Patient's Health Monitoring System using Internet of Things (Iot)

Rohit Kumar Dubey[1],Sakshi Mishra[2],Shreya Agarwal[3,] Ravi Sharma[4,]Nandita Pradhan[5]Vineet Saran[6]
Department of Electronics and Communication Engineering
United College of Engineering and Management, Naini, Allahabad ,UttarPradesh (211010), India

Abstract - *The proposed project envisages developing a health monitoring system that monitors and controls the condition of patient by sending the alert message to the predefined members of health centers for ensuring remedial action by the doctor against the patient through the application of Internet of Things (IoT). In this project we are using different sensors for knowing the real time status of the health of the patients such as temperature sensors, pulse sensors, etc in order to sense the serious health problems with the patients, so that efficient medical services can be provided to the patient in very apposite time. In patients monitoring system, one's require equipment, devices and supplies that measure, displayed record human psychological characA patient monitoring system for providing continuous monitoring of a patient includes a data acquisition and processing of data from the patient and then this health related data is sent to the medical staff through Internet of things (IoT) by using Raspberry Pi kit. This proposed project will leads to expeditious delivery of requisite medicinal help to cure the patients. There are several applications of this method in biomedical field that leads to better accuracy, design security, productivity, speed and flexibility.*

Keywords - *Raspberry pi board, health monitoring, ECG sensor, Blood Pressure sensor, temperature sensor, mobile monitoring, Internet of things (IoT), Putty, Import.*

I. INTRODUCTION

The main objective of our project is to diminish the people obstacle and reinforcing the convenience. This paper portrays about the patients health monitoring system using IoT. The evolution in technology has emphasized the convenience for the people. The health monitoring system is the best example of that because we have used IoT(Internet of things).In past decades we perceived that we used different technology in this system like as patients health monitoring system using GSM, RFID, Arduino, Zigbee. Accelerometer etc but in our project we evolved IoT. Using IoT we can easily transfer data over a network without needing human to human or human to computer interaction. IoT

equipped the smart life with innovated technology IoT offers an encouraging technology to accomplish the aforementioned health care service .This system is designed to undermine the discomfort for the old and physically challenged people who cannot visit to doctor for daily checkup. With the assist of IoT this system monitors the health without hospitalizing the patient. This is a wireless, affordable, trustworthy, portable system which can be easily used and give a quick response. It is impossible for the patients or their family members to use the treatment at home which hospitals provide to check their patients health .They are not accomplished with the treatment which doctors can do and it can be expensive, high weighted, complicated to use. Using this system we can save many lives by providing an immediate service if the system detects any abnormalities in patients health.

Sensors used in the system

In our project we have used three types of sensors to monitor patient's health. These sensors are Electrocardiography sensor, Blood pressure sensor and Body temperature sensor. The brief description of the sensors is explained below and rest part is explained in methodology and implementation.

ECG Sensor

ECG is the phenomena of analyzing the electrical movement of the heart over a period of time with the help of electrodes placed on a skin. This system gives the knowledge of pulse and rhythm and provides the imformation and testimony of myocardial infarction. The normal range of the heartbeat should be 60 to 100 beats per minute.

Blood Pressure Sensor

Blood pressure is the measure of force that pumps blood against the walls of the arteries as blood flows through them. Blood pressure is the pressure of distributing blood on the walls of blood vessels. The normal range of the human blood pressure should not more than 120 over 80 and less than 140 over 90. It is measured in millimeter of mercury (mmHg). The blood pressure monitors electronic pressure and

pulsating sensor to identify signal on digital form. The screen consists of two parts. The top of the screen is used to measure systolic blood pressure and the lower part of the screen is used to measure diastolic blood pressure.

Temperature Sensor

This sensor is used for measuring the temperature of the body, air, liquid and round temperature. Our system is designed to measure health status so we will measure only body temperature but it can be used to measure other parameters.

