

# PATIENT HEALTH MONITORING SYSTEM USING IOT

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**Abstract** - In this project we have planned to design a compact wireless Patient Health Monitoring System. The idea is to use a Raspberry Pi 3, Arduino Uno, Heartbeat sensor, monitoring circuit, temperature sensor to directly get the data on the Doctor's computer. These components play a vital role in monitoring the patient health status. Since time plays a key role in saving a person's life, the device aims at saving time required by the doctor to monitor each and every patient. The process starts by monitoring of physical parameters like heart beat and temperature readings sending the measured data directly to a Doctor's computer through a server database. The devices used in this project are very cheap and cost effective and can be widely used for wireless communication within indoor management. It is very easy to assemble and very less errors are introduced.

**Key Words:** IOT, Health monitoring, Blood Pressure, Heart rate, Sensor, Temperature.

## 1. INTRODUCTION

A Patient Health Monitoring System is an extension of a hospital medical system where a patient's vital body state can be monitored remotely. Traditionally the detection systems were only found in hospitals and were characterized by huge and complex circuitry which required high power consumption. Continuous advances in the semiconductor technology industry have led to sensors and microcontrollers that are smaller in size, faster in operation, low in power consumption and affordable in cost. According to research, we found that approximately 2000 people died monthly due to the only carelessness of their health.

This is because they don't have time for themselves and forget about their health management due to a heavy workload. The reason behind to make this project is the growing world of technology and people forget their health checkup which is needed to be done monthly or quarterly. As we all know that internet of things made our life easier. So, we have decided to make an internet of things based healthcare project for people who provide them all the personal information about their health on their mobile and they can check their all historical health data.

The best part of this project is that it can be used by everyone and make our health management easier than available systems. It provides a solution for measurement of body parameters like, Temperature Sensor and Heartbeat,

Blood Pressure. It also detects the body condition and location of the patients. This system also generates an alert when it required that means at the time of any critical conditions and notifications about the medicines, location change, conditions etc.

## 2. LITERATURE REVIEW

1.) Patient-Monitoring Systems, Reed M. Gardner & M. Michael Shabot, Year 2014 To meet the increasing demands for more acute and intensive care required by patients with complex disorders, new organizational units—the ICUs—were established in hospitals beginning in the 1950s. The earliest units were simply postoperative recovery rooms used for prolonged stays after open-heart surgery. Intensive-care units proliferated rapidly during the late 1960s and 1970s. The types of units include burn, coronary, general surgery, open-heart surgery, pediatric, neonatal, respiratory, and multipurpose medical-surgical units. Today there are an estimated 75,000 adult, pediatric, and neonatal intensive care beds in the United States.

2.) IoT-Based Health Monitoring System for Active and Assisted Living, Ahmed

Abdelgawad, School of Engineering and Technology, Central Michigan University, Mt. Pleasant, MI 48859, USA, Year 2017. The Internet of Things (IoT) platform offers a promising technology to achieve the aforementioned healthcare services, and can further improve the medical service systems [1]. IoT wearable platforms can be used to collect the needed information of the user and its ambient environment and communicate such information wirelessly, where it is processed or stored for tracking the history of the user [2]. Such a connectivity with external devices and services will allow for taking preventive measure (e.g., upon foreseeing an upcoming heart stroke) or providing immediate care (e.g., when a user falls down and needs help). Recently, several IoT systems have been developed for IoT healthcare and assisted living applications.

3.) IOT based health monitoring systems, Nayna Gupta & Sujata Pandey, Year 2012.

In this fast placed world, managing work and health simultaneously have become a matter of concern for most people. Long waiting hours at the hospitals or ambulatory patient monitoring are well known issues. The issues demand for a health monitoring system which can monitor

the daily routine health parameters and heart rate monitoring seamlessly and can report the same to the concerned person with the help of GSM module. With progressing in technology various monitoring systems have come up and provided ease to the individuals. This paper portrays the current research and development in the field of health. Different implemented systems have been compared and evaluated to identify the concerned lacking areas and what can be done in order to provide better throughput than the current scenario systems.

