HEALTH MONITORING SYSTEM WITH IOT

DISSERTATION-II

Submitted in partial fulfillment of the

Requirement for the award of the

Degree of

MASTER OF TECHNOLOGY

IN

Embedded System

by

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Under the Guidance of

Mr. Kranthi Kumar Pulluri

Electronics and communication engineering

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TOPIC APPROVAL PERFORMA

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PROPOSED TOPIC : Design of Heath monitoring System with IOT on Raspberry pi

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2	Project Feasibility: Project can be timely carried out in-house with low-cost and available resources in the University by the students.	7.33
3	Project Academic Inputs: Project topic is relevant and makes extensive use of academic inputs in UG program and serves as a culminating effort for core study area of the degree program.	7.33
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This is to certify that the Dissertation-II titled “Health Monitoring system with IoT” that is being submitted by “Dheeraj Kumar” is in partial fulfillment of the requirements for the award of MASTER OF TECHNOLOGY DEGREE, is a record of bonafide work done under my guidance. The contents of this Dissertation-II, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma and the same is certified.

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With great pleasure and deep sense of gratitude, I express my indebtedness to my supervisor Mr. Kranthi Kumar Pulluri for his invaluable guidance and constant encouragement at each and every step of my thesis work. He exposed me to the intricacies of relevant topic through proper counseling and discussions and always showed great interest in providing timely support and suitable suggestions.

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APPROVAL

This is to certify that I Dheeraj Kumar bearing Registration no 11507354 has completed objective formulation of Dissertation II title titled, “Health monitoring system with IoT” under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of the thesis has ever been submitted for any other degree at any University. The thesis is fit for submission and the partial fulfillment of the conditions for the award of MASTER OF TECHNOLOGY DEGREE Signature and Name of the Research Supervisor Designation-II School Lovely Professional University Phagwara, Punjab.

Date: APRIL 2017

DECLARATION

I, Dheeraj Kumar, student of M-Tech Embedded System under Department of Electronics and communication of Lovely Professional University, Punjab, hereby declare that all the information furnished in this Dissertation-II report is based on my own intensive research and is genuine.

This thesis does not, to the best of my knowledge, contain part of my work which has been submitted for the award of my degree either of this university or any other university without proper citation.

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ABSTRACT

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Health is the one of the important issue of this world. Every country spends lots of money to provide better health facilities to its citizens. With advanced technologies like IOT and others, we can provide a better health environment. With advanced technologies doctors can work more efficiently. With help of IoT healthcare system can be made more fast, efficient, reliable which will give a better service for the people. In the coming decades, the delivery model of healthcare will transform from the present hospital-centric, through hospital-home-balanced in 2020th, to the final home-centric in 2030th[1]. There are also some challenges in IoT implementation. The security of the data is one them. As the huge amount of data will be gathered from various resources. This data can be general data or very important data of some secret agency or organisations like Army. So if the proper security is not provided in the implementation, this data can be accessed and manipulated by some person for his advantage. The other some issue with IoT are Low power systems, manufacturing and processing. . In the IoT most of the things will be battery operated. It will not convenient to replace the batteries or charge the battery after small interval of times. To avoid this we have use the devices and sensors that consumes as less power as possible. Show the duration of the battery can be increased. The IoT is in its starting phase so the appropriate and regulated manufacturing is not available for it. Then the selection of hardware and software are mainly up to the manufactures.

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CHAPTER 1

INTRODUCTION

The phrase "Internet of Things" (IoT) was coined at the beginning of the 21st century by the MIT Auto-ID Centre with special mention to Kevin Ashton (Ashton 2009) and David L. Brock (Brock 2001).[1] The concept of internet of things was put ahead in early 21st century by the MIT Auto-ID Centre with special mention to Kelvin Ashton and David L. Brock. The basic idea of internet of things can be understood easily from two words “INTERNET” and “THINGS”. Now “THING” can be anything from our daily life to an industry, organisation, And Natural resources etc. So the basic approach of IOT is to collect data from the required THINGS using a network, and then use this data to give an appropriate output or action for a human or system’s needs. So in simple words it’s interconnection b/w different things to perform required action. The concept of IoT will revolutionise the almost every field of work. One of the field in which we can provide more efficient, fast, reliable service to the humanity is Medical field. Many organisations are working are working together to make this possible. Many names are given for the healthcare with advanced technologies such as Health-IoT, IoMT, In Home Health(IHH)[3[. With the help of the IoT the healthcare system can be automated so that doctors can work more efficiently. To understand the concept of the Healthcare along with IoT let use consider the figure below.

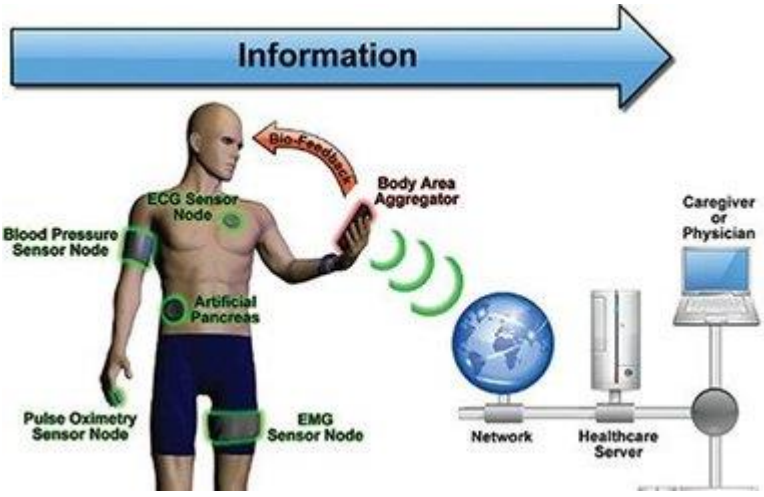


Figure 1.1 Overview of Health-IoT

Here the different sensor such as blood pressure sensor node, EMG sensor node, ECG sensor node etc. is connected to the human body to monitor the health. The data from this sensor is

recorded through a local processing unit and transmitted to the healthcare server through the internet. Further this data can be used by the doctor, nurse, or some care giver to monitor the health of the patient from anywhere as this data can be access through internet from anywhere. The one did need to go to

room of the patients repeatedly for checking the health.

1.1 INTERNET OF THINGS

The internet of things is the concept of connecting the daily used things to the internet instead of the laptop, computer, tablet or other gadget. Now these things can be anything like your umbrella, car, refrigerator etc. The various protocols are used to connect these things to the internet. In the upcoming 10 years there will be billion of the things will be connected to the internet [4]. They will collect the data from required source or environment and share the data or the output depending on that data with the human or other sensing node or machine. The things which are connected to the internet will embedded with sensors, hardware, software, or actuators etc. The basic idea of the internet of thins could be understood from the picture given below.

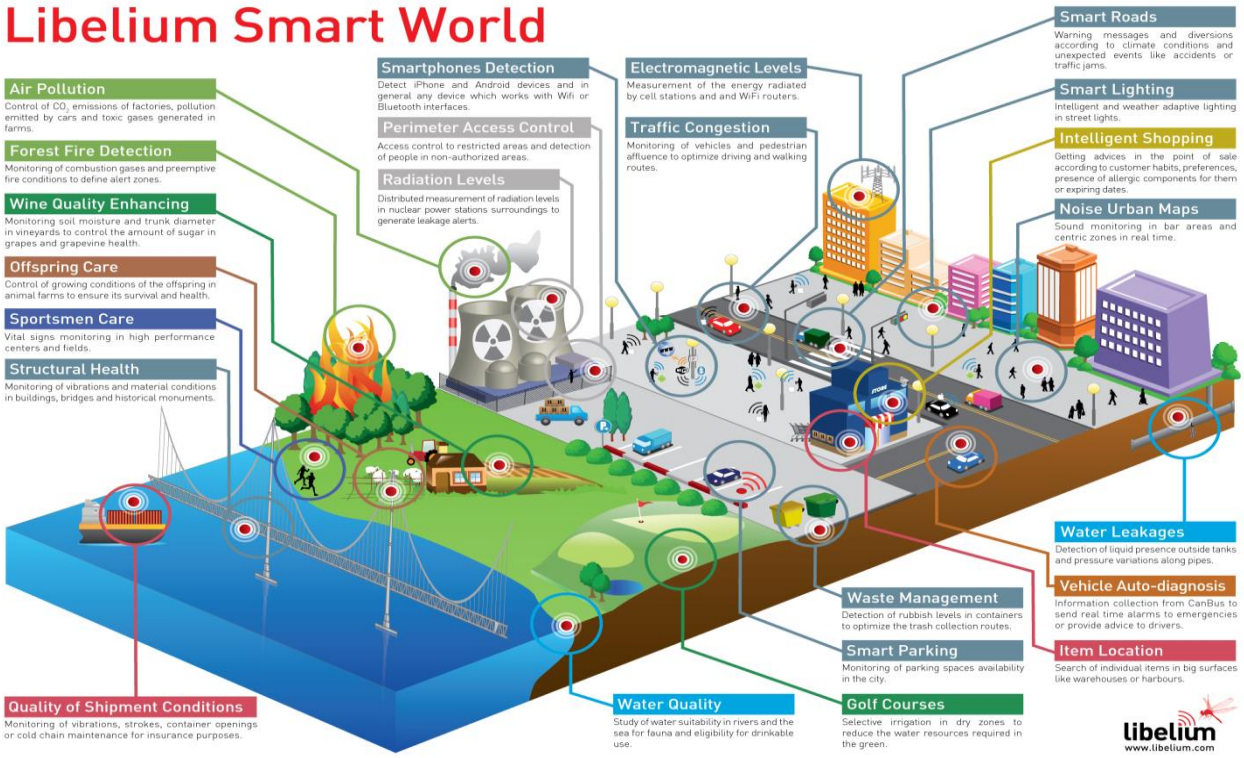


Figure 1.2 High level view of IoT

Here we can see that how the different objects from different area are connected to the internet and each other. Now all these things collect and exchange the data to provide a useful output for the improvement of service of an area.

