IOT Healthcare System

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Abstract- *In recent years Internet of things has developed and is providing a way of making many complex tasks in more efficient and innovative way. IOT has been recognized as the next technical revolution. The use of IOT in healthcare sector can prove to be very helpful in many aspects. One such case is the patients require to do their medical checkup frequently by visiting the doctor. But this doesn't become possible every time due to busy lifestyle and other factors. In this project a IOT based system is designed by using which a patient can take the important readings such as Heartbeat, Temperature, etc. and then send the same to Doctor using Internet and the doctor will respond to the same using an android application.*

Keywords- IOT, Healthcare System, Patient Monitoring System, Efficient healthcare.

I. INTRODUCTION

Good health is the greatest blessings of life. A person in the pink of health enjoys all good things in his life. Whereas health problems can prove to be hindrances in many aspects. Even the famous saying 'Health is Wealth' highlights the importance of health in our life. Already knowing these we still tend to corner our health concerns due to our busy life. There are cases in which it is necessary to meet the doctor frequently. But due many factors like increased population, there is always rush in doctor's clinic. Sometimes it becomes nearly impossible to get the appointment of Doctor. Frequent missing out of such appointments and inattention to health issues can result in degradation of one's health. This Project works on the technology of Internet of Things provides as solution to this problem. The Internet of Things (IoT) is the next paradigm shift, where sensors are connected to the Internet, which collect data for analysis to make our planet more instrumented, interconnected and intelligent. The Patient can remotely do a health checkup with the respected doctor. This will reduce the chances of missing a crucial health checkup. The patient will use this system and send various readings say heartbeat to the doctor directly over the internet . Also the same idea can be implemented for another application for say when there is a patient who is at bed rest at his home, using this system the respective doctor can keep a check on the health of that patient without visiting the patient's home physically.

II. LITERATURE SURVEY

A. Research Elaborations-

Dr. M. Rajasekaran and Mr R. Kumar [1] suggested in their paper that an Smart Patient Monitoring System can be designed using an Raspberry Pi and IoT Technology. According to them the combination of Raspberry Pi and IoT becomes a new innovation technology in healthcare system. They have proposed an idea in which various sensors such as Temperature, Respiration, Accelerometer, Heartbeat etc collect the data of patient and same is then sent to the cloud.

Junaid Mohammed [2] monitors patient's ECG wave anywhere in the world using IOIO- OTG Microcontroller. Android application is created for ECG Monitoring. IOIO-OTG microcontroller is connected to android phone using USB cable (or) Bluetooth dongle. After collecting data, the wave is send to android application. Monitor and store ECG waves in that android based application.

Mohammad S.Jasses [3] focused on body temperature monitoring using Raspberry Pi board in cloud system. In that paper, Raspberry Pi captures the body temperature using sensors and then these parameters are transferred by wireless sensor networks(WSN). Then these data are added to the cloud based websites. Using this website user can monitor the body temperature.

Reza Filsoof [4] used zigbee mesh network to send the patient vitals to the remote station. They Developed signal conditioning device which will convert the finger pulse to Bits Per Minute (BPM).After converting , they transmitted the data and displayed it on remote station using zigbee. The only disadvantage of this system is the limited range.

Jorge Gomez [5] states that the increased use of mobile technologies and smart devices in the area of health has caused great impact on the world. Health experts are increasingly taking advantage of the benefits these technologies bring. They state that today the people with chronic diseases is increasing rapidly. Their system was design to develop a solution based on an ontology with ability to monitor the health status and recommendations of workouts with chronic diseases architecture.

Jungmuk kang [6] developed a system which informs doctors and nurses about the patient's vital signs. However typical patient monitoring systems do not have a remote monitoring capability, which necessitates constant onsite attendance by support personnel.

Sherin Sebastian [7] proposed a paper which provides an image based techniques to acquire and analyses a constant streaming of ECG signal through digital camera for image capturing, Information extraction and analysis performed using MATLAB tools as well as data sending system based on internet network.

V. Ramya [8] developed a project which can be used to inform the doctor about the ICU patient conditions through wireless. For the medical professionals it becomes important to continuously monitor the conditions of patient .But it becomes difficult for a doctor in a large setup like hospital to keep informed about the critical conditions developed in each of the patient.

Punit Gupta [9] present the design and implementation of an IOT based health monitoring system for emergency medical services which can demonstrate collection and integration of IoT data flexibly which can provide support to emergency medical services like Intensive Care Units using Intel Galileo 2nd generation development board.

