ISSN No:-2456-2165

# IoT Based Patient Health Monitoring System

Aman Mehta, Bhavya Mehta, Manthan Joshi, Sharad Gohil, Sheetal Mahadik
Electronics Engineering
Shree L.R. Tiwari College of Engineering
Mira road, Mumbai, India

**Abstract:- With the increasing population today, the number of chronic such as diabetes insipidus and heart diseases such as cardiac arrest is also increasing. The healthcare system nowadays is hospital centric which is inefficient to treat these conditions, that requires immediate assistance. This indirectly leads to increase in the death rates. So, now the main aim is to have patient favorable healthcare system. The major task is to keep a track record of patient's health history. By using technologies such as Internet of Things, Artificial Intelligence, etc. using Raspberry Pi lives can be saved by continuous health monitoring. With the help of medical sensors and Raspberry Pi, we can achieve the objective of this project that is providing better communication between the doctor and the patient and also efficient assistance. Different parameter like Body Temperature, Pulse Rate, Electrocardiogram (ECG), Pulse Oximetry (Spo2) is continuously monitored and provides real time information to the patient and the doctor. Using GSM or cloud services we can give SMS alerts to the doctor when a critical condition arises, and thus it leads to proper communication and assistance between the patient and doctor.**

***Keywords***:- *Raspberry Pi, IoT, ECG, SpO2, Pulse Rate, Temperature Sensor, GSM.*

## I. INTRODUCTION

In today's world the patient is not been getting sufficient treatment mostly in rural areas because of few factors which includes unavailability of doctor, appointment period, etc. Suppose if he gets on time appointment but then too the personal assistant is not appropriate at times and every time the patient needs to visit the doctor and take personal medication. To check and identify different diseases the instrumentation needed is not available with every doctor so along with insufficient assistance it becomes much time consuming visiting different doctors. Records of a patient or all the paper work that can be reports or any such documents has to be maintained. The risk of misplacing or loosing is very high due to hectic maintaince of files Physical presence is needed near the patient all the time to monitor.

## II. PROBLEMS

Now a days we see that the time taken to take a patient to hospital is very high and even after taking to hospital, the service provided is not assured. So, absence of timely and qualified assistance may lead to high number of deaths. The time period of curing chronic diseases and its management becomes an important factor. The cost during this period becomes too high and a middle-class person cannot afford it. So, for the management of chronic diseases cost is the major problem the time taken during pathology detection is very high and during that period there may be certain changes inside our body which becomes very harmful for us and because of this sometimes we are not aware that from which disease we are suffering and at which stage the disease is going. This leads to many consequences and even leads to sudden deaths sometime.

The major problem faced here is the maintenance of patient history It becomes a hectic for patient as well as doctor to get the same data back if it is misplaced or lost. In this manner the patient may need to take the same reports 3-4 times. So, this leads to wastage of money as well as time So this is the major drawback and need to overcome it soon. As we all know, the services available in rural areas are so bad. The facilities provided to rural areas are not sufficient. Whether it be doctor or it be instruments the services are poor in rural areas

## III. OBJECTIVE

This project is based on a modern concept of health monitoring of a patient wirelessly. It is a major development in medical arena. This project provides a brilliant and inexpensive health monitoring system for providing more comfortable living to the people suffering from various diseases using leading technologies like wireless communications, and wireless health monitoring device. Here IOT is used as a major platform for many services & applications; also Raspberry Pi is used not just as a sensor node but also a controller here.

Here the monitoring of the patient is done by the doctor and the patient continuously. Once Internet is connected to the Raspberry Pi board, it acts as a server. Then the server automatically sends data to the webserver. Then these parameters are monitor using webpage anywhere in the world using laptops, smart phone etc. If these parameters reach to abnormal, it will automatically send alert message to the doctor. As a result, visits to doctors decreases as the information regarding patient's health directly reaches to doctor's monitor screen from anywhere the patient resides. Also, based on this doctor can save many lives by imparting them a quick & valuable service at the time of emergency. Also, the data monitored is stored on server permanently which not only reduces the maintenances of records but also makes access easy of earlier record for both doctor as well as patient whenever needed.

