Project Report on
"Iot Based Patient Monitoring System"

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SVERI's COLLEGE OF ENGINEERING, PANDHARPUR

CERTIFICATE

This is to certify that the project report entitled **"IOT BASED PATIENT MONITORING SYSTEM"** is submitted for partial fulfillment of Bachelor Degree in Computer Science and Engineering as per requirement of Punyashlok Ahilyadevi Holkar Solapur University, Solapur for the academic year 2019-2020.

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SYNOPSIS

1. Synopsis of Project Work

(a) Relevance:

Monitoring your beloved ones becomes a difficult task in the modern day life. Keeping track of the health status of the your patient at home is a difficult task. Specially old age patients should be periodically monitored and their loved ones need to be informed about their health status from time to time while at work. So we propose an innovative system that automated this task with ease. Our system puts forward a smart patient health tracking system that uses Sensors to track patient health and uses internet to inform their loved ones in case of any issues. Our system uses temperature ,blood pressure ,sugar as well as heartbeat sensing to keep track of patient health.

(b) Present theories and practices:

i. Patient health monitoring system:

Our system uses temperature as well as heartbeat sensing to keep track of patient health.. If system detects any abrupt changes in patient heartbeat or body temperature, the system automatically alerts the user about the patients status over IOT and also shows details of heartbeat and temperature of patient live over the internet.

ii. Smart patient health monitoring system:

In this system the vital parameters such as temperature, EEG and heart beat readings which are monitored using Arduino Uno. The proposed method of patient monitoring system monitors patient's health parameters using arduino uno.

(b) Proposed work:

i. Scope of project:

A. The Proposed method of patient monitoring system monitors various health parameters of patient using arduino uno.

B. This system measure various health parameters like heart bit, temperature ,blood pressure and sugar remotely.

C. This system will be very useful for health experts to keep an eye on their patients.

D. Our system will be beneficial to all age of people especially for old aged and ICU patients.

ii. Objectives:

The main objective of this type of control system are to monitor the patient health status remotely.

A. To measure the heart rate :

Heart rate is measured by finding the pulse of the body. This pulse rate can be measured at any point on the body where the artery's pulsation is transmitted to the surface by pressuring it with the index and middle finger; often it is compressed against an underlying structure like bone.

B. To measure temperature and blood pressure :

BMP 180 sensor is used to measure temperature and blood pressure. BMP 180 sensor is high precision sensor designed for consumer applications. Biometric pressure is nothing but weight of air applied on everything. The air has weight and wherever there is air its pressure is felt. Also the temperature affects the pressure reading. To compensate the BMP 180 also has good temperature sensor

c.To measure sugar level:

MQ2 gas sensor is used to measure sugar level. MQ2 gas sensor is an electronic sensor used for sensing concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. MQ2 gas sensor is also known as chemiresistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. this change in the value of resistance is used for the detection of gas. We are using isopropyl alcohol solution for conversion of acetone gas into sugar. We need to take this solution on piece of cotton and place that piece of cotton on MQ2 sensor. Then blow on that piece of cotton

d. Panic Button: Panic button is used to provide emergency requirements to the patients

iii. Phase wise Proposed Work

Phase I	**Phase II**
Finalizing project topic	Account creation and related information about cloud database system which acts as server
Requirement Collection	Coding
Design the modules	Testing and Validation

2. Facilities Available:

(a) Arduino uno kit.

(b) Required sensors.

(c) Required software.

(d) Internet.

Contents

Abbreviation

DFD – Data Flow Diagram
ER – Entity Relationship
GNU – General Public License
HTTP – Hyper Text Transfer Protocol
HTML – Hypertext Markup Language
URL – Uniform Resource Locator
UML – Unified Modeling Language
WWW – World Wide Web
BMP-Barometric Pressure

List of Figures

List of Tables

Chapter 1

INTRODUCTION

1.1 Introduction

Health is one of the global challenges for humanity. In the last decade the healthcare has drawn considerable amount of attention. The prime goal was to develop a reliable patient monitoring system so that the healthcare professionals can monitor the patients, who are either hospitalized or executing their normal daily life activities Recently, the patient monitoring systems is one of the major advancements because of its improved technology.Currently, there is need for a modernized approach. In the traditional approach the healthcare professionals play the major role. They need to visit the patient's ward for necessary diagnosis and advising. There are two basic problems associated with this approach.

The healthcare professionals must be present on site of the patient all the time and secondly, the patient remains admitted in a hospital, bedside biomedical instruments, for a period of time. In order to solve these two problems, the patients are given knowledge and Information about disease diagnosis and prevention. Secondly, a reliable and readily available patient monitoring system (PMS) is required. In order to improve the above condition, we can make use of technology in a smarter way.

In recent years, health care sensors along with raspberry pi play a vital role. Wearable sensors are in contact with the human body and monitor his or her physiological parameters.

We can buy variety of sensors in the market today such as ECG sensors, temperature sensors, pulse monitors etc. The cost of the sensors varies according to their size, flexibility and accuracy.

Blood group detection has always played a vital role in the medical field, detection of blood group is an essential process. In this report we will be seeing a method by which blood can be categorized into different groups (A, B, O, AB) in a smaller amount of time then the conventional methods. Blood Groups mainly consists RBC.

This is common in all the groups, the differentiation in the groups occur due to the presence of Antigens in the RBC. For E.g. a group consists of A Antigens and B group consists of B Antigens. The presence and absence of these Antigens helps us in the grouping of blood.

The Internet of things is defined as the integration of all devices that connect to the network, which can be managed from the web and in turn provide information in real time, to allow interaction with people they use it. On the other hand, the Internet of things can be seen from three paradigms, which are Internet-oriented middleware, things sensors oriented and knowledge-oriented semantics.

The arduino is a programmable device that can sense and interact with its environment. It is great open source microcontroller platform that allows electronic enthusiasts to build quickly, easily and with low cost small automation and monitoring projects.

The combination of IoT with arduino is the new way of introducing Internet of Things in Health care Monitoring system of patients. Arduino Uno board collects data from the sensors and transfer wirelessly to IoT website.

1.2 Need of Work

1. To reduce stress of patient.
2. To reduce man power in laboratories.
3. To reduce cost.
4. To make a simpler system.

1.2. EXPECTED RESULTS:

After connecting and programming all the components with each other, we have performed . According to the proposed system, we have designed prototype Iot based Patient monitoring experiment System. Arduino, GSM module and all the sensors are connected with lots of wires**.**

1) **Heart Beat Result Analysis:**
   To verify whether the heartbeat sensor is working or not, we compare the heartbeat resultwith an automatic blood pressure machine's heartbeat output. To proceed with this thought, we have checked the data which is taken from 5 various people having specific age limit.

2) **Temperature and blood pressure Analysis:**
   By using Temperature sensor we can measure temperature and blood pressure of patient.

3) **Sugar level Analysis**:
   By using MQ2 sensor we can measure sugar level of patient and we have also Used isopropyl alcohol solution for that.

4) **Panic Button**:
   Buzzer will get turn on automatically when patient dosen't feel well.

1.3. Objectives

The main processes involved in this type of control system are to monitor the patient's health status. Wifi Module is a connection network that is used to connect different devices at different locations.

1) To measure temperature and blood pressure of patient.
2) To measure heart rate of patient.
3) To measure sugar level of patient.
4) Monitoring all these parameters remotely.

Chapter 2

LITERATURE SURVEY

1.Existing System

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.

2.2 Problem Definition

In this fast pace world, managing work and health simultaneously have become a matter of concern for most of the people. Long waiting hours at the hospitals or ambulatory patient monitoring are well known issues,it is difficult for people to be constantly available for their near ones who might need them while they are suffering from a disease or physical disorder. So also constant monitoring of the patient’s body parameters such as temperature, pulse rate, sugar level etc. becomes difficult.

2.3. Proposed System

In this proposed work the vital parameters such as temperature, blood pressure ,sugar and heart beat readings which are monitored using Arduino Uno. These sensors signals are send to Arduino Uno via amplifier circuit and signal conditioning unit (SCU), because the signals level are low (gain), so amplifier circuit is used to gain up the signals and transmit the signals to the Arduino Uno. Here patients body temperature , sugar,blood pressure and heart rate is measured using respective sensors and it can be monitored in the screen of computer using Arduino Uno connected to a cloud database system as well as monitored anywhere in the world using internet source.

2.3.1.System Architecture

This system consists of four-protocol layers such as the physical layer, network layer, middleware layer and application layer. First, the physical layer consists of devices embedded with sensors and transmitters. The network layer is responsible of transmitting signals from sensors to the Cloudlets whereas the Middleware layer do the work of storing the data into the cloud and make it available to the people who are concerned. Finally, in the application layer, analytics and diagnosis process are performed

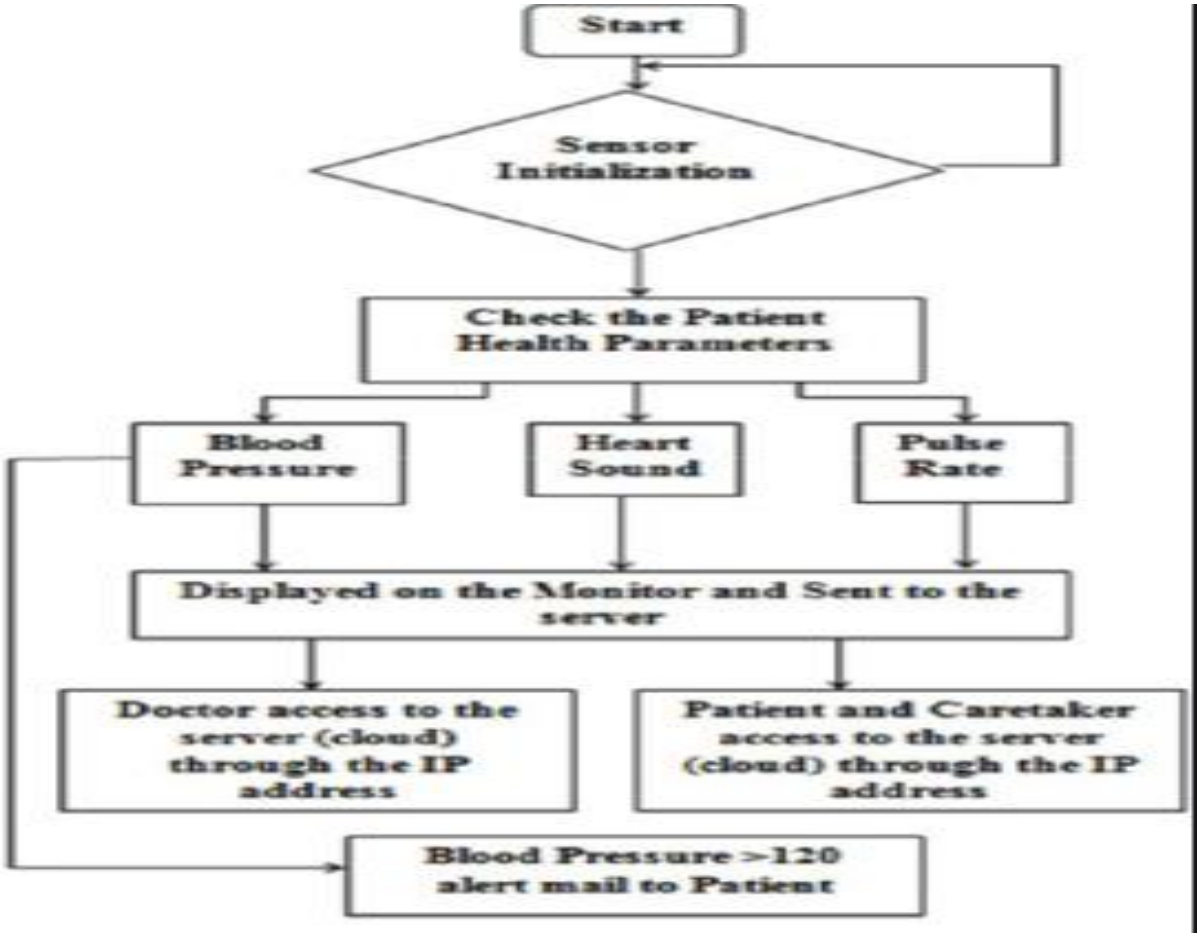


Fig2.1:System Architecture

Data collection and Transmission:

From the compact sensors embedded within the patients body, physiological data is collected consisting of various necessary physiological parameters. Then a small hardware capable of preprocessing the acquired data and a communication software to transmit that data. The sensors must be small, light-weight and not troubling the patient's mobility and movements. Those sensors must operate on small, energy efficient batteries. The batteries are expected to be working continuosly without charging and replcacement.
The system components responsible for data transmission must be able to convert recordings of the patient from any of their location to the health centre with accuracy and security. For transmission, short range low-power digital radio Zigbee or Bluetooth can be used. Further, the acquired data can be relayed to health center through Internet for storage. The sensors involved in the IoT system can be operated through the Internet via the concentrator which can even be a smart phone.

