

IoT BASED DATA LOGGER WEATHER MONTIORING USING NODEMCU WITH ARDUINO IoT CLOUD

Submitted in partial fulfillment of the requirements for the award of Bachelor of
Engineering degree in Electronics and Communication Engineering

By

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SCHOOL OF ELETRICAL AND ELETRONICS

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC|12B Status by UGC | Approved by AICTE

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MAY – 2022



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **PIPPALLA CHAKRAVARTHI (38130166), MASAVARAPU AYYAPPA (38130130)** who have done the project work as a team who carried out the project entitled "**IoT Based Data Logger Weather Monitoring Using Nodemcu With Arduino IoT Cloud**" under mu supervision from September 2021 to May 2022.

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DECLARATION

We **PIPPALLA CHAKRAVARTHI (38130166) , MASAVARAPU AYYAPPA (38130130)** hereby declare that the Project Report entitled “**IoT Based Data Logger Weather Monitoring Using Nodemcu With Arduino IoT Cloud**” done by us under the guidance of **Mr.V Kalist M.E** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

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ACKNOWLEDGEMENT

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I convey my thanks to **Dr. N. M. NANDHITHA. M.E., Ph.D., Dean, School of Electrical and Electronics** and **Dr. T. RAVI. M.E., Ph.D., Head of the Department, Department. of Electronics and Communication Engineering** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express our sincere and deep sense of gratitude to our Project Supervisor **Mr. V Kalist M.E** and our panel members for their valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of **Electronics and Communication Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

The system proposed in this paper is an advanced solution for monitoring the weather conditions at a particular place and make the information visible anywhere in the world. The technology behind this is Internet of Things (IoT), which is an advanced and efficient solution for connecting the things to the internet and to connect the entire world of things in a network. Here things might be whatever like electronic gadgets, sensors and automotive electronic equipment. The system deals with monitoring and controlling the environmental conditions like temperature, relative humidity, light intensity and CO level with sensors and sends the information to the web page and then plot the sensor data as graphical statistics. The data updated from the implemented system can be accessible in the internet from anywhere in the world. Now-a-days many weather reporting applications are available which gives us information about climatic changes that are going to take place by which man can be aware of present climatic changes. Most of the weather reporting applications extracts the data from accurate weather system. Here we are building our own weather reporting system which would give us information about present temperature, humidity etc. Here we used cloud as an Arduino IOT Cloud. Arduino IOT Cloud is an application that helps makers build connected objects in a quick, easy and secure way. We can connect multiple devices to each other and allow them to exchange real-time data and also monitor them from anywhere using a simple user interface. We can setup this in our home and get time to time changes in climate which would help us in planning our daily work easily. Like it would be helpful for a farmer in this agricultural activity by which he can protect his crops climatic changes. It would help in transportation giving information of weather conditions etc.

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LIST OF ABBREVIATIONS

ABBREVIATIONS

GPIO

GPU

PWM

RAM

LED

EPROM

DEFINITION

General Purpose Input Output

Graphics Processing Unit

Pulse Width Modulation

Random Access Memory

Light DEPENDENT RESISTOR

Electrically Erasable Programmable
Read-Only Memory

CHAPTER 1

INTRODUCTION

Here we introduce a smart weather reporting system over the Internet. Our introduced system allows for weather parameter reporting over the Internet. It allows the people to directly check the weather states online without the need of a weather forecasting agency. System uses temperature, humidity as well as rain with humidity sensor to monitor weather and provide live reporting of the weather statistics. The system constantly monitors temperature using temperature sensor, humidity using humidity sensor and also for rain. Weather monitoring system deals with detecting and gathering various weather parameters at different locations which can be analysed or used for weather forecasting.

The aim of this system is achieved by technologies such as Internet of Things (IOT) and Cloud. The idea of internet of things is to connect a device to the internet and to other required connected devices. Using Internet the information from the IOT device can easily be transferred to the cloud and then from the cloud to the end user. Weather Monitoring is an essential practical implementation of the concept of Internet of Things, it involves sensing and recording various weather parameters and using them for alerts, sending notifications, adjusting appliances accordingly and also for long term analysis. Also we will try to identify and display trends in parameters using graphical representation. The devices used for this purpose are used to collect, organize and display information. It is expected that the internet of things is going to transform the world by monitoring and controlling the phenomenon of environment by using sensors/devices which are able to capture, process and transmit weather parameters. Cloud is availability of computer system resources like data storage, computing power without direct active management of user. The data captured is transmitted to the cloud so that the data could be further displayed. Besides this, the system consists of components such as NodeMcu board which is a microcontroller board consisting of 14 digital pins, a USB connection and everything used to support microcontroller; DHT11 is Temperature and humidity sensor which is used for detecting these mentioned parameters; WIFI module is used to convert the data collected from the sensors and then send it to the web server. So, in this way weather conditions of any location can be monitored from any remote location in the world. The system constantly transmits this data to the micro controller which now processes this data and keeps on transmitting it to the online web server over a Wi-Fi connection. This data is live updated to be viewed on the online server system. Also system allows user to set

alerts for particular instances. In today's world many pollution monitoring systems are designed by different environmental parameters.

