IOT BASED SENSOR MONITORING WITH ALERT AND AUTOMATION

A PROJECT REPORT

Submitted by

TREZEN PARMAR

In fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

in

Electronics and Communication Engineering Department

Government Engineering College, Bharuch

Gujarat Technological university, Ahmedabad

June, 2021

Government Engineering College, Bharuch

Electronics and Communication Engineering Department

June, 2021

CERTIFICATE

Date : 16/06/2021

This is to certify that the dissertation entitled "IOT BASED SENSOR MONITORING WITH ALERT AND AUTOMATION" has been carried out by TREZEN PARMAR under my guidance in fulfilment of the degree of Bachelor of Engineering in Electronics and Communication Engineering (7th Semester) of Gujarat Technological University, Ahmedabad during the academic year 2021-2022.

Guide : Prof. Hiren Vasava

Head of department

Prof. Kunjal Tandel

Acknowledgement

I would sincerely like to thanks first of all my project guide Prof. Hiren Vasava for guiding me and giving me the permission to proceed with the mini project that I chose, which also helped me in doing a lot of research and I came to know about so many new things.

I would like to extend my gratitude to all the faculty members for giving their valuable time and guiding us all, especially thanks to our HOD Prof. Kunjal Tandel and Prof. Tejas Darji for introducing and guiding all the way through this new subject.

Any attempt at any level can not be satisfactorily completed without the support and guidance of my family and friends.

Thank you to my family and friends for constantly having faith in me and helping me find this project of mine in limited time, gathering different information and supporting me when I was making my project despite of their busy schedule.

Trezen Parmar (180140111059)

Abstract

The Internet of things (IoT) empowers physical resources into smart entities through existing network infrastructures, IoT is inter-networking of physical devices embedded with electronics, software, sensors, actuators, and network connectivity that enable this objects to collect and exchange data. IoT allows objects to be controlled and gather information remotely across the already established network, this gathered information in form of data can be processed, visualized and can be monitored.

The goal of my project is to collect sensor data, send it to Thingspeak IoT cloud service, process and visualize the data in different graph plots, act on received data like when a certain predefined data limit is breached we can get an alert on our device this is done by IFTTT when triggered by react app from Thingspeak via ThingHTTP and accordingly control the AC appliances using a web UI.

This project can be adopted in houses, agriculture, industries, public places etc, to work smart towards improving the efficiency and quality of these sectors.

LIST OF TABLES

Table No. Table Description Page No.

LIST OF FIGURES

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE

Sr.	Symbol / Name	Abbreviations
1.	IoT	Internet of Things
2.	IFTTT	If This Than That
3.	LDR	Light Dependent Resistor
4.	HTTP	Hypertext Transfer Protocol
5.	IP	Internet Protocol
6.	UI	User Interface
7.	LCD	Liquid Crystal Display
8.	Wi-Fi	Wireless Fidelity
9.	AC	Alternating Current
10.	DC	Direct Current
11.	IDE	Integrated Development environment
12.	LED	Light Emitting Diode

TABLE OF CONTENTS

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Chapter 1 : Introduction

1.1 Problem summary and introduction

Monitoring something being personally present at the site is a very time consuming and unproductive thing, even after monitoring to do things that effect the monitored values also take time and human effort. I intend to reduce this human effort by using the concepts of IoT.

We do not need human presence for monitoring something constantly, even we can do this by services provided by different IoT platforms. I have used here Thingspeak IoT cloud services which take up data from the sensor via NodeMCU. This received data can be processed by using MATLAB which is already available on the Thingspeak and also can be visualized using different graph plots.

I have used the React app with ThingHTTP from Thingspeak which senses the change in predefined threshold values, which when exceeded sends HTTP request to IFTTT service with the help of ThingHTTP which sends us mobile notification. Further we can act on received notification by changing the status of devices which can control the values of data received by sensors. For example take light monitoring system which monitors light values with the help of LDR sensor continuously, if light gets low from a predefined value the system will be activated and above stated process will happen which will ultimately send us a notification on our device, and then we can switch ON the light by using the Web UI which can be accessed by a specific IP address. This IP address remains same on the same network so we do not have to check IP constantly.

1.2 Aim and objectives of the project

The main aim of this project is to connect society to IoT. The perks of IoT can make our society smart, more productive and lives easy. We can collect important data of places we want to monitor which has not much sharp changes in data using several sensors and can use them to reduce the harm that human latency can do to the efficiency and productivity.

Today the world is on internet, we all know the advantages, this project is going to connect things also to the internet, this means this all advantages goes to things also. Ultimately this all gives to society, make lives of people easy.

1.3 Plan of the work

I have summarized brief plan of work in these below points.

- Selecting the microcontroller board with Wi-Fi access and connecting it to internet.
- Setting up LCD module to display us the current IP address.
- Interfacing the sensor to microcontroller board.
- Creating a Thingspeak account and a new channel to take up sensor data.
- Connecting Thingspeak channel to microcontroller board so that the collected sensor data could be sent to the Thingspeak channel.
- Visualizing the data with different graph plots.
- Setting up React to act upon data when a certain predefined data limit is reached.
- Setting up IFTTT account to notify us via a mobile notification when React app triggers.
- Connecting the ThingHTTP service to React to send an HTTP request to IFTTT to further send the notification.
- Interfacing relay module to control the AC appliances.
- Designing the Web UI to control the AC appliances over Wi-Fi.
- Connecting the Web UI to microcontroller board and internet to change state of AC appliances online.
- Integrating all this using coding to make each component work simultaneously.

1.4 Materials / Tools required

- NodeMCU.
- Arduino IDE.
- 5v DC power supply.
- LDR sensor.
- Relay module.
- 16*2 LCD module.
- LEDs.
- Resistors.
- Jumper wires.
- Breadboard.
- Internet connection.
- User Accounts on Thingspeak and IFTTT.

Chapter 2 : Implementation

2.1 Working Model

This project is practically implemented and truly tested by myself on all grounds of faults that came to my understandings. Below I present the detailed working and photo of my mini-project setup.