ISSN No:-2456-2165

## IV. OUTLINE

Raspberry Pi is the core of our project. 5v power supply is given to the Raspberry Pi. After that all the sensors are interfaced with the PI. The sensors interfaced are heart pulse sensor, temperature sensor, ECG sensor and SpO2 sensor. Once interfaced it starts measuring and detecting all the values of the particular sensors. After getting different values for different sensors. It is displayed on the 16 x 2 LCD. GSM module is used for communication between doctor and patient. In case the sensed value goes above or below the predefined values an alert is send to the doctor through this. Open source web applications such as MIT app developer, Thing speak, etc. are used as for data storing, retrieving and updating. All manipulation, updation and maintenance of data is done through this IoT based open source web application.

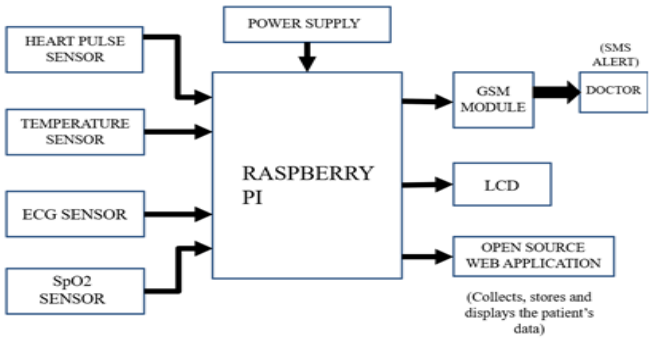


Fig 1:- Block Diagram

## V. PROPOSED METHODOLOGY

It works on the principle of two login systems that is user login and doctor's login. In user login, system will start monitoring user's health parameters such as Temperature, ECG, Pulse Rate, Spo2 level. All the values are predefined in the monitoring system. Once the parameters are measured the system will start comparing the measured values with the predefined values. If the values are below or above the predefined values then an SMS alert will be sent to the doctor through the GSM module.

Now, in doctor's login, the doctor can check all the measured values from any place and at any point of time. Doctor can give precautions and prescriptions if he thinks the patient's health is not stable. Doctor can even give immediate assistance to the patient if he sees that the patient's health is critical. The doctor will have all the record maintained digitally and can access the data anytime.

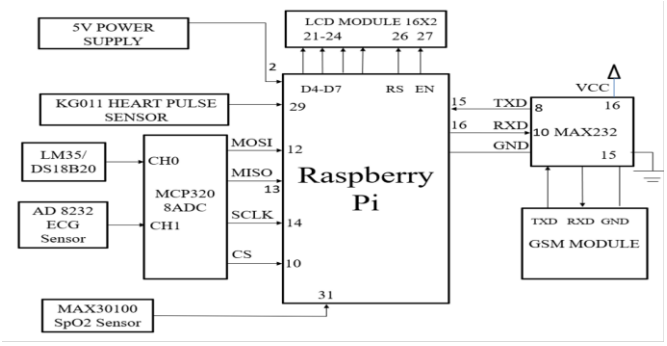


Fig 2:- Circuit Diagram

## VI. HARDWARE DETAILS

Temperature Sensor: The temperature sensor is an analog/digital device which measures the temperature of the surrounding, or an object, or in our project specially for measuring Body Temperature, and gives the information to the Raspberry Pi. The sensor which is used here is LM35 Temperature Sensor. Since it is an Analog sensor, it is connected to the Channel 0 of the MCP3208 Analog to Digital Converter. Thus, the data is first converted into digital format then given to the Raspberry Pi.

Pulse Rate/Heart Beat Sensor: This sensor is a digital device which measures the pulse rate of the human heart by placing the finger on the sensor. The sensor used is KG011 Pulse Rate Sensor. It is connected to pin no. 29 of Raspberry Pi.

ECG Sensor: This sensor is an Analog device which does the process of Electrocardiography (ECG) by using three probes which are placed on the right hand, left hand and the left leg. The sensor used is AD8232 ECG Sensor. Since it is an Analog sensor, the data is converted into digital format by connecting the sensor to Channel 1 of the MCP3208 ADC. This digital data is supplied to the Raspberry Pi and the data is shown in the form of a graph on the open source development platform.

Pulse oximetry (SpO2) Sensor: This sensor provides digital output in terms of percentage. This digital output is the amount of haemoglobin carrying oxygen through the blood. So, by placing the finger on this sensor, the oxygen amount in the blood is obtained in terms of percentage. The sensor used is MAX30100 Pulse Oximeter. This sensor is connected to the pin no. 31 of Raspberry Pi.

