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# PATIENT HEALTH MONITORING WITH HEALTH ASSISTANT

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**Abstract -** *A great demand of today world is to get everything within a very short time. At present situation, people want to realize their current health condition and also want proper care rapidly at their home. As a result, this project is an attempt to solve a healthcare problem currently society is facing. The main objective of the project was to design a remote healthcare system with healthcare assistant. It's comprised of five main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and this can be monitored from anywhere in the world over internet., the third part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor and guardian to monitor a patient's health progress away from hospital premises and also send an email/SMS alert whenever those readings goes beyond critical values, fourth part is the two-way communication the doctor can send required prescription to the patient or guardians through SMS or Emails, and the last part was the virtual health assistant which can interact with the patient to take their medicine on time and give some suggestions about their current health condition and also it communicate with the patient to avoid the loneliness. Apart from helping the medical doctor screen the patient's basic fitness parameters this health monitoring machine also ensures that the affected person takes the prescribed remedy at the proper times. The raspberry pi acts as a non-public server which logs the details of the patient's medicine. The affected person is sent reminders to take medicines via SMS in line with his prescription. This system uses IOT technology to achieve this system in an efficient way.*

***Key Words***: IoT, Health Monitoring, Pulse rate, Temperature, Heartbeat, Raspberry pi, Health Assistant.

## 1.INTRODUCTION

In current years, health risks are developing daily at excessive pace every day. Worldwide average births per year are 131.Four million and death rate is 55.Three million. Sources: population reference bureau & the sector fact e book. This is a big hassle round the world. Hence, it's time to overcome such problems. The wireless sensor generation gives facts on numerous wi-fi sensors by using supplying a alternate in variety sensor generation. It receives information about the human frame temperature (BT), blood pressure (BP), and heart beat (HB).

This is certainly extra available via IOT platform via the Internet. The affected person's fitness records might be examined and analyzed at any time and by means of any physician. Patient health statistics permanently saved at the server. This paper affords a health monitoring device that identifies human frame situations which includes blood stress, frame temperature, coronary heart rate, ECG, respiration, accelerometer and more facts at the IOT server via wi-fi community technology.

In emergency conditions, this system routinely sent a warning message/name to the affected person's caregivers, to the health facility and additionally to the ambulance on if any odd statistics detected. An uninterrupted fitness record may be used to perceive the disease greater successfully. Now-a-days, human beings are getting extra attention to stopping the ailment on the earliest stages. In addition, new generation mobile technologies, and their services have been discussed with different wireless networks. Different sensors inclusive of the ECG, BP, temperature, acceleration and pulse rate for some seconds are used to collect frame health parameter statistics for the prognosis. The use of Raspberry Pi and IoT is quality in health supervision, and this paper gives the idea of both structures. A popular Raspberry Pi platform offers a complete Linux server on a small platform with IoT at a very low price. Raspberry permits interface offerings and mechanisms through the overall motive I/O interface. By using this combination, the proposed structure is greater powerful. An IoT is connecting the devices and which offers the human interplay to a better existence.

This paper, which affords an overview of health care management generation, protects patients from destiny fitness issues, and enables docs to take the right measurements at the proper time on the affected person's health. The task entails alerting the physician thru SMS if any vital parameter of the patient deviates from the ordinary value. Apart from supporting the physician display the patient's simple health parameters this fitness tracking machine also ensures that the affected person takes the prescribed medication on the right instances. The raspberry pi acts as a private server which logs the information of the patient's medicine. The affected person is sent reminders to take drugs thru SMS in step with his prescription.

The goal of every healthcare provider is to enhance affected person consequences and patient survival prices. To assist them reap this aim technology can offer especially powerful affected person monitoring the use of a digital health assistant. These are relatively powerful patient monitoring

and comply with-up systems within the form of web or cell apps. These digital assistants can be used by patients anywhere and at each time thanks to the pervasiveness of smartphones.

