1 Title Page

Smart Health Care Monitoring System Using IOT Technology

A PROJECT REPORT

Submitted by

Dhage Swapnil
Pawar Sonali
Yamunwad Maheshwari

DIPLOMA IN

Medical Electronics Engineering Department

At

Government Polytechnic College Nanded

1964

Roll No- 1710,1713,1718

2 Acknowledgement

I would like to express my special thanks of gratitude to my mentor **Mr.S.D.Kharjule Sir** as well as our HOD **Mr.B.V.Yadav** Sir who gave me the golden opportunity to do this wonderful project on the topic **Smart Helath Care Monitoring System Using IOT Technology**, which also helped me in doing a lot of Research and i came to know about so many new things I am really thankful to them.

Secondly i would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

3 Abstract

IOT is one of the booming field in forthcoming years and plays a major role in the field of health care.

Smart health is important application in Internet of things.

Patients with abnormal health conditions can be quickly monitored through smart health care system and provide a rapid solution for the patients.

This type of solutions can be encountered through wearable gadgets that

continuously monitor the activity and condition of the patient in a predictable method. The main aim of this work is to provide an extensive research in capturing the sensor data's, analyzing the data and providing a feedback to patients based on different health parameters.

4 Contents

5 List of Figures

6 Chapter-

6.1 INTRODUCTION-

6.1.1 Project Overview-

In this project, we have designed the *IoT Based Patient Health Monitoring System using ESP8266 & Arduino.*

The IoT platform used in this project is Thing Speak.

Thing Speak is an open-source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network.

This IoT device could read the pulse rate and measure the surrounding temperature.

It continuously monitors the pulse rate and surrounding temperature and updates them to an IoT platform.

The Internet of Things for the medical equipment will produce data that can go a long way in not only increasing equipment efficiency, but also patient health.

The Internet of Things (IoT) is increasingly being recognized by industry and different services mainly in healthcare. (Mrs. Anjali S. Yeole)

6.1.2 Hardware Specification-

6.1.2.1 Components Used In Projects-

1. ***Arduino Board-*** (Louis, April 2016)

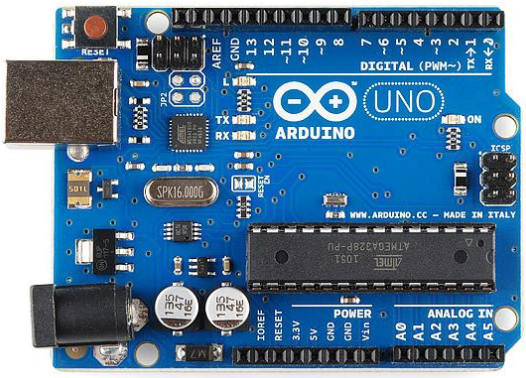


Figure 1Arduino Uno Board

Arduino is an open source microcontroller which can be easily programmed, erased and

reprogrammed at any instant of time.

Introduced in 2005 the Arduino platform was designed to provide an inexpensive and easy way for hobbyists, students and professionals to create devices that interact with their environment using sensors and actuators.

Based on simple microcontroller boards, it is an open source computing platform that is used for constructing and programming electronic devices.

It is also capable of acting as a mini computer just like other microcontrollers by taking inputs and controlling the outputs for a variety of electronics devices.

It is also capable of receiving and sending information over the internet with the help of various Arduino shields.

Arduino uses a hardware known as the Arduino development board and software for developing the code known as the Arduino IDE (Integrated Development Environment).

Built up with the 8-bit Atmel AVR microcontroller's that are manufactured by Atmel or a 32-bit Atmel ARM, these microcontrollers can be programmed easily using the C or C++ language in the Arduino IDE.

- **Elements of arduino boards-**

Elements of an Arduino Board can be done into two categories:

1. Hardware
2. Software

- **HARDWARE-**

1.Microcontroller:- This is the heart of the development board, which works as a mini computer and can receive as well as send information or command to the peripheral devices connected to it.

The microcontroller used differs from board to board; it also has its own various specifications.

2.External Power Supply:- This power supply is used to power the Arduino development board with a regulated voltage ranging from 9 – 12 volts.

3.USB plug: This plug is a very important port in this board. It is used to upload (burn) a program to the microcontroller using a USB cable. It also has a regulated power of 5V which also powers the Arduino board in cases when the External Power Supply is absent.

4.Internal Programmer: The developed software code can be uploaded to the microcontroller via USB port, without an external programmer.

5.Reset button: This button is present on the board and can be used to resets the Arduino microcontroller.