1.2 Healthcare and IoT(Health-IoT)

Health is the one of the important issue of this world. Every country spends lots of money to provide better health facilities to its citizens. With advanced technologies like IOT and others, we can provide a better health environment. With advanced technologies doctors can work more efficiently. The concept of Health IOT is not limited to a patient it can be used to monitor health of a healthy person to provide the suggestions for staying healthy. There could be instance where the doctor couldn't be shared remotely with other doctors who are specialist in that field and the family members. In the upcoming years the service model of the Health care will transform from the today's hospital-centred, to the hospital-home-balanced in 2020th, and finally to the complete home -centric by 2030th.[4]

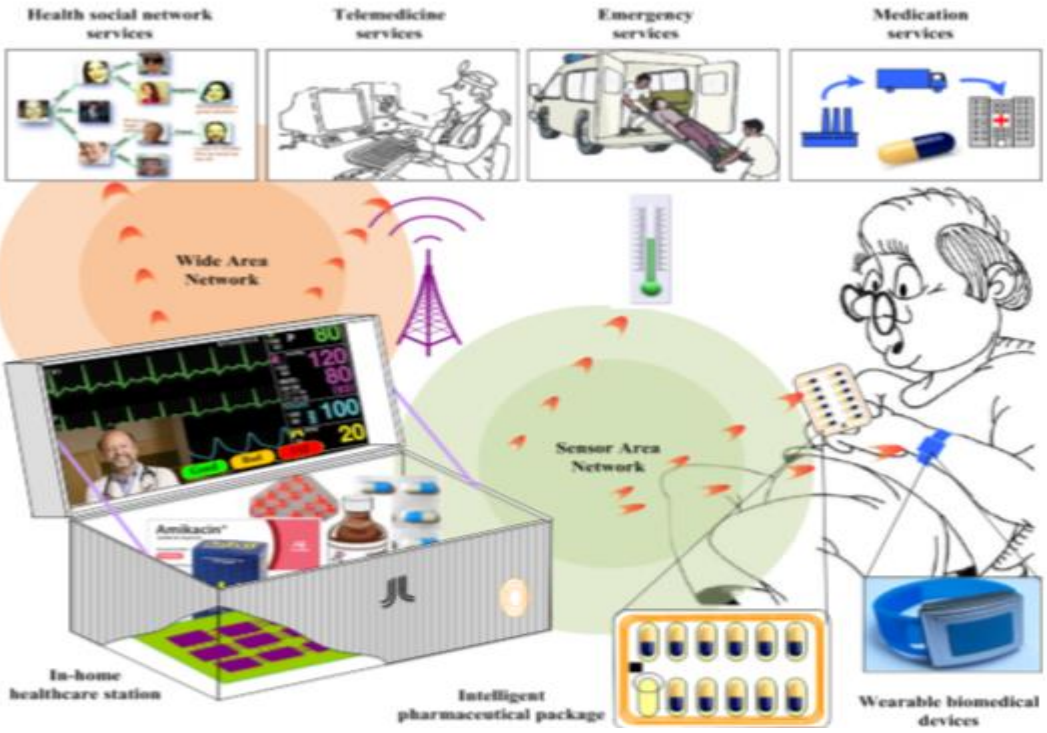


Figure 1.3 Operations of IoT in Healthcare

The health-IoT solution include the following operations:

1. Tracking and Monitoring: To keep the track of the patient health, equipments and medicine as continuous monitoring of the patient health.

2. Remote service: To provide the heath service remotely.

3. Information Management: To manage the collected data.

4. cross-organization integration: The hospital information system are extended to patient home, and can integrate with larger scale healthcare.

1.3 challenges of Internet of Things

Following are the requirement for the implementation of the internet of things:

a. Low power device support:

In the internet the many of the daily life thins will be connected to the internet of things it means the things will monitored with help of some sensor or actuators which are further connected to some communication and processing units[5]. Now to put these all into working condition we need the power supply from some source like Home main supply, battery etc. In the IoT most of the things will be battery operated. It will not convenient to replace the batteries or charge the battery after small interval of times. To avoid this we have use the devices and sensors that consumes as less power as possible. Show the duration of the battery can be increased.

b. Security and Privacy:

security and privacy is the most challenging and complex issue of the internet of things. As in internet of things data will be collected is often sensitive, it may range from highly personalised consumer information like sleep and health pattern, to trade secrets of the enterprises to the state secrets of the government and the military. The data can be missuses by some malicious agent. So

We have to ensure the security of the whole system.

c. manufacturing and process:

The IoT is in its starting phase so the appropriate and regulated manufacturing are not available for it. Then the selection of hardware and software are mainly up to the manufactures.

CHAPTER 2

TERMINOLOGY

IOT	INTERNET OF THINGS
IHM	IN HOME HEALTH
BPM	BEAT PER MINUTE
HTML	HYPERTEXT MARKUP LANGUAGE
PHP	PERSONAL HOME PAGE
RAM	RANDOM ACCESS MEMORY
SPI	SERIAL PERIPHERAL INTERFACE
UART	UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER
SIM	SUBSCRIBER IDENTITY MODULE

CHAPTER 3
REVIEW OF LITERATURE

Jan Kietzmann (2016 IEEE)," Introduction to The Internet of Everything: Connecting People, Things, and Data Minitrack "

In this paper author describe about the concept of the Internet of Everythings. The goal of the internet of things is to connect the everyday physical object to the internet and these things interact with the other network devices and perform the data exchange.The people and smart devices like

mobile, laptop, tablet etc. are already connected to the internet hence created IoP i.e. internet of people. With the connecting people, devices, and general daily life things to the internet an internet of everything will be created. The author has given this term name as IoE i.e internet of Everything.

M. Surya Deekshith Gupta, (2015 ICGCIoT)" Healthcare based on IoT using raspberry pi

", In this paper author a health monitoring using the small size board computer Raspberry pi. The raspberry Pi is used as the main processing board which has Raspbian OS(Linux based OS) installed on it. In this paper author explain that how we can use Raspberry Pi to collect the data from different sensors connect to the body of a patient. The two sensor are used here one is for heart beat i.e ECG sensor and another is body temperature sensor. Data from both sensor is stored on the Mysql data base. This data is used for the monitoring the health of the patient by displaying it on a website. The authorised Doctor or other staff member can log in to the website and view the heath record of the patient. In this one another approach is discussed for alerting the doctor about the health of the patient is the using GSM mobile communication. Whenever the heart beat of the patient goes below or above a required range the an alert message is send to the doctor them. So with help of this system proposed by M. Surya the doctor can monitor the health of a patient in more efficient way.

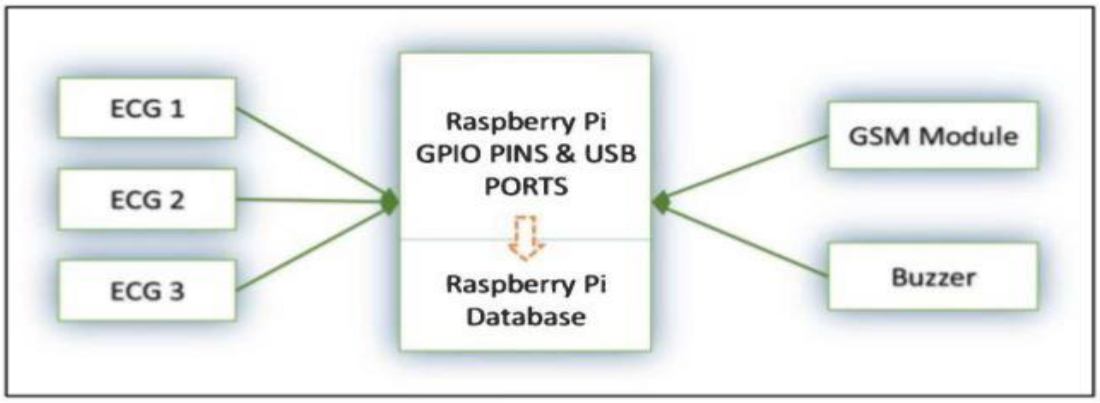


Figure 3.1 Function blocks of proposed system

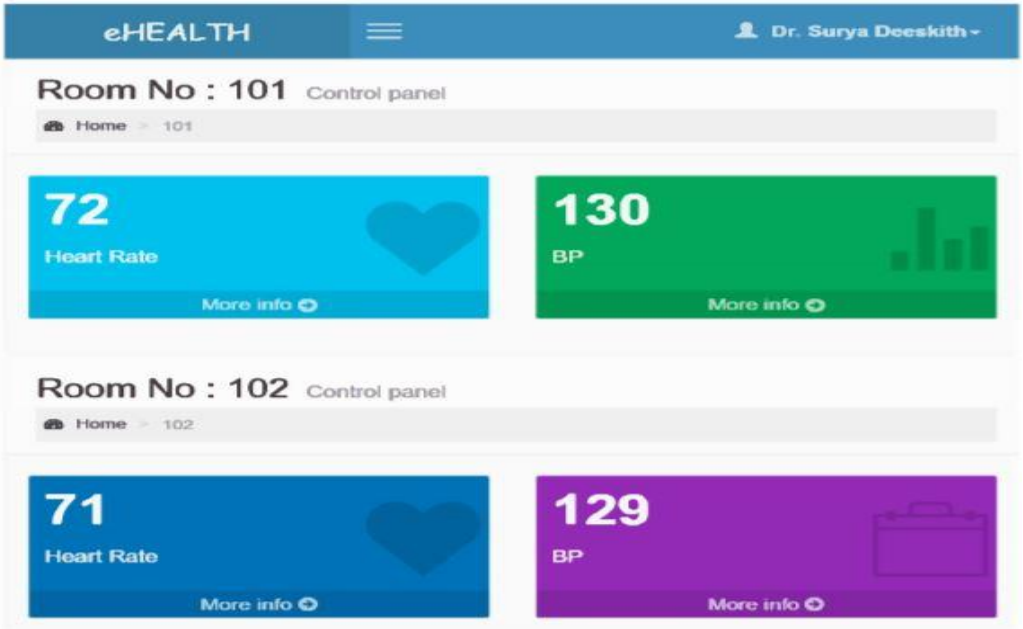


Figure 3.2 Website designed

Ananda Mohon Ghosh(2016 IEEE) ,“ Remote Health Monitoring system through IoT”, This paper also explain the concept of the monitoring the health using the IoT. Here the data is taken from the patient body as well as from his surrounding environment. The data obtained from the patient body is ECG, Body Temperature, body position and the humidity and temperature the room.

