

# Early Warning System for Possible Heart Attacks Using IOT

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## Article Info

Volume 8, Issue 3

Page Number : 572-580

Publication Issue :

May-June-2021

## Article History

Accepted : 15 June 2021

Published: 25 June 2021

## ABSTRACT

Now-a-days, diseases related to heart are mounting at a very great speed. Due to these problems, timely health check up has become vital. A modern concept of health monitoring a patient includes wirelessly monitoring. It is a major development in medical arena. This system depends on doctor examining patient continuously without patient being physically present for check up. In medical science, excellent and cost effective gadgets related to monitoring health utilizing popular technologies such as wireless communications and portable remote health monitoring device are developed. This development provides ease to the patients having various diseases. As a result, visit of patients to the doctors constantly has lowered because various types of reports can be generated remotely and wirelessly at doctor's end at regular interval of time. Because of this recent development in scientific technology, doctors are saving several lives. Internet of Things provides platform for development of many intelligent gadgets & applications. IoT infrastructure provides base of connectivity and technology. IoT intelligent devices can implement the facilities of monitoring health remotely and notifying any health issues in emergency.

In this paper, we propose a design for transfer of personal medical information and facility for storing the same over cloud infrastructure. The hardware devices like Raspberry Pi, Heartbeat sensor, Blood Pressure sensor, SpO2 sensor, Body Temperature sensor will be used in this system. Raspberry Pi will perform dual role of being a sensor node as well as system controller.

Keywords : Raspberry Pi, IoT, GSM, Heartbeat sensor, SpO2 sensor, Blood pressure sensor, Body Temperature sensor, ECG sensor.

## I. INTRODUCTION

Now a days, health related problems are mounting at a very high speed. High mortality rate is a big concern

for many countries. Thus, today there is requirement of time to conquer high mortality rate. We, therefore, are modeling a system having several wireless sensors

which will measure health related information like body temperature, blood pressure, saline level, heart beat rate, etc. and transmit over internet to be accessed by other user at remote location. Daily basis patient's health database is created and recorded and the same can helpful in analysis by doctor, if needed. This paper proposes a health examining system which is having capability of analyzing various parameters and discovering health issues. Threshold values are set based on past reading from the database. At time of urgent situation when threshold values are crossed, alerts will be generated automatically which doctor can also see for taking necessary actions.

People now a days are taking health seriously which help in prevention and/or detection of health issue at initial stage. Also, next generation smart phones and intelligent gadgets like smart watch and such have great impact on our lives. Various types of Sensors like for ECG Monitoring, measuring systolic pressure and diastolic pressure & pulse rate measuring sensors are being used in the gadgets. Immensely successful work has been done in health examination using Raspberry Pi as well as IoT. Here, in our paper, we are giving embedded concept of both. By using combination of these, the proposed model will be more effective. In this paper, we investigated recent papers related to health examination systems & IoT.

The concept of IoT is connection of devices which will automatically fetch and process to generate intelligent data which will be useful to provide a better life. This paper will show the progress in medical science technology, and would be beneficial in saving patients from arising health issues and also help doctors in taking necessary actions at a right time to make sure patient's health is not deteriorated.

## II. COMPONENTS USED IN IMPLEMENTATION

In implementations of health monitoring system, several components are suitable and manipulate health problems. Commonly used components include: temperature-DS18B20 sensor, SpO2 sensor, blood

pressure sensor, heartbeat sensor, ECG sensor, Raspberry Pi and GSM module.

### A. RASPBERRY PI :

"Raspberry Pi is a credit card sized computer having limited functionality". SD card is used for booting the operating system as well as for storing the data. As we understand that the computing speed is less that our personal computer still it is a good choice for for experimentation and educational purpose. Various configurations of Raspberry Pi are available in the market. The B model of Raspberry Pi costs nearly Rs.3000 and can easily be purchased from ecommerce websites as well as physical stores.



Fig 1. Raspberry Pi

### B. HEARTBEAT SENSOR

Heartbeat of a patient is measured using heartbeat sensor. When a finger is placed on heart beat sensor, it generated digital output. It is very compact in size. +5V is the working voltage for functioning of heart beat sensor. It works on the principle of light modulation by blood flow through finger at each pulse. Heart beat sensor is used to measure heart beat which normally lies between 60-100bpm [27].



### C. BLOOD PRESSURE SENSOR

The blood pressure of a human is measured by blood pressure sensor. Also systolic and diastolic pressure and pulse rate can be recorded by this sensor. It is more accurate than traditional blood pressure measuring method. In other words, pressure of blood against blood vessels walls or arteries is measured using blood pressure sensors.



### D. SPO2 SENSOR :

Arterial oxygen saturation provides early information related to transportation of oxygen to the tissues in the human body which is an important indicator of the patient's health. It gives the ratio of oxygenated hemoglobin to the total amount of hemoglobin in the blood. The SpO2 value is represented as a percentage. Normal range of a healthy person is between 95 to 100%. If it is below mentioned range, it specifies poor blood oxygenation and considered as hypoxic. [21]

### E. TEMPERATURE SENSOR-DS18B20

Temperature sensor DS18B20 is used for designing body temperature monitoring system. Data is collected at regular interval of body temperature using temperature sensor DS18B20 and a 4.7k resistor [26]. Several disadvantages such as longer measurement timing, lower monitor precision, etc. are overcome using this sensor. The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and also has an alarm function with non-volatile user programmable upper and lower trigger points. The DS18B20 device communicates over a 1-Wire® bus which requires only one data line (and ground) for communication with microcontroller. The operating temperature range of DS18B20 is -55°C to + 125°C and it provides the accuracy about ±0.5°C over the range of -10°C to +85°C. This sensor derives power directly from the data line which eliminates the need for an external power supply to drive the device. Each DS18B20 is provided with a unique 64-bit serial code, this feature allows more than one DS18B20s to function on the same I-Wire bus. Thus, to control several DS 18B20s distributed over a large area requires only one microcontroller [26].



