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IoT Based Heart Beat And Body Temperature Measurement

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***Abstract*— Health related issues are increasing at a very high pace day by day. So it is essential to monitor the basic body parameters of the patient in case of emergency as well as in hospitals at any point of time. Wireless technology has emerged as a solution provider for healthcare industry. This work presents a system that is capable of providing real time remote monitoring of the heartbeat and body temperature. This project aims at the design and implementation of a low cost, efficient and flexible heartbeat and body temperature monitoring and alert system using GSM technology. It is designed in such a way that the heartbeat/pulse rate is sensed and measured by the sensors and the measured value is passed on to the health experts/ hospitals using the IoT. Thus, this system proposes a continuous, real time, remote, safe and accurate monitoring of the heartbeat rate and body temperature helps in patient's diagnosis and early and preventive treatment of cardiovascular ailments.**

Keywords— heart beat sensor, temperature sensor, Bluetooth, arduino

I. INTRODUCTION

Technological innovations in the field of disease prevention and maintenance of patient health have enabled the usage of wireless technologies for various health monitoring systems. Heart rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. It reflects different physiological conditions such as biological workload, stress at work and concentration on tasks, drowsiness and the active state of the autonomic nervous system. It can be measured either by the ECG waveform or by sensing the pulse - the rhythmic expansion and contraction of an artery as blood is forced through it by the regular contractions of the heart.

Recent survey shows that cardiovascular disease is one of the main causes of death in many countries. In addition, several million people are disabled by cardiovascular disease [1]. This is because of the delay in providing medication to affected patients. So if resources are deployed for early detection and treatment of heart disease, then there is a chance for reduction in fatality associated with cardiac disease than improved care after hospitalization. Hence new strategies are required in order to reduce time before treatment. Monitoring of patients is one possible solution. Also, the trend towards an independent lifestyle has also increased the demand for personalized non-hospital based care. Most of the time, heart disease problems harm the elderly person. Very frequently, they live with their own and no one is willing to monitor them for 24 hours a day [1].

A heart rate monitor is a personal monitoring device that allows one to measure one's heart rate in real time. Early models consisted of a monitoring box with a set of electrode leads which is attached to the chest[3]. Newer versions of the heart rate monitor include a microprocessor for continuously monitoring the ECG and calculating the heart rate and other vital parameters. Most of the previous works are based on PPG (photoplethysmograph) technique and makes use of PIC controller. As a result of making monitoring systems flexible and cost effective, a new device has been proposed. In this proposed device, the heart beat and temperature of patients are measured by using sensors. ARDUINO controller device is used for temporary storage of the data used for transmission [2]. This project combines the features of Android smart phone and Bluetooth technology. ARDUINO UNO has been used for interfacing the Bluetooth module as well as for passing the vital parameters of patient to the health centre/medical practitioner. On reception of data, primary medication will be sent back to the transmitted end and the required first-aid can be provided so as a life loss can be prevented.

II. MODULE DESCRIPTION

A. *Arduino UNO*

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. Its more interactive since it has an USB port. Also it can be easily programmed using C/C++ language. In this project, it acts as the controller for all the activities carried out by the robot.

Fig 1: Arduino Uno

B. *Sensors used*

A sensor is an electronic component whose purpose is to detect events or changes in its environment and send the

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information to other electronics. The sensors used here are (i) heart beat sensor (ii) temperature sensor

1) Heart Beat Sensor

Pulse Sensor is designed to plug-and-play heart-rate sensor for Arduino. The sensor clips onto a fingertip or earlobe and plugs right into Arduino. The front of the sensor is the pretty side with the Heart logo. This is the side that makes contact with the skin. On the front there is a small round hole, which is where the LED shines through from the back, and there is also a little square just under the LED. The square is an ambient light sensor to adjust the screen brightness in different light conditions. The LED shines light into the fingertip or earlobe, or other capillary tissue, and sensor reads the amount of light that bounces back. The other side of the sensor is where the rest of the parts are mounted. This sensor monitors the flow of blood through the finger and is designed to give digital output of the heartbeat when a finger is placed on it. [5] proposed a system about Efficient Sensor Network for Vehicle Security. Today vehicle theft rate is very high, greater challenges are coming from thieves thus tracking/ alarming systems are being deployed with an increasingly popularity .