1.1 EXISTING SYSTEM :

Existing system model uses Zigbee based wireless sensor networks to monitor physical and environmental conditions. The sensors nodes directly communicated with moving nodes deployed on the object and RFID is used to storing and retrieving data through electromagnetic transmission to an RF compatible integrated circuit. A tag has an identification (ID) number and a memory that stores additional data such as manufacturer ,product type , environmental factors such as temperature ,humidity .

Zigbee does have limitations in the area of energy use restrictions for certification , processing speed of data , and size of bandwidth. It cannot be used as a outdoor wireless communication system because of the short distance communication system due to it has short coverage limited(10-20m). Tag collision may occur may occur if a reader picks up signals from multiple tags at the same time. It is also highly risky to be used for official private information and does not have many end devices yet

1.2 PROPOSED SYSTEM :

The proposed Embedded device is for monitoring Temperature ,Humidity , pressure ,rainfall, ozone gas ,carbon gas and light intensity levels ,LPG gas sensor. To make the environment intelligent or interactive with the objects through wireless communication. The implemented system consists of a Nodemcu microcontroller as a main processing unit for the entire system and all the sensor and devices can be connected with the microcontroller. Wireless communication uses internet of things (IoT) technology where sensors communicate with other devices through the internet and it is also a machine to machine communication. The data will be stored in the cloud which can access from any part of the world on real time.

CHAPTER 2

LITERATURE SURVEY

Author: M. Popa, Catalin Iapa

Title: Embedded weather station with remote wireless control

Content: Weather monitoring is of great importance in many domains such as: agriculture, military, entertainment etc. There are several solutions for monitoring the weather. The classical solution consists in static weather stations. Another solution is based on wireless sensor networks (WSNs). The third solution uses low dimensions weather stations. This paper presents a weather station made of temperature, humidity, pressure and luminosity sensors embedded in a microcontroller based board. The station is controlled through the SMS service of mobile phones.

Author: Gustavo Solano, Jimmy Tarrillo

Title: Monitoring weather parameters from difficult access places

Content: The following article show the design and implementation of a weather station to remote places, it making the acquisition of meteorologic variables and there can be obtain in any device with Internet connection. The purpose of this survey is to collect information from any place for futures studies, fact like temperature, humidity, wind speed, radiation and rain precipitation.

Author: A. Malhotra, S. Som, S. Khatri

Title: IoT Based Predictive Model for Cloud Seeding

Content: Weather prediction is an attempt to predict the conditions of weather in the near future and what should be expected from the weather. The parameters which determine the conditions are temperature, humidity, wind. We will consider temperature and humidity to predict the future weather conditions. The data will be collected from DHT11 sensor and FC-37, they are low-cost sensors which are used to collect temperature, humidity and rain values. The sensors installed on the raspberry pi collect the data and store it in the pi. The data is

stored in the form of CSV file which is used for analyzing the data further. R is used to do analysis on the data collected. R is a very effective language and software for analyzing data and comes with many inbuilt functionalities for statistical data analysis. The motive is to find situations in which drought could occur and generate artificial clouds over the place for temporary relief.

Author: D. Gaurav, D. Mittal, B. Vaidya, and J. Mathew

Title: A GSM based low cost weather monitoring system for solar and wind energy generation

Content: Renewable Energy is a pressing need in the 21st century as non-renewable sources are no longer fit for our energy needs. This is especially important in a country like India, where supply to demand ratio is very low. In this paper, we intend to identify the geographical areas for solar and wind energy generations at low cost. It is achieved by monitoring atmospheric weather conditions, such as temperature, humidity, wind speed and light intensity. Our design is based on remotely operated system with sensors, which gathers weather information and transmits measured values to the ground. In our research, we have considered a number of options to device atmospheric weather monitoring system at low cost, long lasting and durable for extreme weather conditions. The cost of the system is estimated to be nearly thirty dollars. It is highly reliable and deployable, and is a very useful utility in a country like India. The system can be easily deployed at areas to keep track of continuous climatic changes. The system is operated by battery, and is expected to run with a long life span, because of the system optimizations done for maximum power savings. Our system weighs only less than 150 gm, and is easily floatable and recoverable with the help of a simple Hydrogen balloon

Introduction:

The rising "Industry 4.0" idea is an umbrella term for another modern worldview which grasps a lot of future mechanical advancements including digital physical frameworks (CPS), the Internet of things (IoT), the Internet of administrations (IoS), apply autonomy, enormous information, cloud fabricating and expanded reality . Mechanical procedures need most undertakings to be directed locally because of time postponements and security imperatives, and organized information should be imparted over the web. Innovative improvements have empowered to be assumed great frameworks position via Automatic and propelled frameworks. Furthermore, the accessibility of quick preparing, steady and delicate items gave specific advantages in modern robotization. Because of the advancements in Communication innovations, frameworks are never again checked and controlled by faculty utilizing great