In the health monitoring system, the existing Wireless Sensor Networks(WSN) must be customized so as to remodify the sensing nodes based on relative distance between sensors and health center, also to acquire more physical information for long time by avoiding redundant tasks. [18]. When we focus on low energy consumption, threshold levels should be set so as to handle the emergency situations. At the same time, the other sensors can be powered off to save batter lifetime.
When energy consumption is limited, there increases the need of low power protocols for communication. When compared with IEEE 802.15.4, Zigbee is a low rate Wireless Personal Area Network (LR-WPAN) which operates even in the distance of 10m. Zigbee is implemented in mesh networking with reliability and extended battery life.
Another wireless communication preferred is Bluetooth low energy (BLE) which is for short range communication with low power consumption. It suits for particular requirements of applications such as health monitoring, home entertainment and also sports. Using BLE, the components can be put in sleep for long intervals and so the energy consumption will be highly reduced in terms of number of bytes sent per Joule of energy [19]. Further the protocol Low Power Wireless Personal Area Networks (6LoWPAN) can also be utilized in case of connecting energy constrained WPAN devices to the Internet [20].

2.3.2 Modules to be Implement

IoT Based Patient Health Monitoring System using ESP8266 & Arduino. Pulse Sensor and LM35 Temperature Sensors measures BPM & Environmental Temperature respectively. The Arduino processes the code and displays to 16*2 LCD Display. **ESP8266 Wi-Fi module** connects to Wi-Fi and sends the data to IoT device server. The IoT server used here is Thingspeak. Finally the data can be monitored from any part of the world by logging into Thingspeak channel.

.

Pulse Sensor:
The **ESP8266** is a very user friendly and low cost device to provide internet connectivity to your

projects. The module can work both as a Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making Internet of Things as easy as possible. It can also fetch data from internet using API's hence your project could access any information that is available in the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user friendly.

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.

Fig 2.2:Pulse Sensor

The pulse sensor has three pins: VCC, GND & Analog Pin.

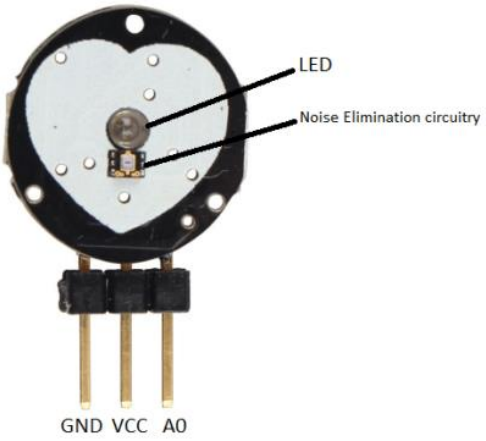


Fig2.3:Pulse sensor-Analog pin

There is also a LED in the center of this sensor module which helps in detecting the **heartbeat**. Below

the LED, there is a noise elimination circuitry which is supposed to keep away the noise from affecting the readings.

ture devices with an output voltage
LM35 device has an advantage over
r is not required to subtract a large
ntigrade scaling. The LM35 device does
e typical accuracies of ±¼°C at room
rature range.

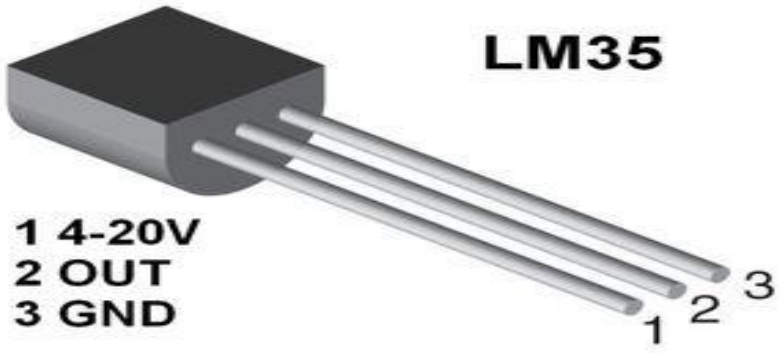


Fig2.4 :LM35 Tempreature Sensor

ESP8266:

The **ESP8266** is a very user friendly and low cost device to provide internet connectivity to your projects. The module can work both as a Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making Internet of Things as easy as possible. It can also fetch data from internet using API's hence your project could access any information that is available in the internet, thus making it smarter. Another exciting feature of this module is that it can be programmed using the Arduino IDE which makes it a lot more user friendly.

Sugar Sensor:
MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. MQ2 is a metal oxide semiconductor type gas sensor. Concentrations of gas in the gas is measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

This sensor contains a sensing element, mainly aluminium-oxide based ceramic, coated with Tin dioxide, enclosed in a stainless steel mesh. Sensing element has six connecting legs attached to it. Two leads are responsible for heating the sensing element, the other four are used for output signals.

Oxygen gets adsorbed on the surface of sensing material when it is heated in air at high temperature. Then donor electrons present in tin oxide are attracted towards this oxygen, thus preventing the current flow.

When reducing gases are present, these oxygen atoms react with the reducing gases thereby decreasing the surface density of the adsorbed oxygen. Now current can flow through the sensor, which generated analog voltage values.

These voltage values are measured to know the concentration of gas. Voltage values are higher when the concentration of gas is high.

Fig2.5:MQ2 Gas Sensor

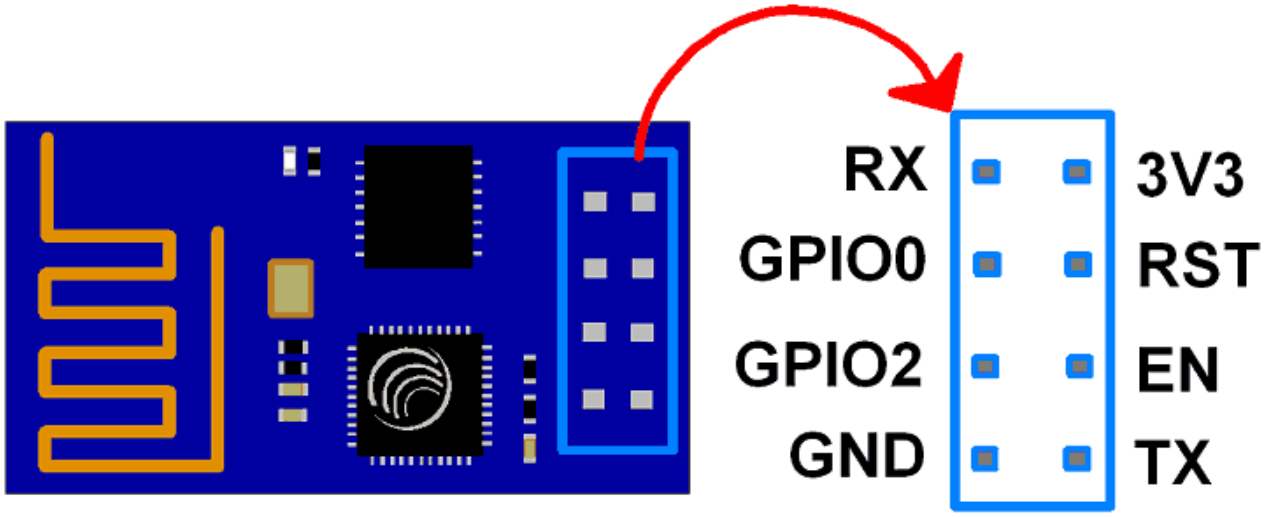


Fig2.6 :ESP8266 WIFI Module

The ESP8266 module works with 3.3V only, anything more than 3.7V would kill the module hence be cautions with your circuits. Here are its pins description.

Pin 1 : Ground : Connected to the ground of the circuit
Pin 2 : Tx/GPIO – 1 : Connected to Rx pin of programmer/uC to upload program
Pin 3 : GPIO – 2 : General purpose Input/output pin
Pin 4 : CH_EN : Chip Enable/Active high
Pin 5 : Flash/GPIO – 0 : General purpose Input/output pin
Pin 6 : Reset : Resets the module
Pin 7 : RX/GPIO – 3 : General purpose Input/output pin
Pin 8 : Vcc : Connect to +3.3V only

Circuit Diagram and Connections:

For designing IoT Based Patient Health Monitoring System using ESP8266 & Arduino, assemble the circuit as shown in the figure below.

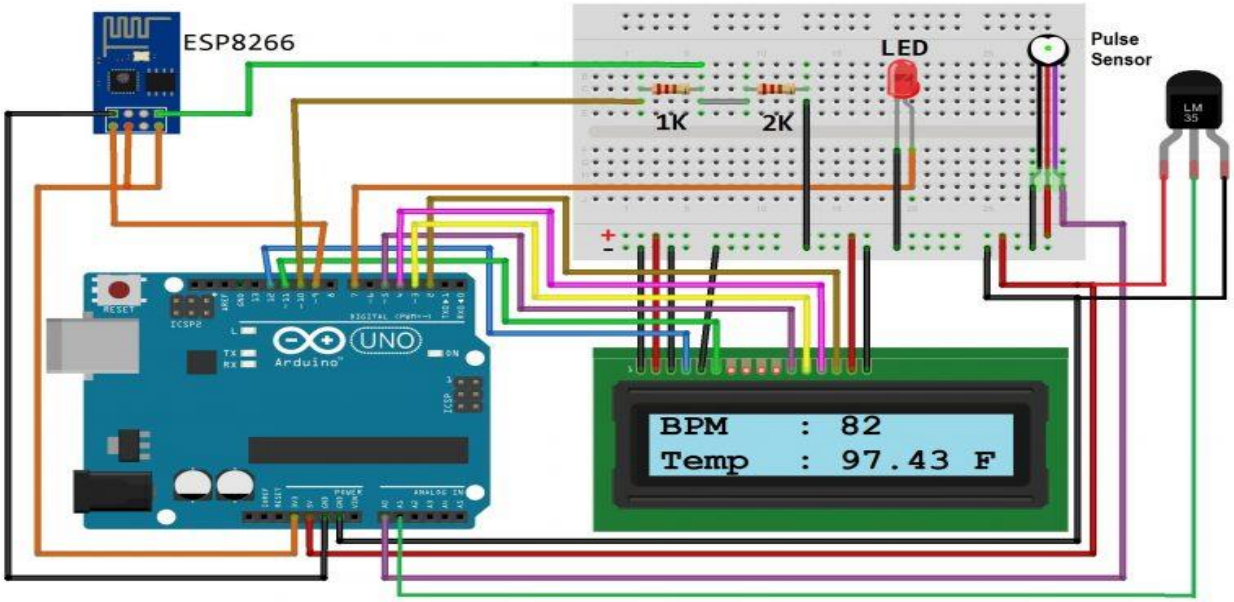


Fig:2.7. Circuit Diagram and Connections

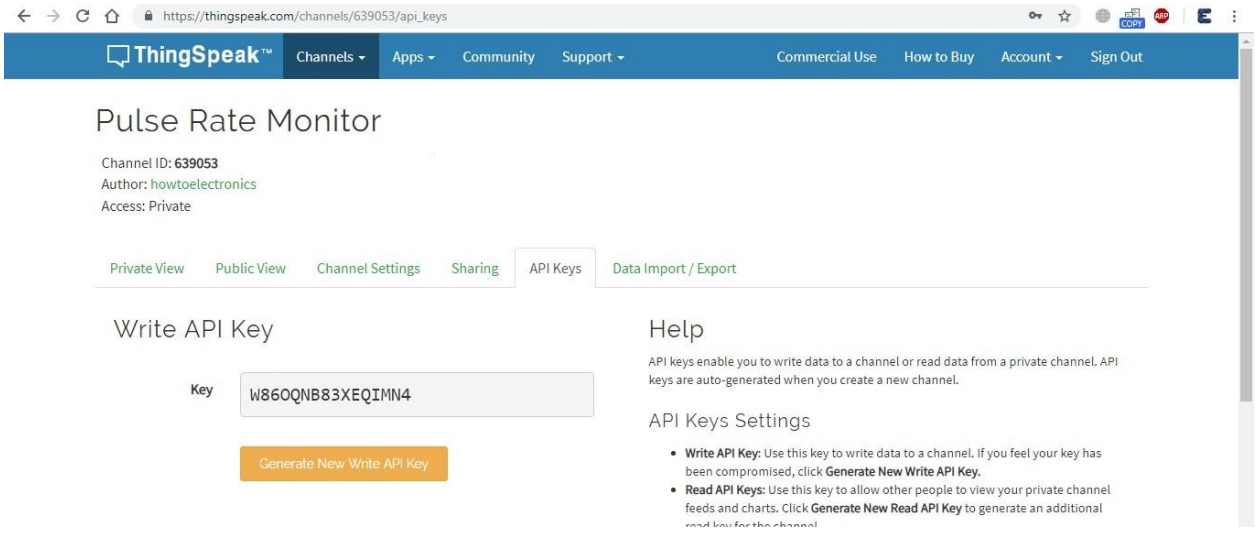
1. Connect Pulse Sensor output pin to A0 of Arduino and other two pins to VCC & GND.
2. Connect LM35 Temperature Sensor output pin to A1 of Arduino and other two pins to VCC & GND.
3. Connect the LED to Digital Pin 7 of Arduino via 220 ohm resistor.
4. Connect Pin 1,3,5,16 of LCD to GND.
5. Connect Pin 2,15 of LCD to VCC.
6. Connect Pin 4,6,11,12,13,14 of LCD to Digital Pin12,11,5,4,3,2 of Arduino.
7. The RX pin of ESP8266 works on 3.3V and it will not communicate with the Arduino when we will connect it directly to the Arduino. So, we will have to make a voltage divider for it which will convert the 5V into 3.3V. This can be done by connecting 2.2K & 1K resistor. Thus the RX pin of the ESP8266 is connected to the pin 10 of Arduino through the resistors.
8. Connect the TX pin of the ESP8266 to the pin 9 of the Arduino.