Figure 3.3 Website designed

The all this data is stored on a data base along with detail of patient i.e. his age, sex, time of admitting etc. Three records are made i.e. for patient, doctor authentication, family member Authentication. So the doctor as well as the family member can see the health detail of the patient.

ZHIBO PANG(2013), " Technologies and Architecture of Internet-Of-Things (IoT) for Health and Well-being" ,

In this paper author explained about Food-IoT and Health-IoT. Author explained that there is a gap between the real business model and IoT. As the developer not consider about that how this technology can be used in the real scenario. To fill this gap both business developer and IoT developer has to work together. Author has also discussed that how the IoT can make revolutionary change in world with upcoming few 10-15 years. With in upcoming the
the health care will shift from the hospital to the IHH (In Home Health). The whole system of health will be connected to each other with help of the IoT.Also the IoT can be used in the Food processing. With help of IoT the complete food processing system can be automated. Thus the consumer will get more hygienic, valuable food. Author also exlain about the technologies enabling
the IoT in the food-IoT and health-IoT.

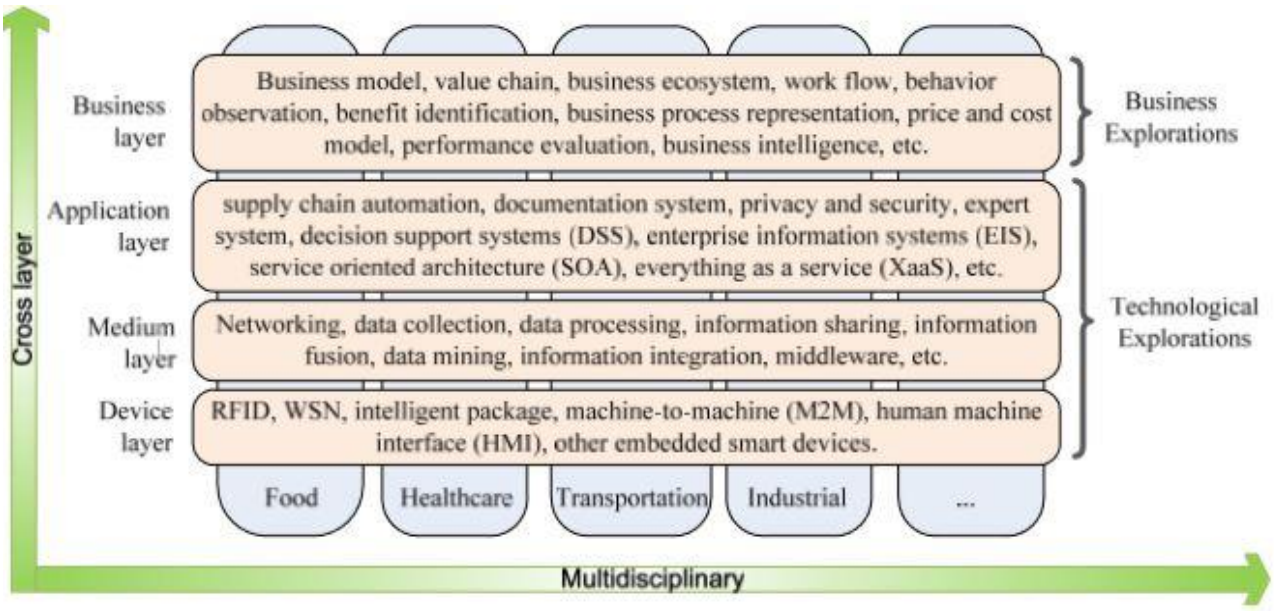


Figure 3.4 Gap b/w the business model and IoT

Amra Sofic (2016, BIHTL),"Implementation of Internet of Things in the Market of Bosnia and Herzegovina " ,

In this paper the author discuss about the telecommunication sector of Bosnia and Herzegovina and described the importance of coordinated development of business models and infrastructure wit respect to the market needs. In the Bosnia and Herzegovina telecommunication sector still uses the traditional business models and services. They can approach the market through three roles: (1) IoT connectivity int, (2) IoT service provider (3) IoT data manager.The product and market for IoT can be categorised by user need such as: Home, Lifestyle, Health, Mobility etc. The main goal of this paper was to give the insight of the steps required for the implementation of IoT products in the market of Bosina and Herzegovina.

Yassine Maleh (2016), " An Enhanced DTLS Protocol for Internet of Things Applications " ,

In this paper author has described the way to improve and optimize the performance of the Datagram Transport Layer Protocol Security (DTLS) network for Constrained Application CoAP in Internet of Thing. Two techniques were designed for the better performance and efficiency of the protocol DTLS.

Ahmad El Kouche (2012 IEEE ICC), " A Wireless Sensor Network design for the Internet of Things ", In this paper author has describe about a WSN platform architecture is proposed for the Internet of Thins. There are 3 major divisions of the system, the middleware, hardware, and network layer. Here the unique wsn platform is discussed "sprout". It is low cost, open source, and multi-standard WSN platform that provide an interoperable WSN platform. Common wsn platform in use are almost same in the hardware perspective like 16 bit MSP430 microcontroller unit or the 8 bit ATmega128 MCU, in combination with an 802.15.4 Zigbee based network architecture. The sprout also can support a zigbee network but due to the complexity, and associated cost increase sprouts use the new Bluetooth low energy IEEE.802.15.1. Sprouts platform deny the use of old ARM Cortex M3 standard architecture and use the BLE network standard as a better choice.

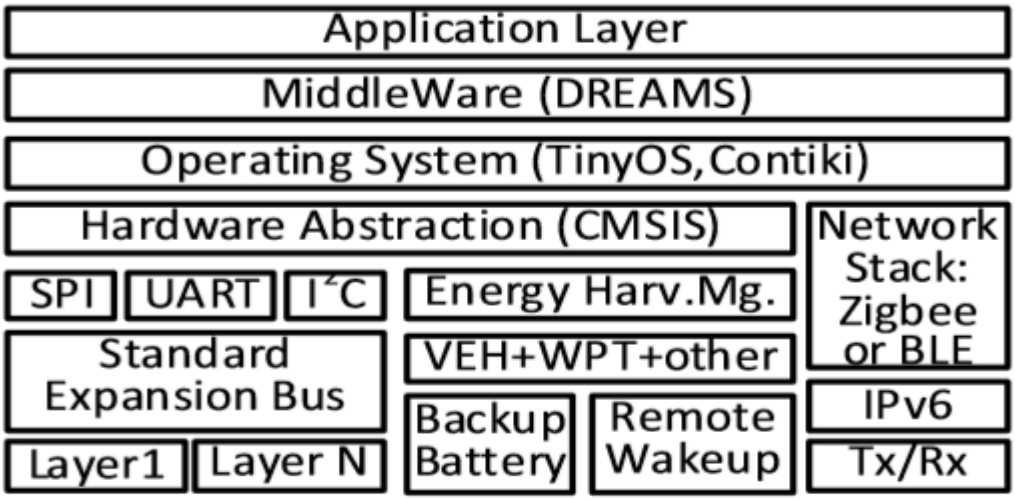


Figure 3.5 Sprout platform for wireless sensor

Farah NASRI (2014 IEEE), " Internet of Things: Intelligent system for healthcare Based on WSN and Android ,"

In this paper described that how we can use android and wsn for the healthcare. Here a physiological signal recognition algorithms developed which were implemented and built-in in the smartphone. The various physiological parameters such as blood pressure saturation of haemoglobin, and ECG are monitored and upload the important information to the health care centre for storage and analysis.

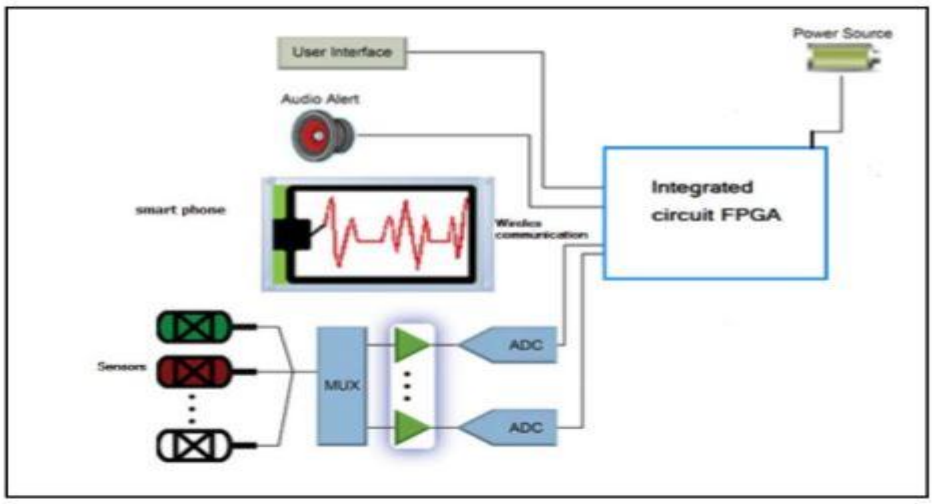


Figure 3.6 Healthcare systems with smart phone

Sandip Ray (2015 IEEE),"The Changing Computing Paradigm with Internet of Things: A Tutorial Introduction"

In this paper the author had given more clearance about the concept of Internet of Things. The paper describes the research challenges of Internet of Things, Security issues in the implementation of internet of things and energy efficiency. According to the paper following are the research problems in the implementation of internet of things

1. Data Interoperability.
2. Low-power Device support.
3. Security and privacy.
4. Manufacturing and process.
5. Analytics
6. Software

Guneet Bedi (2016 IEEE),” Navigating the Challenges of Internet of Things (IoT) for Power and Energy Systems”

In this paper the author has discussed about the challenges of IoT and recommended solution for the IoT. IoT will provide the number of opportunities but it also has the various challenges. One of the most important issue with IoT is Privacy and security of the data which will obtained from the iot devices. Following are the challenges listed in the paper.