techniques, however consequently by PC controlled or remote-controlled gadgets. Modern ecological conditions have been updating step by step with this recently presented programmed system because of disposing of the ordinary methodology of assembling expanding enormous outstanding tasks at hand. The cutting edge ventures will be unquestionably further developed and programmed as contrasted and existing ones. This expedites another phrasing of "Keen Industries" right now of Monitoring just as controlling of different Industrial applications. As a developing innovation realized with rapid advances in current remote media transmission, the Internet of Things (IoT) has pulled in a ton of research consideration and is relied upon to carry advantages to various applications. The recently presented idea of "Web of Things" (IoT) is giving some assistance to achieve the Industrial mechanization through remote access. In IoT, every gadget or gadget comprising of a framework will have the option to speak with different gadgets or frameworks on similar premises over a typical stage. Henceforth this prompts trade of applicable information, measurements, logs, and different parameter data among different gadgets are planned to improve their exhibition, which will assist businesses by enabling better efficiency, the executives and expanded throughput. The most usually utilized and mechanized frameworks are wired framework by utilizing SCADA and PLC's. They use the machine to machine conventions for correspondence. As the cost of such a framework is high, little scale and medium scale enterprises can't bear the cost of such an innovation. Our point is to make this computerized framework innovation which makes the creation and working in ventures increasingly agreeable. This paper proposes a minimal effort answer for enterprises. It includes remote monitoring, control, and security Proceedings of the Fourth International Conference on Computing Methodologies and Communication (ICCMC 2020) IEEE Xplore Part Number:CFP20K25-ART; ISBN:978-1-7281-4889-2 978-1-7281-4889-2/20/\$31.00 ©2020 IEEE 67 2020 Fourth International Conference on Computing Methodologies and Communication (ICCMC) 978-1-7281-4889-2/20/\$31.00 ©2020 IEEE 10.1109/ICCMC48092.2020.ICCMC-00012 Authorized licensed use limited to: Macquarie University. Downloaded on June 22,2020 at 18:41:32 UTC from IEEE Xplore. Restrictions apply. system utilizing the Internet of things. Web of things (IoT) is drifting innovation. It is arrange framed by physical gadgets installed with programming, sensors, actuators, and network that empower gadgets to convey and trade information. Right now, the proposed framework utilizes smoke, fire, moistness, and temperature, current and voltage sensors for monitoring and

CHAPTER 3

AIM AND SCOPE OF THE PROJECT

3.1 AIM AND OBJECTIVE

- To increase the efficiency of the System we are upgrading from Arduino Uno board to NodeMcu Board its Special designed for IoT applications
- And also upgrading Arduino IoT cloud platform its reliable and secure for tracking the our own weather data
- Provide a remote monitoring and controlling application for analysis of a particular sensor data
- Allow the user to manipulate the data and take some necessary actions
- To provide very user-friendly interface for interacting with given data by sensors
- The monitoring framework incorporates sensors like fire sensor, smoke sensor, ultrasonic sensor, moisture and temperature sensor, current and voltage with Wi-Fi module for control operations. With the benefits of unusual exercises, reasonable activities will be activated.

3.2 PROBLEM DEFINATION

The typical weather forecasting Existing system model is presented in uses ZigBee based wireless sensor networks to monitor physical and environmental conditions with thousands of application in different fields. Short distance communication, Lot of hardware requirements and accuracy of the system .

3.3 PROBLEM STATMENT

Weather forecasting is a major problem when we dealing with cropping we didn't know when will rain fall occur or humidity change and rain fall percentage .The study is to understand .This project reduce the cost also reducing the hardware wiring using multiplexer and increasing the efficiency using wifi protocol . If any critical condition automatically send the alert message.

3.4 WORKING OF WEATHER MONITORING

The implemented system consists of a NodeMcu microcontroller as a main processing unit for the entire system and all the sensor and devices can be connected with the microcontroller. The sensors can be operated by the microcontroller to retrieve the data from them and it processes the analysis with the sensor data and updates it to the internet through Wi-Fi module connected to it. The gas sensor used to monitor the gas level in atmosphere, the DHT11 used to measures the temperature as well as humidity in the environment. The sensor used to monitor temperature level and Humidity level sensor is used to monitor the air moisture level. The smoke sensor (CO₂) is used to measure the poisons gases. LDR is used to identify the sun light, when the sun light below the threshold level then turn on the light. If any critical condition automatically send the alert message. The carbon monoxide sensor are analog sensor the value retrieve from the sensor through adfruit ad115 analog to digital multiplexer it continuously coming data from sensor and then it fed to nodemcu development board and then its process the data with some mathematical calculations then we send the data to cloud with MQTT protocol and we can remotely see the data from anywhere in the world with mobile or web API . The pressure sensor working was so fascinating it will calculate the pressure in hector Pascal with this calculation we know the day is sunny or cloudy when the pressure less than normal day the chances will be high for rain fall else the its greater than threshold the chances of sunny.