### 3. PROPOSED METHOD

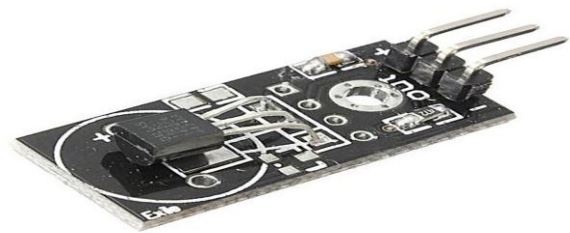
Raspberry pi 3 model B is a development board in PI series. It can be considered as a single board computer that works on LINUX operating system. The board not only has tons of features it also has terrific processing speed making it suitable for advanced applications. PI board is specifically designed for hobbyist and engineers who are interested in LINUX systems and IOT (Internet of Things).

We can connect the Raspberry pi to any TV or computer with Display and keyboard and hence perform any computing task like sending emails, monitoring data, playing games, etc.



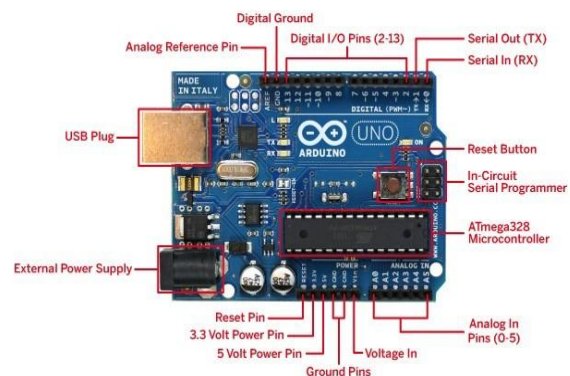
#### Temperature Sensor DS18B20:

The DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature of the device. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply.



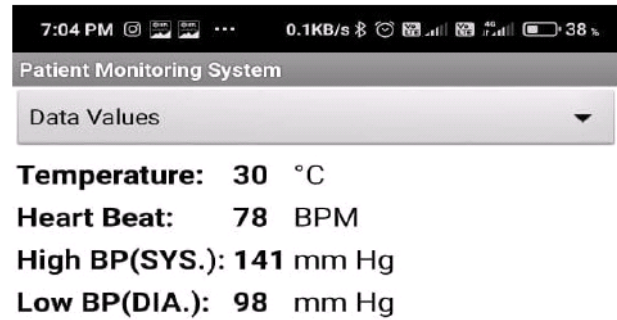
#### Arduino Board

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. The ATmega328P also supports I2C (TWI) and SPI communication. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. There are two RX and TX LEDs on the arduino board which will flash when data is being transmitted via the USB-to-serial chip and USB connection to.



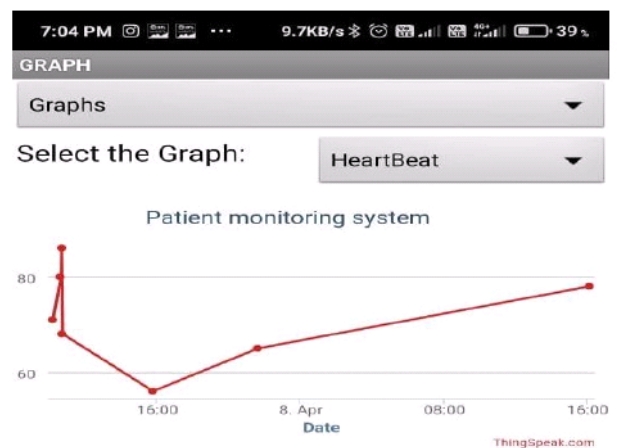
#### Heart Rate Sensor

The Pulse Sensor is a plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. The essence is an integrated optical amplifying circuit and noise eliminating circuit sensor. Clip the Pulse Sensor to your earlobe or fingertip and plug it into your Arduino, you can ready to read heart rate. Also, it has an Arduino demo code that makes it easy to use. The pulse sensor has three pins: VCC, GND & Analog Pin.



### Blood Pressure Sensor

Blood Pressure (BP) is one of the important vital signs. It is the pressure exerted by the circulating blood on the walls of blood vessels. Blood Pressure is expressed as the ratio of the systolic pressure over diastolic pressure. Mercury sphygmomanometer is being used for measuring blood pressure. In this, the height of the column of mercury is considered for measuring the blood pressure.



### Real time data on Android App

Below are the real time values of the parameters being monitored. The real time data of the patient's vital parameters are displayed on the app made using MIT app inventor.