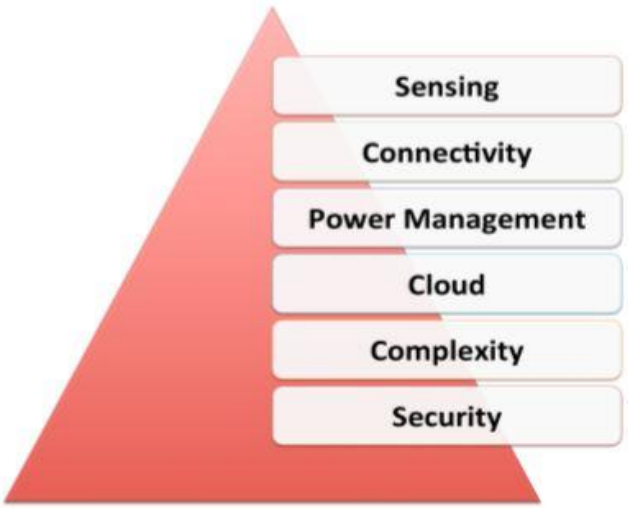


Figure 3.7 Challenges of IoT

Jorge E. Luzuriaga (2015 IEEE),” Handling Mobility in loT applications using the MQTT protocol “,

In this paper the MQTT protocol has discussed for handling the mobility in IoT applications. In the present widely used protocol in M2M and IoT are MQTT, CoAP, LWM2M. All these protocols are directly depended on the TCP/IP protocol suite. MQ Telemetry Transport is a lightweight messaging protocol designed to be open, simple, lightweight and easy to implement.

Kaleem Ullah (2016 IEEE), "Effective Ways to Use Internet of Things in the Field of Medical and Smart Health Care"

In this paper a model for the health care is purpose named as K-healthcare. The K-heathcare make the use of four layers

1. sensor layer.
2. Network layer.
3. Internet layer.
4. service layer.

All these layer work in combination with each other effectively and efficiently to provide the platform for accessing the patient heath data using the smart phones.

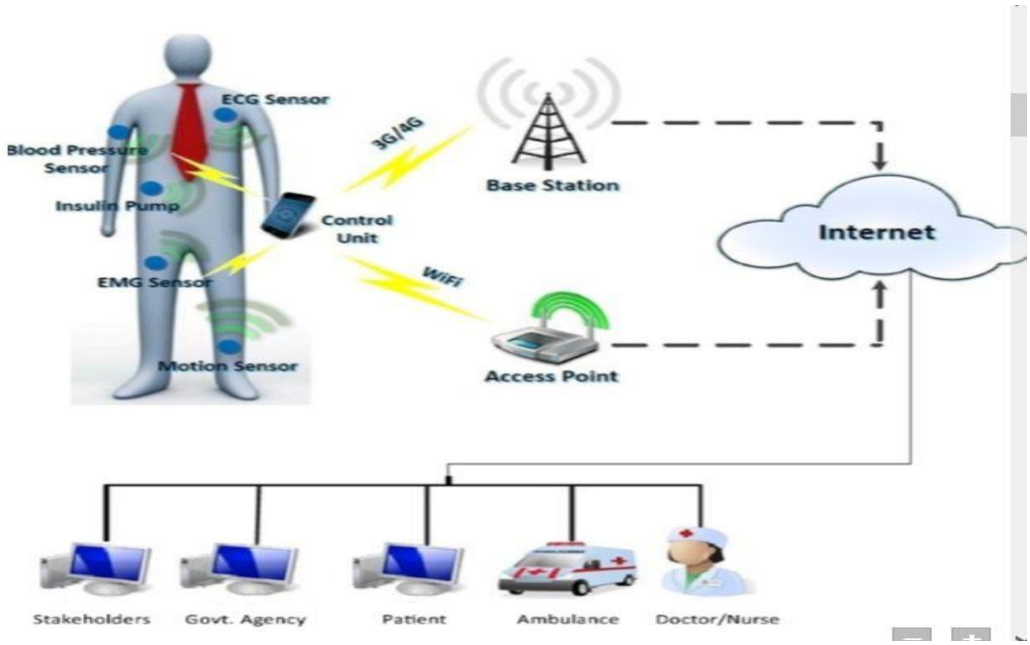


Figure 3.8 K-Healthcare system

Yashar Rajavi (2016 IEEE),"An Energy Harvested Ultra-Low Power Transceiver for Internet of Medical Things "

In this paper an energy harvested ultra-low power transceiver for medical applications is presented.

Which is a RF-powered and enabled bidirectional full-duplex communication using time division duplexing at 1.85GHz. The date rate of 7.2Mbps and 1.8Mbps is achieved in Tx and Rx respectively. The power consumed is 54micro-watt and 9.4 micro-watt for Tx and Rx respectively.

John A. Stankovic (2014 IEEE),"Research Directions for the Internet of Things ",

This paper describes that to achieve the goal of Smart devices, smart cities, smart cars, small homes in one word "smart world" many research communities are working. Some of these are: Internet of Things, mobile computing, pervasive computing, wireless sensor networks, and most recently cyber-physical system. In this paper the author describe the problem and required research areas.

Which are massive scaling, architecture and dependencies, creating knowledge and big data, robustness, openness, security, privacy, and human in the loop.

Antonio Marsico (2015 IEEE),"Learn by Examples how to Link the Internet of Things and the Cloud Computing Paradigms: a Fully Working Proof of Concept"

This paper describe the fully-working proof of concept centred around a smart enterprise scenario and able to shed led on the power offered by linking the Internet of Things (IoT) and the Cloud Computing (CC) paradigms together. To implement this system they used the three different blocks

1.sensor and actuators: to obtain the parameters from the physical world and then take action.

2. IoT gateway: It is create the link between the IoT and the distributed applications.

2. Cloud service: for the storage and processing make use of cloud.

Hongju Liu (2016 IEEE),"Remote Intelligent Medical Monitoring System Based on Internet of Things",

In this paper a remote intelligent medical monitoring network solution is proposed. This system make the acquisition of physiological parameters of patient and send them to a corrosponding monitoring centre.

M. Mazhar Rathore (2015 IEEE),"The Internet of Things based Medical Emergency Management using Hadoop Ecosystem",

This paper describe a Hadoop-based medical emergency system using IoT technology. In this system the data collected from million of sensors attached to the human body which is further transmitted through the network and processed at the intelligent building to process and perform the

necessary actions using various units such as, collection unit, Hadoop Processing Unit(HPU), and Analysis and decision unit. The system is implemented on Hadoop using UBUNTU 14.04 LTS core TMi5 machine.

Kevin I-Kai Wang (2014 IEEE),"A wearable Internet of Things mote with bare metal 6LoWPAN protocol for pervasive healthcare"

In this paper the concept of 6LoWPAN i.e. IPv6 over low power personal area network for integrating small scale Body Area Nerwork for vital sign monitoring to the wider internet. A open metal design of 6LoWPAN is made to provide the strict memory and processing power requirement of an very-low power embedded mode. An router and router stack of the 6LoWPAN are made to find out a full IPv6 access for an embedded BAN tree topology. The protocol of the router determined through successful connectivity tests and packet drop tests. The single-hop communication latency is also measured to give an signal of the overflow by adding the stack.

Figure 3.9 Overview of 6LoWPAN

CHAPTER 4

RATIONALE AND SCOPE OF THE STUDY

The Internet of Things will change the way of living and working when its completely implemented In the various field. There are no. Of possibility with IoT in almost every field like Healthcare Agriculture, Science, Engineering, Food-chain, Daily life and many other. With the implementation the IoT the work can be done with more efficiency. We will try to implement a healthcare system along with IoT. With help of IoT healthcare system can be made faster, efficient, reliable which will Result into a better service for the people. In the coming decades, the delivery model of healthcare will transform from the present hospital-centric, through hospital-home-balanced in 2020th, to the final home-centric in 2030th[1]. There are also some challenges in IoT implementation. The security of the data is one them. As the huge amount of data will be gathered from various resources. This data can be general data or very important data of some secret agency or organisations like Army. So if the proper security is not provided in the implementation, this data can be accessed and manipulated by some person for his advantage. The other some issue with IoT are Low power systems, manufacturing and processing.

CHAPTER 5

OBJECTIVE OF THE STUDY

My objective is to design a "**Health Monitoring system with IoT**" for Monitoring the health of a patient. In this system various sensors like pulse rate sensor, temperature sensor, accelerometer for body position etc. will be connected to the patients body and the will transferred to Raspberry pi board which is small sized board computer. The system is defined in the following steps.

1. To obtain the data from patient body and patient's room using various sensors like ECG sensor, Body temperature sensor, Room temperature and humidity sensor.

2. To convert this information from analog form into the Digital form for furtherer processing on Raspberry pi.

3. To create the database of the data obtained from various sensors.

4. To design a web server and make a website to display the all data in an appropriate form.

5. To create authentication database for the website so that it can be accessed by only authorised users like family members, doctors and other staff.

6. To alert the doctor in case of inappropriate health condition of the patient.

CHAPTER: 6
MATERIALS AND RESEARCH METHODOLOGY

6.1 Raspberry Pi 3

For system design the Raspberry pi 3 board is used as main processing unit. Raspberry. Raspberry Pi is a small credit card size computer board. It has a 1.2GHz 64-bit quad-core ARMv8 CPU. It has inbuilt 802.11n Wireless LAN, Bluetooth 4.1, Bluetooth Low Energy (BLE)[2]. The OS used for the raspberry pi is raspbian OS.Following are the feature of Raspberry Pi.