CHAPTER 4

METHODOLOGY

4.1 INTRODUCTION

In this chapter, the procedure for design and development of weather monitoring system is explained. The block diagram of the system is shown. The schematic of embedded control hardware circuit is shown in diagram. The hardware and software description of the data acquisition system for monitoring weather parameters are described below

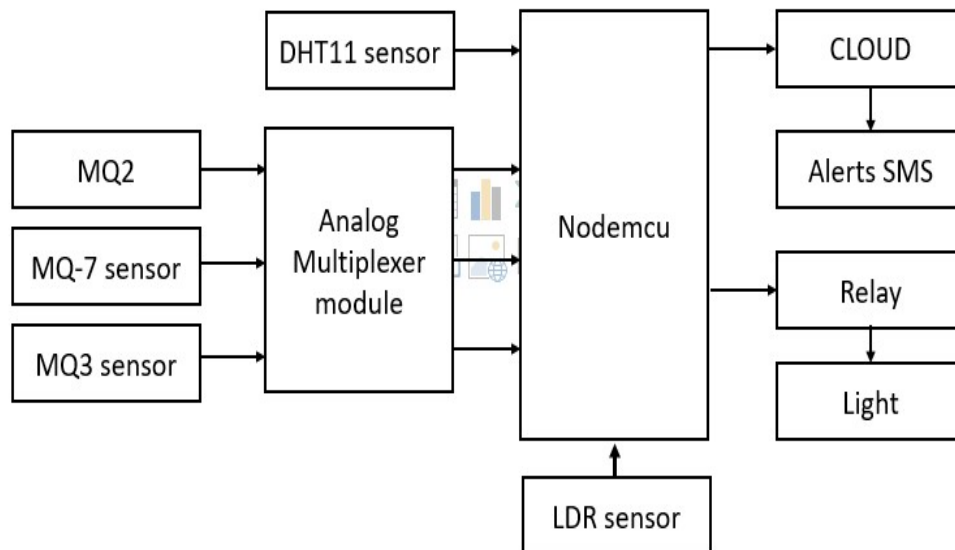


Fig 4.1 Block Diagram of weather station

4.2 HARDWARE REQUIRED

- ❖ NODE MCU
- ❖ ADS115 (Analog Multiplexer)
- ❖ Mq-7 Sensor
- ❖ Mq-2 Sensor
- ❖ Water Level Sensor
- ❖ Voltage Regulator
- ❖ LIGHT DEPENDENT RESISTOR
- ❖ RELAY
- ❖ BUZZER

❖ BMP 180 PRESSURE SENSOR

❖ DHT 11

4.2.1 NodeMcu

NodeMcu is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems^[6] began production of the ESP8266.^[10] The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core,^[citation needed] widely used in IoT applications (see related projects). NodeMCU started on 13 Oct 2014, when Hong committed the first file of nodemcu-firmware to GitHub.^[11] Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the Gerber file of an ESP8266 board, named devkit v0.9.^[12] Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform,^[13] and committed to NodeMCU project, then NodeMCU was able to support the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib^[14] to NodeMCU project,^[15] enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

In summer 2015 the creators abandoned the firmware project and a group of independent contributors took over. By summer 2016 the NodeMCU included more than 40 different modules. Due to resource constraints users need to select the modules relevant for their project and build a firmware tailored to their needs.

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFi SoC, popularly called the "ESP8266 Core for the Arduino IDE".^[16] This has

become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

IoT platform node MCU is open source . Language used in it is lua scripting language. It is based on the eLua project, and built on the ESP8266 SDK 0.9.5. It uses many open source projects, such as lua-cjson, and spiffs. It includes firmware which runs on the ESP8266 Wi-Fi SoC, and hardware which is based on the ESP-12 module. NodeMCU was created shortly after the ESP8266 came out. In December 30, 2013, Espressif systems began production of the ESP8266. The ESP8266 is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications. NodeMCU started in 13 Oct 2014, when Hong committed the first file of NodeMCU - firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit 1.0. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed to Node MCU project, then Node MCU was able to support the MQTT IoT protocol, using Lua to access the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to NodeMCU project, enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

The main objective of this project is to develop a home automation system using an Node MCU board with Internet being remotely controlled by any Android OS smart phone. As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, involving remote controlled switches. Presently, conventional wall switches located in different parts of the house makes it difficult for the user to go near them to operate. Even more it becomes more difficult for the elderly or physically handicapped people to do so. Remote controlled home automation system provides a most modern solution with smart phones.

In order to achieve this, a relay module is interfaced to the Node MCU board at the receiver end while on the transmitter end, a GUI application on the cell phone sends ON/OFF commands to the receiver where loads are connected. By touching the specified location on the GUI, the loads can be turned ON/OFF remotely through this technology. The loads are operated by IOT board through Relay Module.

NODEMCU (esp8266) has been selected as the controller for this system due to its compact size, compatibility, easy interfacing over several other type of controller including

Programmable Integrated Circuit (PIC), Programmable Logic Controller (PLC) and others. ESP8266 is an open source firmware that is built on top of the chip manufacturer's proprietary SDK. The firmware provides a simple programming environment, which is a very simple and fast scripting language. The ESP8266 chip incorporates on a standard circuit board. The board has a built-in USB port that is already wired up with the chip, a hardware reset button, Wi-Fi antenna, LED lights, and standard-sized GPIO (General Purpose Input Output) pins that can plug into a bread board..Figure-4.2.1 shows the diagram of NODEMCU (ESP8266).It has Processor called L106 32bit RISC microprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz and has a memory of 32 Kbit instruction RAM ,32 Kbit instruction cache RAM, 80 Kbit user data RAM&16 KbitETS system data RAM. It has inbuilt Wi-Fi module of IEEE 802.11 b/g/n Wi-Fi.