6. Analog Pins: There are some analog input pins ranging from A0 – A7 (typical). These pins are used for the analog input / output. The no. of analog pins also varies from board to board.

7. Digital I/O Pins: There are some digital input pins also ranging from 2 to 16 (typical). These pins are used for the digital input / output. The no. of these digital pins also varies from board to board.

8.Power and GND Pins: There are pins on the development board that provide 3.3, 5 volts and ground through them.

Technical Specification of Arduino- (2000)

1. Processor-ATmega328 @ 16 MHz
2. RAM size:- 2048 bytes
3. Program memory size:- 31.5 Kbytes
4. Digital I/O pins- 14
5. Analog Pins- 6
6. Max current on a single I/O:- 40 mA
7. Minimum operating voltage:-7 V
8. Maximum operating voltage:- 12 V

2. Pulse Sensors-

Figure 2 Pulse Rate Sensor

The pulse sensor module includes a lightweight that helps in measurement the heart beat rate.

When we place the finger on the heart beat device, the light reflected can modification supported the quantity of blood within the capillary blood vessel.

(Shivleela Patil, 2018) Pulse sensor is designed to give analog output of heart beat when a finger is placed on sensor. It starts working;

LED on top side will starts blinking with each heart beat.

To see the sensor output, output pin of sensor is connected to controller .

The working principle of sensor is based on light modulation by blood flow through nerves at each heart pulse.

Working of Pulse sensor- (Components 101, n.d.)

The sensor has two sides, on one side the LED is placed along with an ambient light sensor and on the other side we have some circuitry.

This circuitry is responsible for the amplification and noise cancellation work. The LED on the front side of the sensor is placed over a vein in our human body. This can either be your Finger tip or you ear tips, but it should be placed directly on top of a vein.

Now the LED emits light which will fall on the vein directly. The veins will have blood flow inside them only when the heart is pumping, so if we monitor the flow of blood we can monitor the heart beats as well. If the flow of blood is detected then the ambient light sensor will pick up more light since they will be reflect ted by the blood, this minor change in received light is analysed over time to determine our heart beats.

Pin Configuration- (Components 101, n.d.)

Pin Number	Pin Name	Wire Colour	Description
1	Ground	Black	Connected to the ground of the system
2	Vcc	Red	Connect to +5V or +3.3V supply voltage
3	Signal	Purple	Pulsating output signal.

Applications- (Components 101, n.d.)

- Sleep Tracking
- Anxiety monitoring
- Remote patient monitoring/alarm system
- Health bands
- Advanced gaming consoles

3. ESP8266-01 module-

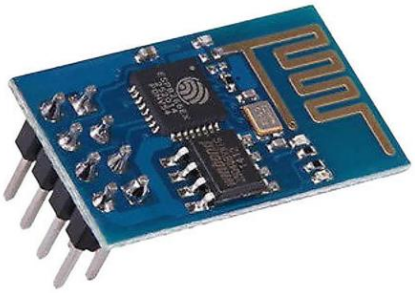


Figure 3 ESP8266-01 Wifi Module

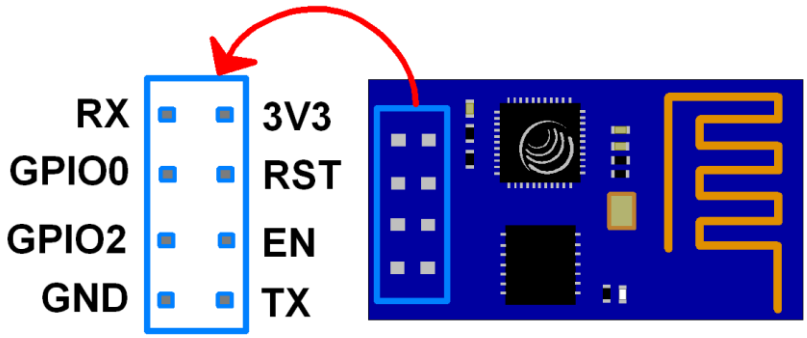


Figure 4 ESP8266 WiFi Module Pinout

1. 3V3: – 3.3 V Power Pin.
2. GND: – Ground Pin.

3. RST: – Active Low Reset Pin.
4. EN: – Active High Enable Pin.
5. TX: – Serial Transmit Pin of UART.
6. RX: – Serial Receive Pin of UART.
7. GPIO0 & GPIO2: – General Purpose I/O Pins. It also known as TX/RX pins are used for Programming the module or for serial I/O purpose.