- 1GB RAM
- 40 GPIO Pins
- Ethernet port
- Combined 3.5mm audio jack and composite video
- Camera interface (CSI)
- Display interface (DSI)
- Micro SD card slot
- 4 USB Ports Full HDMI port

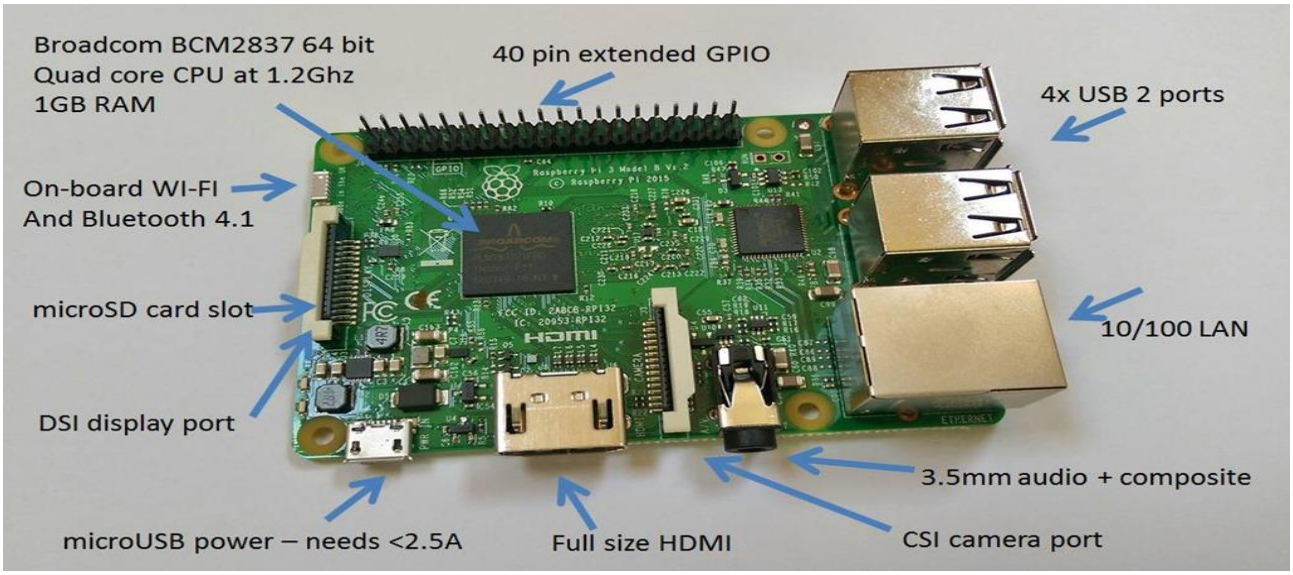


Figure 6.1 Raspberry pi 3

6.2 Programming Languages and Software used

The operating system used for Raspberry Pi is Raspbian OS which is Linux based operating system.

The programming languages and software used for various purpose are python, HTML, PHP, Mysqldb, Apache server. These all languages and software are available on Raspbian os for development purpose. The description of all is as follow.

6.2.1 Raspbian OS:

Raspbian os is linux based os . it consist of various preinstalled packages to development of software and hardware system. As it is open source, there are large no. of developers are working. Due to which various upgrades are added regularly.

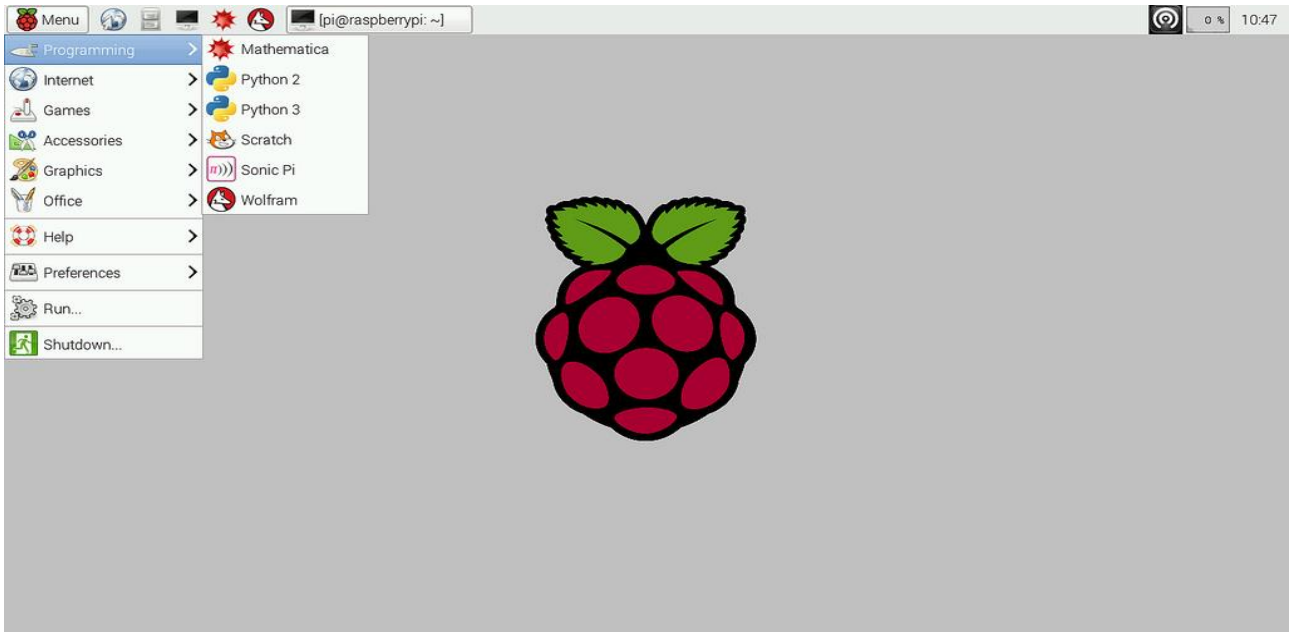


Figure 6.2.1 screenshot of Raspbian OS Desktop Window

6.2.2 Python:

For the programming the pins and other Peripheral and sensor connected with Raspberry Pi Python. language is used. Python is a high level language which was introduced in 1989 by Guido van Rossum[3]. We can right code in few lines with python as compared to C++, JAVA and other languages.

We can right the programs using in python using its IDE or we can also type the program in terminal window of raspbian os just by running the command python.

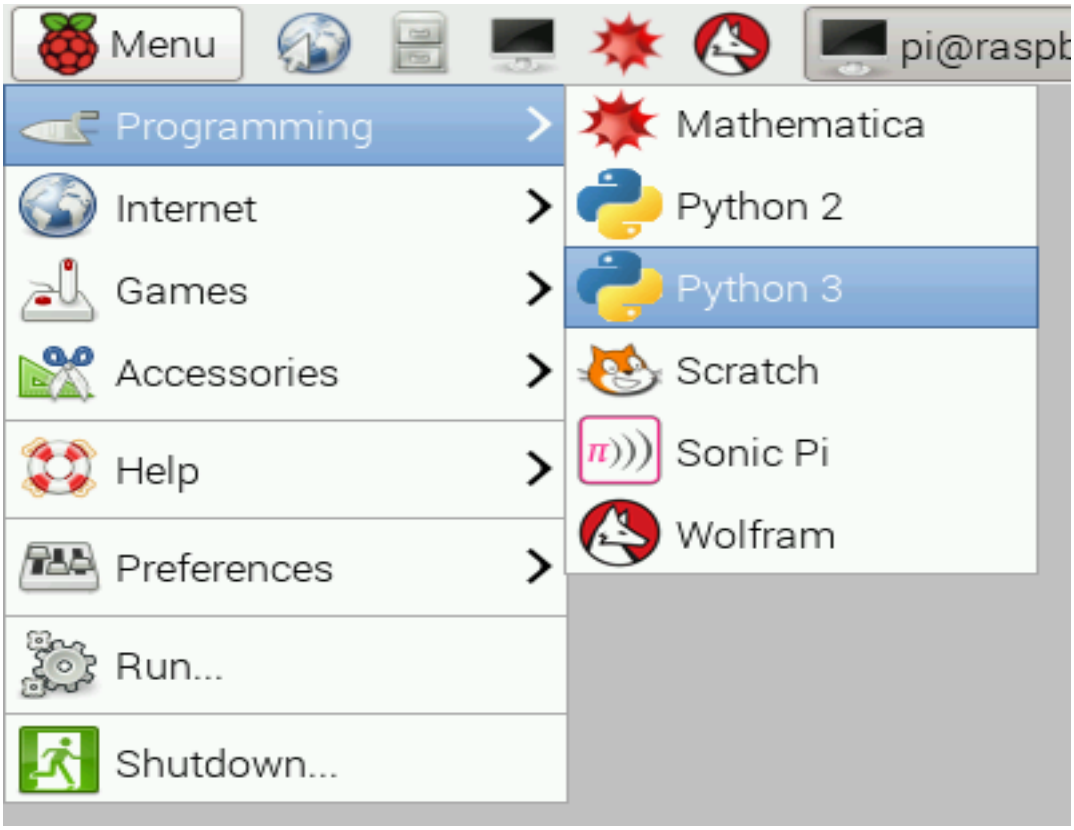


Figure 6.2.2 Python IDE

6.2.3 HTML and PHP :

For the designing purpose of website for healthcare system HTML and PHP are used in combination. The HTML is used for designing of the website that how the content should be displayed on the web-page. Whereas PHP is used as server side scripting language like to load the data from database, Provide authentication for website, to run the python script on the raspberry pi.