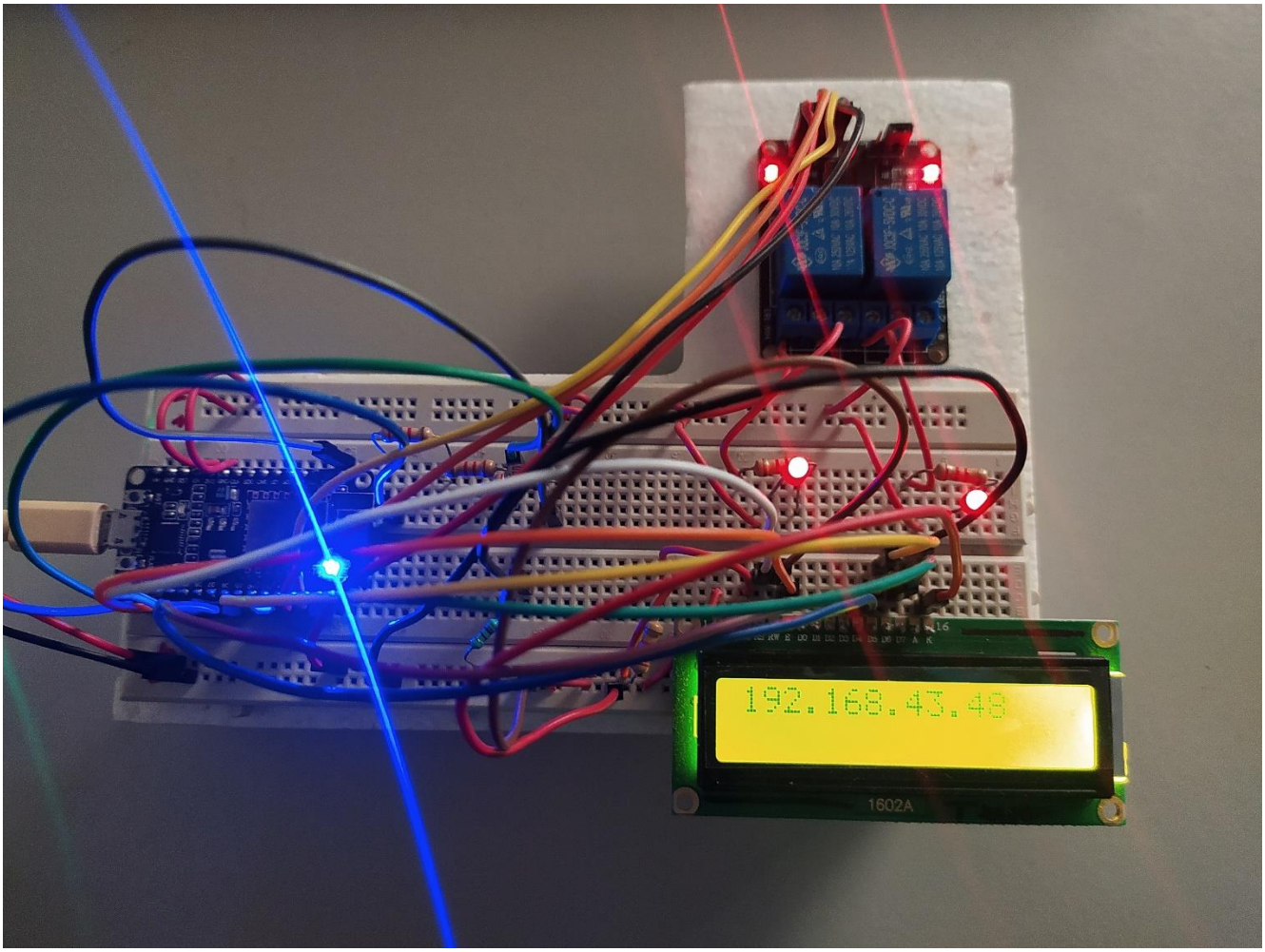


Figure : 1 Mini Project Model

2.2 Project Schematics

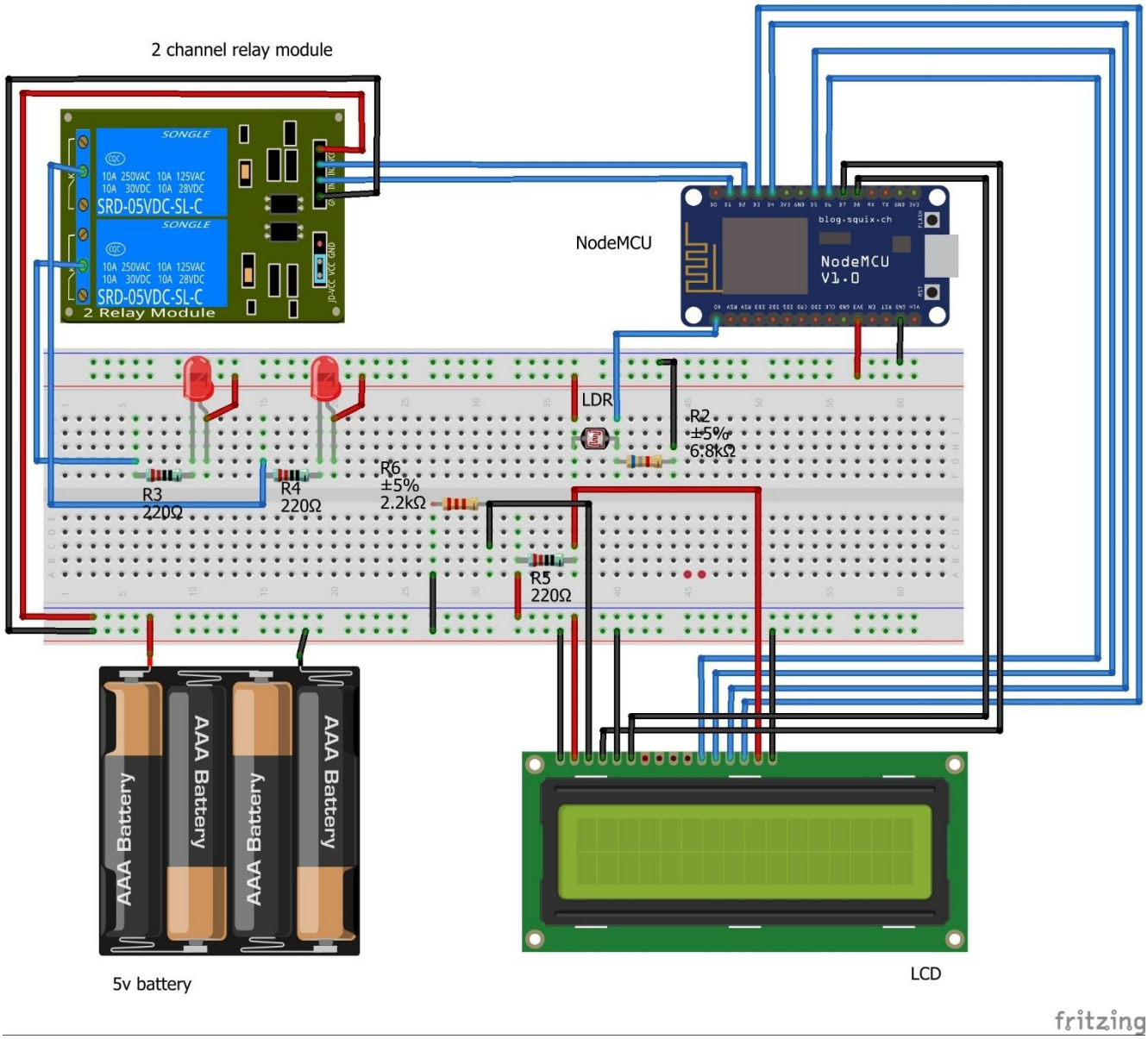


Figure : 2 Breadboard Schematics

The figure above is the detailed schematics of the project made using Fritzing application. The real working project was taken into consideration while designing the schematics.