(Shivleela Patil, 2018) The ESP8266 wifi module is a self contained SOC with incorporated TCP/IP protocol stack that can offer any controller access to wifi network.

It uses 802.11 b/g/n protocols. Standby power consumption is less than 0.1mW.

(techzeero, n.d.)It is mostly used for the development of the Internet of Things (IoT) embedded applications.

There are many third-party manufacturers that produce different modules based on this chip (ESP8266). So, the module may come with different pin availability options like,

1. ESP-01 comes with 8 pins (2 GPIO pins) with PCB (printed circuit board) trace antenna.
2. ESP-02 comes with 8 pins, (3 GPIO pins) with a U-FL antenna connector.
3. ESP-03 comes with 14 pins, (7 GPIO pins) with Ceramic antenna.
4. ESP-04 comes with 14 pins, (7 GPIO pins) and without an antenna.

Technical Specification- (techzeero, n.d.)

1. General-purpose input/output (16 GPIO).
2. Inter-Integrated Circuit (I^2C) serial communication protocol.
3. Analog-to-digital conversion (10-bit ADC).
4. Serial Peripheral Interface (SPI) serial communication protocol.
5. I^2S (Inter-IC Sound) interfaces with DMA(Direct Memory Access) (sharing pins with GPIO).
6. UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2).
7. Pulse-width modulation (PWM),
8. GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2).

4. **LM35 Temperature Sensor-** (Puput Dani Prasetyo Adi, 2018)

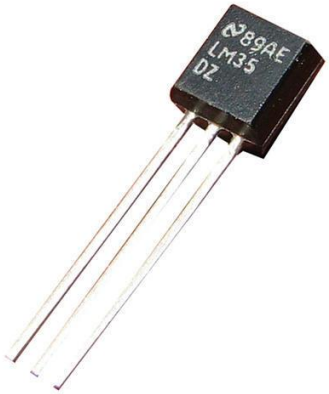


Figure 5 LM35 Temperature Sensor

The LM35 temperature sensor is used to convert temperature to electrical quantities in the form of voltage.

Nevertheless, this sensor has high accuracy and easy to design.

Accordingly, the input pins of LM35 temperature sensors different with DHT11 Temperature and humidity sensors, the difference is in the position of the input data.

The theory of LM35 use analog input data from Arduino board and DHT11 use Digital input data from Arduino board.

LM35 Temperature sensor, in a schematic, describes 3 input/output pins GND, data / Vout and Vs, Vs 4 to 20 Volt Dc, Vout of 10 mV / C.

LM35 Temperature Sensors work with change a temperature value into a voltage quantity.

Accordingly The ideal voltage of LM35 temperature sensor has a temperature ratio of 100°C equivalent to 1 volt. and This sensor has self-heating <0.1 ° C**.**

Therefore, LM35 sensor converts the physical temperature to a voltage that has a coefficient of 10 mV / °C, which means a rise in temperature of 1 ° C will increase in temperature by 10 mV.