## 2. EXISTING SYSTEM

In Existing system is mainly divided into three stages viz., the transmitting section, the processing unit and the receiver section. The transmitting end mainly consists of biological sensors which are used to pick up the biopotential signals from the patient's body. These sensors are held in contact with the subject under treatment in order to extract the biological signals. Such signals are raw and unamplified in nature and hence are passed to Processing system. The second stage consists of Arduino and Raspberry Pi. The Arduino UNO is programmed with Arduino Software known as Integrated Development Environment (IDE) that provides a workspace where the sensors are coded. The program files are created after coding the sensors are then transmitted to Raspberry Pi and further serially communicated to Arduino UNO. The Raspberry Pi collects all the information from Arduino UNO and separately stores it in a file for displaying it on a Web page. For this purpose, it uses Web Server known as Easy PHP which is a Devserver. Easy PHP is referred to as Hypertext Pre-processor which is a widely used general purpose scripting language especially suited for

Web development. Now all the collected parameters regarding the patient's health are displayed online through a specific URL and can be viewed using mobile devices which can be a laptop, smart phone or a personal computer.

## 3. PROPOSED SYSTEM

The system uses Raspberry Pi Board as an IOT device that interfaces three sensors and read the patient health parameters. These health parameters will be sent to cloud. Doctor and caretaker can access these values from cloud. Health monitoring system that is intelligent enough to monitor the patient automatically using IOT. The proposed system has been connected sensors within their respective ways. The device receives the data from the sensors, and integrated these with the board. Raspberry Pi is the major tool in the proposed system; it is connected to all other sensors. Raspberry Pi works at 5V DC power supply. All sensors do not use the same power; here we supposed to use transformers for handling them. In this, we used a step down the transformer with (0-9, 15- 0-15) V/1A values. These could be converted from the voltage 230V is into 0-9V and 15-0-15V and then it sends to switch mode power supply (SMPS). There are three ICs in this circuit, namely 7805, 7812, 7912 and also used + 5v, + 12v, -12v volts respectively. Then these diodes are used to change the wavelength from AC to DC. So there is a 1000uf capacitor to get electricity supply and then the sensor power supply is connected. It collects the status information through these systems which would include patient's temperature, heart rate and blood pressure and sends an emergency alert to patient's doctor as well as to the caretaker with his current status. This would help the doctor and caretaker to monitor his patient from anywhere in the world. The system uses smart sensors that generates raw data information collected from each sensor and send it to a cloud server where the data can be further analyzed and statistically maintained to be used. The proposed technique of affected person monitoring device monitors affected person's fitness parameters using Raspberry Pi. After connecting internet to the Raspberry Pi it acts as a server. Then the server mechanically sends facts to the internet site. Using IP server with absolutely everyone can display the patient's health repute everywhere in the world the use of laptops, capsules and smart telephones. Apart from supporting the health practitioner screen the patient's primary fitness parameters this health tracking device also ensures that the patient takes the prescribed remedy on the right instances. The raspberry pi acts as a non-public server which logs the info of the affected person's medicine. The patient is sent reminders to take medicines through audio according to his prescription and also it interacts with the humans and gives some suggestions about the present health condition.