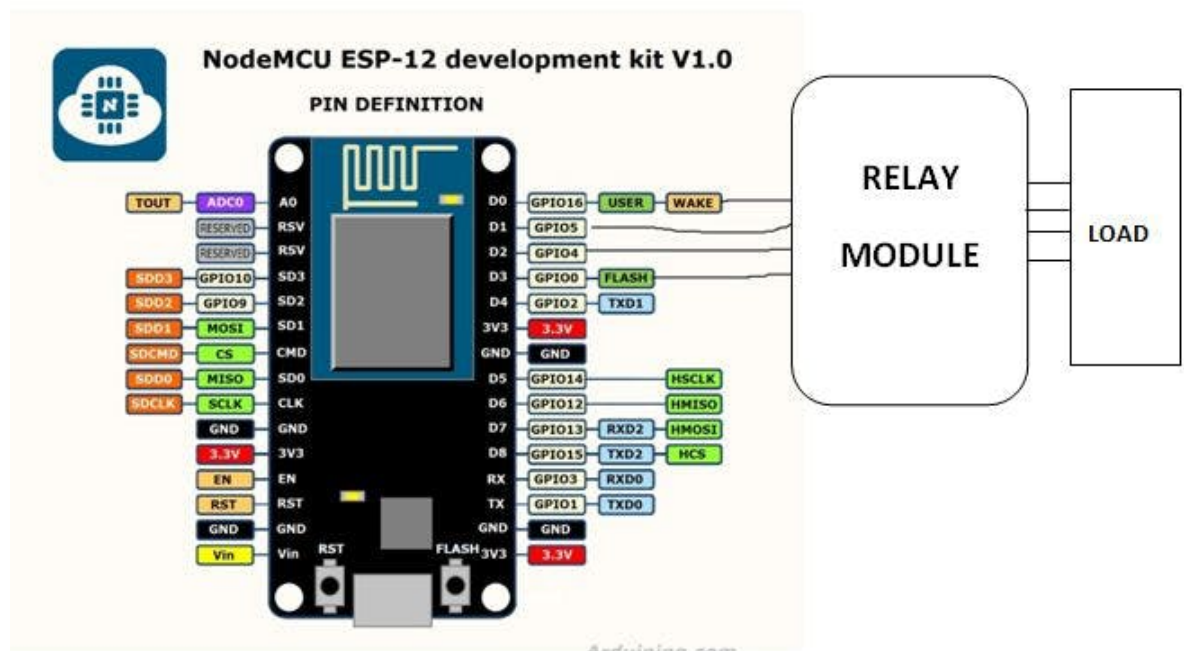


Figure : 4.2:NodeMcu

4.2.1.1 CIRCUIT DIAGRAM DESCRIPTION OF NODEMCU

The operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an AC voltage, a steady DC voltage is obtained by rectifying the AC voltage, Then filtering to a DC level, and finally, regulating to obtain a desired fixed DC voltage. The regulation is usually obtained from an IC voltage regulator Unit, which takes a DC voltage and provides a somewhat lower DC voltage, Which remains the same even if the input DC voltage varies, or the output Load connected to the DC voltage changes.

4.2.2 LDR-Light Dependent Resistors Circuit and Working Principle

The controlling of lights and home appliances is generally operated and maintained manually on several occasions. But the process of appliances controlling may cause wastage of power due to the carelessness of human beings or unusual circumstances. To overcome this problem we can use the light-dependent resistor circuit for controlling the loads based on the intensity of light. An LDR or a photo resistor is a device that is made up of high resistance semiconductor material. This article gives an overview of what is LDR, light-dependent resistor circuit and its working.



Figure:4.3 Light Dependent Resistor

4.2.2.1 Construction of an LDR

The construction of an LDR includes a light-sensitive material that is placed on an insulating substrate like as ceramic. The material is placed in a zigzag shape in order to get the required power rating and resistance. The area of zigzag separates the metal placed areas into two regions.

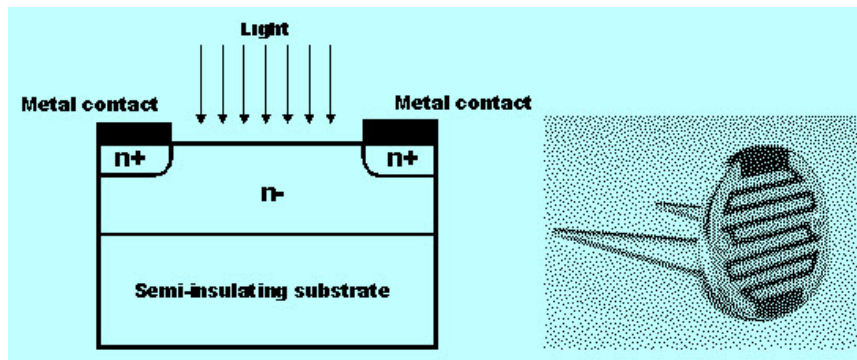


Figure:4.4 Construction of an LDR

Where the Ohmic contacts are made either on the sides of the area. The resistances of the contacts must be as less as possible to make sure that the resistance, mainly varies due to the

light effect only. The use of lead & cadmium materials is avoided as they are injurious to the environment.