5. LCD 16x2 Display-

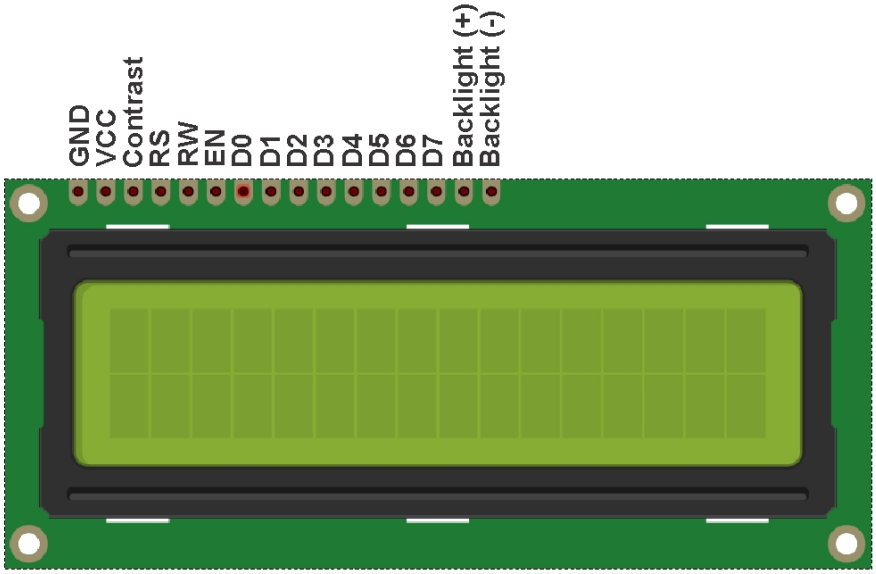


Figure 6 Pin Diagram Of LCD 16x2 display

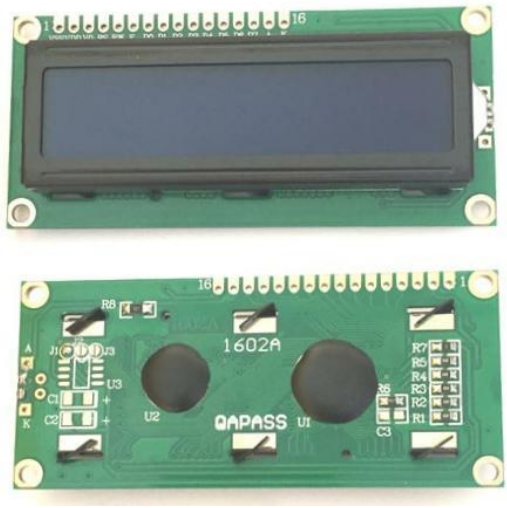


Figure 7 front and Back Side of LCD 16x2 display

(thingbits, n.d.) An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications.

A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix.

The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols.

This LCD has two registers, namely, Command and Data.

Features of LCD 16x2- (ElProCus, n.d.)

- ✓ The operating voltage- 4.7V-5.3V
- ✓ It includes two rows where each row can produce 16-characters.
- ✓ The utilization current - 1mA with no backlight
- ✓ Every character can be built with a 5×8 pixel box
- ✓ The alphanumeric LCDs alphabets & numbers
- ✓ Is display can work on two modes like 4-bit & 8-bit
- ✓ These are obtainable in Blue & Green Backlight
- ✓ It displays a few custom generated characters.

Registers of LCD- (ElProCus, n.d.)

A 16×2 LCD has two registers like data register and command register. The RS (register select) is mainly used to change from one register to another. When the register set is '0', then it is known as command register. Similarly, when the register set is '1', then it is known as data register.

- Command Register- The main function of the command register is to store the instructions of command which are given to the display. So that predefined tasks can be performed such as clearing the display, initializing, set the cursor place, and display control. Here commands processing can occur within the register.
- Data Register- The main function of the data register is to store the information which is to be exhibited on the LCD screen. Here, the ASCII value of the character is the information which is to be exhibited on the screen of LCD. Whenever we send the information to LCD, it

transmits to the data register, and then the process will be starting there. When register set =1, then the data register will be selected.

Applications of LCD 16x2 Display- (microcontrollerslab, n.d.)

1. In most of the applications that's have only small values to show, uses the LCD.
2. Most of the commercial meters use this module to represent the data output.
3. In the toys and developing projects, it is still vastly in use.
4. In black and white printers, it helps to show the printer settings and status.

6. Potentiometer-

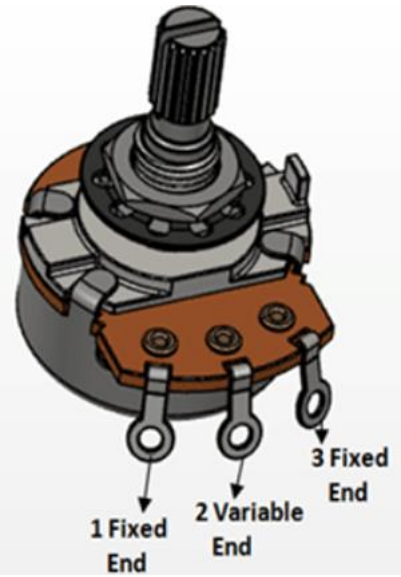


Figure 8 Poterntiometer

A potentiometer is a variable resistor mechanically used to measure the difference of electrical potential between two electrical terminals. The potential difference is what is commonly known as voltage.

The potentiometer is a device that limits the passage of electrical current, causing a voltage fall. The fact that the voltage can vary makes it possible to control different devices, since the operation of the devices can be regulated by the amount of voltage given by the potentiometer.

The value of these resistances can be modified by the user.

7. printed circuit board (PCB)

(Xu, 2019)**PCB** not only is an important electronic component, but also a provider of circuit connections. In our The working principle of the PCB: It isolates the surface copper foil conductive layer by using the board-based insulating material to allow current to flow along pre-designed routes in various components. Thereby performing functions such as work, amplification, attenuation, modulation, demodulation, encoding and the like.