### 3.1 Block Diagram

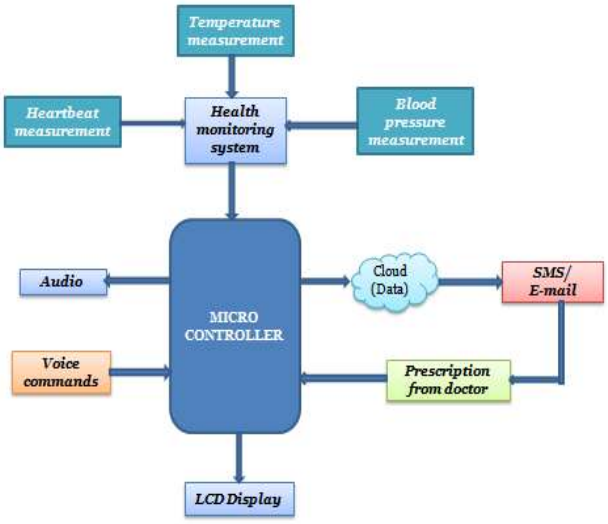


**Fig- 1:** Block diagram

### 3.2 Measuring body temperature of the patient

This sensor measures the body temperature with a voltage. The sensor LM35 has an advantage about conversion from Kelvin to the centigrade, and is also suitable for wireless applications and which is better than the thermostat. This temperature sensor connected to the Raspberry pi is used to check the patient's body temperature. If the temperature of the patient is above normal, the doctor is alerted through an SMS immediately.

### 3.3 Measuring heartbeat of the patient

It is used to measure the heartbeat of the patient. Here, the heart rate sensor uses + 5V DC voltage. This gives the digital result, which is placed on the hand artery nerves. This works

on the principle of light modulation through the blood flow of the arterial nerve at each pulse. The heart rate should be between about 60-100bpm. A lot of research is taking place in the wearable sensor field in recent years. We use a fit bit wearable sensor module for heart rate sensing. From the heart rate measured using the fit bit, if any abnormality is found, the doctor is alerted about the patient through SMS immediately.

### 3.4 Measuring Blood pressure of the patient

Blood pressure sensor measures blood stress, inclusive of systolic, diastolic pressure and pulse price of the body. This technique gives accurate and dependable results than the sphygmomanometer. The existed technique used airborne gall bladder armor and a stethoscope to measure the blood pressure. In preferred, blood pressure sensors acquire the blood stress from the vessel walls or arteries.

### 3.5 Patient medication details

We use the forms of input the patient's medication details. The data is stored in the raspberry pi which acts as a personal server. We access the patient's medical database and remind the patient to take medication according to prescription through SMS.

The doctor's details are similarly entered in a form and are used to alert the doctor to abnormalities in the patient's vital parameters and then the doctor sends the required prescription through e-mail or sms to the patient or guardian.

### 3.6 Health assistant

Evidence of the impact of employing HCAs in general practice is limited. Their employment is pronounced to enhance exercise ability and efficiency, 35 as patients may be allocated to personnel on the idea of fee-effectiveness. 39 As unregistered body of workers, HCAs are possibly to require greater ongoing supervision and mentoring, the price of which desires to be taken into consideration, 38 however the advantages of achieving QOF goals and improved patient pride may additionally outweigh the longer appointment times HCAs may need.

### 3.7 Algorithm for the Code

Raspberry pi is installed with a linux based operating system, Raspbian. The code is implemented in Python. The function of the algorithm is to detect the body temperature of the human as well as the heart rate and alert the doctor via SMS in case of any aberrancy. The temperature is detected using the LM35 sensor. The heart rate is detected by using a Pulse sensor and the blood pressure is detected using Pressure sensor which transfers data using a Bluetooth module. The Raspberry pi also functions as a pill reminder, whereby it reminds the person to take his daily pills at the times recorded by him in the database.

The Algorithm is executed as follows:

**Step 1:**

Every person records his details in the database, mentioning his doctor's Contact number, number of pills to be taken daily and their respective times.

**Step 2:**

Raspberry pi continuously receives the data from Fit bit and extracts the heart beat.

**Step 3:**

The program checks if the heart beat falls in the normal accepted range. If the heartbeat is detected as abnormal, alerts the doctor via sms and records the anomalous value in the database. Simultaneously, the person can check his body temperature using the temperature sensor and if unwell, the raspberry pi will alert the person as well as the doctor. The raspberry pi also serves as a pill reminder; fetches the timings at which the person should consume pills from the database and reminds the person to take them.

