to run different application. Today world is engaged with smartphones for various purposes like Banking, Business, analyzing, statistics etc. To send a data from

smart watch to cloud we need a gateway – which is a hardware device that allows the data from one distinct network to another. In this project smartphone which acts as a gateway between smartwatch and cloud. Here we created an android application which helps us from intense communication between smart watch and IOT server. Android application is connected to the smart watch through (BLE-Bluetooth Low Energy) for acquiring the real time data from smart watch shown in Table II. These real time data are collected in smart phone in JSON format that can be.

The recorded signals can be saved as a log using this application. This application continuously monitors the heart parameters without any delays. In this application we had attached the Thing speak cloud API for pinging the smart watch and Thingspeak cloud for data communication. Finally, raw data are sent to cloud for further analyses in Thing speak analytics cloud[11].

C. Thing Speak

Internet of things or IOT is one of the futuristic technologies which are in collaboration with the healthcare and medical applications to deliver out the appropriate results. IOT is going to be a skyrocketing in upcoming years to streamline the entire process. This driving technology has simplified the task of the aid professionals. This helps to access data and information through smart devices which have to be worn in human body to consistently monitor the patient's vital parameters. There are various cloud servers which can be used for analysis. In this project we used Thing speak IOT cloud which is the Matlab analytics cloud in which the data's can be collected, interpreted stored and analyzed under various conditions. In cloud part we are analyzing the heart, whether it is in cardio, normal and abnormal condition which is based on patient's heart rate and age factor. In this project we are parsing the Age, PPG, ECG data to cloud in JSON format. These data are further analyzed in cloud to check the patient's heart condition. In cloud we are using HTTP protocol for forwarding the abnormal alerts to patient's neighbor and also for locality doctors.

D. IFTTT

This is the web-based service provider which can be used for server-to-server communication. It helps to create simple conditional statement which is called as applets. There are many applets in this IFTTT server. These applets pop up when there is a trigger in that connected platform like cloud or other social media and other channels, Here we are connecting the thing speak cloud with this IFTTT for trigger. It can automate the web application tasks there are various automation applets are there for various instances[12].

IV.EXPERIMENTS AND RESULTS

In this project we completely analyzed the ECG data which we receiving from the smart watch, if our heart rate tends be abnormal emergency alert has been triggered in our mobile. We can easily find whether the person is in normal or abnormal condition. I created an algorithm for finding the normal as well as abnormal heart rate if the condition fails the trigger has been given to IFTTT. This will forward an emergency alert to concern patient's relation as shown in the Fig. 6.
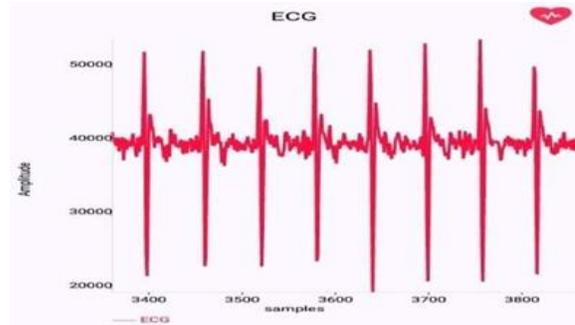
Fig. 2. ECG results in android application
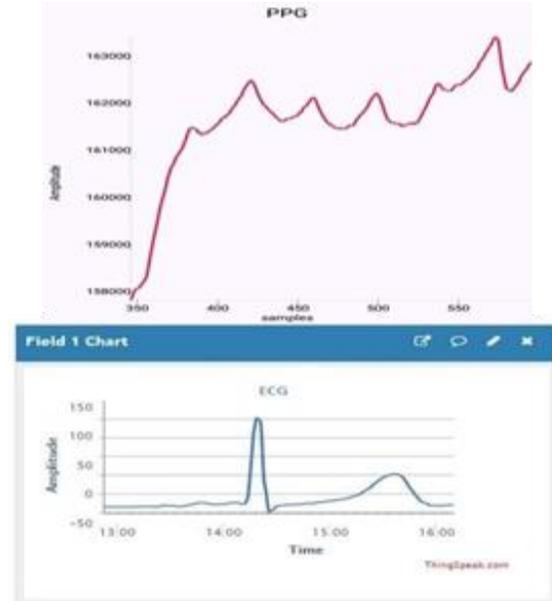

Fig. 3. ECG Results in Thing speak
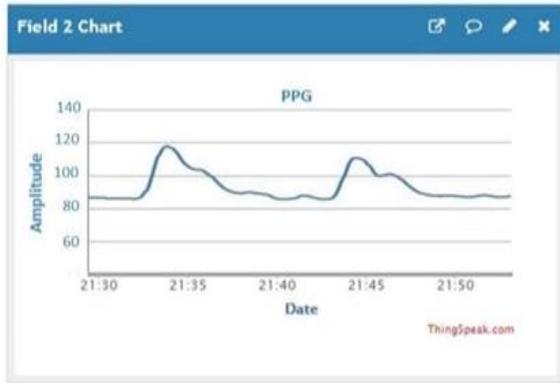
Fig. 4. PPG Results in Thing speak
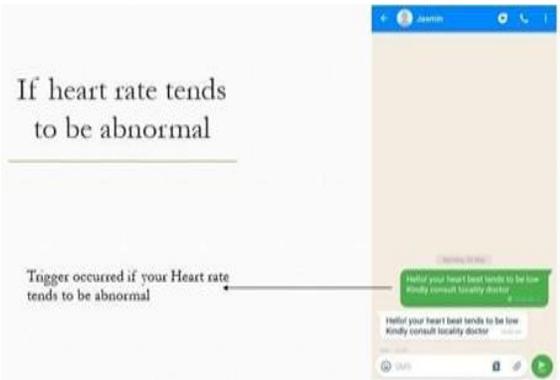
Fig. 5. Emergency alert in mobile

V.CONCLUSION

This smart system continuously monitors patient's health by acquiring vital parameters through respective sensors embedded in wearable gadgets (Smartwatch). Gadgets are connected to smartphone via application and smartphone to IoT cloud thing speak where patient's sensored data analysing is done. If found any abnormalities a notification alert is sent by IFTTT to patient's doctor and relatives.

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