Setting The ThingSpeak:

ThingSpeak provides very good tool for IoT based projects. By using ThingSpeak site, we can monitor our data and control our system over the Internet, using the Channels and web pages provided by ThingSpeak. So first you need to sign up for ThingSpeak. So visit https://thingspeak.com and create an account.

:ThingSpeak First Page

Then create a new channel and set up what you want.



ThingSpeak Server Second Page

Then upload the code to the Arduino UNO by assembling the circuit shown above. Open serial monitor and it will automatically connect to Wi-Fi and set up everything.

2.4 Advantageous of Proposed System

1. By developing flexible remote **Patient Monitoring System** (PMS) that can **benefit** the **patients**
2. Improving the quality of life of **patients**
3. Continuous data monitoring is possible
4. Information storing is possible in this method.
5. Easy monitoring of any patient by doctor.

Chapter 3

SYSTEM ANALYSIS AND DESIGN

System analysis is the process of gathering and interpreting facts, diagnosing problems and using the information to recommend improvements on the system. System analysis is a problem solving activity that requires intensive communication between the system users and system developers.

System analysis or study is an important phase of any system development process. The system is viewed as a whole, the inputs are identified and the system is subjected to close study to identify the problem areas. The solutions are given as a proposal. The proposal is reviewed on user request and suitable changes are made. This loop ends as soon as the user is satisfied with the proposal.

3.1 Requirement Specification

3.1.1 Non Functional Requirements

i. Efficiency Requirements

When an Iot related patient monitoring system implemented patient can monitor physical ranges efficient manner.

ii. Reliability Requirements

The system should provide a reliable environment to both patient and Doctor. All ranges should be reaching at the doctor without any errors.

iii. Usability Requirements

The System is designed for user friendly environment and ease of use.

3.1.2 Functional Requirements

Application must have a module for login using unique credentials of a patient for the doctor to monitor patient's vital data.

Application must have a module for login using unique credentials of a patient for Guardian/Caretaker to monitor patient's vital data.

Location Tracking: Application must have track location option with which doctor or guardian can track location of the patient.

Location sender: Hardware must have a GPRS module to fetch location coordinates which can be used to track location of patient.

Messaging Service: Hardware must have GSM module which send's SMS alert messages to doctor and guardians upon any emergencies. And application must send email alerts upon any emergencies.

Software Specifications

- Operating System: Windows 7 or higher
- Platform: IoT Cloud
- IDE: Arduino 1.8.4
- cloud database system=thingspeak(server)
- Technologies used: C.

Hardware Specifications

- Microcontroller: Arduino Uno Board
- Sensors: BMP(180) ,heart bit sensor,MQ2(sugar sensor)
- Processor: Intel I3 or higher
- Processor speed: 1.6GHz
- RAM: 512 MB
- Disk Space: 250 MB or higher

3.2 UML Diagrams

3.2.1.Use Case Diagram

A Use Case Diagram consists of set of elements and the relationships between them. It depicts all the scenarios, regarding how our application interacts with users and other external systems to achieve the goals of application. The main components of a use case diagram include actors, use cases and their relationships. The use case is an external view of the system that represents some actions that the user performs to get a job done. Actors are the users who interact with the application.

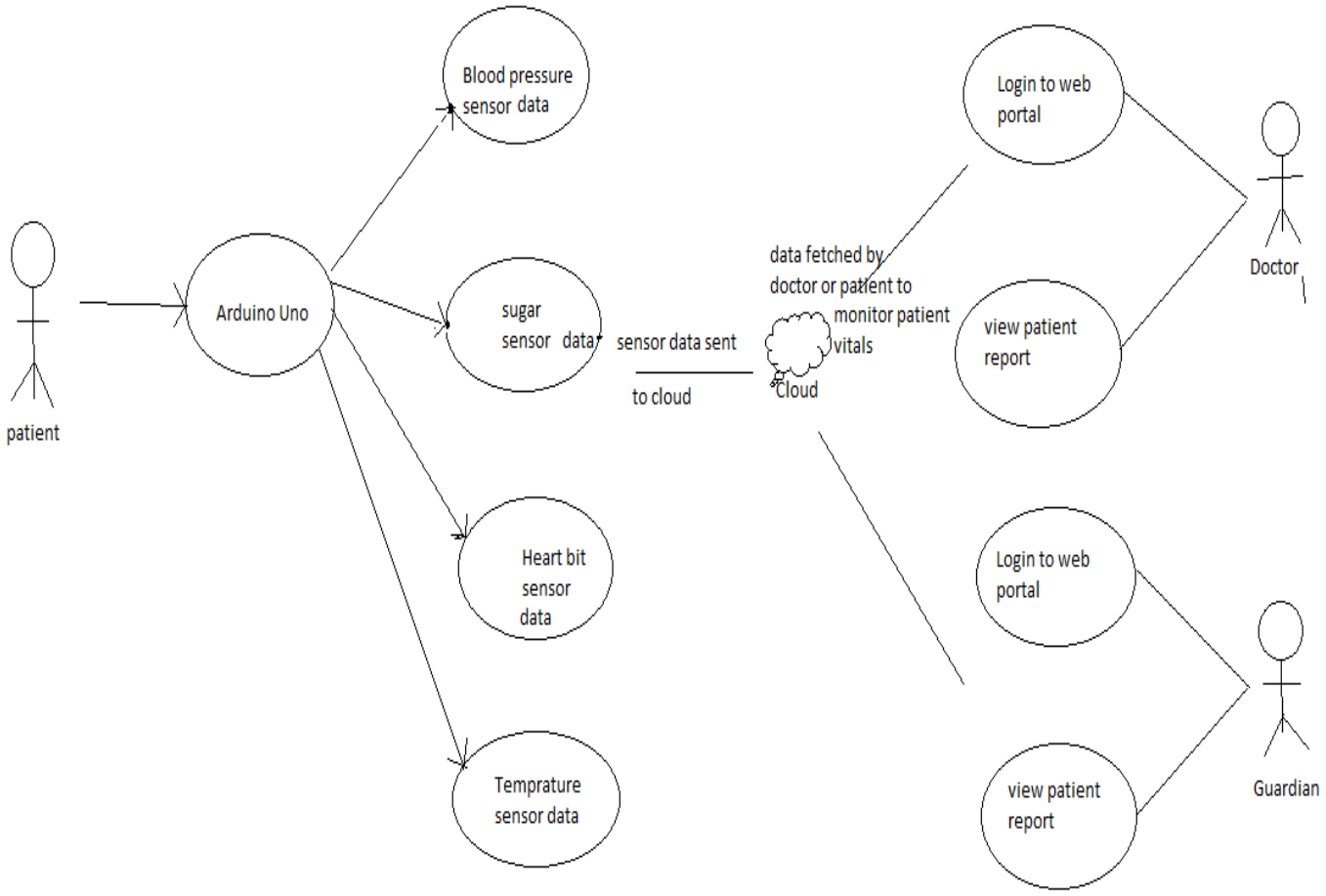


fig:3.1:use case diagram

Actors:

The Actors of the system are Patient, Guardian and Doctor

Use cases:

I have identified a set of use cases based on the functionalities and goals of the application.

Login- This use case denotes a set of actions required for Subject to login into the application.

Call Service- This use case denotes a set of actions required by doctor to call a guardian or patient in case medical emergencies.

View Location- This use case denotes a set of actions required by Guardian or Doctor to locate subject on map after receiving his location details.

Messaging Service- This use case denotes a set of actions required by Doctor to send a message to subject's guardian in case of emergencies.

3.2.2. Data Flow Diagram

A Data Flow Diagram (DFD) is a structured analysis and design tool that can be used for flow charting. A DFD is a network that describes the flow of data and the processes that change or transform the data throughout a system. This network is constructed by using a set of symbols that do not imply any physical implementation. It has the purpose of clarifying system requirements and identifying major transformations. So it is the starting point of the design phase that functionally decomposes the requirements specifications down to the lowest level of detail. DFD can be considered to an abstraction of the logic of an information-oriented or a process-oriented system flow-chart. For these reasons DFDs are often referred to as logical data flow diagrams.

LOGIN DFD

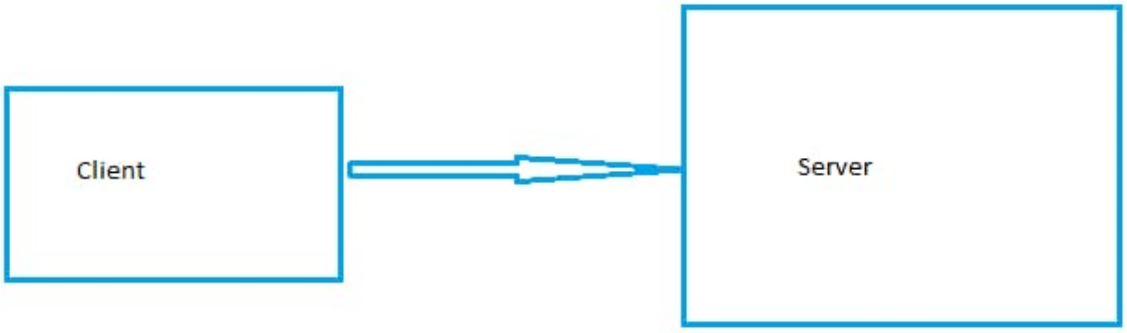


Figure 3.2: DFD LEVEL 0

REGISTRATION DFD

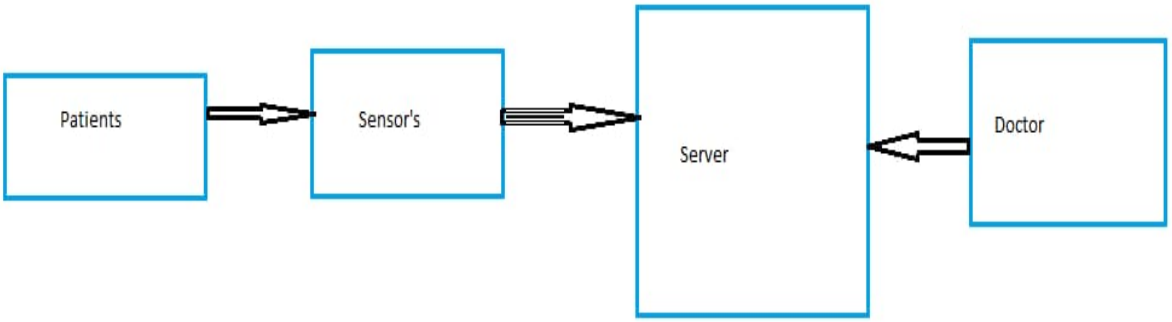


Figure 3.3: DFD LEVEL 1

ADMIN DFD

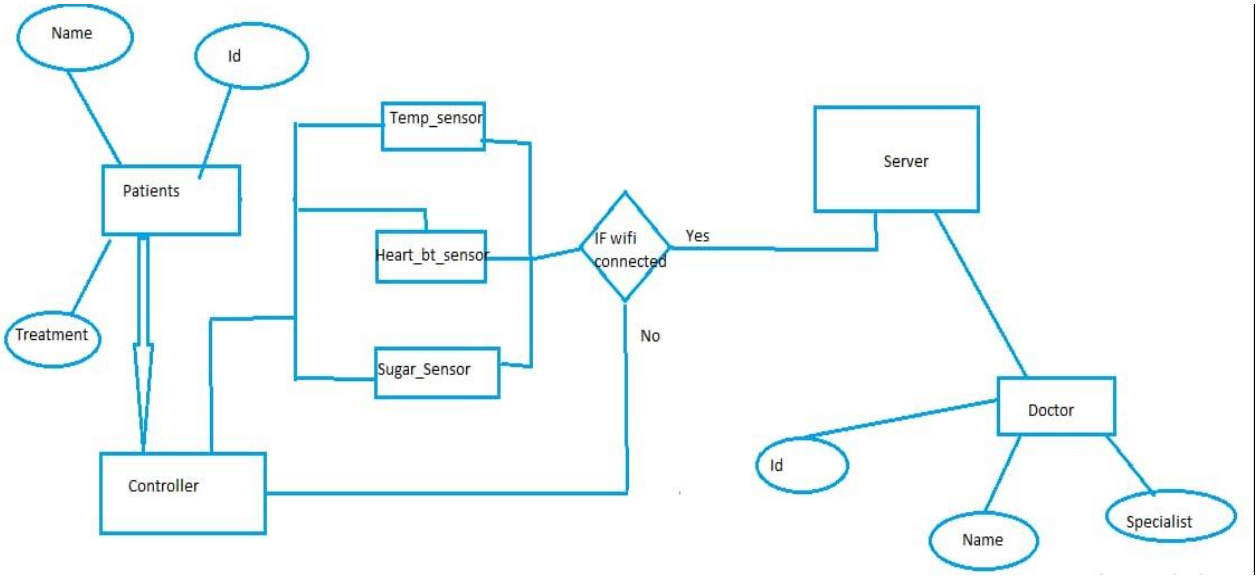


Figure 3.4: DFD LEVEL 2

EXTERNAL ENTITY

An external entity is a source or destination of a data flow. Only those entities which originate or receive data are represented on a data flow diagram. The symbol used is a rectangular box.