### 3.8 Web server Implementation

A web server is a pc frame work that processes requests by means of http, which is the fundamental network protocol to circulate data on World Wide Web. One of the main functions of web server are to store, process and deliver the data to client. On our project we have used GSM to send data and used web server to store data. We have used MySQL database management system for our project. The reason to use of MySQL database is because it is open source, widely used and most popular SQL database management system which is distributed, developed and supported by Oracle Corporation. Again, another reason to choose MySQL is it supports relational database. Therefore it is very flexible to use since we can put information in different table rather than to put all information in one table. Initially we have used our local host for the development, creation, manipulation of databases and testing our project and ensure the quality assurance checking since it is difficult sometimes to identity bug in online and live.

### 3.9 User Interface

The user interface of our application is simple and easy to operate. We have two way communication protocol:

- One for patient
- One for doctor

One cannot install both application at a time on their mobile. Therefore doctor will install only doctor application and patients will install patient application respectively on their mobile. On the following section we will describe the details workflow of both doctor and patient application

## 4. COMPONENTS

### 4.1 Raspberry pi

This device works admirably as a multi-processor. It has an illustrations card, an unpredictable memory, RAM, gadget interfaces and other outer remote gadget interfaces. This raspberry Pi is devouring less power, however it is as yet modest and incredible. It requires a console to give directions, show unit and power supplies as a standard PC. Here, Raspberry Pi utilized the SD card as a hard circle. Raspberry Pi ready to associate through a LAN/Ethernet or by means of a USB modem or by means of remote. Raspberry Pi should bolster for different home and business applications. Raspberry Pi keeps running on a Linux-based OS and which worked by the Raspbian OS. Python is a programming language used to execute the Raspberry-Pi. It is equipped for speaking with other outer gadgets utilizing remote correspondence innovations, cell systems, NFC, ZigBee, Bluetooth and so forth.

This paper was executed on a quick system as 4G with the cell organize. Raspberry can be utilized for some applications thus, it has numerous open doors later on.

**Fig- 2:** Raspberry pi

### 4.2 GSM/GPRS

This GSM/GPRS module is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM/GPRS module consists of a GSM/GPRS modem assembled together with power supply circuit and communication interfaces (like RS-232, USB etc.) for a computer. GSM/GPRS MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM and GPRS network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also, they have IMEI (International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM/GPRS MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

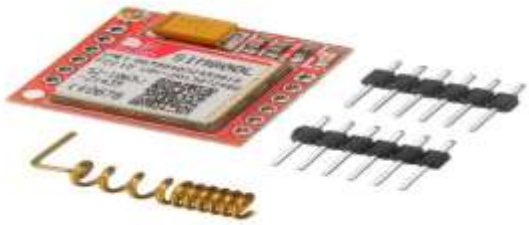

**Fig- 3:** GSM/GPRS

### 4.3 Heartbeat sensor

Heartbeat sensor gives a basic method to ponder the capacity of the heart which can be estimated dependent on the standard of psycho-physiological sign utilized as an upgrade for the computer-generated experience framework. The measure of the blood in the finger changes as for time.

The sensor sparkles a light projection (a little exceptionally splendid LED) through the ear and measures the light that gets transmitted to the Light Dependent Resistor. The intensified sign gets rearranged and separated, in the Circuit. So as to ascertain the pulse dependent on the blood stream to the fingertip, a pulse sensor is gathered with the assistance of LM358 OP-AMP for observing the heartbeat beats.

**Fig-4:** Heartbeat sensor

### 4.4 Temperature sensor

Temperature sensor is a gadget which is planned explicitly to quantify the hotness or frigidity of an article. LM35 is an accuracy IC temperature sensor with its yield corresponding to the temperature (in °C). With LM35, the temperature can be estimated more precisely than with a thermistor. It likewise has low self-warming and doesn't cause more than 0.1 °C temperature ascend in still air. The working temperature range is from - 55°C to 150°C.The LM35's low yield impedance, straight yield, and exact inborn alignment make interfacing to readout or control hardware particularly simple.