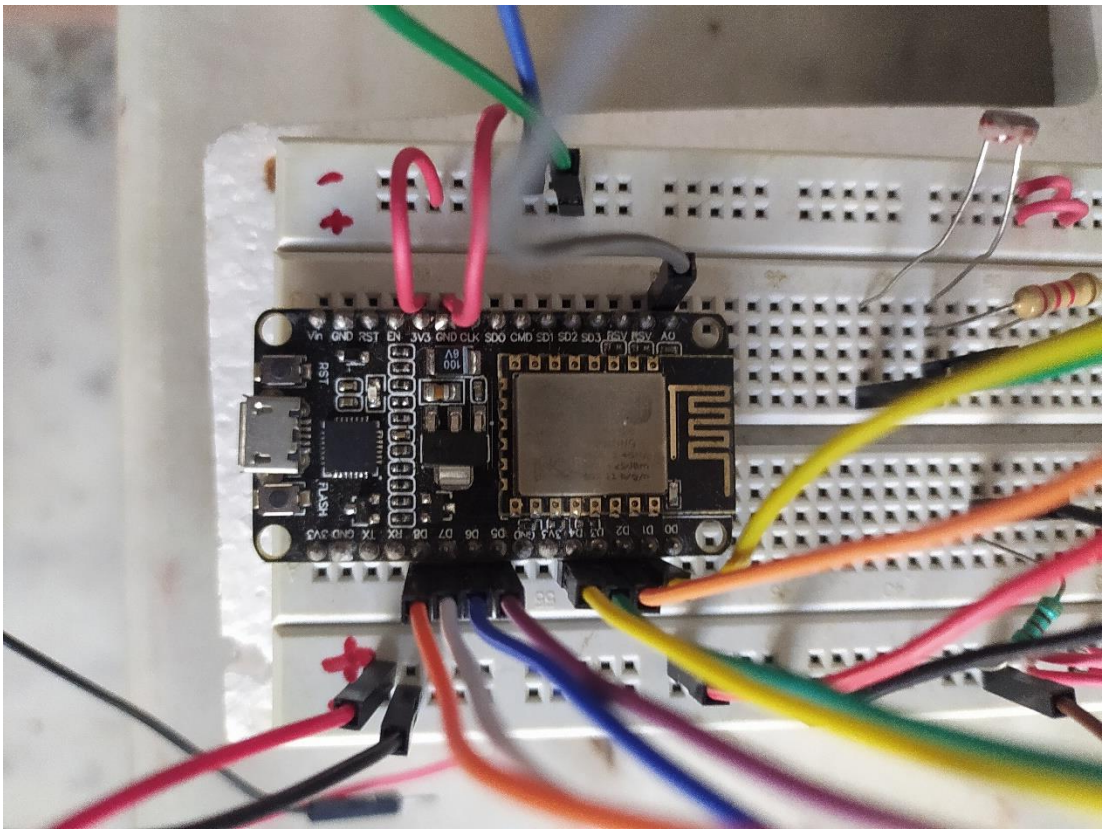
The NodeMCU here is connected directly to the laptop for power supply and debugging purpose.

The AC appliances are replaced by two red LEDs which works as same as AC appliances.

2.2 Detailed working of the model

2.2.1 Step 1 : Configuring the NodeMCU

The working of this project starts with NodeMCU. First we have to setup the NodeMCU connect it to the laptop then open the Arduino IDE and upload the project code wait till the code is fully uploaded. Once uploaded disconnect the NodeMCU from the laptop and then make the necessary connections.



We will see the detailed connections to NodeMCU and interfacing different components in further steps.

To see a detailed pinout diagram of NodeMCU visit Appendix 1.

2.2.2 Step 2 : Interfacing the LDR sensor

Now then we will interface the LDR sensor with the NodeMCU. The LDR sensor detects light and according to the detected light it changes its resistance. This change in resistance in detected and acted upon when the value of the LDR goes below a certain predefined value.

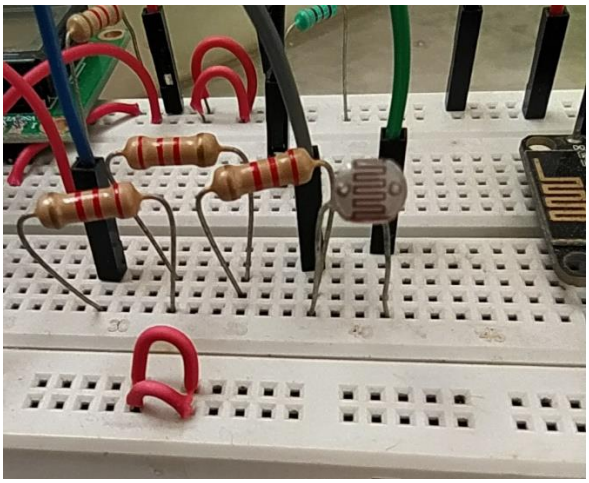


Figure : 3 LDR sensor interfacing

Table 1 : NodeMCU pin connections to LDR sensor

Sr.	NodeMCU pin	LDR
1	A0	Junction of LDR one leg and resistor.
2	3.3v	Other leg of LDR
3	GND	To remaining end of Resistor

The LDR had been tested for values and deciding the threshold. The threshold can be set by observing the LDR values with different light intensities. We can select a low value or a high value depending our need. Here I have selected a intermediate value which when passed we will get an alert.

2.2.3 Step 3 : Configuring the Thingspeak IoT cloud service

Make an account and create a new channel, name it according to the name of project. Below I have shown a screenshot of my Thingspeak channel to monitor LDR sensor data.