4.2.2.2 Working Principle of Light Dependent Resistor

The working principle of an LDR is photo conductivity that is nothing but an optical phenomenon. When the light is absorbed by the material then the conductivity of the material reduces. When the light falls on the LDR, then the electrons in the valence band of the material are eager to the conduction band. But, the photons in the incident light must have energy superior than the band gap of the material to make the electrons jump from one band to another band (valance to conduction).

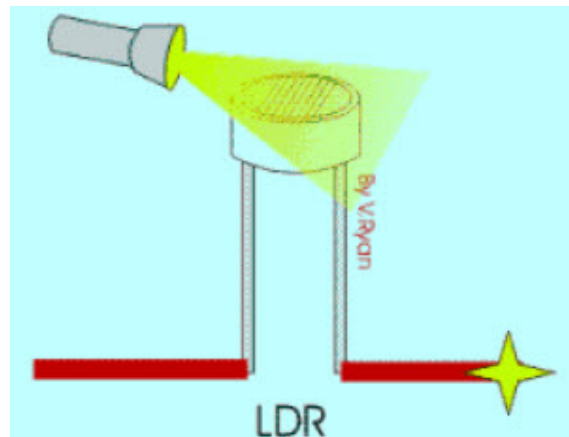


Figure:4.5 LDR Working Principle

Hence, when light having ample energy, more electrons are excited to the conduction band which grades in a large number of charge carriers. When the effect of this process and the flow of the current starts flowing more, the resistance of the device decreases.

4.2.2.3 Applications of LDR

Light-dependent resistors are simple and low-cost devices. These devices are used where there is a need to sense the presence and absence of light is necessary. These resistors are used as light sensors and the applications of LDR mainly include alarm clocks, street lights, light intensity meters, burglar alarm circuits. For a better understanding of this concept, here we have explained one project namely; power conserving of intensity controlled street lights using LDR.

4.2.3 DHT11 (DIGITAL HUMIDITY TEMPERATURE SENSOR)

Measurement and control of temperature and relative humidity finds applications in numerous areas. These days devices are available which have both temperature and humidity sensors with signal conditioning, ADC, calibration and communication interface all built inside them. The use of such smart sensors greatly simplify the design and reduces the overall cost. Humidity and temperature measurements with Sensirion's SHT1x/SHT7x sensors. These sensors are capable of measuring both temperature and relative humidity and provide fully calibrated digital outputs. While SHT1x/SHT7x are very accurate sensors, they are still expensive for hobbyists use. This articles discusses the DHT11 sensor which also provides calibrated digital outputs for temperature and humidity but is relatively lot cheaper than the Sensirion sensors. The DHT11 sensor uses a proprietary 1-wire protocol which we will be exploring here and implementing with the NodeMcu ESP8266 microcontroller that will receive the temperature and humidity values from the sensor and display them on cloud.

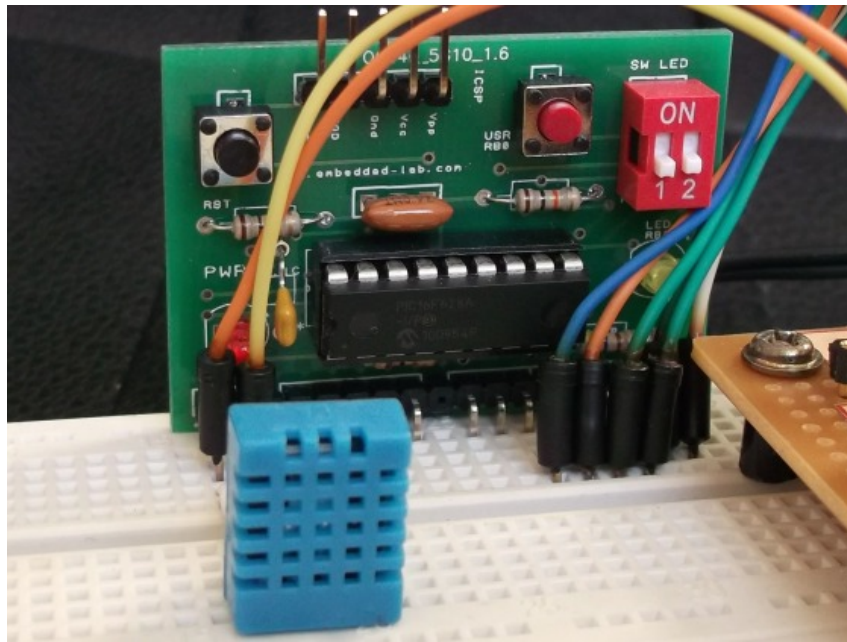


Figure:4.6 Interfacing DHT11 sensor with NodeMcu

The DHT11 sensor comes in a single row 4-pin package and operates from 3.5 to 5.5V power supply. It can measure temperature from 0-50 °C with an accuracy of $\pm 2^{\circ}\text{C}$ and relative humidity ranging from 20-95% with an accuracy of $\pm 5\%$. The sensor provides fully calibrated digital outputs for the two measurements. It has got its own proprietary 1-wire protocol, and therefore, the communication between the sensor and a microcontroller is not possible through a direct interface with any of its peripherals. The protocol must be implemented in the firmware of the MCU with precise timing required by the sensor.