Fig 2: Pulse Sensor

2) Tempreature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device does not require any external calibration or trimming. The device is used with single power supplies, or with plus and minus supplies.

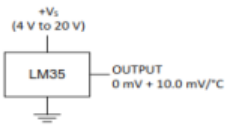

Fig 3: Tempreature Sensor

III. SYSTEM ARCHITECTURE

A heart rate monitor is a personal monitoring device that allows a subject to measure their heart rate in real time or record their heart rate for later study. The heart rate of a healthy adult at rest is around 72 beats per minute (bpm) & Babies at around 120 bpm, while older children have heart rates at around 90 bpm. Lower than the normal heart rate leads to illness. So monitoring of the heart rate along with body temperature is essential for saving the life of heart patients. The proposed block diagram is given in Fig. . The heart of the architecture is the ARDUINO controller. Temperature sensor, pulse sensor and Bluetooth has been interfaced to this controller. The whole system has been powered by 9V power supply. User can send information about the patient to the medical practitioner through the IoT. Both temperature and heartbeat of the patient will be constantly monitored using the sensors. The output of the sensors will be obtained in the form of graph and will be available in Things speak which can be used for giving the primary medication for the patient before reaching the clinic. The recorded values can be connected to the database of any hospital through the App developed using MIT app inventor which has phone numbers of the hospitals as data base. On pressing the button, the call will be connected to the respective hospital and patients condition can be monitored from any place and required medication can be provided.

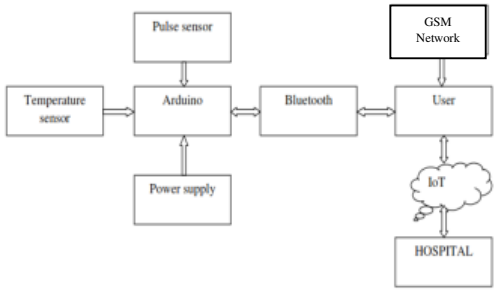

Fig 4: Block Diagram

The app for establishing connection with the Bluetooth module as well as for constant updation of data in IoT has been developed using the MIT App Inventor. Bluetooth module HC-05 has been used. Whenever connection needs to be established with HC05, the user sends signal. On reception of the signal, the connection is established with the Bluetooth module and the module responds back with a signal indicating connection established. Once connected, the user can make contact with the intended hospital by making a call and start updating the parameters of the patient in the thingspeak which can be viewed in real time by the concerned doctor by logging using the patient's ID number in Thingspeak.

For the purpose of connecting an object to the IoT, ThingSpeak API is used. The interface provides simple communication capabilities to objects within the IoT environment, as well as interesting additional applications. ThingSpeak allows you to build applications around data collected by sensors. It offers near real-time data collection, data processing, and also simple visualizations for its users. Data is stored in channels. All incoming data is time and date stamped and receives a sequential ID. Once a channel has been created, data can be published by accessing the *ThingSpeak* API with a randomly created unique alphanumeric string used for authentication.

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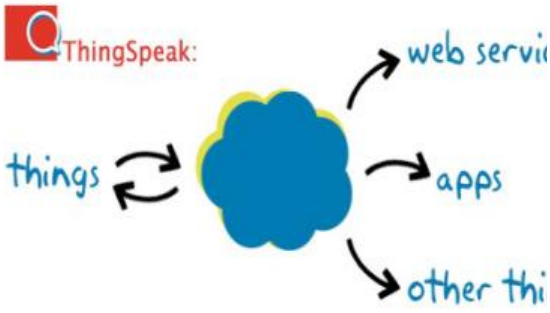

Fig 4: ThingSpeak

The temperature and heart beat rate of the patient is constantly recorded and stored in the controller which is updated constantly using IoT. This data is seen when the user ID of the patient is given to the medical practitioner.