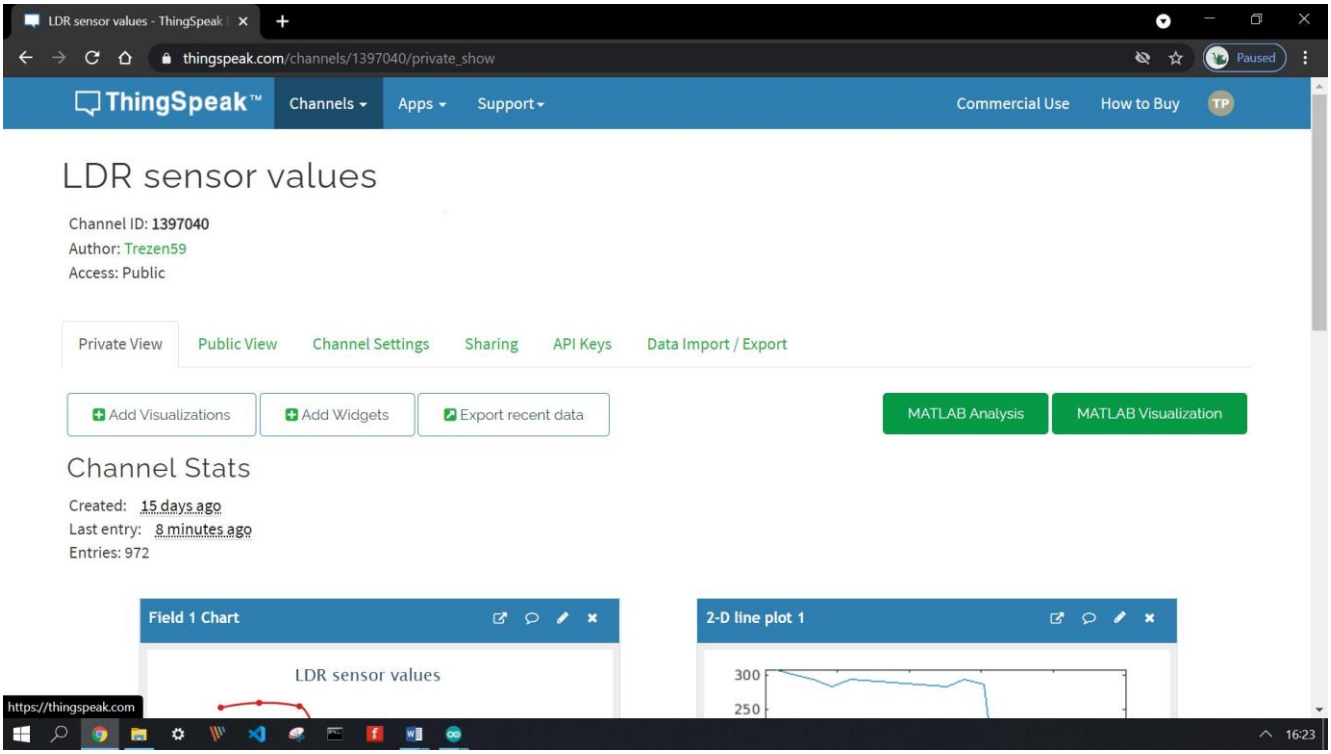


Figure : 4 Thingspeak channel Homepage

You will see your channel ID, your Author name, access and many more things on the home page of your channel.

You can also observe the last time when data was recorded, when was the channel created and total number of entries to the channel.

Make sure you have uploaded the code to your NodeMCU and have connected to the internet. You will automatically see the data values gets updated, you can see the changes in graph or you can export the data as excel file or csv file to further use data.

You can visualize your data in different graph formats by choosing the “MATLAB visualization” button. Here I have shown below different graph plots to visualize data.

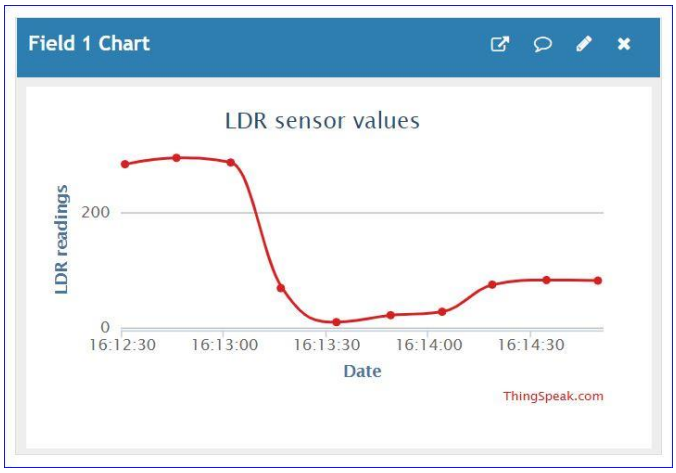


Figure : 5 Data chart 1

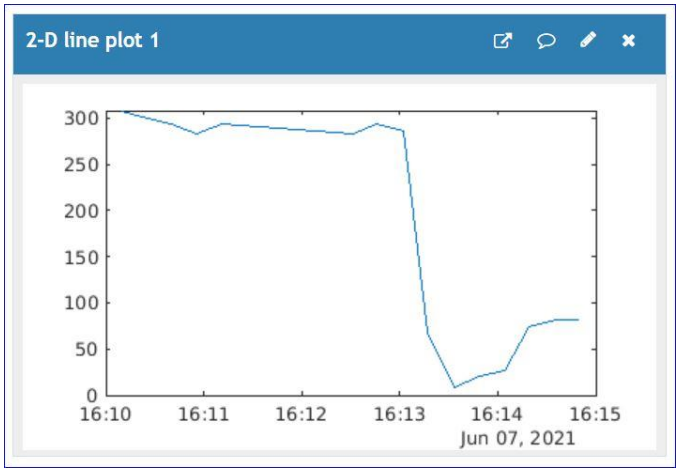


Figure : 6 Data chart 2

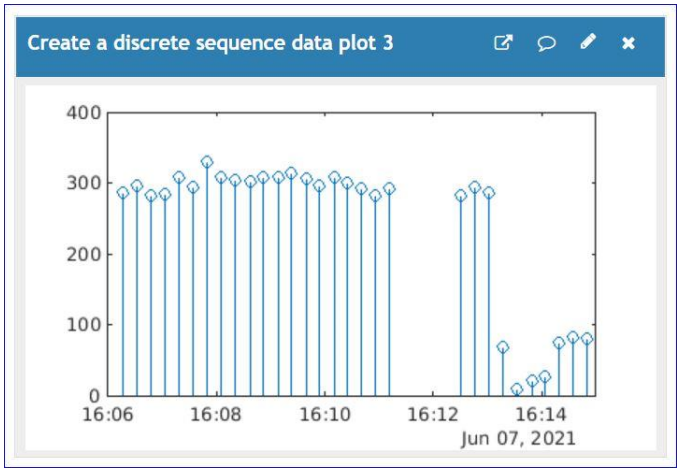


Figure : 7 Data chart 3

2.24 Step 4 : Interfacing the Relay module

The relay module helps us to interface and control the state of AC appliances. I have used a 5v 2 channel relay module connected to the NodeMCU and LEDs which depicts the AC appliances.

The relay is configured in normally open (NO) connection, which means that the relay only let the AC appliances work when we make the relay work. When we turn relay ON the appliances also turn ON accordingly.