Hardware used

- Raspberry pi 3 kit
- Regulated power supply
- Temperature and humidity sensor
- ECG setup
- Blood pressure sensor
- PC or Android phone(user interface)

Software used

- Python software language application (Version 2.7.14 or 3.6.3)
- PHP(Wamp server 32bit or Wamp server 64 bit)
- Database management system

Raspberry pi 3 Kit

The main purpose of using Raspberry pi 3 kit is to minimize the size of the project and avoid using different components to make our project light and portable. Raspberry is an affordable and credit card sized computer. The raspberry pi can be easily plugged into a computer monitor or TV. Mouse and keyboards are used to give the input.
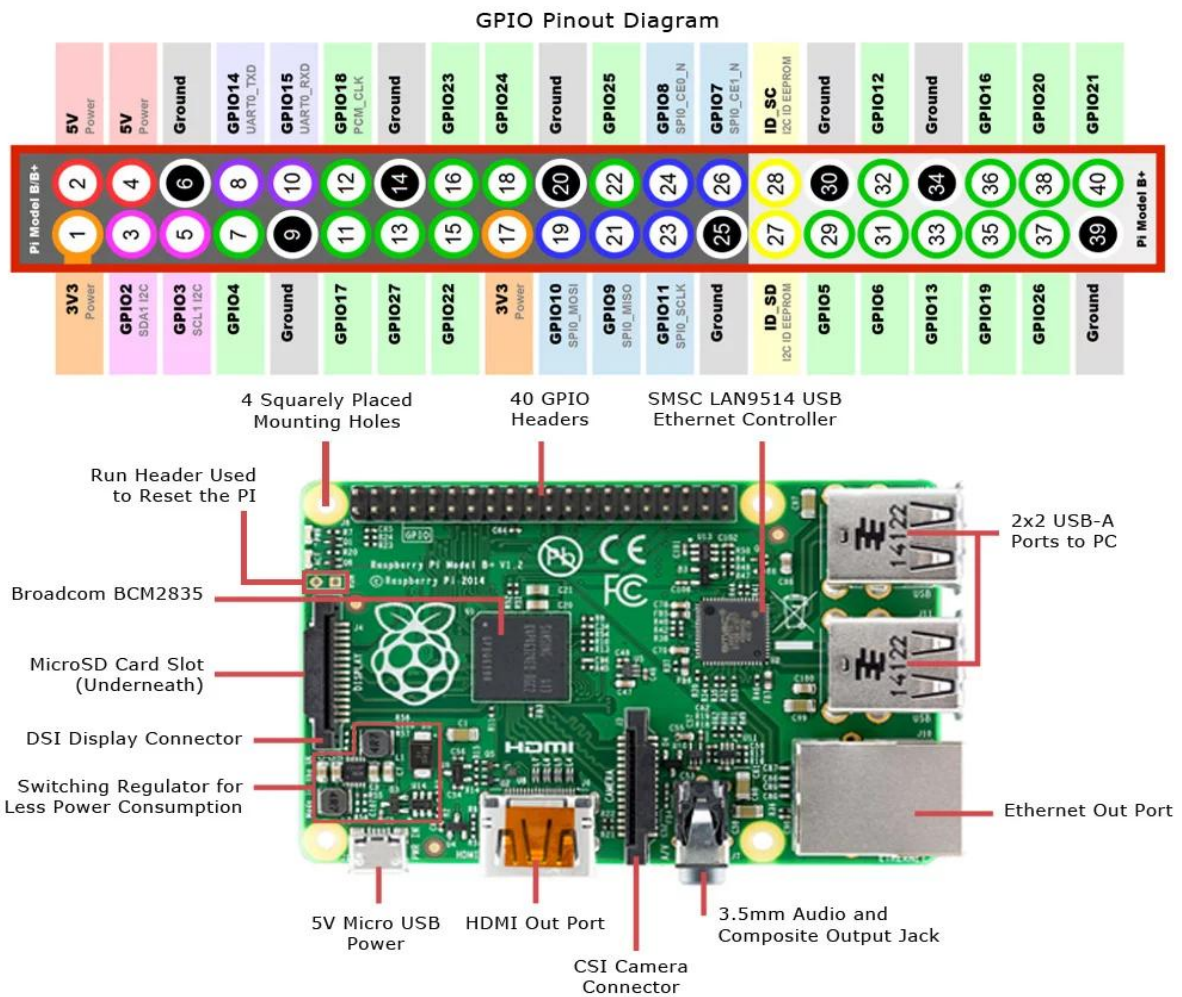

Fig.1- Circuit and pin diagram of Raspberry pi kit [6]

Specification of Raspberry pi 3 kit [1]

- 64 bit ARMv7 Broadcom BCM2837 Quad core computer running at 1.2 GHz.
- 1 GB RAM
- BCM43143 Wi-Fi on board
- Bluetooth Low energy (BLE) on board
- 40 pin extended GPIO
- 4 x USB 2 Ports
- 4 pole stereo output and composite video port
- Full size HDMI
- CSI camera port for connecting the raspberry Pi camera
- DSI display port for connecting the Raspberry Pi touch screen display
- Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source(now supports up to 2.4 Amps)