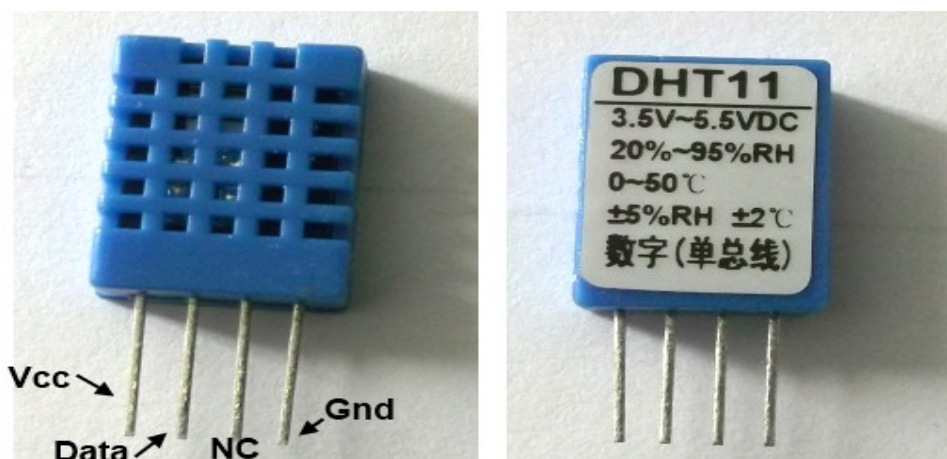


Figure:4.7 DHT11 sensor comes in a single row 4-pin package

The following timing diagrams describe the data transfer protocol between a MCU and the DHT11 sensor. The MCU initiates data transmission by issuing a “**Start**” signal. The MCU pin must be configured as output for this purpose. The MCU first pulls the data line low for at least 18 ms and then pulls it high for next 20-40 ?s before it releases it. Next, the sensor responds to the MCU “**Start**” signal by pulling the line low for 80 ?s followed by a logic high signal that also lasts for 80 ?s. Remember that the MCU pin must be configured to input after finishing the “**Start**” signal. Once detecting the response signal from the sensor, the MCU should be ready to receive data from the sensor. The sensor then sends 40 bits (5 bytes) of data continuously in the data line. Note that while transmitting bytes, the sensor sends the most significant bit first.

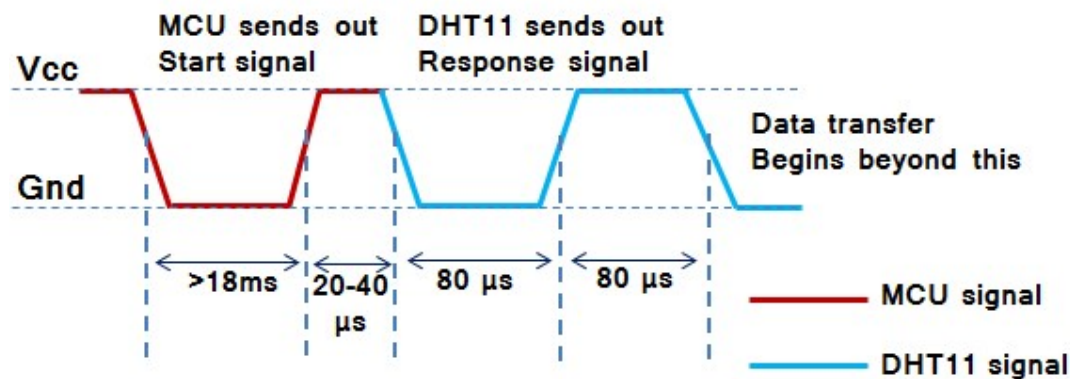


Figure:4.8 Signal Diagram

"Start" and "Response" signals

The 40-bit data from the sensor has the following structure.

Data (40-bit) = Integer Byte of RH + Decimal Byte of RH + Integer Byte of Temp. + Decimal Byte of Temp. + Checksum Byte

For DHT11 sensor, the decimal bytes of temperature and humidity measurements are always zero. Therefore, the first and third bytes of received data actually give the numeric values of the measured relative humidity (%) and temperature ($^{\circ}\text{C}$). The last byte is the checksum byte which is used to make sure that the data transfer has happened without any error. If all the five bytes are transferred successfully then the checksum byte must be equal to the last 8 bits of the sum of the first four bytes, i.e.,

Checksum = Last 8 bits of (*Integer Byte of RH + Decimal Byte of RH + Integer Byte of Temp. + Decimal Byte of Temp.*)

Now let's talk about the most important thing, which is signalling for transmitting "0" and "1". In order to send a bit of data, the sensor first pulls the line low for 50 µs. Then it raises the line to high for 26-28 µs if it has to send "0", or for 70 µs if the bit to be transmitted is "1". So it is the width of the positive pulse that carries information about 1 and 0.