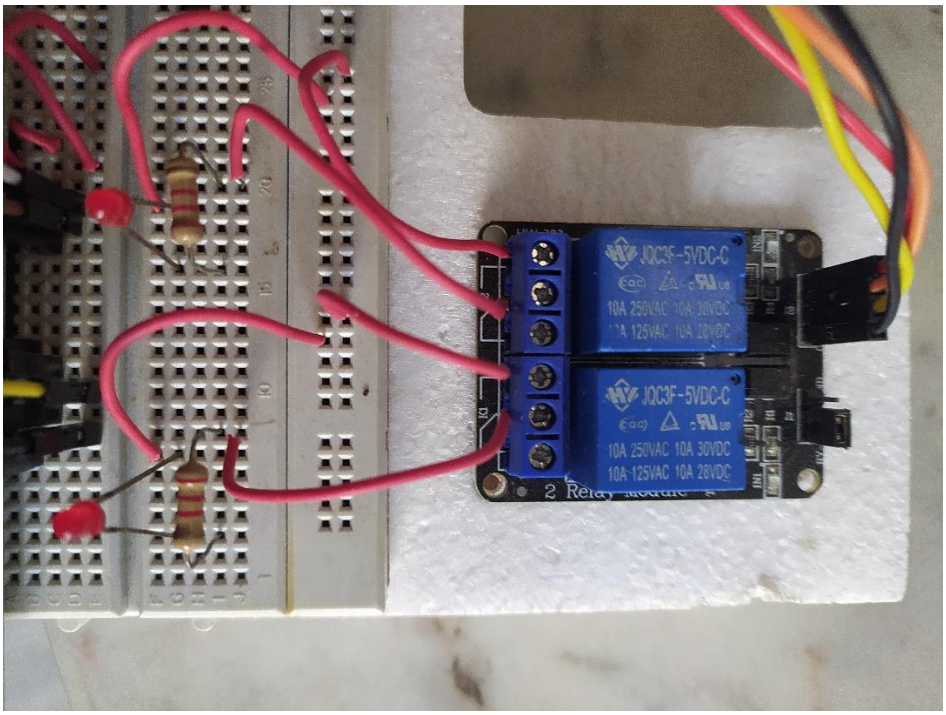


Table 2 : NodeMCU pin connections to Relay module

Sr.	NodeMCU pin	Relay pin
1	5v	VCC
2	GND	GND
3	D1	IN1
4	D2	IN2

The LEDs are connected together by 3.3v power source and the ground terminals of the LEDs are connected to the relays which control the current flow, ultimately the operation of LEDs.

2.2.5 Step 5 : Interfacing the LCD to display the IP address

When the NodeMCU gets connected to the internet the IP address allocated is displayed in the LCD. We have to enter this IP address in the browser, it can be a desktop or a mobile browser to control the AC appliances.

We need to note the IP address again and again but only once when we connect, the IP address remains the same all over the connected session. This is how we can remotely control the appliances.

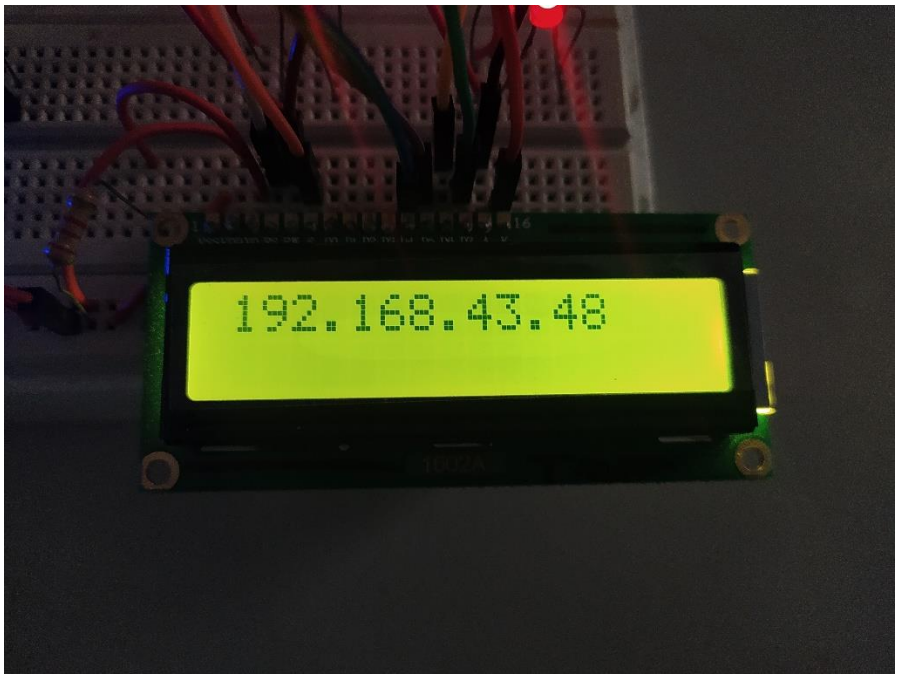


Table 3 : NodeMCU pin connections to the LCD module

Sr.	NodeMCU pins	LCD pins
1	GND	VSS
2	5v	VDD
3	GND via 2k2 resistor	V0
4	D7	RS
5	GND	RW
6	D8	E
7	D6	D4
8	D5	D5
9	D4	D6
10	D3	D7
11	5v via 220 Ohm resistor	A
12	GND	K

2.2.6 Step 6 : React app in Thingspeak with ThingHTTP to trigger IFTTT notifications

The React app in Thingspeak monitors for specific change in data, when it observes specific changes in the received data it triggers ThingHTTP to send a HTTP request to IFTTT which sends us a notification on our mobile.

This notification can be turned on and off as per our convenience and also can be changed as per our need. For example I have set the notification message as “It’s too dark turn ON the light…”.