On the most basic PCB, the parts are concentrated on one side and the wires are concentrated on the other side. Since the wire only appears on one side, this PCB is called a single-sided PCB.

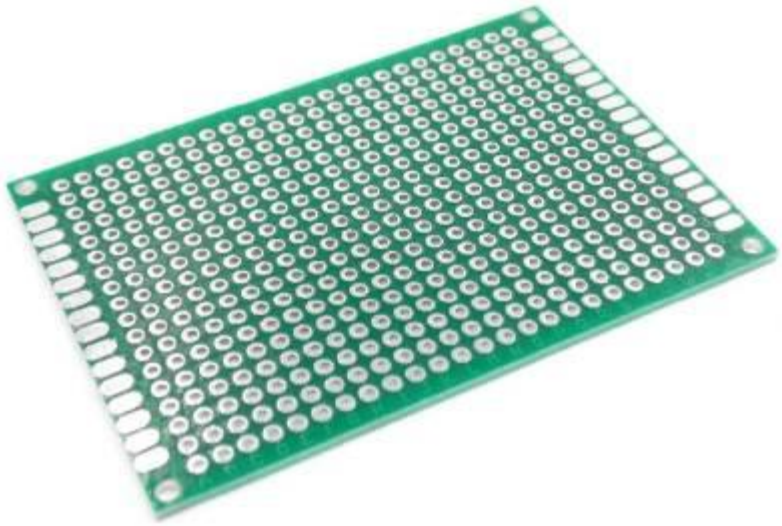


Figure 9 PCB

Application :

1. Medical Devices

The healthcare sector is using growing numbers of PCBs as technologies advance, revealing new capabilities. PCBs play a role in devices used for diagnostics, monitoring, treatment and more.

2. LEDs

Light-emitting diodes, or LEDs, are an increasingly popular lighting technology used for residential and commercial lighting and across numerous industries including the automotive, medical and computer technology sectors. LEDs are favored for their energy efficiency, long life and compactness.

3. Consumer Electronics

Smartphones, computers and the many other consumer products that people use daily require PCBs to function. As we add electronics to more of our products, PCBs become a bigger part of our daily lives.

4. Industrial Equipment

Printed circuit board uses in the industrial sector vary widely. Electronic components power much of the equipment in manufacturing and distribution centers as well as other types of industrial facilities.

5. Automotive Components

Automotive manufacturers are using growing numbers of electronic components in their vehicles. In earlier times, PCBs were only used for things like windshield wipers and headlight switches, but today they enable many advanced features that make driving safer and easier.

6. Aerospace Components

The electronics used in aerospace applications have similar requirements to those used in the automotive sector, but aerospace PCBs may be exposed to even harsher conditions. PCBs may be used in a variety of aerospace equipment including planes, space shuttles, satellites and radio communications systems.

7. Maritime Applications

All sorts of marine vessels and systems rely on PCBs to function. This includes small vessels, large cargo ships, submarines, communications systems and navigation equipment.

8. Safety and Security Equipment

Many aspects of security systems, whether for homes, businesses or government buildings, rely on PCBs. They play a role in our safety and security more often than many people realize.

9. Telecommunications Equipment

PCBs are a critical part of the telecommunications industry. They're necessary for consumer devices such as smartphones but also for the infrastructure that enables those devices to work.

10. Military and Defense Applications

The military uses PCBs for a wide range of applications, including communications equipment, computers, vehicles, firearms and more.

(https://emsginc.com/resources/10-common-pcb-applications/)

Specification of PCB :

- Dimension - 4×6 CM
- Quantity: - 2 PCS
- Base Material - FR4
- Copper Thickness - 1-4 OZ
- Board Thickness - 1.6
- PCB Weight: - 6 gm
- PCB color: - Gree

8. **Jumper Wires-**

Figure 10 Jumper wires

(K. Chidhambaram, May 2019) The jumper wires used in Arduino uno and breadboards is of three major types they are as follows.

• Male to male jumper wires.

• Male to female jumper wires.

• Female to female jumper wires

Wires suitable for prototyping these wires can be connected to any header with a 2.54 mm (0.1") pitch.

Handy for making wire harnesses or jumpering between headers on PCB's they have 0.1" sockets on either end or fit cleanly next to each other on standard-pitch header.

For best results, when plugging these in a line, have the sides with the 'silver latch bit' sticking out since that side is a tiny bit wider.