MCP3208 Analog to Digital Converter: It is an 8-channel, 12-bit Analog to Digital converter. MCP3208 is used to convert the Analog inputs provided by the Temperature sensor and ECG sensor into digital output and then given to the Raspberry Pi through Serial Peripheral Interfacing (SPI). Since MCP3208 uses SPI to communicate with Raspberry Pi, the pins used are MOSI, MISO, SCLK and CS which are connected to pin nos. 12, 13, 14 and 10 respectively of Raspberry PI.

GSM Module: The GSM Module is used to send SMS Alerts to the doctor/clinic whenever a critical condition is observed in any of the parameters mentioned above. The GSM Module used is SIM900A. This is a complete Quad-band GSM/GPRS module in a SMT type. It communicates with Raspberry Pi serially. Thus, the TXD and RXD pins of SIM900A are connected to MAX232 which then communicates with the Pi.

MAX232: It is an IC which converts signals from RS232 serial ports to signals suitable for use in digital logic circuits, which in this case is Raspberry Pi. It is dual transmitter/dual receiver. Pins 8 & 10 of MAX232 which are TXD and RXD pins respectively are connected to pin nos. 15 & 16 of Pi.

LCD Module: A 16x2 LCD Module is used to display all the parameters values which are tested one by one and other messages as well. The pins D4-D7 and RS & EN pins of LCD Module are connected to pin nos. 21-24 and 26 & 27 respectively of the Raspberry Pi.

## VII. SOFTWARE DETAILS

Raspbian: As mentioned before, Raspbian is an official operating system for Raspberry Pi devices, supported by Raspberry Pi Foundation. There are three most popular versions of Raspbian, widely spread among users now: Wheezy, Jessie and Stretch. All of them are based on Debian: Debian 7 Wheezy, Debian 8 Jessie and Debian 9 Stretch respectively. The Stretch is the latest one. It contains a lot of useful stuff: Chromium browser, Sonic Pi, Real VNC, Node RED, Blue and Green foot Java IDE, Geaney, Python, Scratch, and Wolfram.

Python Ide-PUTTY: PUTTY is a free and open-source terminal emulator; serial console and network file transfer application. It supports several network protocols, including SCP, SSH, Telnet, rlogin, and raw socket connection. It can also connect to a serial port. The name "PUTTY" has no official meaning. PUTTY was originally written for Microsoft Windows, but it has been ported to various other operating systems. Official ports are available for some Unix-like platforms, with work-in-progress ports to Classic Mac OS and macOS, and unofficial ports have been contributed to platforms such as Windows Mobile and Windows Phone.

*Open Application Softwares:*

Thing speak: According to its developers, "Thing Speak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. Thing Speak was originally launched by Iobridge in 2010 as a service in support of IoT applications.

MIT App Inventor: App Inventor is a cloud-based tool, which means you can build apps right in your web browser. This website offers all the support you'll need to learn how to build your own apps.

MIT App Inventor is an intuitive, visual programming environment that allows everyone – even children – to build fully functional apps for smartphones and tablets.

## VIII. CONCLUSION

In this paper, using IoT we have made a compact health monitoring system which is operated by Raspberry-Pi. Any irregularities in the health conditions is immediately recognized and this irregularity is informed to the doctor via SMS using GSM module and the data is stored on the cloud database which can be analyzed in the future by the patient and the doctor. The proposed prototype is easy to use, efficient in terms of power consumption and simply accessible.

## REFERENCES

[1]. Gupta, N., Saeed, H., Jha, S., Chahande, M., & Amity, S. P. (5097). Iot Based Health Monitoring Systems. Iot Based Health Monitoring Systems, 12(19), 5647–5652. https://doi.org/10.15662/IJAREEIE.2016.0508067

[2]. Engineering, C., & Engineering, C. (2016). STATUS OBSERVING METHOD USING INTERNET OF THINGS, 101–104.

[3]. Health Monitoring Systems using IoT and Raspberry Pi.pdf. (n.d.).

[4]. Koshti, M., Ganorkar, S., & Student, M. E. (2016). IoT Based Health Monitoring System by Using Raspberry Pi and ECG Signal. International Journal of Innovative Research in Science, Engineering and Technology (An ISO Certified Organization), 3297(5), 8977–8985. https://doi.org/10.15680/IJIRSET.2016.0505337

[5]. Krishnan, D. S. R., Gupta, S. C., & Choudhury, T. (2018). An IoT based Patient Health Monitoring System. Proceedings on 2018 International Conference on Advances in Computing and Communication Engineering, ICACCE 2018, 1–7. https://doi.org/10.1109/ICACCE.2018.8441708.