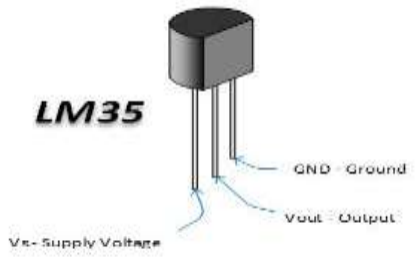


**Fig- 5:** Temperature sensor

### 4.5 Pressure sensor

A pressure sensor, sensor in electronic circuits is in the form of an integrated circuit that acts as a transducer, that is, it replicates (in the form of an electrical signal) the signal it receives as a function of imposed pressure. A pressure sensor is also known as a pressure transducer, pressure transmitter, pressure sender, pressure indicator, piezometer and manometer.

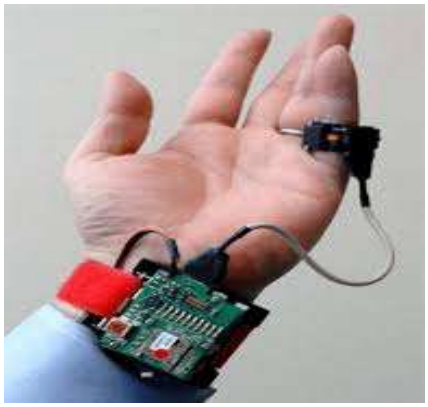

**Fig- 6:** Pressure sensor

### 4.6 LCD Display

A Liquid Crystal Display (usually contracted LCD) is a slender, level showcase gadget made up of any number of shading or monochrome pixels exhibited before a light source or reflector. It is frequently used in battery-controlled electronic gadgets since it utilizes extremely modest quantities of electric power.

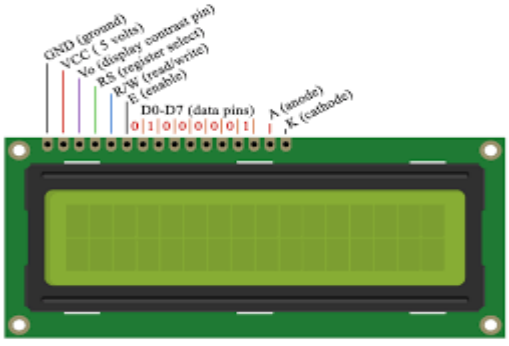


**Fig- 7:** LCD Display

### 4.7 Speaker

The Speakers are one of the most well-known yield gadgets utilized with PC frameworks. A few speakers are intended to work explicitly with PCs, while others can be snared to a sound framework. Despite their structure, the motivation behind speakers is to deliver sound yield that can be heard by the/audience.


**Fig- 8 :** Speaker

Speakers are transducers that convert electromagnetic waves into sound waves. The speakers get sound contribution from a gadget, for example, a PC or a sound collector. This information might be either in simple or computerized structure. Simple speakers just intensify the simple electromagnetic waves into sound waves. Since sound waves are created in simple structure, computerized speakers should initially change over the advanced contribution to a simple sign, at that point produce the sound waves.

### 4.8 USB Microphone

In short it is the most straightforward approach to make top notch chronicles on your PC. A USB Mic implies you don't need to purchase heaps of hardware, and it is extremely simple to set up. USB Microphones are compact and cross stage so in the event that you get one you ought to have the option to utilize it on your PC, Mac, iPad, and PC with least object. It is the most practical choice for getting a better than average chronicle onto your PC, tablet or cell phone. It is truly a receiver which contains all the wiring important to just associate with a USB port and start recording. Furthermore, frequently a USB mic will likewise have an earphone out, so just as chronicle, you can listen straightforwardly to the sound through earphones.

**Fig-9: USB** Microphone

## 5. OUTCOME

The kit implementation for Health Monitoring System is shown in the figure 3.The Mouse and Keyboard connected to the USB port of Pi and the Monitor connected to the HDMI video port. The sensors connected to the GPIO pin through which the data from the Pi is transferred to the server and the patient can monitor the data on the monitor.