Hasmah Mansor et al [10] monitors body temperature using LM35 temperature sensor. The LM35 temperature sensor is connected to the Arduino uno board. After hat creating a website in SQL database format. Arduino uno board is connected to that website. Then sensor output is send to the website. Using this website anybody can monitor body temperature in login process
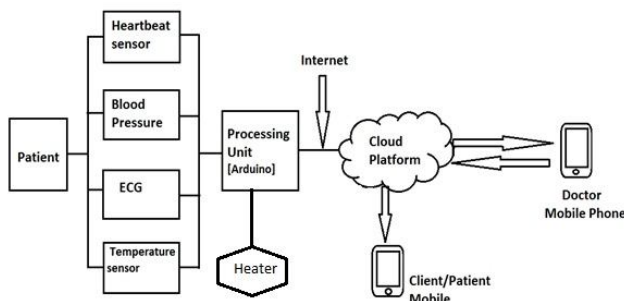
B. Block Diagram

Figure 1. Block diagram

As seen in the figure 1 this is overall block diagram of our project. The system is designed for household use. It will be available with the patient at his home. It will comprise

of various health sensors which will take the patient various parameters readings and this are given to the Arduino. Here Arduino is the main controller unit. Arduino will then send this data over cloud using internet. For uploading purpose a Arduino WiFi shield is required. Also a good internet connection is mandatory. For Cloud server the Google Firebase can be used as it provides 1 GB of storage for free. For further commercial use there are various paid cloud services available. Now Coming to the android app section. There will be two android apps. One with the patient and another with the doctor. The doctor app will have a window in which he can see the data which is sent by the patient. Then the doctor can respond accordingly to the patient. The patient app will display the response of the doctor and also will contain a list of prescribed medicines by the doctor. The app will also give a notification to the patient regarding the medicine to be taken at respective times. Also to show that the communication can be bidirectional, we will be connecting a heater using a relay to the Arduino which can be remotely controlled by the doctor.

C. Hardware Requirements

From the fig 1 , we are clear that the proposed system will be requiring a processing unit for which an Arduino microcontroller will be used. The same system can be designed using Raspberry Pi as a controller but the cost of raspberry pi will make the system costly. Hence for making a cost effective system one can use Arduino . Also various health sensors for measuring the patient parameters are required . Following are some health sensors which can be used.

1. Temperature sensors-

a. Thermocouple

Wide Temperature range -100 to 500 degrees
For connecting with Arduino we have MAX6675 IC to which a thermocouple can be connected and this IC connects the thermocouple with the Arduino

Disadvantage- costly . cost of thermocouple plus cost of max 6675 (Rs 600 approx)

b. SHT 15

It is temperature and humidity sensor.

Figure 2. SHT 15

Temp range => -40 to 123 degrees
Accuracy- +- 0.3 degrees

The two sensors built into the SHT15 have been seamlessly coupled to a 14bit analog to digital converter and a serial interface circuit resulting in superior signal quality, fast response time, and a strong resistance to external disturbances.

c. LM35

Figure 3. LM35

Temp range => 0 to 100 degrees
Output can be take from the output pin.
Each 10 mv is directly proportional to 1 celcius.

Good sensor which can be used with Arduino and also easily available. By a little programming one can easily get the temperature data

d. DS 18B20

Figure 4. DS 18B20

The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with Arduino. The sensor shown above is a wired version of DS18B20 sensor which is also waterproof . Usable temperature range: -55 to 125°C (-67°F to +257°F).

2. Heartbeat Sensor

a. Pulse Sensor

Various readymade pulse sensors are available in the market which can be put on the finger and it will measure the heartbeat by measuring the pulse rate. On of is shown in fig 5.

Fig 5. Pulse sensor

This pulse sensor fits over a fingertip and uses the amount of infrared light reflected by the blood circulating inside . When the heart pumps, blood pressure rises sharply, and so does the amount of infrared light from the emitter that gets reflected back to the detector. Advantage of using this sensor is that it is readily available and accuracy is upto mark.

b. Build a Pulse sensor

If one doesn't want to use the readymade pulse sensor the one can also design one . It will surely require some electronics knowledge. A simple pulse sensor can be designed using IR (Infrared) transmitter and receiver . A circuit will be required to build using the IR and some amplification circuitry using operational amplifiers.

3. Blood Pressure

There is no such direct sensor to measure the blood pressure. The traditional way of measuring blood pressure using a cuff and pressure sensor will work .

4. ECG

ECG is a optional part for the system as one doesn't require to frequently measure the ECG wave. But if the patient is on complete bed rest and the doctor require to check the ECG wave then he can do so. For this various ECG electrodes and a signal amplification circuitry will be required.

III.   CONCLUSION

The problem that the patient may miss frequent appointments with his/her doctor can be solved by this system. As IOT is an emerging technology there are lot of developments yet to come in this field. This technology can be adapted in any field where something is to be done smartly. As discussed in this paper , the IOT helped to make healthcare more smarter. The system is not limited to the sensors discussed in this paper . One can use any sensor for that particular parameter as lot of sensors are available today in the market. By making certain modifications in the system discussed in this paper, the same system can be used in ICU sections of the hospitals. As it is not possible for the doctor to be continuously present in the ICU. So by implementing this system the doctor can see the status of patients by sitting in his cabin or at home. The monitoring is not limited to android app , the same can be done by designing a webpage for the same.

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