PROCESS

A process shows a transformation or manipulation of data flow within the system. The symbol used is an oval shape.

DATA FLOW

The data flow shows the flow of information from a source to its destination. Data flow is represented by a line, with arrowheads showing the direction of flow. Information always flows to or from a process and may be written, verbal or electronic. Each data flow may be referenced by the processes or data stores at its head and tail, or by a description of its contents.

DATA STORE

A data store is a holding place for information within the system: It is represented by an open ended narrow rectangle. Data stores may be long-term files such as sales ledgers, or may be short-term accumulations: for example, batches of documents that are waiting to be processed. Each data store should be given a reference followed by an arbitrary number.

3.2.3. Sequence Diagram

Sequence diagrams model the flow of logic within your system in a visual manner, enabling you both to document and validate your logic, and are commonly used for both analysis and design purposes.

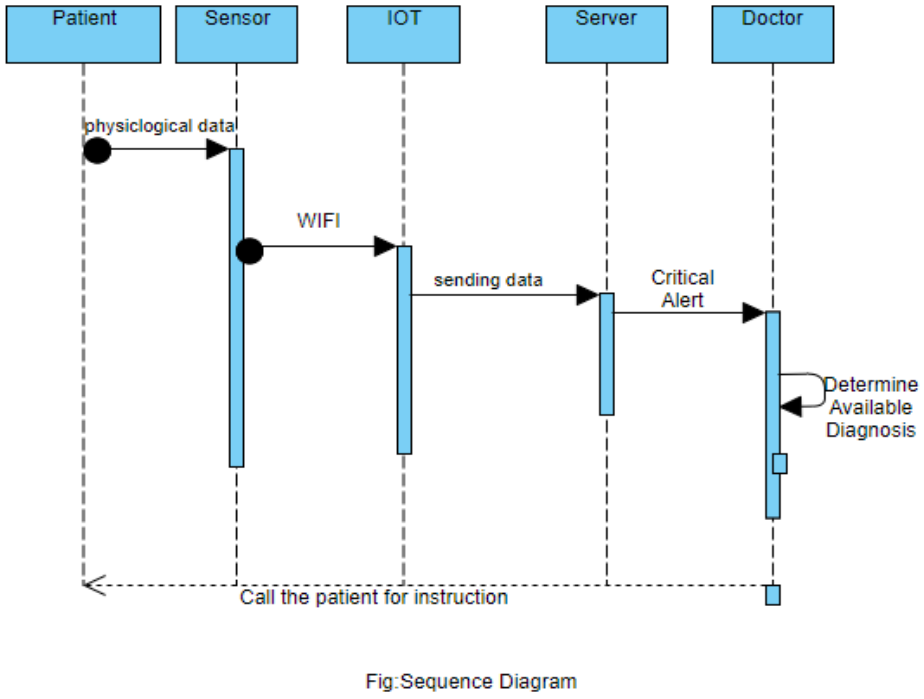


Fig:Sequence Diagram

fig3.5: Sequence Diagram

3.3 Design and Test Steps / Criteria

A test case is a set of test data, preconditions, expected results and post conditions, developed for a test scenario to verify compliance against a specific requirement. I have designed and executed a few test cases to check if the project meets the functional requirements.

Test Objectives: Navigation from Login page to Monitoring page

TEST CONDITION	INPUT SPECIFICATION	OUTPUT SPECIFICATION	PASS/FAIL
The user is currently on the login page	User enters credentials and clicks on login button	Directs to monitoring page	PASS

Table 1: Test case for navigation from Login page

Test Objectives: Navigation from Monitoring page to Google Maps page

TEST CONDITION	INPUT SPECIFICATION	OUTPUT SPECIFICATION	PASS/FAIL
The user is currently on the Monitoring page	User clicks on Track location link on monitoring page.	Directs to google maps page	PASS

Table 2: Test case for navigation from Monitoring page to Google maps page

Test Objectives: Navigation from Google maps page to Monitoring page

TEST CONDITION	INPUT SPECIFICATION	OUTPUT SPECIFICATION	PASS/FAIL
The user is currently on the Google Maps page	User clicks on Monitoring page link	Directs to Monitoring page	PASS

Table 3: Test case for navigation from Google maps page to Monitoring page

Test Objectives: Microcontroller sends SMS alert

TEST CONDITION	INPUT SPECIFICATION	OUTPUT SPECIFICATION	PASS/FAIL
Any of the patient's vital exceeds above or below required condition	Vitals values	System sends SMS alert immediately to doctor and guardian	PASS

Table 4: Test case for system sending alert indication

Test Objectives: System sends emails alert

TEST CONDITION	INPUT SPECIFICATION	OUTPUT SPECIFICATION	PASS/FAIL
Any of the patient's vital exceeds above or below required condition	Vitals values	System sends email alert immediately to doctor and guardian	PASS

Table 5: Test case for system sending redmark alert

3.4 Testing Process

Following are the scenarios where performance testing can be performed on IoT framework.

1. Device to device communication
2. Device to server communication
3. Server to server communication
4. Network bandwidth, latency and packet loss

Based on above scenarios and focusing the scope of this project, below are the performance test cases that are tested on this project.

Test Objectives: Time taken to send data to cloud

TEST CONDITION	OUTPUT SPECIFICATION	OPTIMAL
Time taken to send sensor data database in cloud.	Micro controller sends data every 15 seconds to cloud. Here network plays important role and time taken to send each record is <200ms including response time. But if there is issue with network bandwidth then performance will be deteriorated as system takes additional to check network connectivity and send data to cloud.	TRUE

Table 7: Test case checking time taken to send data to cloud

Test Objectives: Time taken to initialize WIFI Module

TEST CONDITION	OUTPUT SPECIFICATION	OPTIMAL
Time taken to initialize WIFI module to identify network and enable internet	Micro controller executes set of commands on WIFI module which takes 2min to 5min once the system powered on. And once network is found and connected, system would be able to send data in a real time.	TRUE

Table 8: Test case for checking time taken to initialize WIFI

Test Objectives: Time taken to relay patient data on web page

TEST CONDITION	OUTPUT SPECIFICATION	OPTIMAL
Time taken to fetch data from cloud and view it on web	Time taken to run query and relay information on web page is <500ms	TRUE

Table 9: Test case for checking time taken to fetch data from cloud and relay on web

Test Objectives: Time taken to relay patient data to Micro controller

TEST CONDITION	OUTPUT SPECIFICATION	OPTIMAL
Time taken to fetch data from sensors to Micro controller	Time taken to fetch data from sensor and relay information to Micro controller is <50ms	TRUE

Table 10: Test case for checking time taken to fetch data from sensor to

Micro controller

Test Objectives: Time taken to send SMS alert by WIFI Module

TEST CONDITION	OUTPUT SPECIFICATION	OPTIMAL
Time taken to send RedMark alert message	WIFI Module sends RedMark alert message to doctor and caretaker in real time.	TRUE

Table 11: Test case for checking time taken to send RedMark alert message

Chapter 4

METHODOLOGY/ TECHNIQUES USED

4.1 Development Tools

The entire development process has been subdivided into two: the front end de- velopment and the backend development. The front end comprises of the visually visible parts IOT cloud platform(Thingspeak login page). The back end contains the cloud database system which act as server.

1. **Front End Development:**

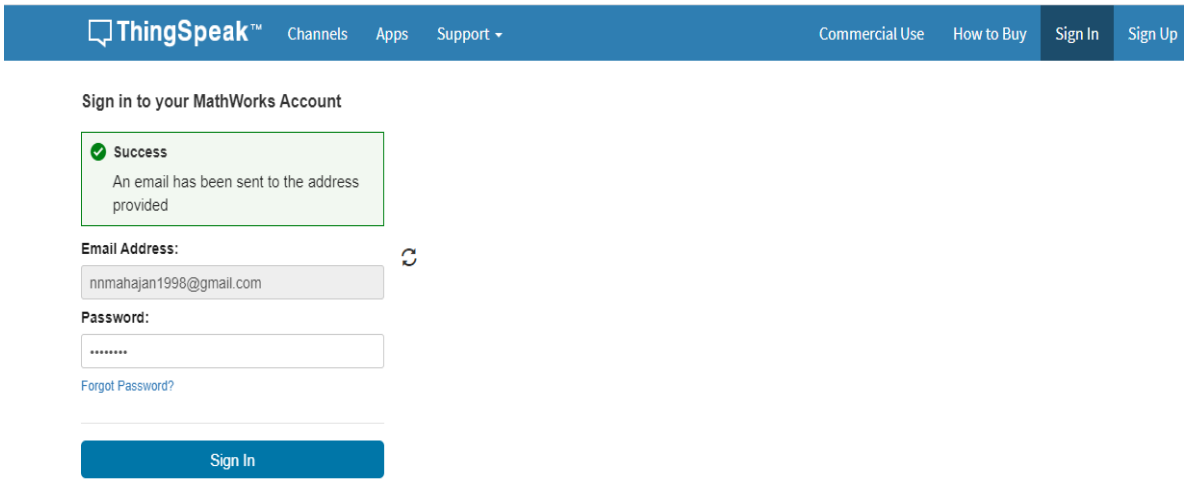
   Thingspeak provides very good tool for IoT based projects. By using ThingSpeak site, we can monitor our data and control our system over the Internet, using the Channels and webpages provided by ThingSpeak. ThingSpeak 'Collects' the data from the sensors, 'Analyze and Visualize' the data and 'Acts' by triggering a reaction. Send sensor data privately to the cloud.

   There are sensors all around—in our homes, smart phones, automobiles, city infrastructure, and industrial equipment. Sensors detect and measure information on all sorts of things like temperature, humidity, and pressure. And they communicate that data in some form, such as a numerical value .

   Sensors, or things, sense data and typically act locally. ThingSpeak enables sensors, instruments, and websites to send data to the cloud where it is stored in either a private or a public channel. ThingSpeak stores data in private channels by default, but public channels can be used to share data with others. Once data is in a ThingSpeak channel, you can analyze and visualize it, calculate new data, or interact with social media, web services, and other devices.

   We will use ThingSpeak to monitor patient heartbeat and temperature online using internet. We will also connect ThingSpeak to redmark which indicate alert message service so that alert message can be sent whenever the patient is in critical state.