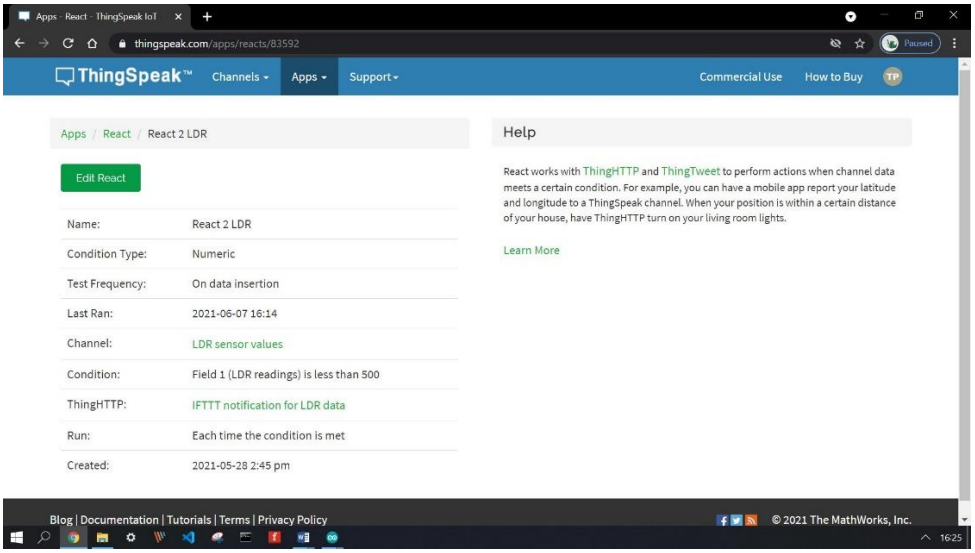


Figure : 8 React app Thingspeak

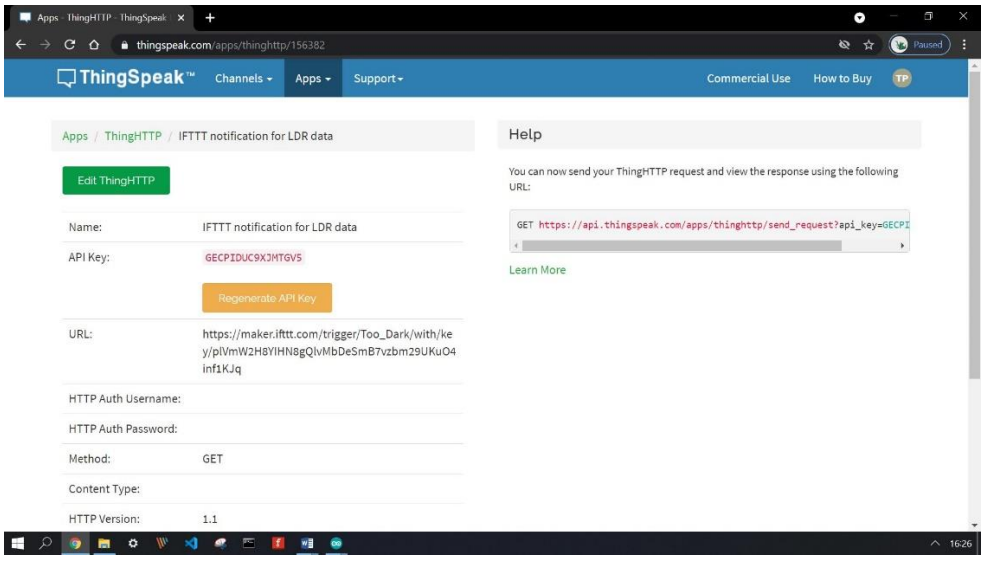
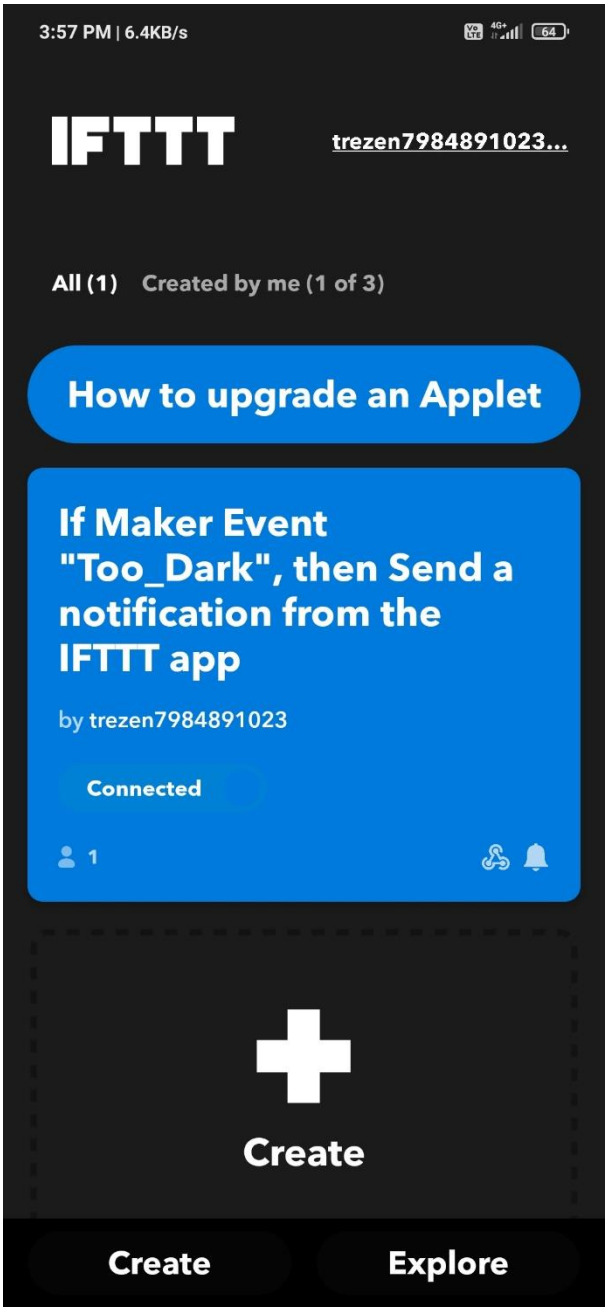