II. LITERATURE SURVEY

The innovated technology always gives the latest and versatile trend in every field. In past years we perceived that every task was difficult due to the backward technology but now a day's technology provides a new direction in every field of electronics, agriculture, business, medical etc. This papers portrays about the evolution in technology in the field of medical .The main innovation of our project is that we composed a system which can monitors health through four types of sensors .In previous published on health monitoring system we found that there were only a single sensor built on the system but in our project we have built four types of sensors .So we can say that our system monitors four influential activities in human's body. The different types of system were made using different techniques. These techniques are RFID, GSM, Zigbee, Accelerometer etc but in our project e used IoT. The main purpose of using IoT is to track the patients health over the internet from anywhere in the world. The severe disadvantage using these technique was that the doctors cannot get the alert message if any abnormality occurs but this system is capable to send alerts if any abrupt changes occurs in patient's health.

A paper presented by Amir Mohammad Rahmani [2] shows that they developed a system that monitors ECG using Panda Board. In our project we used a Raspberry pi kit. When the Raspberry pi is connected to the internet it acts as a server which automatically sends the data to the web server. Panda board is complicated to operate as compared to Raspberry pi kit. Han Yan Tung [3] had prepared a system which monitors body temperature, ECG, Heart rate through DRZG microcontroller. Zigbee module is connected to the microcontroller which sends the data to the neighboring place. So this system was not capable to send the data to the long distance. In our project we connected Raspberry kit to the internet and this system

can monitors patient's health over the internet anywhere in the world. Dong Her [4] developed an embedded system using RFID and WSN based methods. RFID covers only a short distance but our system covers the whole word using IoT. Spinsante [5] developed a system to monitors the patient's health suing camera. The disadvantage of the system is that the doctor cannot keep an eye at a same time for different patient and the camera was supposed to work in a given view angle .But our system can easily monitors the patient's health and sends an alert message to the doctor or the family members of the patients.

III. METHODOLOGY

IoT based patient monitoring system has three sensors. First one is a temperature sensor, second is Heartbeat sensor and the others are Blood Pressure and ECG sensors. All these parameter are then fed to the Raspberry pi kit, where the various operations is performed like comparison of different health parameter and then finally send to gateway server.The Raspberry pi kit The Raspberry pi continuously reads input from these sensors. Then it sends this data to the cloud by sending collected data to a particular URL/IP address. This action of sending data to IP is repeated after a particular interval of time. For example in this project, we will develop the module which will send the patients information after every 30 seconds connects to the Wi-Fi network using a Wi-Fi module.After getting the vital information from remote patient expert doctor will send advice/treatment plan to the patient immediately and hence saving the precious life.
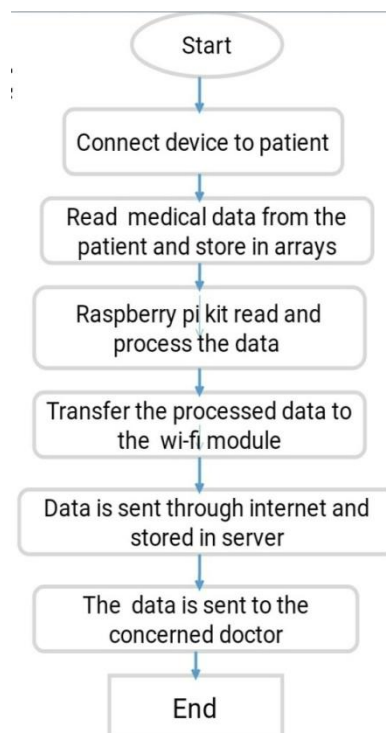

Fig .2- Flow chart of the system

The method of patient's health monitoring system using (IoT) monitor patient's heart rate, blood pressure, temperature, pulse rate using raspberry pi. Raspberry Pi acts as a server after connecting to the internet. Then the server is automatically sends data to the website using IP address anybody can monitor the patient's health condition and status anywhere in the world with the use of smart phones, tablets, laptops. If any of the above mentioned parameters indicates high or low above the required point then it will automatically sends alert notification or message to the concerned doctors and relatives.