6.1.3 Software Specifications-

- **SOFTWARE-**

In this project software used-

1. **Arduino IDE-** (Louis, April 2016)

The program code written for Arduino is known as a sketch. The software used for developing such sketches for an Arduino is commonly known as the Arduino IDE.

This IDE contains the following parts in it:

• Text editor: This is where the simplified code can be written using a simplified version of C++ programming language.

• Message area: It displays error and also gives a feedback on saving and exporting the code.

• Text: The console displays text output by the Arduino environment including complete error

messages and other information

• Console Toolbar: This toolbar contains various buttons like Verify, Upload, New, Open, Save

and Serial Monitor. On the bottom right hand corner of the window there displays the

Development Board and the Serial Port in use.

2. Thing Speak-

(Pasha, June 2016) The Matlab R2016a is a recent release from the Mathworks and is a new opportunity to offer reliability for the IoT projects and presently Thingspeak is the only IoT web service that offers the data analysis on the Matlab platform as open source with full profile access and a thorough analyzing is possible as per need of the project implementation in the respected areas such as hospitals, oil gas industries etc

Thingspeak is a web based open API IoT source information platform that comprehensive in storing the sensor data of varied 'IoT applications' and conspire the sensed data output in graphical form at the web level.

Thingspeak communicate with the help of internet connection which acts as a 'data packet 'carrier between the connected 'things' and the Thingspeak cloud retrieve, save/store, analyze, observe and work on the sensed data from the connected sensor to the host microcontroller such as 'Arduino,

The most primary feature of Thingspeak functionality is the term 'Channel' that have field for data, field for location, field for status for varied sensed data.

Once channels are created in the 'Thingspeak' the data can be implemented and alternately one can process and visualize the information using the MATLAB and respond to the data with tweets and other forms of alerts.

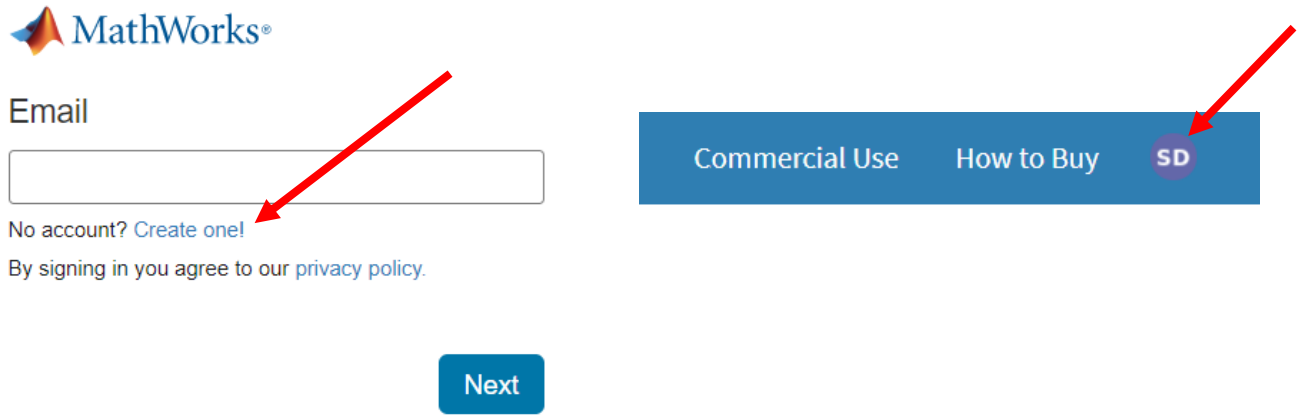
Thingspeak also provide a feature to create a public based channel to analyze and estimate it through public.

6.1.3.1 Steps of connecting thingspeak to the Project-

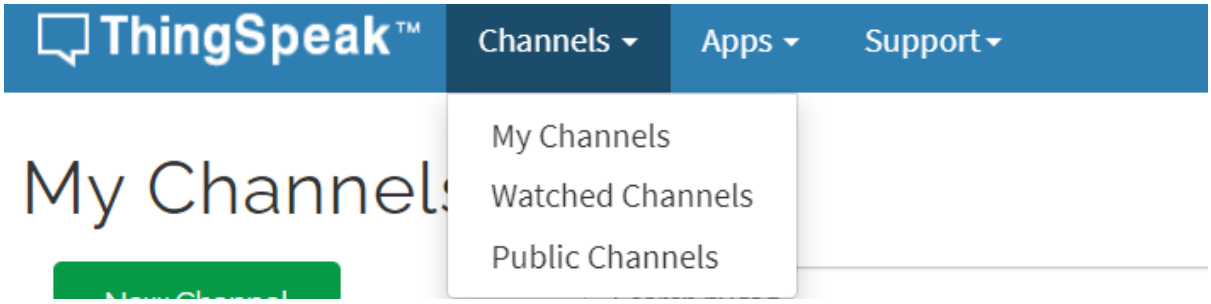
Steps to Connect ESP8266 to Thing Speak-