The health monitoring system on the patient's monitor. After the use of the pulse rate, blood pressure and heart sound sensor, the digital output from the sensor through the Pi is displayed on the Monitor.

The Pi camera output is displayed on the server, the IP address of the server is same as the IP address of the raspberry pi.

The Sensors output is displayed on the server, the IP address of the server is same as the IP address of the raspberry pi which is shown in figure 6. This is data base where the patient's health report is stored for future requirement by the doctor and the patient. If the patients' blood pressure >120 an alert mail is sent to the patient by the doctor for the medial medication.

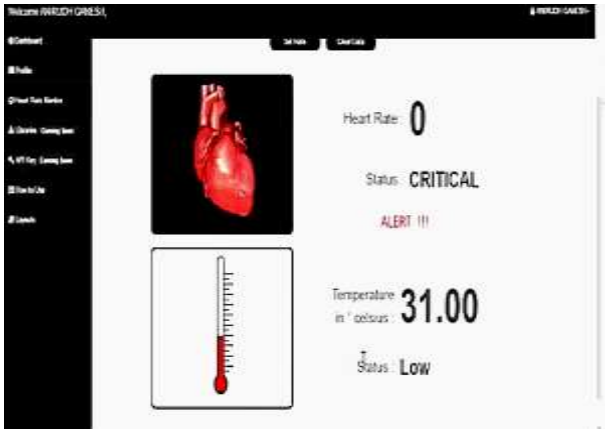


**Fig- 10:** Hardware Setup

**Fig- 11:** Software Setup

In this research analyzed the Raspberry-based health monitoring system through IOT. There are two ways to connect and operate the raspberry device; one is directly connecting peripherals and the other way is to connect the computer after install the putty software with IP address, subnet mask, gateway to that system. If any abnormalities notice in the patient health, this will directly report to the authorized or guardian via GSM over the network. The proposed method is modelled for impressive features like easy to use; power consumption is very less and understandable. This system is a good communicator between patient and the doctor. As per that we implemented this project and finds the output results have been successfully validated.

**Table - 1: Measured Temperature**

| TEMPERATURE °C | FREQUENCY |
|---|---|
| 36.4 | 3 |
| 36.5 | 5 |
| 36.7 | 8 |
| 36.8 | 2 |
| 37.4 | 6 |
| 37.5 | 5 |
| 37.6 | 4 |
| 37.7 | 2 |
| 37.8 | 3 |
| 38 | 2 |

The above table shows the output of Temperature sensor that is a graph of time versus temperature of different

patient's. The reading from sensor is taken every 5 seconds and the value is updated accordingly.

**Table – 2: Measured Heartbeat**

| HEART BEAT RANGE | FREQUENCY |
|---|---|
| 60-65 | 5 |
| 66-70 | 5 |
| 71-75 | 10 |
| 76-80 | 7 |
| 81-85 | 2 |

The above table shows the output of heartbeat sensor that is a graph of time versus heart beat pulses. The reading from sensor is taken every 5 seconds and the value is updated accordingly.

The expected result is Raspberry Pi collects and stores the medical data through the sensors attached. The collected data is transferred to the doctor's side through IoT that helps in improving the health of patients.

## 6. CONCLUSION

The Internet of Things is transforming how companies and consumers go about their days around the world. We project that there will be more than 55 billion IOT devices by 2025, up from about 11 billion in 2018. Among that our device prototype focus on the healthcare. Health care system is an integral part of every society. Automating these services helps in reducing the burden on human beings and yields more accurate results. The transparency of the system helps people to rely on it. That is when there is a spike in the heart rate, the raspberry pi immediately alerts the user. The objective of developing such a system is to reduce health care costs and also provide a faster way to detect a problem. We have used Raspberry pi in particular because of its multi-tasking capability and its low power consumption.

This system can be easily installed in hospitals, houses and can serve as a large database to collect data. The results can be integrated with the mobile by developing an application so that it can be easily accessed at all times and at all locations.

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