Figure : 9 ThingHTTP Thingspeak



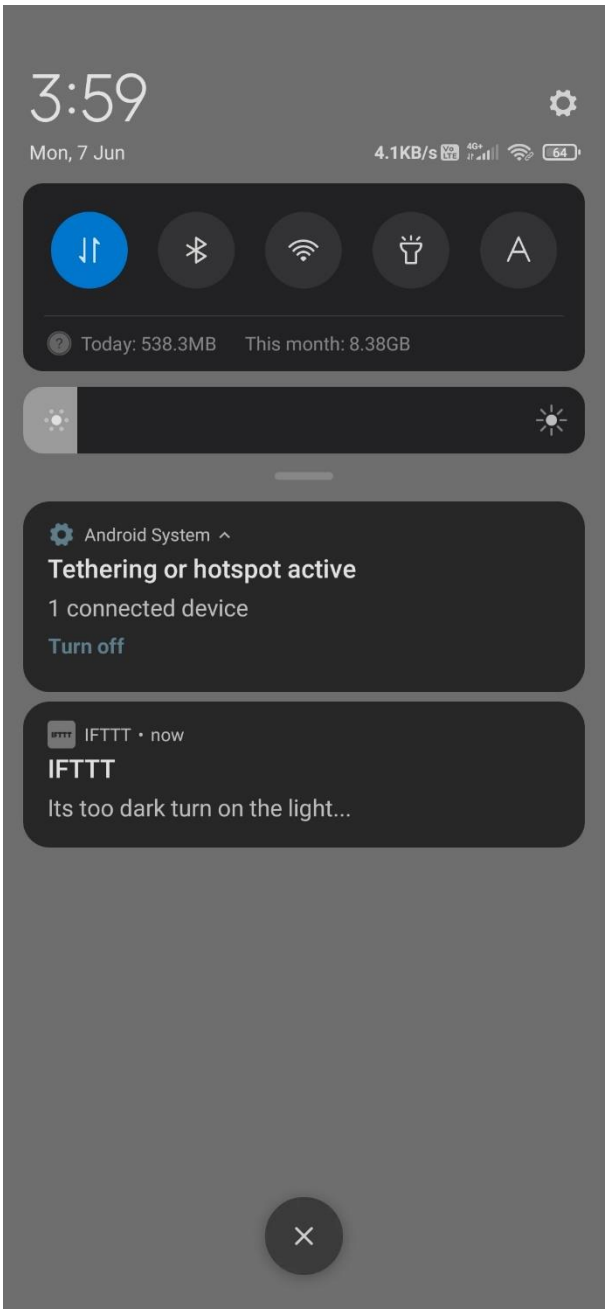


Figure : 10 IFTTT Applet

Figure : 11 IFTTT Notification

2.2.7 Step 7 : Web UI to control the Relay module

Now we have interfaced all things we need, it is time to control the things. This we will do with the help of a web UI (User Interface).

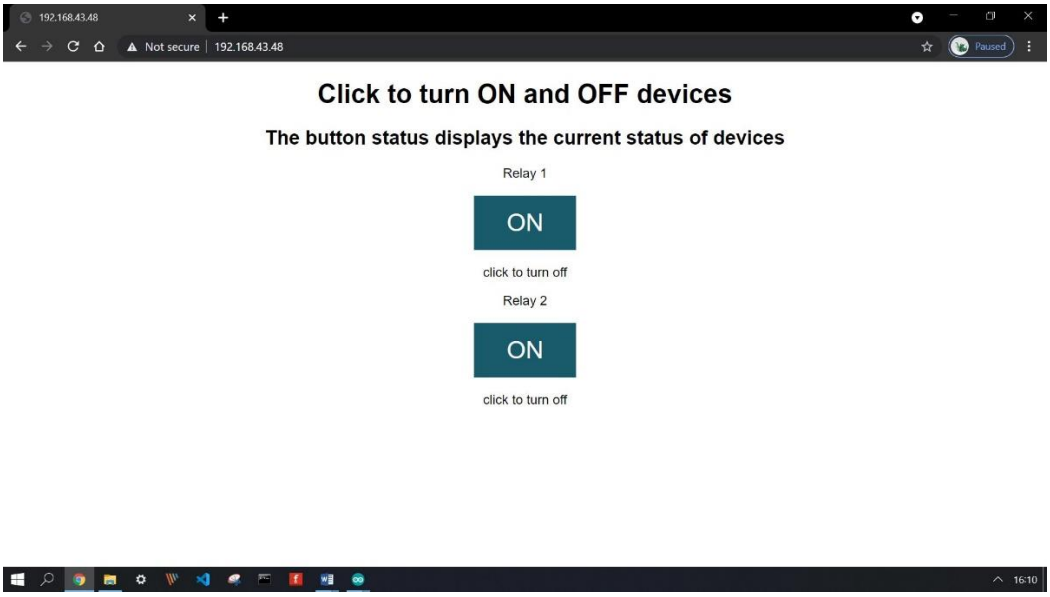


Figure : 12 Web UI (Both relays ON)

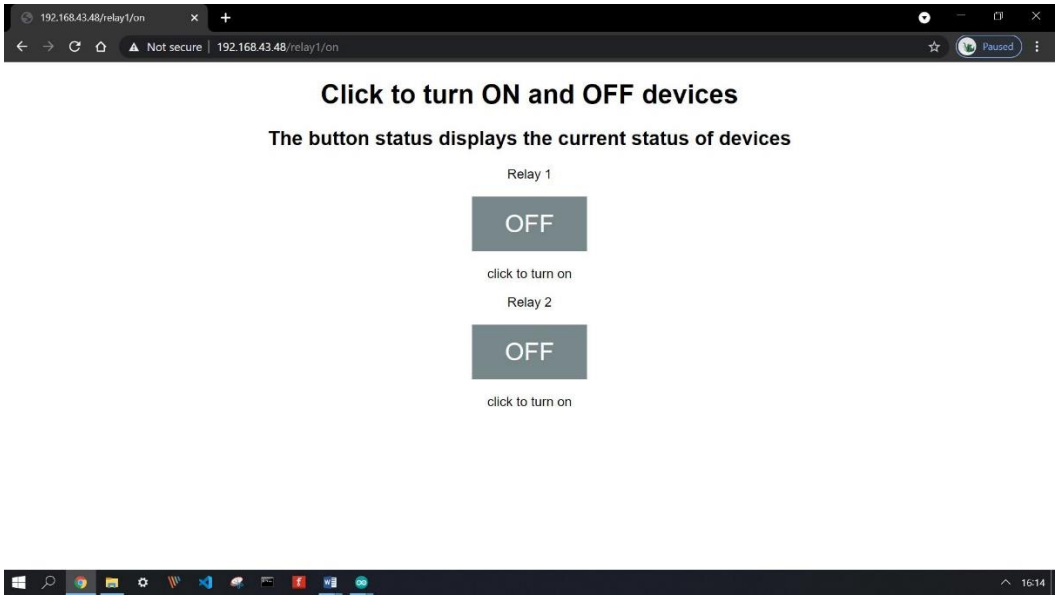


Figure : 13 Web UI (Both relays OFF)

Chapter 3 : Summary of the Results

3.1 Advantages

- Increased uptime.
- Better Operational efficiency.
- Efficient building functionalities.
- Improve safety compliance.
- Strengthen access control.
- Enhance customer insights.
- Improve operations in the public sector.
- Healthcare benefits.
- Benefits in agriculture sector.
- Benefits for consumers.
- Energy efficiency and savings.
- Ease to handle and maintain.
- Enhances security and monitoring.
- Manage user identity.
- Easy management of large data.
- Better time management.
- Requires less space.

3.2 Unique Features of the Project

- Low cost.
- User friendly.
- Easy to install.
- Full control of appliances in the house on your smartphone.
- Multi sensor interface.
- Data recorded can be processed and visualized on the go.
- Instant notification service.