### Firebase Server

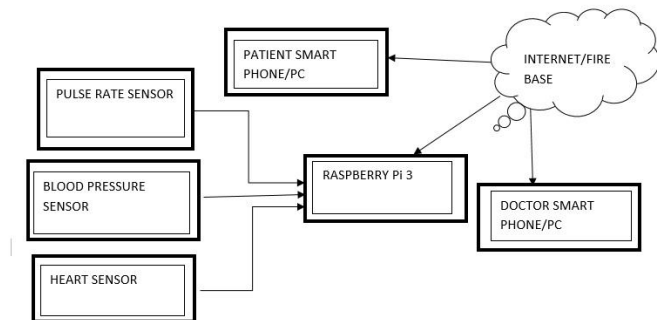


Google Firebase Google Firebase is a Google-backed application development software that enables developers to develop iOS, Android and Web apps. Firebase provides tools for tracking analytics, reporting and fixing app crashes, creating marketing and product experiment. Firebase offers a number of services, including:

- Analytics – Google Analytics for Firebase offers free unlimited reporting on as many as 500 separate events. Analytics presents data about user behavior in iOS and Android apps, enabling better decision-making about improving performance and app marketing.
- Authentication – Firebase Authentication makes

it easy for developers to build secure authentication systems and enhances the sign-in and onboarding experience for users. This feature offers a complete identity solution, supporting email and password accounts, phone auth, as well as Google, Facebook, GitHub, Twitter login and more. • Realtime database – the Firebase Realtime Database is a cloud-hosted NoSQL database that enables data to be stored and synced between users in real time.

#### 4. WORKING



This IOT based ICU patient monitoring system works on the principle of monitoring patient body temperature and blood pressure. When this system is installed in ICU room then blood pressure device cuff is inflated permanently around the patient arm or wrist and temperature sensor is also attached with patient body. Temperature sensor is the resistance base sensor whose resistance is changed by changing the patient body temperature, Similarly the blood pressure sensor is the oscillation or vibration base sensor whose value is transduced into electrical signal. when blood oscillation or vibration is changed then this electrical signal value is changed. Both sensors measurements values are received by the pic controller which is the main or intelligent controller of this whole system. After receiving these values, the microcontroller displays these values on mobile display as well as these values are also send toward IOT system using programmed algorithms. The IOT system which displays these values on doctors dedicated website using Wi-Fi sources and here for this purpose Firebase database has been used. Using this database and app the doctor's society can easily know the blood pressure and temperature of their respective patient any time form anywhere With the development in the integrated circuit industry, Micro Electro Mechanical Systems (MEMs) and Raspberry pi system have become affordable, have increased processing speeds, miniaturized and power efficient. This has led to increased development of embedded systems that the healthcare specialists are adopting. These embedded systems have also been adopted in the Smartphone technology. And with increased internet penetration in most developing countries through mobile phones, and with use of Internet of things (IoT) will become adopted at a faster rate. The Patient Health Care system utilizes these concepts to come up with a system for better quality of life for people in society. From an

engineering perspective, the project has seen concepts acquired through the computer science and embedded study period being practically applied. The Electric circuit analysis knowledge was used during design and fabrication of the individual modules. Electromagnetic fields analysis used in the wireless transmission between microcontrollers and Software programming used during programming of the microcontrollers to come up with a final finished circuit system. The whole health monitoring system, which we have proposed can be integrated into a compact unit as small as a cell phone or a wrist watch. This will help the patients to easily carry this device with them wherever they go. The VLSI technologies will greatly come handy in this regard.

#### 5. CONCLUSIONS

The project work has been studied and implemented a complete working model using an Arduino board. The programming is done on the Arduino software and Raspbian OS. This project elaborates the design and construction of patient health monitoring system. This work could be a life saving thing for many people and can be very handy for the doctors to monitor the patient health. The design and verification of a Patient Health Monitoring System was done successfully. In this paper, we found the importance and fruitful benefits of implementation of IoT in remote health monitoring systems.

The compact sensors with IoT will make a huge impact on every patient's life, that even though they are away from home and physician, this helps them to reduce the fear of danger. The sensory data can be acquired in home or work environments. Also, the challenges in sensing, analytics and prediction of the disease are also highlighted and those can be addressed to provide a seamless integraton into the medical field.

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