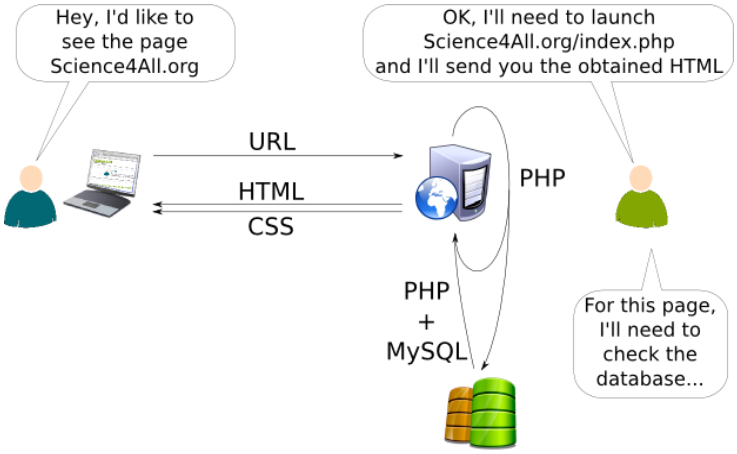


Figure 6.2.3a HTML and PHP

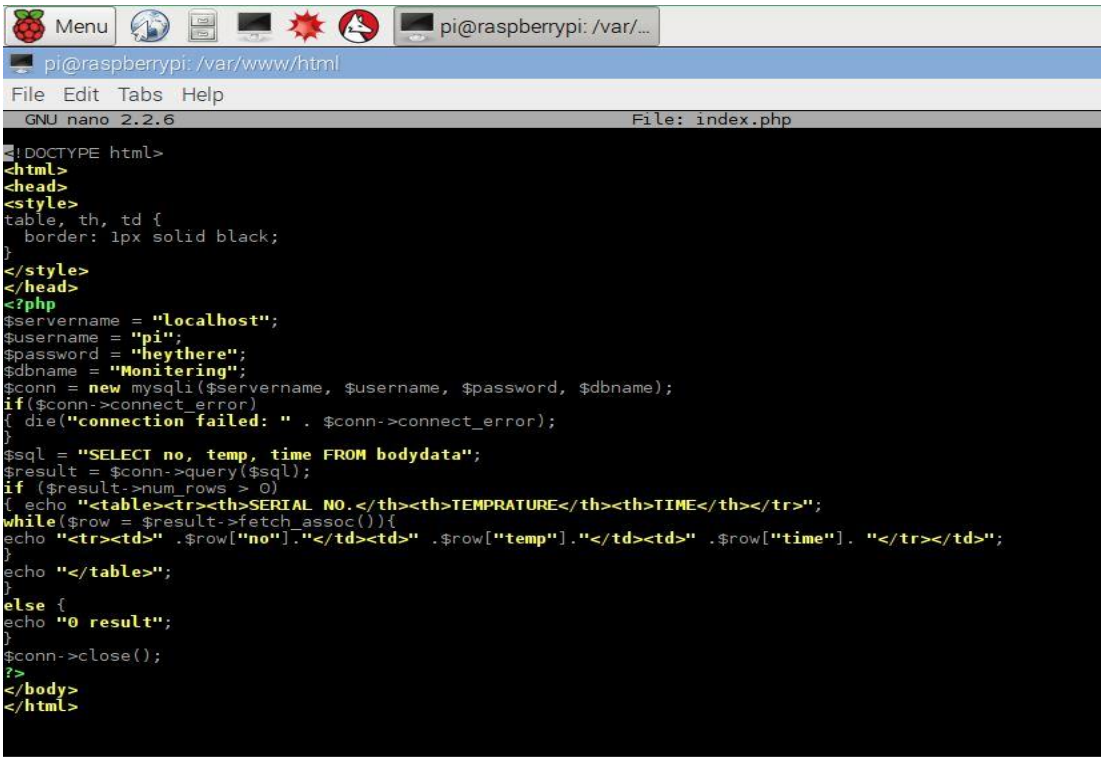


Figure 6.2.3b HTML & PHP in raspbian terminal

6.2.4 Mysql:

Mysql is an open-source relational database management system. It can be used to create the database for an organisationor a system. In this system of Healthcare Monitoring the mysql is used for creating the database for physiological data and authentication data for website.

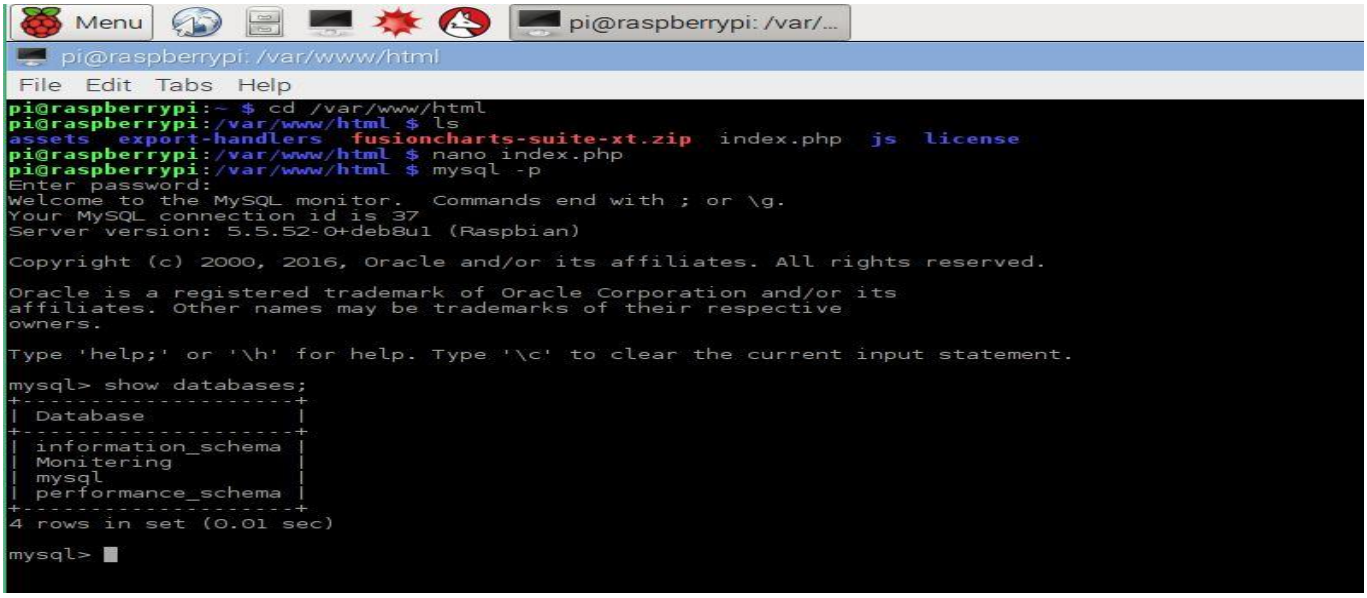


Figure 6.2.4a Mysql in Raspbian OS

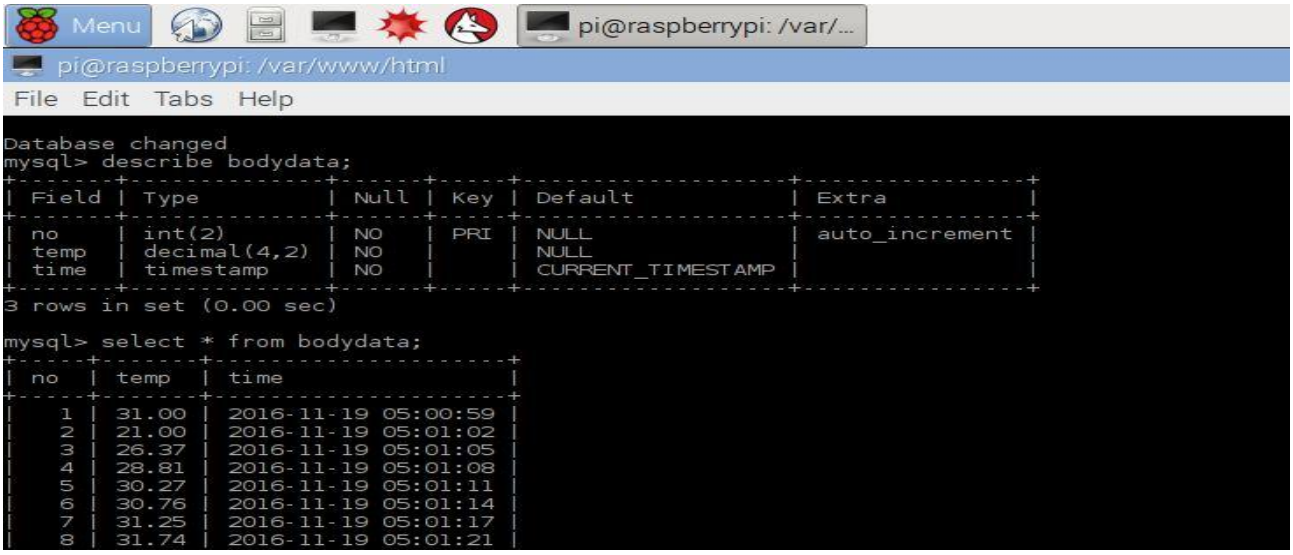
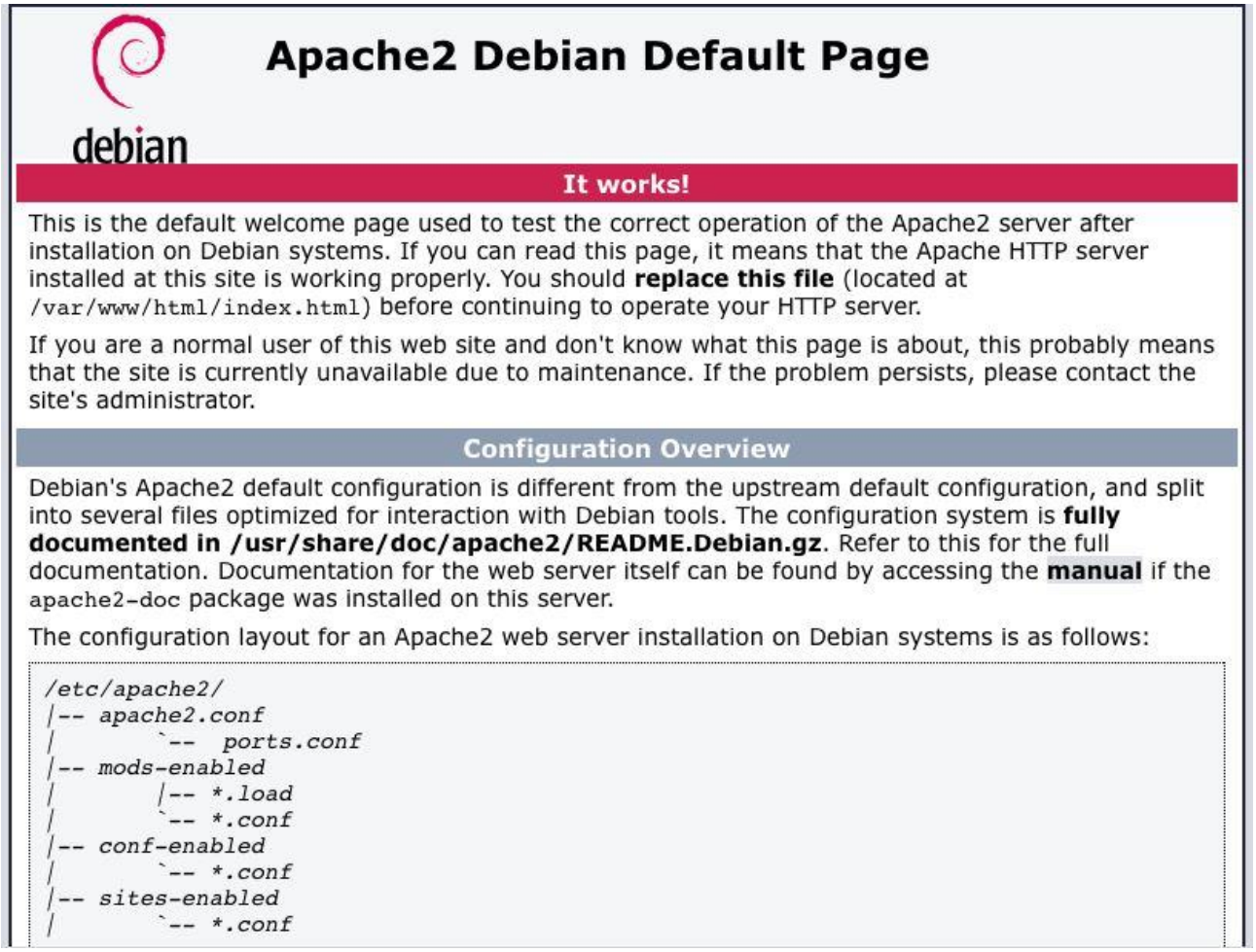