IV. IMPLEMENTATION

Our system is designed to monitors the patient's health using three types of sensors. These sensors are Blood Pressure Sensor, Heart Beat Sensors, ECG sensors and Temperature and Heart Beat sensors .Using these sensors we can easily monitors the patients health over the internet using Internet of Things .Now implementation of these sensors are discussed below.
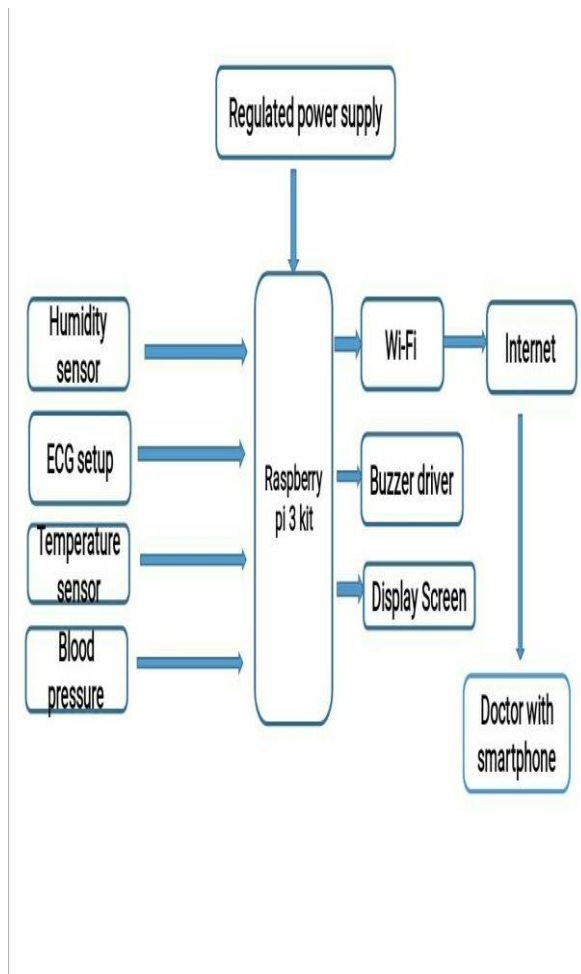
Fig.3- Block diagram of the system

WORKING MODEL

Below diagram shows the working model of the IoT based patient's health monitoring system in which laptop shows the transmitter end through which data is send to the server and stored there. The Smartphone shows the receiver end through which data is received from the server.

Fig. 4– Working model

ECG SENSOR

The electrocardiogram ECG is a diagnostic device that is regularly used to calculate the electrical and muscular functions of the heart. The heart is a two stage electrical pump and the heart's electrical activity can be determined by electrodes placed on the skin. The rate and rhythm of the heartbeat is determined by the electrocardiogram as well as provide indirect testimony of blood flow to the heart muscle.

ECG is primarily a mechanism for examination of cardiac diseases. An ECG sensing device commonly consists of a group of electrodes to reveal electrical events of a heart. The ECG is the electrical instance of the contractile task of the heart, and can be recorded fairly easily with surface electrodes on the limbs or chest. The rhythm of the heart in terms of beats per minute (BPM) may be easily by predicted the readily identifiable waves .The amplifier takes the input from 3 electrodes which are connected to the patient.
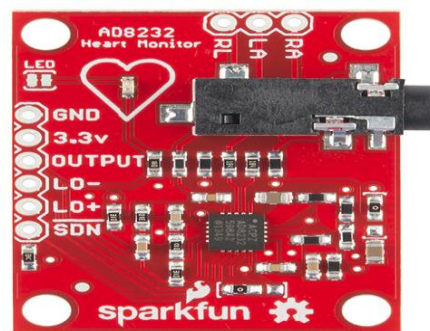
Fig.5- Circuit diagram of ECG sensor [7]

The raspberry pi has also been used to send the data to the cloud through the use of APACHE –an open

source web server. The heart rate of patient on being determined in bpm and sent to database server on cloud. The doctors analyses the heartbeat values and ECG signals recorded by this system. Through this the doctors can alert the patient if they found any variation of heartbeat values or signals from normal heart beat value and ECG signal of a normal person. The doctors can also interpret the signals of the patient in ambulance before the patient reaches hospital.

BLOOD PRESSURE SENSOR

Blood pressure is the pressure of the blood in the arteries as it is pumped around the body by heart. When your heart beats, it contracts and pushes blood through the arteries to the rest of your body. This force creates pressure on the arteries. We can record blood pressure by two numbers-the systolic pressure (as the heart beat) over the diastolic pressure (as the heart relaxes between beats).