Login page:



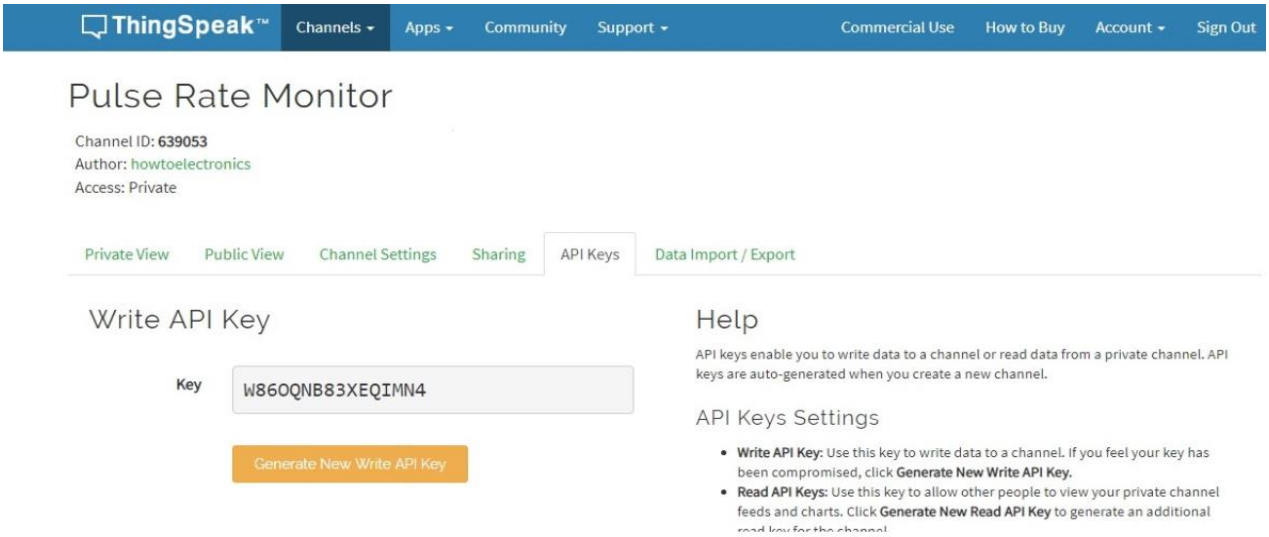
2. Backend :

The proposed method of patient monitoring system monitors patient's health parameters using Arduino Uno. After connecting internet to the Arduino uno, it is connected to cloud database system which acts as a server. Then the server automatically sends data to the receiver system. Hence, it enables continuous monitoring of the patient's health parameters by the doctor. Any abrupt increase or decrease in these parameter values can be detected at the earliest and hence necessary medications can be implemented by the doctor immediately.

BACKEND STEPS:

Create a Channel

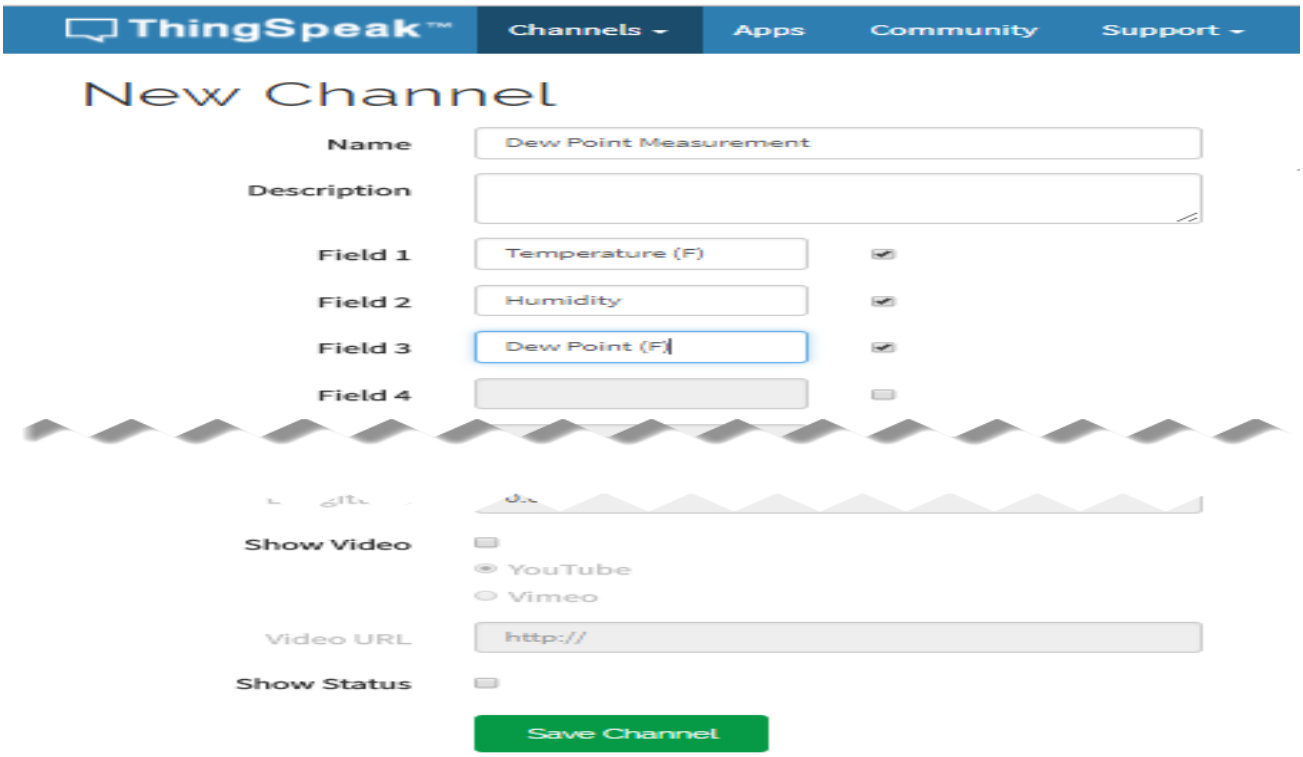
1. **Sign In** to ThingSpeak™ using your MathWorks Account, or create a new **Math Work account.**
2. Click **Channels** > **MyChannels**.



3. On the Channels page, click **New Channel**.

4. Check the boxes next to Fields 1–3. Enter these channel setting values:

- **Field 1**: Temperature
- **Field 2**: Sugar
- **Field 3**: Heartbeat
- **Field 4**: blood pressure



5.Click Save Channel at the bottom of the settings.

You now see these tabs:

- **Private View**: This tab displays information about your channel that only you can see.
- **Public View**: If you choose to make your channel publicly available, use this tab to display selected fields and channel visualizations.
- **Channel Settings**: This tab shows all the channel options you set at creation. You can edit, clear, or delete the channel from this tab.
- **Sharing**: This tab shows channel sharing options. You can set a channel as private, shared with everyone (public), or shared with specific users.
- **API Keys**: This tab displays your channel API keys. Use the keys to read from and write to your channel.
- **Data Import/Export**: This tab enables you to import and export channel data.

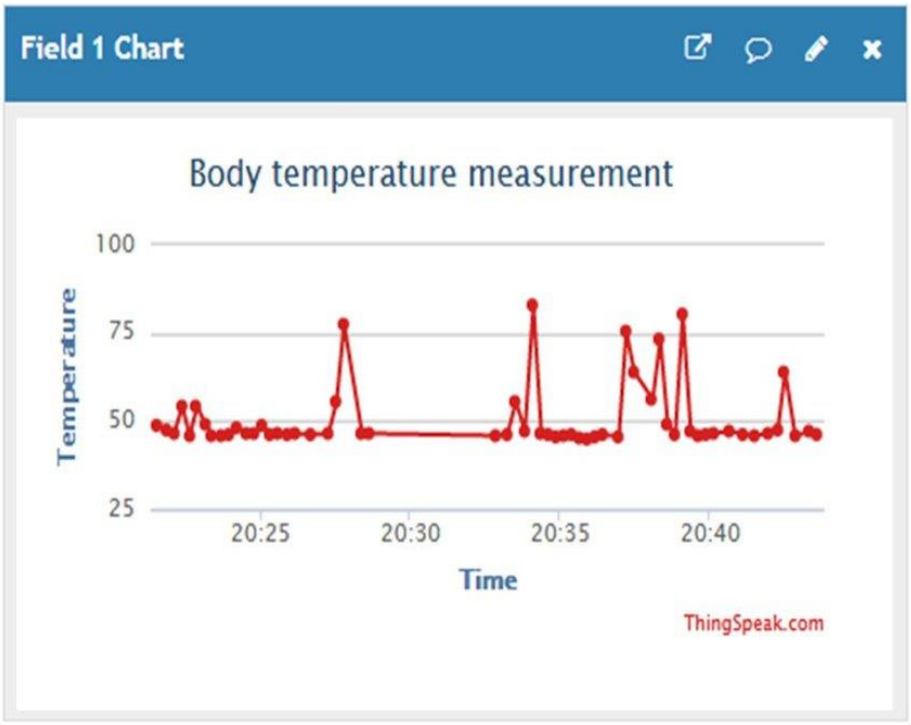
6.Your channel is available for future use by clicking Channels > My Channels.

In the next example, Analyze Your Data, you use the temperature and humidity data from the public WeatherStation channel to calculate the dew point data.

Then you can write the temperature, humidity, and calculated dew point data to Fields 1, 2 and 3, respectively, of your Dew Point Measurement channel. For advanced weather analysis with MATLAB® and ThingSpeak, see Arduino Weather Station Data Analysis on MakerZone.

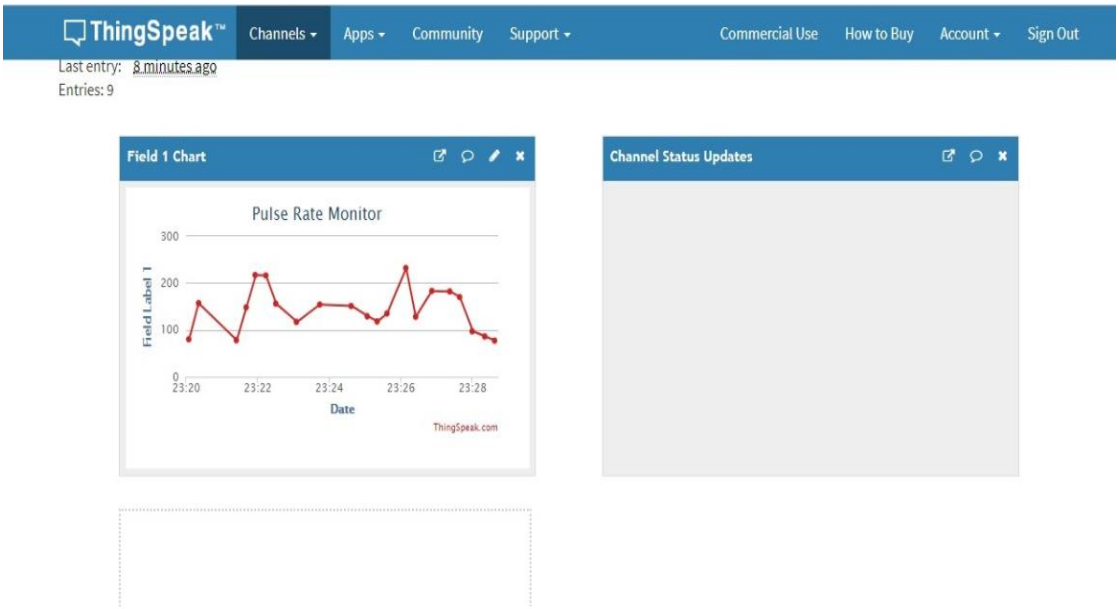
Output step:

1.temperature

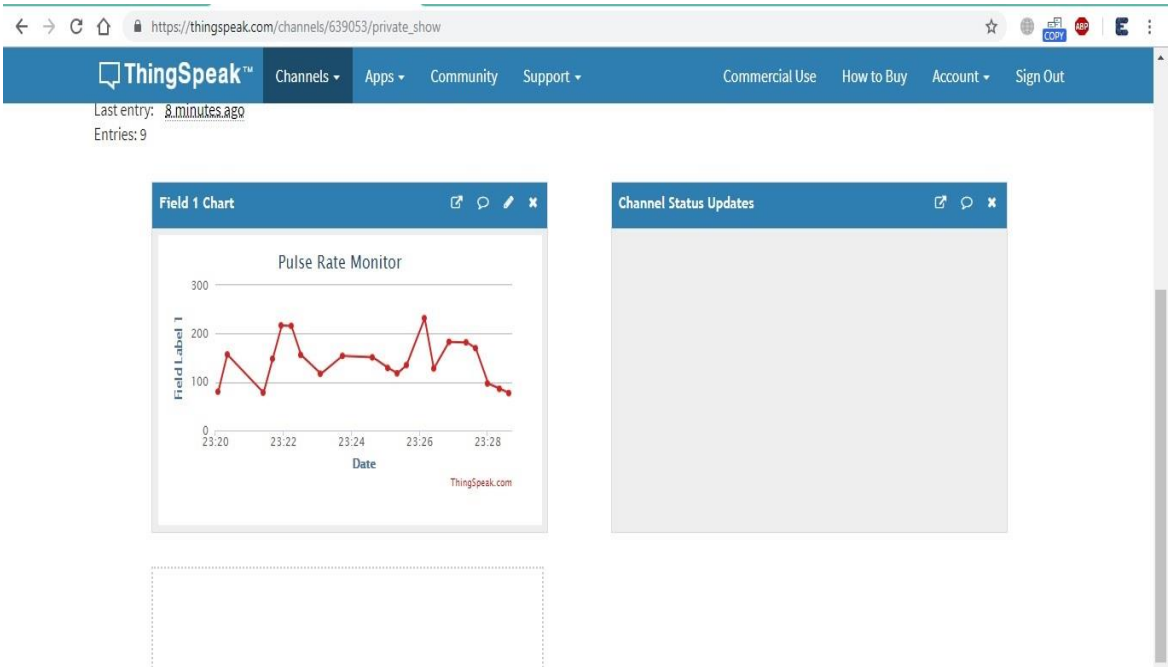


2.heartbeat:


Field 1 Chart
Beat
125
100
75
50
Heart Beat
16:30
16:35
16:40
16:45
Date
ThingSpeak.com


ThingSpeak™
Channels
Apps
Community
Support
Commercial Use
How to Buy
Account
Sign Out
Last entry: 8 minutes ago
Entries: 9
Field 1 Chart
Pulse Rate Monitor
300
200
100
0
Field Label 1
23:20
23:22
23:24
23:26
23:28
Date
ThingSpeak.com
Channel Status Updates

3.blood pressure:



Source Code/Program:

sugar sensor code:

```
void setup()
{
 Serial.begin(9600);
 Serial.println("SUGAR SENSOR PROJECT.....");
 delay(1000);
 Serial.println("PLZ BLOW ON THE SENSOR....");
 delay(2000);
}

void loop()
{
float sensorValue=analogRead(A0);
Serial.println("SUGAR VALUE=");
if(sensorValue>65)
{
Serial.print(sensorValue/7);
Serial.println("MG/DL");
delay(5000);
}
}
```

BMP(180):

```
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
long last_millis=0;
long current_millis=0;
PulseSensorPlayground pulseSensor;
String msg = "GET /update?api_key=MY490MGI21L1X36Q";
//SoftwareSerial Serial(2,3);

//Variables
const int PulseWire = A2
 ANALOG PIN 0
const int LED13 = 13;
 int Threshold = 550
float myTemp;
```

```
int myBPM;
String BPM;
int HB;

int error;
int panic=10;
int raw_myTemp;
float Voltage;
float tempC;
String temp,temp1,temp2;
void setup()
{
pinMode(10,INPUT);
  lcd.begin(16,2);
  pinMode(13,OUTPUT);
  digitalWrite(13,LOW);
  lcd.print("initialising...");
  Serial.begin(115200);
  delay(100);
  Serial.println("AT");
  delay(500);
  Serial.println("AT+CWMODE=1");
  delay(500);
  pulseSensor.analogInput(PulseWire);
  pulseSensor.blinkOnPulse(LED13 with heartbeat.
  pulseSensor.setThreshold(Threshold);

    if (pulseSensor.begin()) {
    Serial.println("We created a pulseSensor Object !");    }
```

BLOOD PRESSURE:

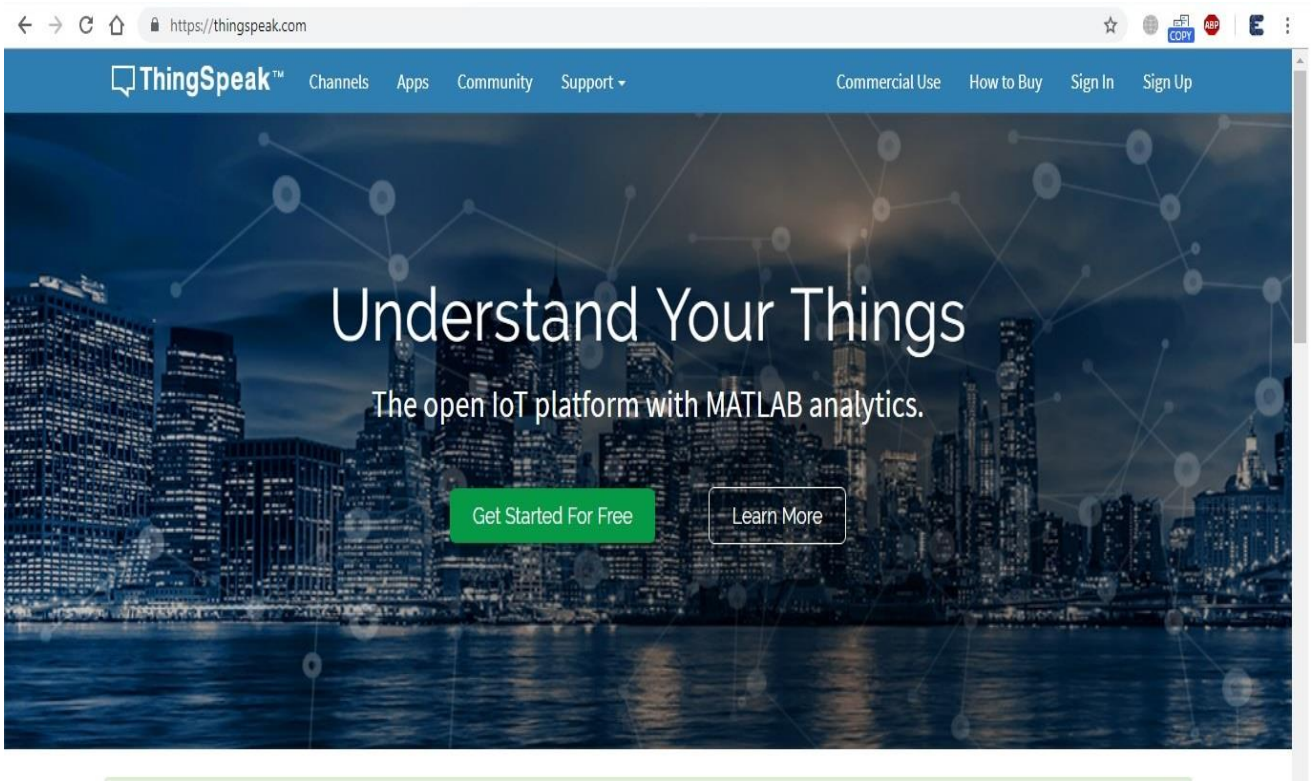
```
pressure.begin();
 char status;
  double T, P, p0; //Creating variables for temp, pressure and relative pressure


    status = pressure.startTemperature();

    delay(status);

    status = pressure.getTemperature(T);
```

```
Serial.print("Temp: ");
Serial.print(T, 1);
Serial.println(" deg C");

lcd.setCursor(0,1);
lcd.print("T=");
lcd.print(T);

status = pressure.startPressure(3);


  delay(status);

  status = pressure.getPressure(P, T);

    Serial.print("Pressure measurement: ");
    Serial.print(P);
    Serial.println(" hPa ");
    lcd.setCursor(8,1);
    lcd.print("P=");
    lcd.print(P);
```

Chapter 5

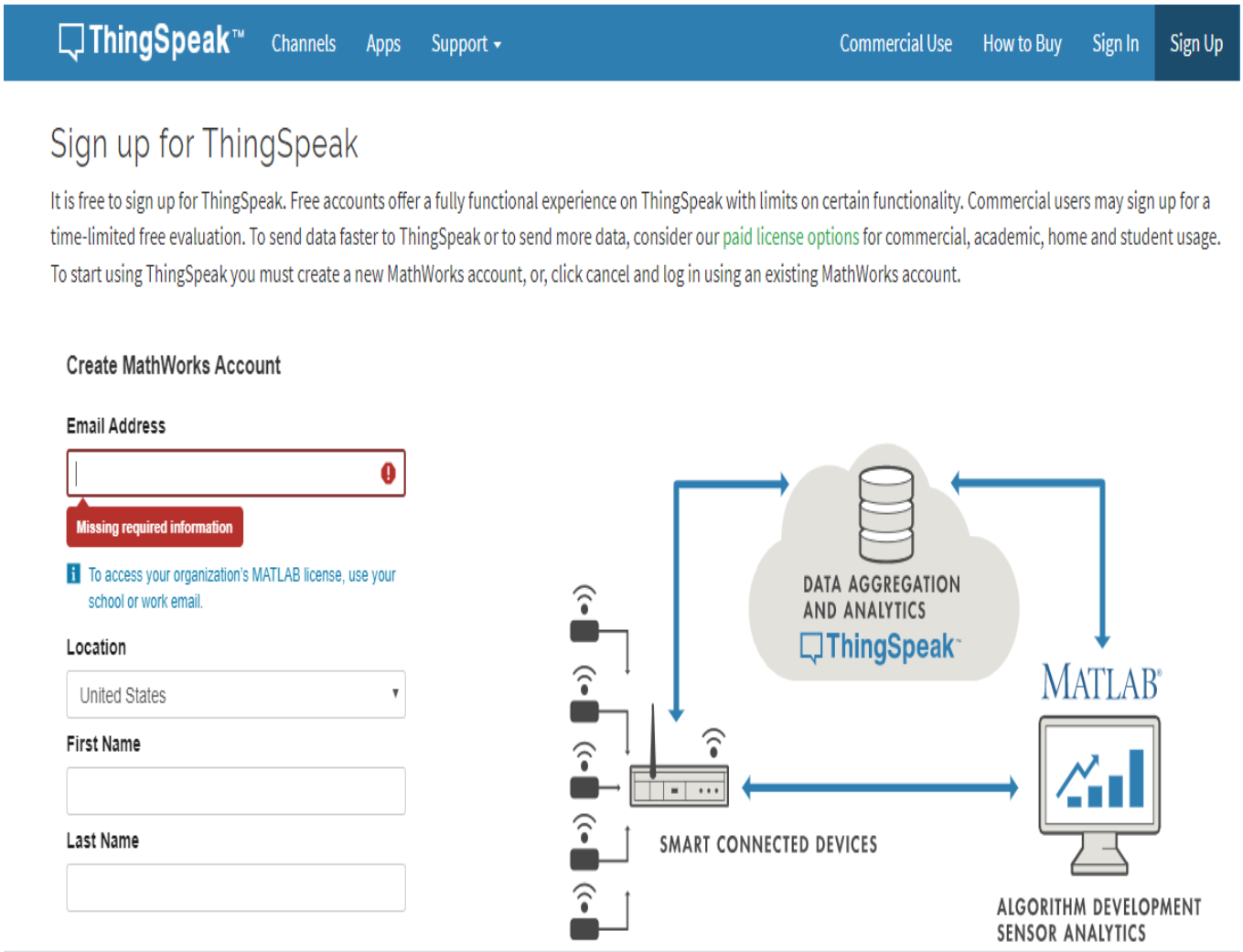
EXPERIMENTAL RESULTS / OUTPUTS

- Home Page: -



First type Thingspeak.com in search bar it will show above page .To create new MathWork account .click on sign up button

Thingspeak sign up page:

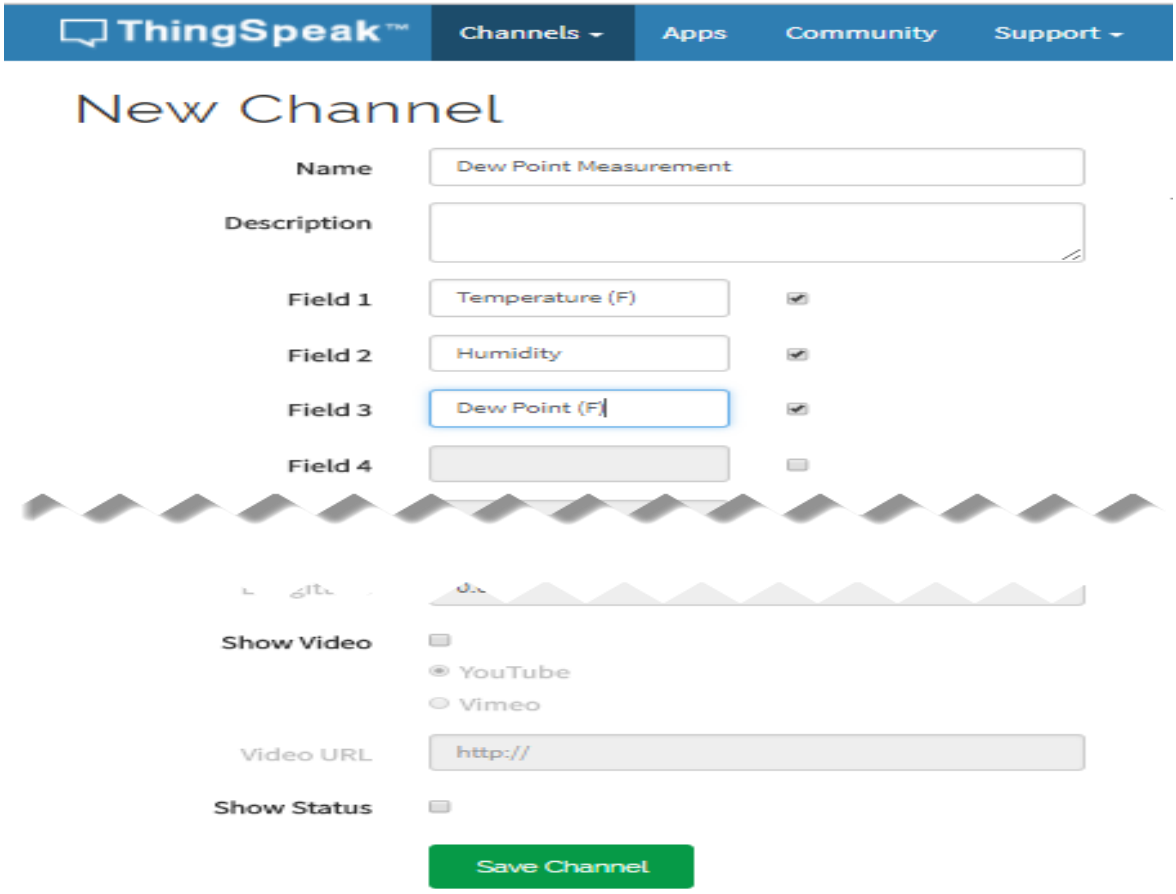


This is sign up page of thingspeak server.Enter your Email Addreess ,location,first name,lastname and create mathwork account by clicking on create button.