Figure 6.2.4b Database example

6.2.5 Apache server:

The apache sever software is used to make the web server on the raspberry pi. It is very easy to install apache server on raspberry pi. One can install by using sudo apt-get command easily. After installing the apache server a index.html file is created under /var/www/html directory.

One can edit this file to design the website according to the need.



Figurer 6.2.5 Apache server

6.3 Sensors and ADC

1. Pulse sensor:

For obtaining the pulse rate of a human pulse sensor is used. The pulse sensor is used to measure the BPM i.e. beat per minute. The sensor makes the use green light, as the colour of the blood is red it reflect red light and absorb green light. the sensor are designed to compensate for low signal levels by increasing both LED brightness and sampling rate. That's why the heart rate sensor on the flashes its LED lights hundreds of times per second, helping the device calculates heart rates precisely.

Figure 6.3.a pulse sensor

The pulse sensor consist of 3 pins i.e. VCC, GND, SIGNAL. The output of the pulse sensor is analog . The ADC is used to convert it into digital for further processing.

2. LM 35:

For the measurement of body temperature LM35 is used. LM35 is sealed so it does not affected by oxidation. It can operate on 4-20 volts. It has three pins like pulse sensor i.e. VCC, GND, OUT. The output of LM35 is also analog

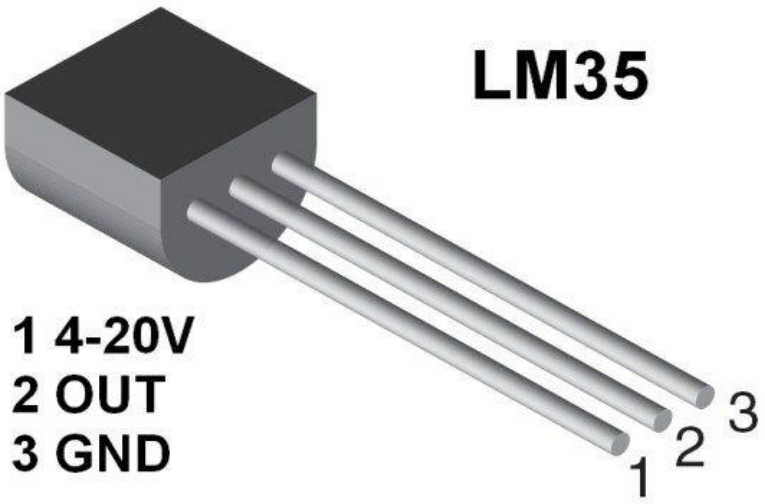


Figure 6.3.b LM 35

3. MPC3008 ADC:

MPC3008 is 16 pin analog to digital conversion IC. It consist 8 channel input i.e. it can convert 8 analog input signal into digital at a time. SPI protocol is used to communicate with MPC3008 through raspberry pi board.

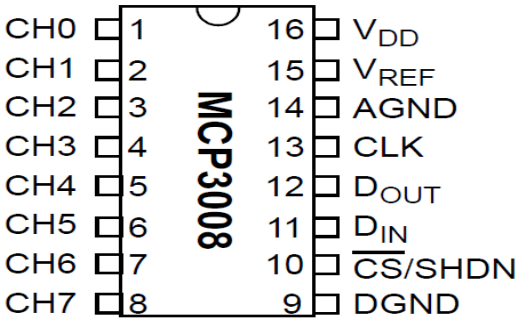


Figure 6.3.c MPC3008 ADC

6.4 GSM module SIM9000a

GSM Modem is a wireless modem that works with a GSM wireless network. The baud rate can be modified using AT commands from 9600 to 115200. It is operated on 12V supply and frequencies 900/1800 MHz. It consists of a SIM card slot and an antenna to receive signals. Using serial communication, it can be connected to Raspberry Pi; PC etc. Several AT commands are used to perform various operations like sending and receiving SMS, voice calls. With a set of extended set of AT commands 1the strength of the signal, reading, writing and searching phone book entries is also possible. Functions such as receiving and sending messages, answering calls can be done using AT commands through serial port on Raspberry Pi.

Figure 6.4 SIM900A GSM Module

To give command to the GSM module UART protocol is used. When the heat rate is abnormal the message is sent through the GSM Module to the doctor.

6.5 System Architecture

In this system various sensors will be used to obtain the physiological data from human body and the surrounding environment. This data will be stored into the database using Mysql for further use.

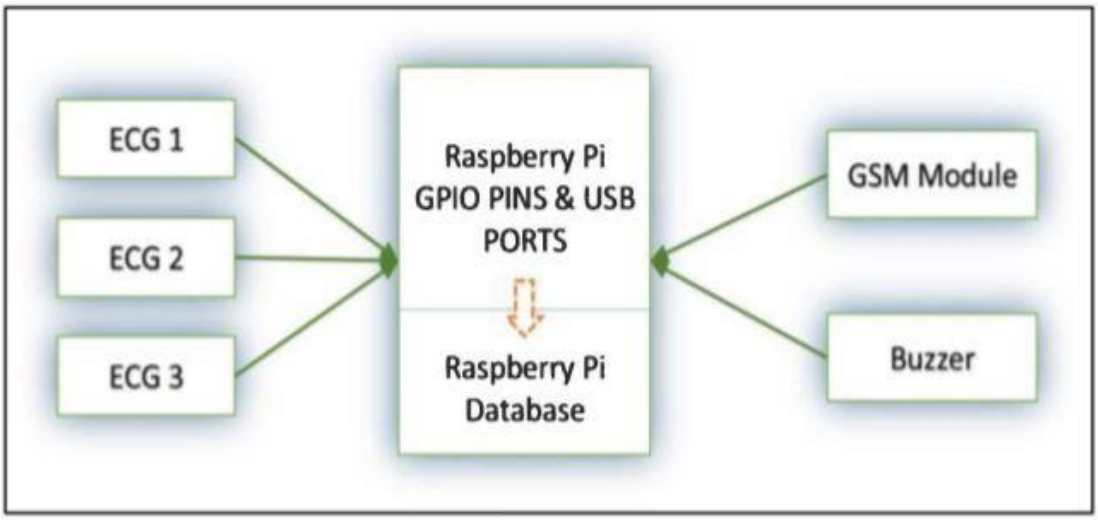


Figure 6.5 System Architecture

Advantages

1. The history of patient's health will be created which can be used to take the appropriate action.
2. Doctors can monitor the patient's health from anywhere using the website.
3. In case of inappropriate health conditions the alert message will send to the doctors or other staff members.

Disadvantages

1. In Real-time operation of system may give delay sometimes due some technical issue.
2. In the IoT main issue will be the security so to provide the complete security for the data will be issue.

6.6 Research Methodology

Following flow chart is describing the algorithm used:

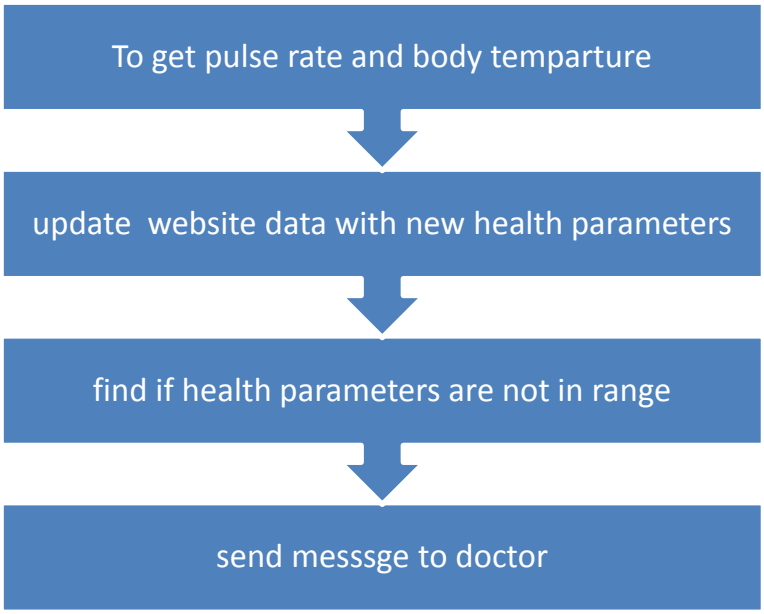


Figure 6.6 algorithm

As shown in the flowchart our first step is to get Physiological data from the various sensors connected to the body. After getting the data a database of all Physiological data for the website will be created with help of mysql with the time stamps and it will updated at regular intervals. Then the doctor can view the health statics of the patient by accessing the website from anywhere. In condition of any inappropriate health statics an alert message will be send to the doctor and buzzer will be turned on.