### F. ECG SENSOR

Placing electrodes on the skin, activity of the heart can be recorded. This process is known as Electrocardiography (ECG). These electrodes are capable of detecting even minute electrical change on the skin that occurs from the heart muscle's pattern. Instrumentation Amplifier is the prime component of ECG, which is capable of taking the voltage difference between leads and amplifying the signals.[29]



### G. COMMUNICATION NETWORK

Wireless networking system is utilized for forwarding measurement via gateway towards cloud in health monitoring systems. Wireless network used in health monitoring system is IoT. IoT simply means Internet of Things, which in general can be said as Internet of everything. Today, various wireless communication technologies like NFC, Bluetooth, zigbee, cellular network, etc. are being utilized for connecting the IoT devices to the local networks, and these local networks and or those individual IoT devices to the Internet. In our research paper, we propose using cellular network connectivity reason being widespread mobile networks such as 3G or LTE provide reliable high-speed connectivity to the Internet. However, there is a constraint that they have tendency to consume high

power which make it not recommendable for M2M or local network communication [10].

### III. BLOCK DIAGRAM OF SYSTEM

Fig.1 shows the block diagram of Early warning system for possible heart failures [23]. It consists of a transmitter and a receiver section. In the transmitter section, BP and pulse rate module, Heartbeat sensor, SpO2 sensor, temperature sensors are connected to the Raspberry Pi. These sensors measure the physiological signals from the patient and send the corresponding parameter values to Raspberry Pi using the ZigBee transmitter. Raspberry Pi stores the readings received from ZigBee receiver, and uploads them on to the webpage along with date and time, and also send AT commands to GSM modem to send a SMS alert in critical condition [21].

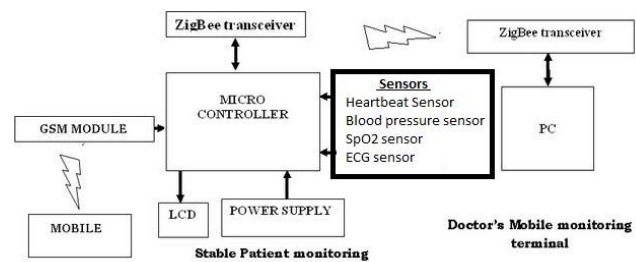


Fig. 1 Block Diagram of System

### IV. SYSTEM DESIGN

The system is categorized into two sections, viz. Hardware & Software. Hardware part has transmitter and receiver section while software part consists of software languages like python, MATLAB, etc as well as their interfacing. In this section, we are to talk about IoT applications which are helpful in health monitoring.



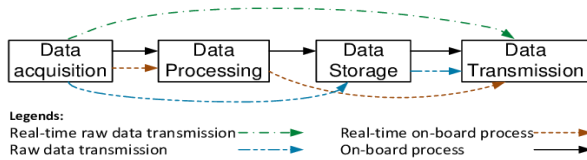


Fig.2 IoT application stages

In Fig.2 [25], the general functional phases of an IoT application comprises firstly of data acquisition, secondly; data processing, thirdly; data storage, and finally data transmission. The first and final phases are available in every application, while rest phases may or may not be there in some applications [10]. Here raw real time data transmitted is used in data acquisition phase. MEMS technology can be used for reducing energy consumption during data acquisition. Many IoT applications have the property of data sparse and are capable of making the most of the compressed sensing paradigm. Compressed sensing has been explored and studied comprehensively in health monitoring applications and wireless body sensor network [12]. Energy efficiency in a processing unit can be achieved by 1) ultra-low power processors [13] and 2) efficiently customized co-processors [14]. In recent times, main focus is given in improving energy efficiency using a ultra low power near threshold processor alongside with a high performance processor. Data transmission can be improved by integrating radio transceivers into SoCs, providing low power multi-radio chips, etc. To reduce the amount of data to be stored or transmitted, new data compression techniques, especially for the streams of data, are needed [17]. Figure 3 shows a general architecture of the main components of an IoT SoC platform [16].

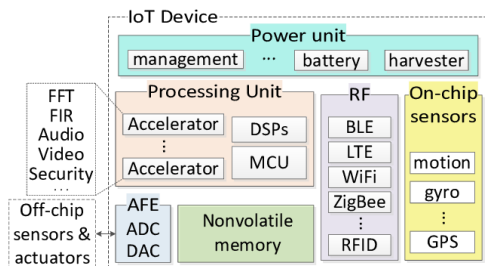


Fig. 3 Architecture of IoT device

## V. CONCLUDING REMARK

In this paper, we have proposed a Raspberry-Pi based health monitoring system using IoT. Any anomaly in the health conditions is notified and informed to the concerned person via GSM technology or via internet. The proposed system is simple yet power, efficient and easy to understand. It acts as a connection between patient and doctor.

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**Cite this article as :**

Tushar A Shah, "Early Warning System for Possible Heart Attacks Using IOT", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 8 Issue 3, pp. 572-580, May-June 2021. Available at doi : <https://doi.org/10.32628/IJSRSET229655>  
Journal URL : <https://ijsrset.com/IJSRSET229655>