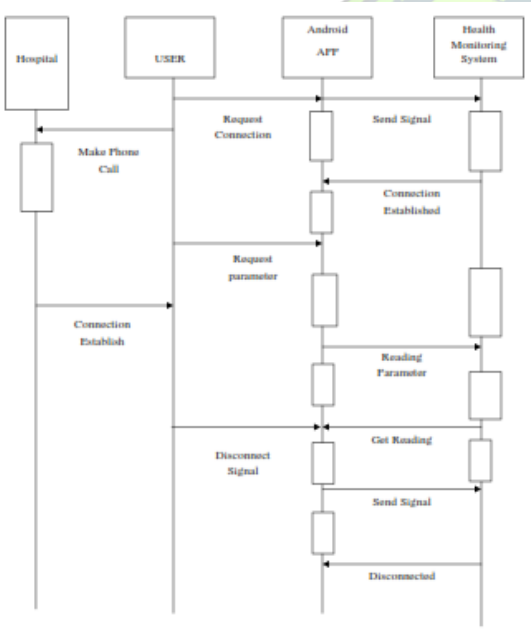

Fig 5: Sequence Diagram

IV. DESIGN

App Inventor makes Android app development highly visual. The android APP has been developed using the MIT App inventor. The block diagram of the App is shown in Fig.

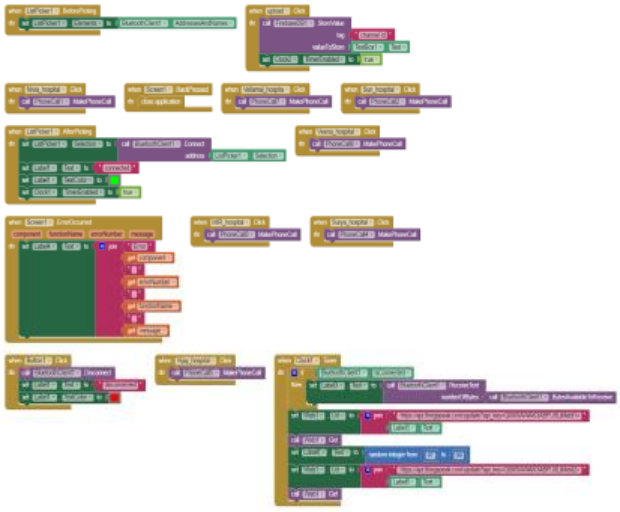

Fig 6: App Inventor

The App has buttons for establishing as well as disconnecting the connection with the Bluetooth module. The App also searches for the nearby Bluetooth devices along with MAC addresses. It is implemented through list picker. The user has to just select the required MAC address displayed in the list picker for establishing connection with that device. Once the connection is established, it's shown as connected in the App. It has additional buttons for connecting the call to the selected nearby hospitals. Once the button is pressed, call gets connected to the intended hospital.

Fig 7: Application Layout

The heart beat rate and the temperature of the patient is also constantly displayed as a value in the screen. Apart from these, there is a field where the user –id of the patient can be uploaded to monitor the condition of the patient. The same App may also be used to monitor the condition of the patients in hospitals by providing each patient with unique ID. This helps the doctor to monitor simultaneously more than one person at a time.

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. Fig 8: Application Layout

V. CONCLUSION

Heart is one of the main organs of the human body. For a sound and healthy person normal functioning of the heart is mandatory. Death rate due to cardio vascular disease is increasing day by day. So monitoring of the heart and body temperature is necessary for a healthy body. Biomedical engineering (BME) combines the design and problem solving skill of engineering with medical and biological sciences to improve patient's health care and the quality of life of individuals. This project gives an ultimate solution by monitoring the heart condition of the patients and passing the information to the concerned authorities. Based on the patient's health condition, primary medication is provided. Thus a life can be saved by implementing this system.The same set up can also be implemented in hospitals to monitor the patient's parameters from a single place so that multiple patients can be kept in observation at a time.

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