1. Go to thingspeak.com.

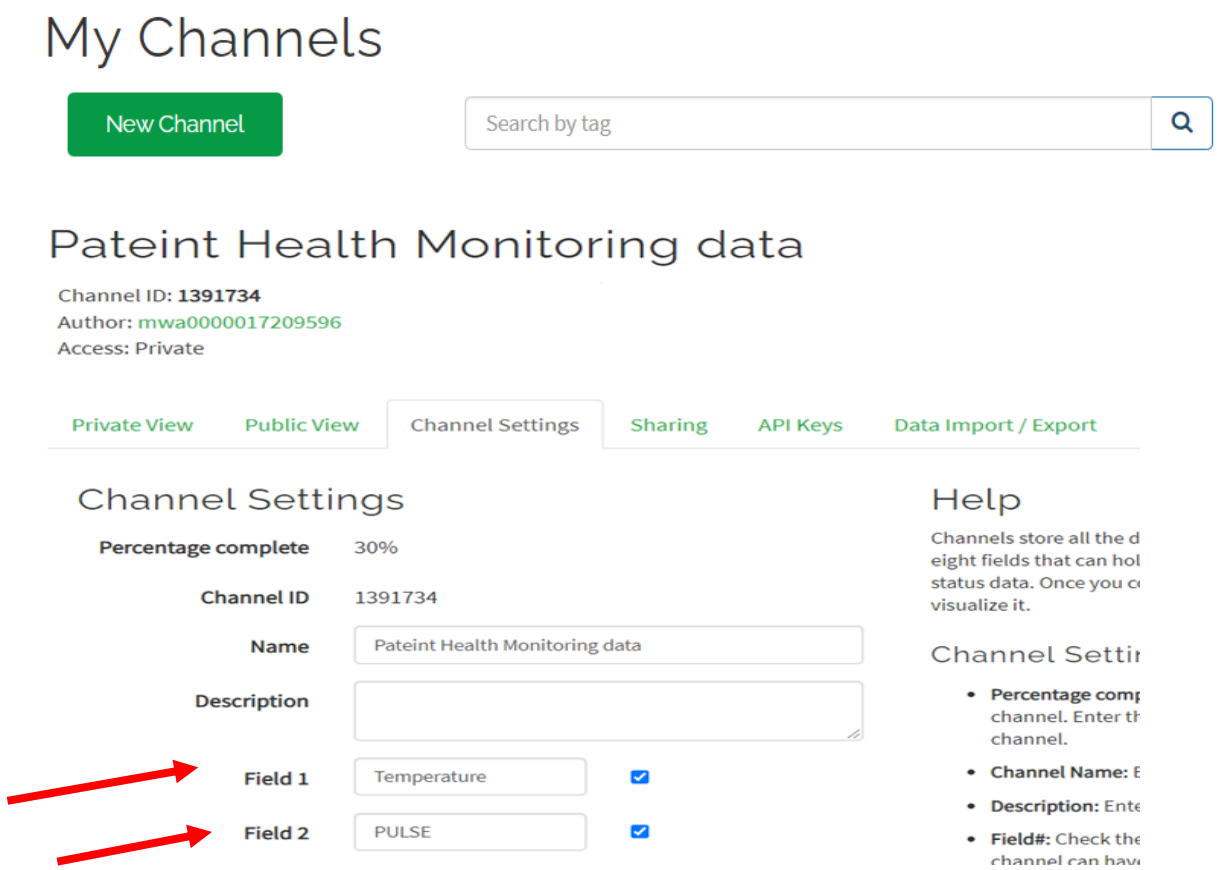
2. Create new account & sign in on thingspeak.com.