Appendix 1

1.1 NodeMCU detailed pinout diagram.

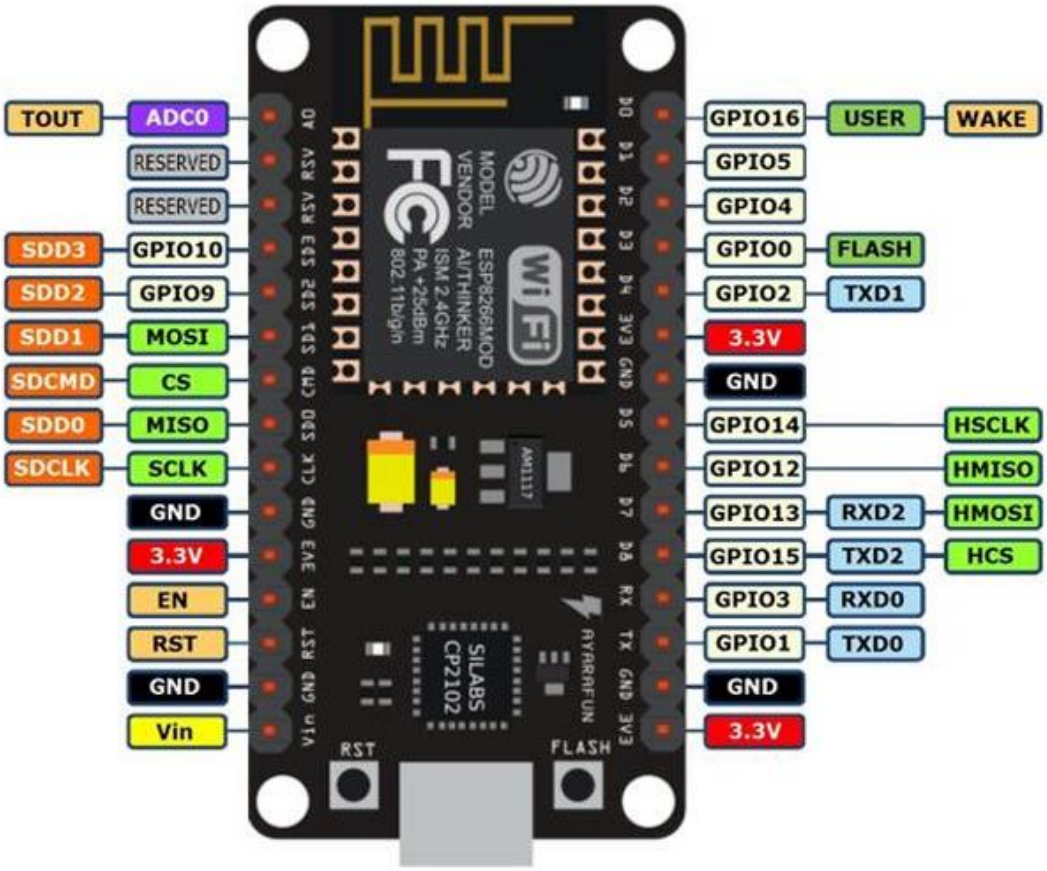


Figure : 14 Appendix 1 (NodeMCU Pinout)

"Courtesy of components101.com"

Appendix 2

2.1 16×2 LCD display module detailed pinout diagram.

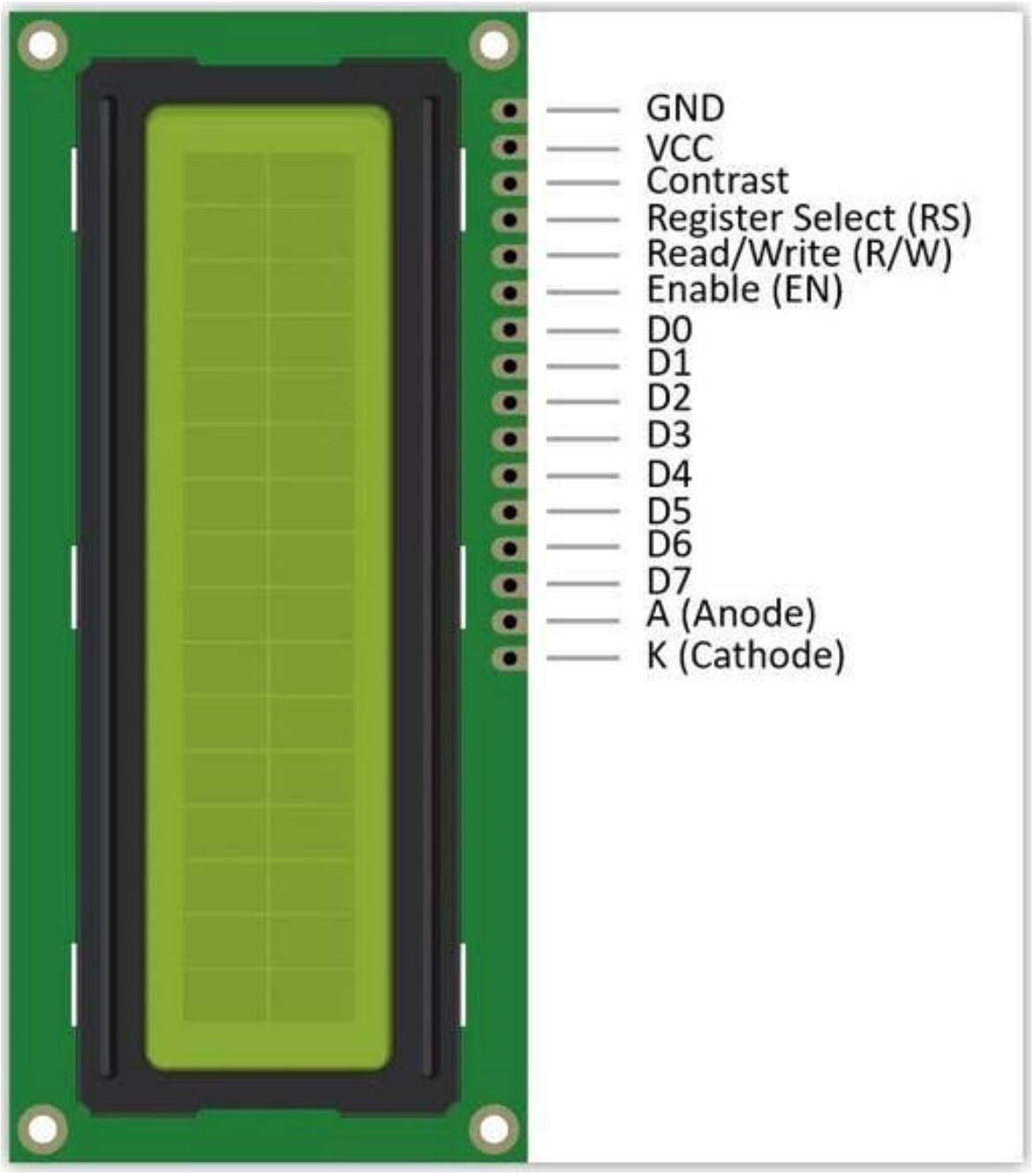


Figure : 15 Appendix 2 (16×2 LCD Pinout)

"Courtesy of hackster.imgix.net"

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