CHAPTER 7
RESULTS AND DISCUSSION

7.1 Experimental work

The two physiological are data taken i.e. pulse rate and body temperature. These two parameters can be monitored remotely. The Apache server software is used to make the raspberry as web-server. And when we dial the IP address of the Pi from the sensor data is displayed on the webpage. To make the web page globally accessible port forwarding technique used. With help of this web interface designed to display physiological parameter was successfully accessed over wide area network.

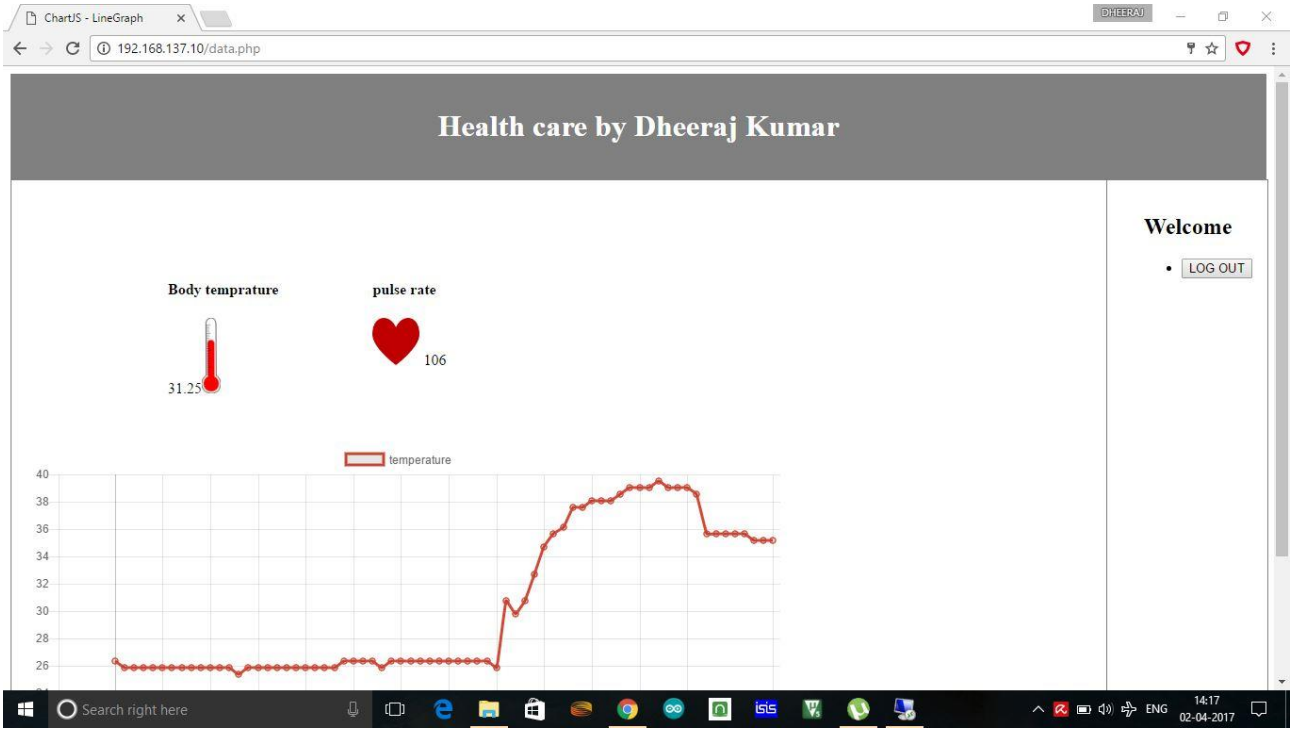


Figure 7.1.a Body temperature and pulse rate displayed on webpage

For the security of the data so that it cannot be accessed by unauthorised person a log in system is used. Thus only authorised person can access the person.

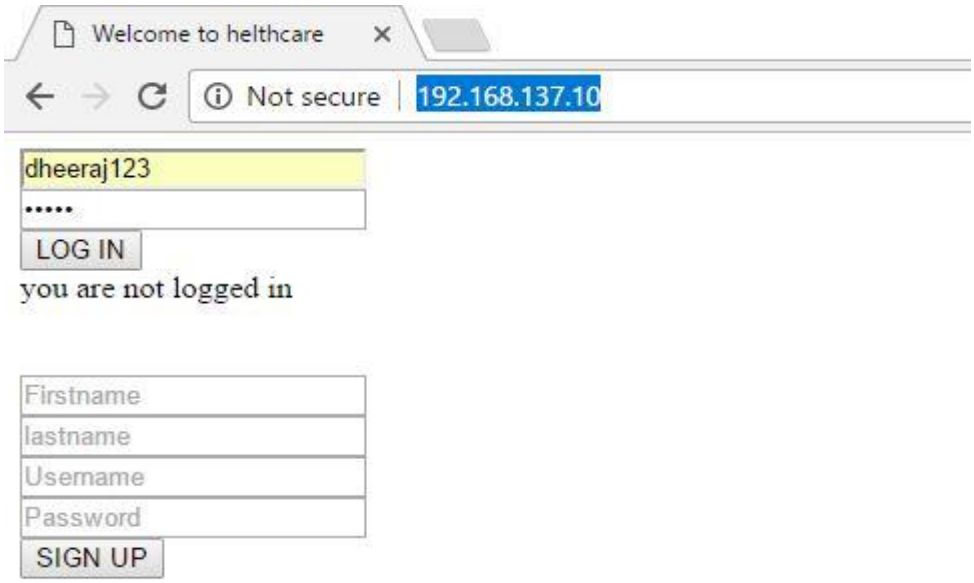


Figure 7.1.b authentication provided to website

When the heart rate is above 100 BPM the message is to be sent the doctor through GSM module.

7.2 Performance Evaluation:

The system gives satisfactory result to monitor the health of a human being. The two physiological data i.e. pulse rate and body temperature are accessible remotely through the website. The parameter is accessed immediately without any delay. The pulse sensor gives the average accuracy reading of BPM which are sufficient for monitoring the normal BPM rate. The accuracy of LM35 to measure body temperature was good. The message was send to the doctor within 10 seconds to the doctor in case of abnormal health condition.

S.NO.	PARAMETER	SPEED	STATUS
1	Data access through website	Immediately	yes
2.	Authentication	Not valid	yes
3.	Message sending time	Within 10 sec	yes
4.	Pulse sensor accuracy	Not valid	average
3.	LM 35 accuracy	Not valid	Good

CONCLUSION AND FUTURE SCOPE

In This study an approach of healthcare system with Internet of Things is presented. That provides an easy way to monitoring the heath of a patient and provides the alert to doctor in case of inappropriate conditions. Raspberry pi is used for this application because of its multi-tasking capability and low power consumption. Also this system can be installed easily in all the hospitals and huge data obtained can be stored in the database. Moreover this data is much valuable. Raspberry Pi, with its broad variety of features can be used for several purposes and have much scope in future. Even the results can be made to be accessed from mobile through an application. Any intelligent system can be added and can be further improvised to facilitate the clinicians and the patients.

REFERENCES

1. Jan Kietzmann (2016 IEEE),” Introduction to The Internet of Everything: Connecting People, Things, and Data Minitrack “
2. M. Surya Deekshith Gupta, (2015 ICGCIoT)”Healthcare based on IoT using raspberry pi“
3. Ananda Mohon Ghosh(2016 IEEE) ,“ Remote Health Monitoring system through IoT”,
4. ZHIBO PANG(2013), “ Technologies and Architecture of Internet-Of-Things (IoT) for Health and Well-being”
5. Amra Sofic (2016, BIHTL),”Implementation of Internet of Things in the Market of Bosnia and Herzegovina “ ,
6. Yassine Maleh (2016), “ An Enhanced DTLS Protocol for Internet of Things Applications “ ,
7. Ahmad El Kouche (2012 IEEE ICC), “ Towards a Wireless Sensor Network Platform for the Internet of Things “,
8. Farah NASRI (2014 IEEE), “ Internet of Things: Intelligent system for healthcare Based on WSN and Android ,”
9. Sandip Ray (2015 IEEE),”The Changing Computing Paradigm with Internet of Things: A Tutorial Introduction”
10. Guneet Bedi (2016 IEEE),” Navigating the Challenges of Internet of Things (IoT) for Power and Energy Systems”
11. Jorge E. Luzuriaga (2015 IEEE),” Handling Mobility in loT applications using the MQTT protocol “,
12. Kaleem Ullah (2016 IEEE), “Effective Ways to Use Internet of Things in the Field of Medical and Smart Health Care”
13. Yashar Rajavi (2016 IEEE),”An Energy Harvested Ultra-Low Power Transceiver for Internet of Medical Things “
14. John A. Stankovic (2014 IEEE),”Research Directions for the Internet of Things “,
15. Antonio Marsico (2015 IEEE),”Learn by Examples how to Link the Internet of Things and the Cloud Computing Paradigms: a Fully Working Proof of Concept”
16. Hongju Liu (2016 IEEE),”Remote Intelligent Medical Monitoring System Based on Internet of Things”,
17. M. Mazhar Rathore (2015 IEEE),”The Internet of Things based Medical Emergency

Management using Hadoop Ecosystem",

18. Kevin I-Kai Wang (2014 IEEE),"A wearable Internet of Things mote with bare metal 6LoWPAN protocol for pervasive healthcare"
19. http://internetofthingsagenda.techtarget.com/definition/IoMT-Internet-of-Medical-Things
20. http://searchhealthit.techtarget.com/essentialguide/A-guide-to-healthcare-IoT-possibilities-and-obstacles
21. https://www.kaaproject.org/healthcare/