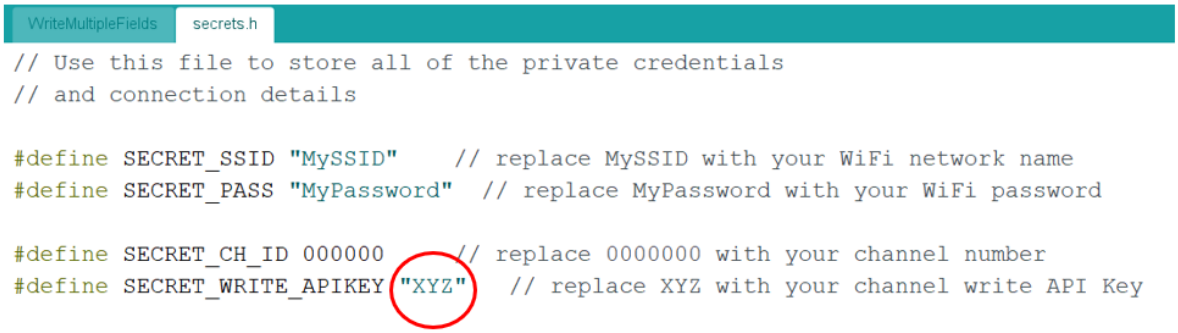
3. Go to my channel menu



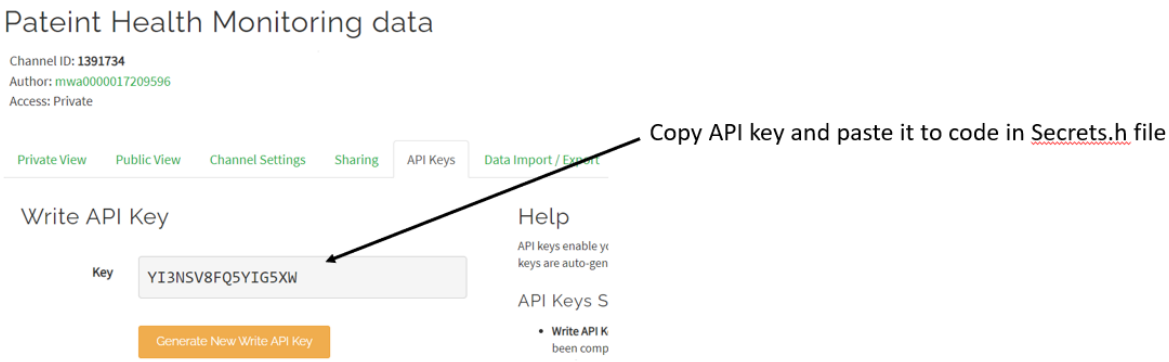
4. Create new channel , with 2 Field



5. code of project, where API and Channel Id are Placed-



6. Go to Thing Speak & click on the **API** key menu-



6.2 SYSTEM STUDY AND ANALYSIS-

6.2.1 Existing System-

6.2.2 Proposed system-

6.2.3 Problem Description-

6.3 SYSTEM DESIGN-

6.3.1 Database Design-

7 Discussion

8 Conclusions

9 References-

(n.d.). Retrieved from microcontrollerslab: https://microcontrollerslab.com/16x2-lcd-pinout-working-examples-programming-applications/

Components 101. (n.d.). Retrieved from https://components101.com/about-us

thingbits. (n.d.). Retrieved from https://www.thingbits.in/products/standard-lcd-16x2-display

(2000). (Pololu) Retrieved from https://www.pololu.com/about

ElProCus. (n.d.). (ElProCus Technologies Pvt Ltd,) Retrieved from https://www.elprocus.com/lcd-16x2-pin-configuration-and-its-working/

https://emsginc.com/resources/10-common-pcb-applications/. (n.d.). Retrieved from Top 10 Applications for PCBs.

K. Chidhambaram, S. A. (May 2019). DESIGN ANALYSIS OF LAND SURVEYING ROBOT USING ARDUINO UNO. *International Research Journal of Engineering and Technology (IRJET)* , 1-7.

Louis, L. (April 2016). International Journal of Control, Automation, Communication and Systems. *WORKING PRINCIPLE OF ARDUINO AND USING IT*, 1-9.

Mrs. Anjali S. Yeole, D. D. (n.d.). *Use of Internet of Things (IoT) in Healthcare*, 1-6.

Pasha, S. (June 2016). Thingspeak Based Sensing and Monitoring System. *International Journal of New Technology and Research (IJNTR), Volume-2*, 1-6.

Puput Dani Prasetyo Adi, A. K. (2018). Performance Evaluation of Multi-Sensor LM35 . *(IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 9*, 1-9.

Shivleela Patil, D. S. (2018). Health Monitoring system using IoT. *International Research Journal of Engineering and Technology (IRJET)*, 1-6.

techzeero. (n.d.). Retrieved from https://techzeero.com/sensors-modules/esp8266-wifi-module/

Xu, N. (2019, June 26). Retrieved from The Working Principle of the PCB.