Thingspeak channel page:

After creating mathwork account click channels>mychannel

New Channel page:



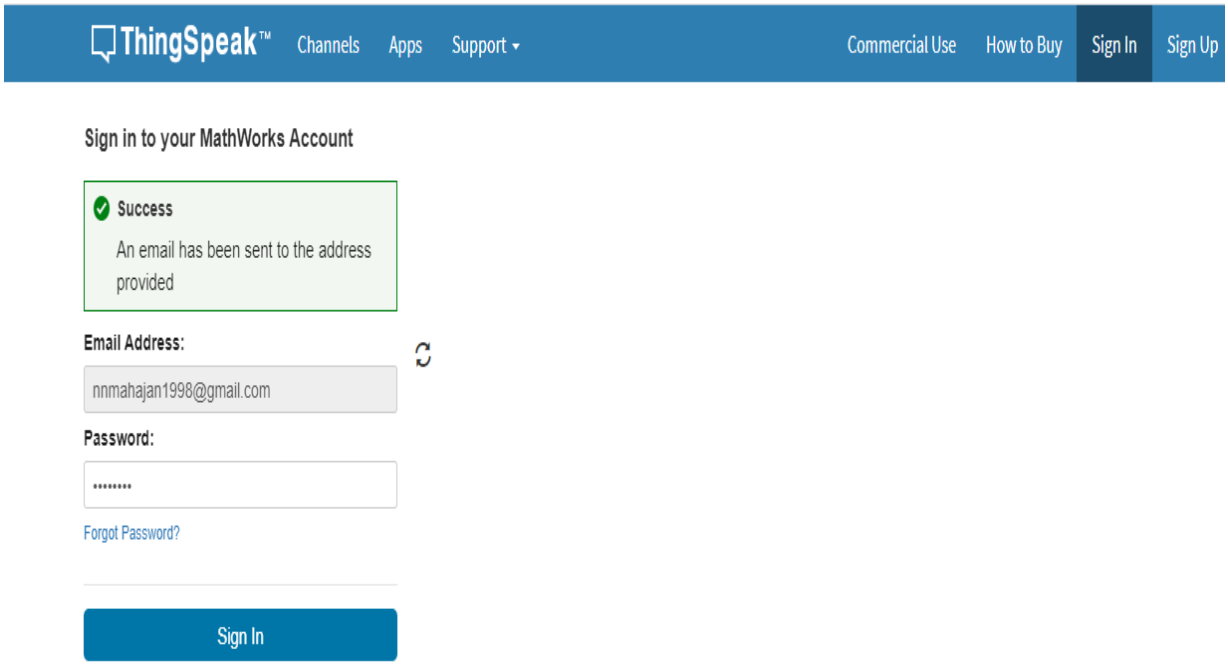
This is new channel page.check the boxes next to fields 1-3.

each channel contains 8 fields and each field associated with one sensor.

then click on save channel at bottom of setting which shows various

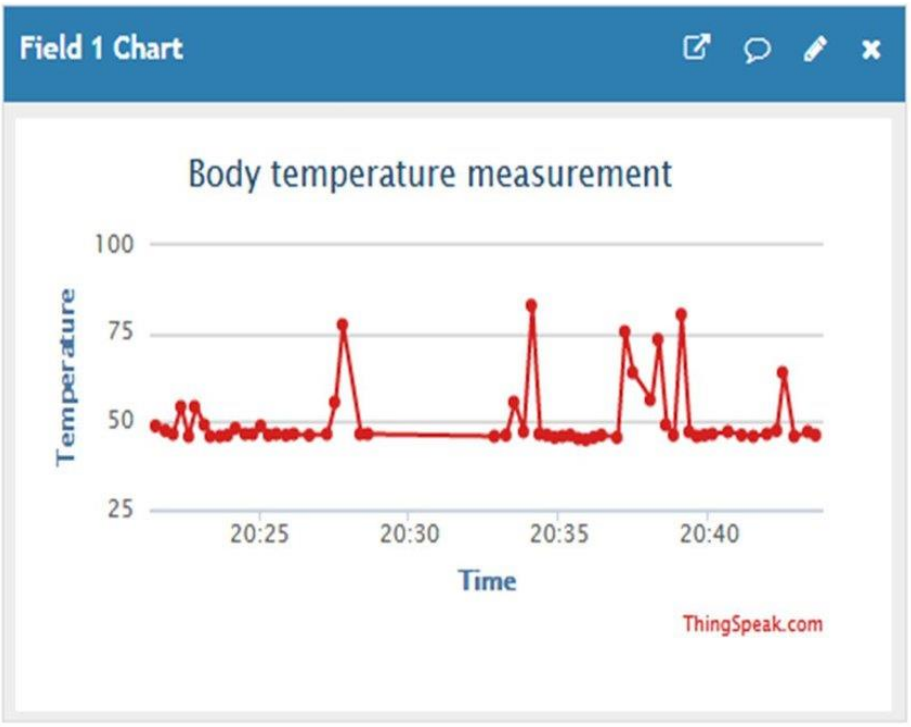
tabs like private view,public view ,channel setting sharing,api keys ,data import/expport.

Login page:



This is login page of Thingspeak server.
Free accounts offer a fully functional experience on ThingSpeak with limits on certain functionality. Commercial users may sign up for a time-limited free evaluation. To send data faster to ThingSpeak or to send more data, consider for commercial, academic, home and student usage.
To start using ThingSpeak you must create a new MathWorks account, or, click cancel and log in using an existing MathWorks account.

Temperature Measurement:

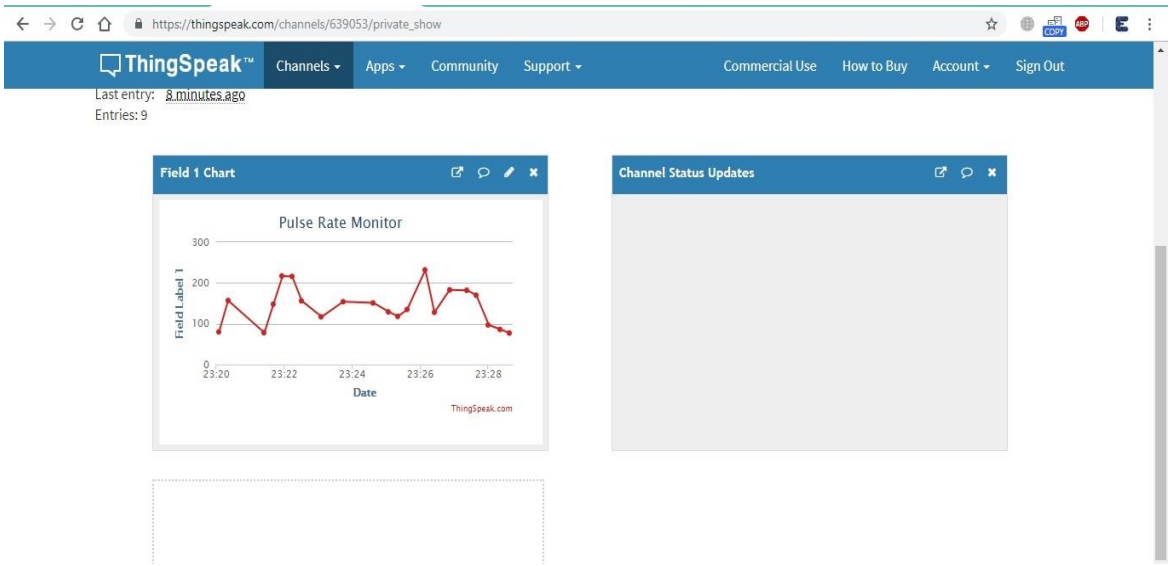


This is output screen which show body temperature of particular patient.

HeartBeat Measurement:

This is output screen which show Heartbeat of particular patient.

Blood Pressure Measurement:



Above field associated with Blood pressure sensor which shows blood pressure particular patient .

Chapter 6

CONCLUSIONS AND FUTURE SCOPE

CONCLUSION:

The proposed system of patient health monitoring keeps track of your patient's health status.specially our system very for people who wants to keep track of their patient health status while at work. And our system is also useful in big hospitals.so our system puts forward a smart patient health tracking system that uses internet to inform their loved ones in case of any issues. Our system monitor four health parameter of patient such as temperature, blood pressure, heartbeat, sugar. And system measures sugar level of patient without taking blood sample from patients body which is advantage of our system.so in this way the proposed system of patient health monitoring can monitor,
record and store patient health status.

FUTURE SCOPE:

Based on current status of proposed system following features will be considering for future enhancement. our current work can also extend further to monitor eyeblink
Of comatose patient and patient affected by other particular disease during coma phase.

We can also extend this system by connecting mobile application to current system.

In future the iot device can be combined with the cloud computing so that the database can shared in all the hospitals for intensive care and treatment

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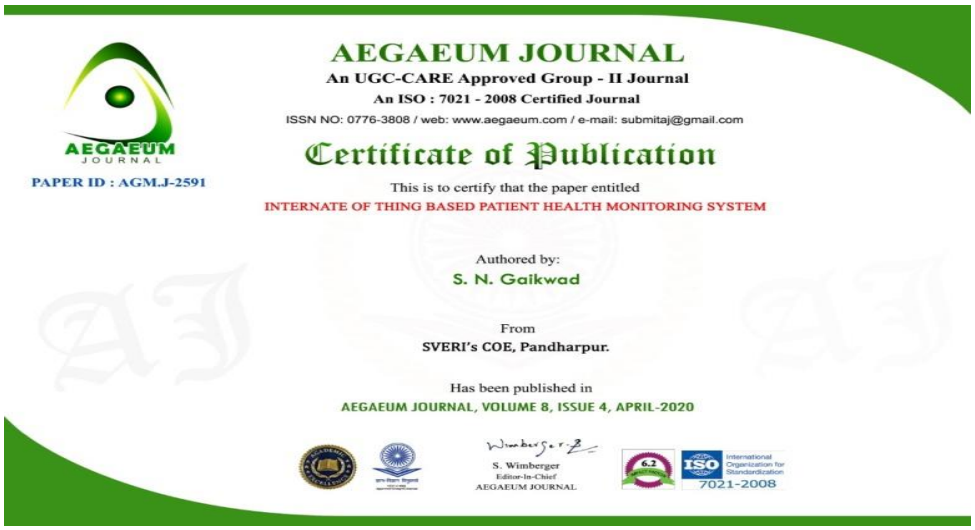

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Authored by:

S. N. Gaikwad

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SVERI's COE, Pandharpur.