Fig.6- Blood pressure sensor [8]

The electronic blood pressure monitor is composed of electronic blood pressure monitor, data processing center, and doctor work station and communication facilities. There is a switching button to start measuring. The blood pressure monitors electronic pressure and pulsating sensor to identify signal on digital form. The screen consists of two parts. The top of the screen is used to measure systolic blood pressure and the lower part of the screen is used to measure diastolic blood pressure. The blood pressure monitors electronic pressure and pulsating sensor to identify signal on digital form. The screen consists of two parts. The top of the screen is used to measure systolic blood pressure and the lower part of the

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TEMPERATURE SENSOR (DS18B20)

DS18B20 is 1-Wire digital temperature sensor. It observes degrees in Celsius with 9 to 12-bit precision, from -55 to 125 (+/-0.5). Each sensor has a unique 64-Bit Serial number etched into it and allows for a huge number of sensors to be used on one data bus. The core functionality of the DS18B20 is the direct to digital temperature sensor. The resolution of the temperature sensor is user-configurable to 9, 10, 11, or 12 bits, corresponding to increments of 0.5°C, 0.25°C, 0.125°C, and 0.0625°C, respectively. If we want to start a temperature measurement and A to D converter, Convert T[44h] command should be issued by the master. The resulting thermal data is stored in the 2-byte temperature register in the scratchpad memory and the DS18B20 returns to its idle state. If external supply powers the DS18B2O, "read time slots" is issued by the master after the cover T command. The DS18B20 will react by transmitting 0 while the temperature conversion is in progress and 1 when the conversion is done.

Fig.7- Body temperature sensor [9]

OUTPUT OBTAINED BY THE SENSORS

The images given below shows the complete output displayed by the sensors of the concerned person on their laptop or smart phone .It shows the status of human health over the internet using Internet of

Things. The parameters displayed by the sensors are temperature, humidity, blood pressure and ECG.

Fig.8- Obtained result at transmitting side

Fig.9 -Obtained result at receiving side

V.RESULT

The proposed IoT based health monitoring system is being deployed and tested over a patient whose personal details are entered into the web server. The patient is connected with the health monitoring system which consists of a heart rate sensor, blood pressure sensor, ECG sensor, humidity and a temperature sensor. The data of the patient's heart rate, blood pressure and temperature is being monitored on a python based database server. The IoT device used here is Raspberry pi3 kit. The system of IoT based patient health monitoring system which includes a server connected Raspberry pi3 board that uploads the data received by the sensors onto the database for further analysis and recording.

VI.CONCLUSION

This paper portrays about the patients health monitoring system using internet of things .Using IoT patients health can be easily monitored over the internet. The doctor does not need to present every time and everywhere with the patients. There health status can be easily monitored over the internet using IoT .We have used raspberry pi kit .This is a small sized kit and perform different types of functions .In our system we have implemented four types of sensors .These sensors are Blood Pressure Sensor, ECG Sensor, Heart Beat Sensor, Temperature and Humidity Sensors .Using this system patient's or his caretaker's smart phone the patient can view his health status.. In response to these types of needs, health monitoring systems are being proposed as a low cost solution. Such a system consists of physiological data that stores, process and communicate through a local manner such as smart phones, personal computers. Such systems should satisfy strict safety, security, reliability, and long-term real-time operation requirements.

VI. FUTURE SCOPE

According to Grand View Research the global IoT remote health monitoring market is expected to grow from $58.4 billion in 2014 to more than $300 billion by 2022.In the future, IoT health monitoring will provide increased independence and mobility for elderly, sick, and physically or mental disabled patients and reduces stress for family and doctors who can be alerted and react immediately as soon as issue arises. In future the patient's health can be improved by integrating smart sensors, wireless communication and network technology. Through this system vital signs such as heart rate, electrocardiogram, body temperature and blood pressure in post-operative patients can be monitored over the internet. Our system is used to increase the energy efficiency of wireless sensor nodes at the same time avoid packet losses and high storage capacity serves in compared to other monitoring system without aggregation technique. Over 15-20 years, the use of remote health monitoring system in conjunction with the electronic health record could save the healthcare industry by $700 billion.

VII. APPLICATIONS

i. It allows the healthcare provider to collect the medical and health data of an individual and transfers it to the clinical staff such as doctors, nurses etc.

ii. Patient health parameter data is stored over the cloud. So it is more beneficial than maintaining the records on printed papers kept in the files.

iii. With the IoT health monitoring, we can have the database of these changes in the health parameters. Doctors can take the reference of these changes of the patient while suggesting the treatment of the patient.

iv. With the emerging technology or connected tools, patients, elders or clinical study participants are not required to visit hospital premises for checkup.

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