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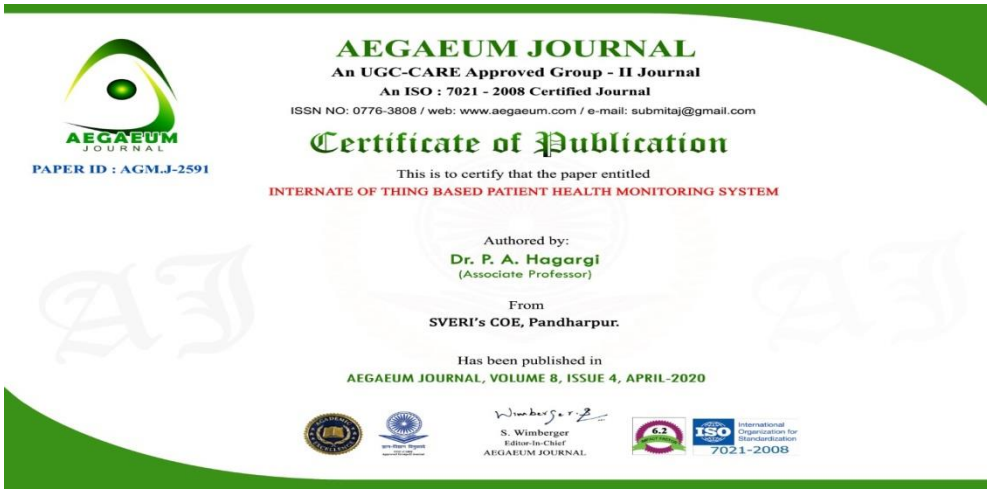

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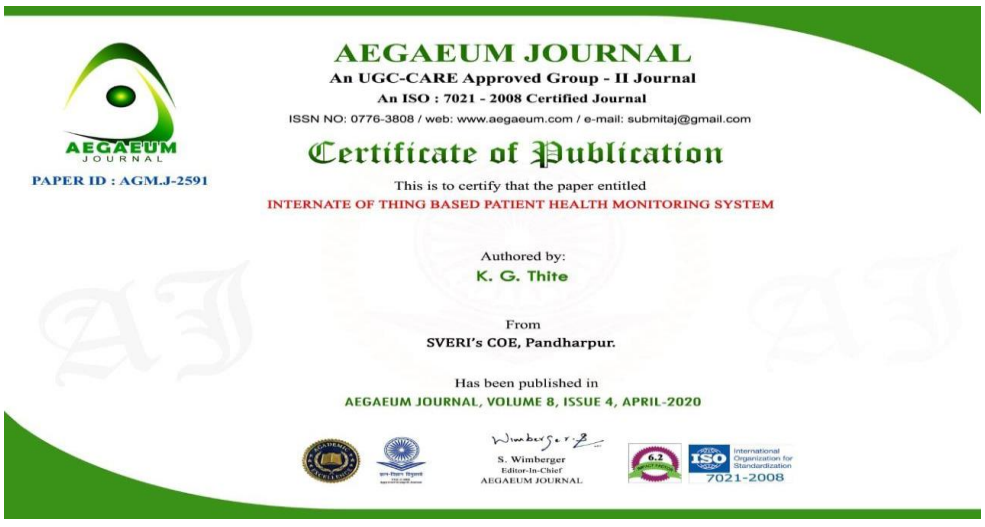

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INTERNATE OF THING BASED PATIENT HEALTH MONITORING SYSTEM

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Abstract:*The technical revolution in the region of Internet of Things makes all object interconnected. The concept of IoT has been used in so many fields from Smart Home to Smart City. But the main assistance of IoT in healthcare is just out-of-the-way. Patients are facing a problematic situation of unforeseen demise due to the specific reason of heart problems and attack which is because of nonexistence of good medical maintenance to patients at the needed time. This is for specially monitoring the old age patients and informing doctors and loved ones. This paper proposes an idea of Patient Monitoring System which monitors the real time health parameters of the patient which includes Temperature, Heartbeat, blood Pressure, Sugar Level with the use of different sensors are connected to the Arduino-uno. To track the patient health micro-controller is in turn interfaced to a LcD display and wi-fi connection to send the data to the web-server (wireless sensing node). In case of any abrupt changes in patient heart-rate or body temperature alert is sent about the patient using IoT.To design an efficient Remote Monitoring System, Security is of imperial importance. Therefore the system presents quality healthcare to all patients.*

Keywords: **Internet of Thing(IoT); Atmega328p microcontroller; Temperature Sensor(LM3); Heartbeat Sensor; Sugar Sensor(MQ2); Wi-Fi module(ESP 8266); L.C.D;**

1. Introduction

In the recent years wireless technology has increasing for the need of upholding various sectors .In these recent years IoT graped the most of industrial area specially automation and control. Biomedical is one of recent trend to provide better health care. Not only in hospitals but also the personal health caring facilities are opened by the IoT technology. So having a smart system various parameters are observed that consumes power, cost and increase efficiency .In according to this smart system , this paper is reviewed.In traditional method, doctors play an important role in health check up. For this process requires a lot of time for registration, appointment and then check up. Also reports are generated later. Due to this lengthy process working people tend to ignore the checkups or postpone it. This modern approach reduces time consumption in the process. In the recent years use of wireless technology is increasing for the need of upholding various sectors .In these recent years IoT groped the most of industrial area specially automation and control. Biomedical is one of recent trends to provide better health care. Not only in hospitals but also the personal health care facilities are opened by the IoT technology. So having a smart system, various parameters are observed that consume power, cost and increase efficiency .In accordance with this smart system, this paper is reviewed. Medical scientists are trying in the field of innovation and research since many decades to get better health services and happiness in human lives. Their contribution in medical area is very important to us and cannot be neglected.

The Internet of things is defined as the integration of all devices that connect to the network, which can be managed from the web and in turn provide information in real time, to allow interaction with people they use it. On the other hand, the Internet of things can be seen from three paradigms, which are Internet-oriented middleware, things sensors oriented and knowledge-oriented semantics.

The arduino is a programmable device that can sense and interact with its environment. It is great open source microcontroller platform that allows electronic enthusiasts to build quickly, easily and with low cost small automation and monitoring projects. The combination of IoT with arduino is the new way of introducing Internet of Things in Health care Monitoring system of patients. Arduino Uno board collects data from the sensors and transfer wirelessly to IoT website.

2. Methodology:

The main purpose of proposed system is to monitor various health parameters of patient such as Temperature,Blood Pressure,Heart beat , and sugar remotely.The proposed method of Internet Of Thing based patient monitoring system monitors patients health parameter using arduino uno. After connecting internet to the arduino uno, it is connected to cloude database system(Thing speak) which act as server.

2.1 Block Diagram:

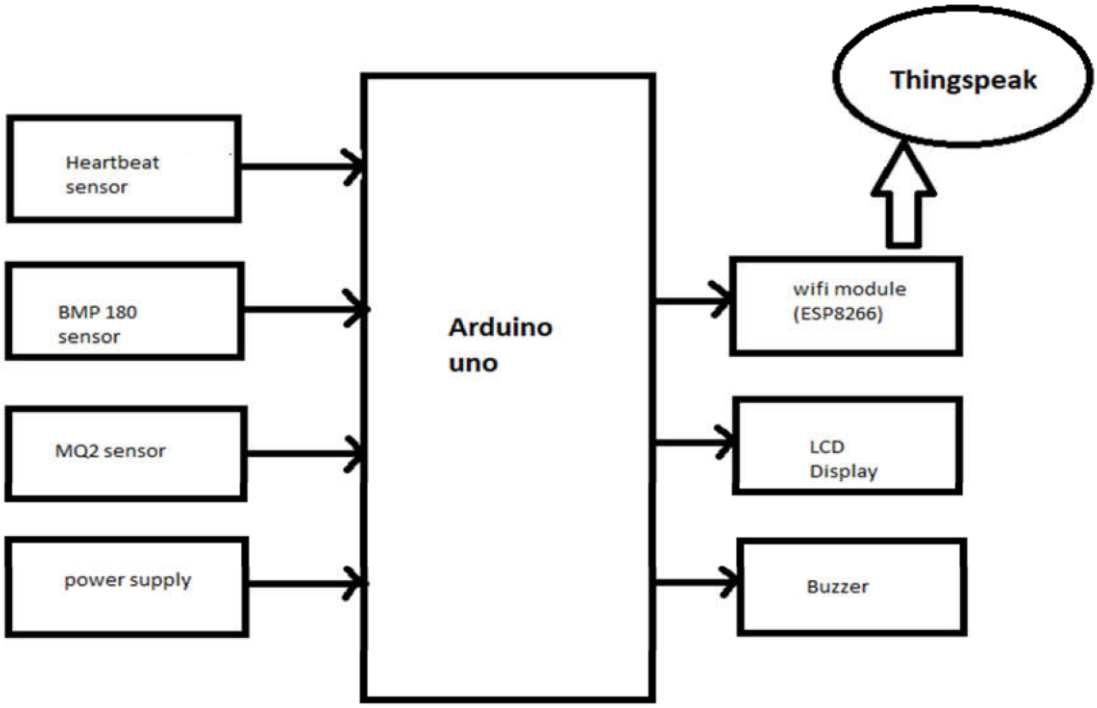

Figure 1. Block Diagram

Internet Of Thing based patient health monitoring system consists of Arduino uno,wifi module(ESP8266),LCD Disply,Buzzer,Power supply and sensors.

2.2. Hardware Used:

The sensors used for the proposed system are:

1.Heart beat sensor:

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats Per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Figure 2. Heart

Beat sensor.

2.Sugar

sensor(MQ2):

This sensor is used to measure sugar level. MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide. MQ2 gas sensor is also known as chemiresistor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

Figure 3. sugar sensor.

3. BMP180 sensor:

This sensor is used to measure Temperature and Blood Pressure. BMP180 is one of sensor of BMP XXX series. They are all designed to measure Barometric Pressure **or** Atmospheric pressure. BMP180 is a high precision sensor designed for consumer applications. Barometric Pressure is nothing but weight of air applied on everything.

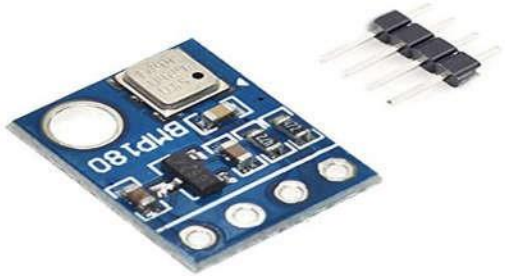

Figure 4. BMP180 sensor.

4. Microcontroller:

The uno is microconttroller board based on the ATmega328p. ATmega328 is a microcontroller chip found on Arduino Uno boards. ATmega328 microcontrollers are from the 8-bit AVR microcontroller family.The image below shows an AVR ATmega328 microcontroller chip. The exact part number of this chip is ATMEGA328P-PU as found printed on the top of the chip.

Figure 5. Microcontroller

5. WIFI module(ESP8266):

The Arduino Uno WiFi is an Arduino Uno with an integrated WiFi module. The board is based on the ATmega328P with an ESP8266 WiFi Module integrated. The ESP8266 WiFi Module is a self contained SoC with integrated TCP/IP protocol stack that can give access to your WiFi network (or the device can act as an access point). One useful feature of Uno WiFi is support for OTA (over-the-air) programming, either for transfer of Arduino sketches or WiFi firmware.

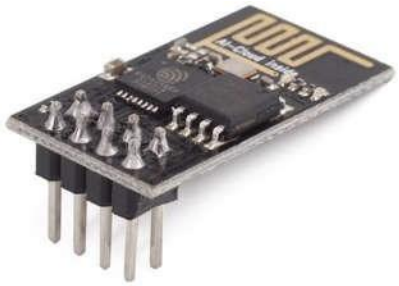

Figure 6. WIFI module(ESP8266).

6.LCD Display:

A Liquid Crystal Display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

Figure 7. LCD Display

6. Buzzer:

Arduino: Piezo speakers (buzzers) A "piezo buzzer" is basically a tiny speaker that you can connect directly to an Arduino. "Piezoelectricity" is an effect where certain crystals will change shape when you apply electricity to them. By applying an electric signal at the right frequency, the crystal can make sound.

Figure 8. Buzzer

2.2. Algorithm Of Working Principle:

start
Step 1: Turn on power supply.
Step 2: Hardware Component initialization.
Step 3: Check WIFI is connected to ESP8266 or not.
If Yes go to
Step 4 Else go
to Step 5
Step 4:The Controller fetches data from the sensors attached to the patient's body anddisplay it on LCD at the same time send it to server.if patient vital parameters are not within the standard range it will display red marks which indicate alert message to server via WIFI module.
Step 5:Wait for WIFI connection.
Step 6: Repeat the above steps in an
infinite loop . stop

3. CONCLUSION:

The proposed system of patient health monitoring keeps track of your patient's health status.specially our system very for people who wants to keep track of their patient health status while at work. And our system is also useful in big hospitals.so our system puts forward a smart patient health tracking system that uses internet to inform their loved ones in case of any issues. Our system monitor four health parameter of patient such as temperature, blood pressure, heartbeat, sugar. And system measures sugar level of patient without taking blood sample from patients body which is advantage of our system.so in this way the proposed system of patient health monitoring can monitor, record and store patient health status.

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