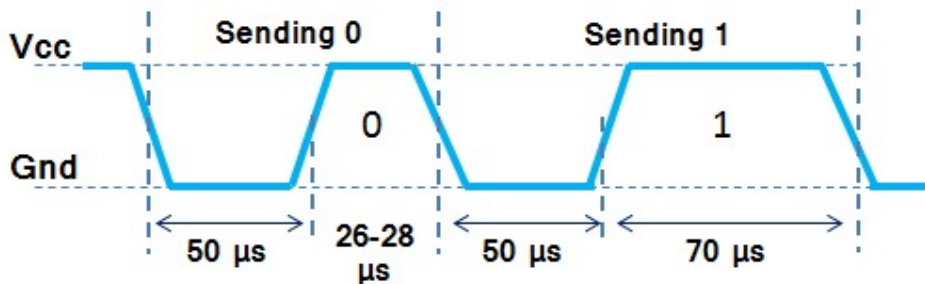


Figure:4.9 Timing difference for transmitting "1s" and "0s"

4.2.4 VOLTAGE REGULATOR

A regulated power supply is very much essential for several electronic devices due to the semiconductor material employed in them have a fixed rate of current as well as voltage. The device may get damaged if there is any deviation from the fixed rate. The AC power supply gets converted into constant DC by this circuit. By the help of a voltage regulator DC, unregulated output will be fixed to a constant voltage. The circuit is made up of linear voltage regulator 7805 along with capacitors and resistors with bridge rectifier made up from diodes. From giving an unchanging voltage supply to building confident that output reaches uninterrupted to the appliance, the diodes along with capacitors handle elevated efficient signal conveyed.

A voltage regulator is a system designed to automatically maintain a constant voltage level. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or

more AC or DC voltages. Electronic voltage regulators are found in devices such as computer power supply where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distribution system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line. As we have previously talked about that regulated power supply is a device that mechanized on DC voltages and also it can uphold its output accurately at a fixed voltage all the time although if there is a significant alteration in the DC input voltage. ICs regulator is mainly used in the circuit to maintain the exact voltage which is followed by the power supply.

A regulator is mainly employed with the capacitor connected in parallel to the input terminal and the output terminal of the IC regulator. For the checking of gigantic alterations in the input as well as in the output filter, capacitors are used. While the bypass capacitors are used to check the small period spikes on the input and output level. Bypass capacitors are mainly of small values that are used to bypass the small period pulses straightly into the Earth.

A circuit diagram having regulator IC and all the above discussed components arrangement revealed in the figure below. As we have made the whole circuit till now to be operated on the 5V DC supply, so we have to use an IC regulator for 5V DC. And the most generally used IC regulators get into the market for 5V DC regulation use is 7805. So we are connecting the similar IC in the circuit as U1. IC 7805 is a DC regulated IC of 5V. This IC is very flexible and is widely employed in all types of circuit like a voltage regulator. It is a three terminal device and mainly called input, output and ground. Pin diagram of the IC 7805 as shown in the Fig: 4.18. The pin explanation of the 7805 is described in the following Fig: 4.2

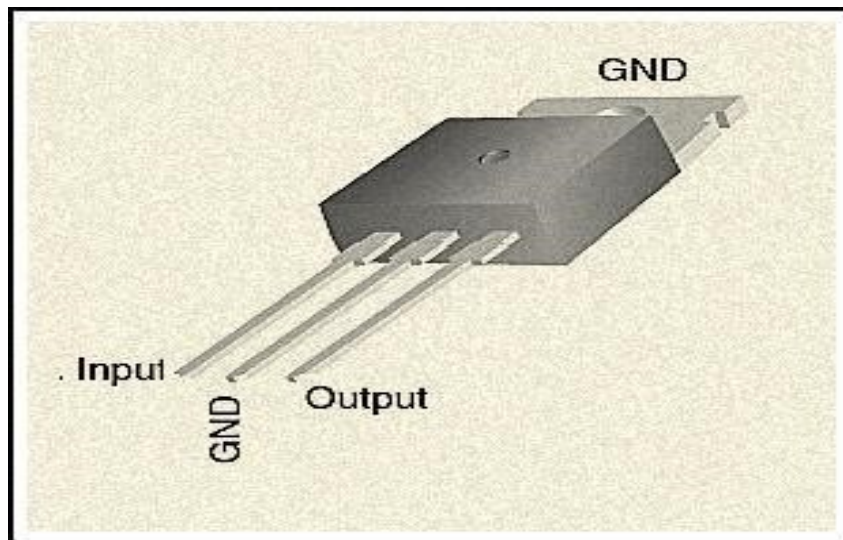


Figure:4.10 Voltage Regulator

PIN NO	PIN	DESCRIPTION
1	INPUT	This capacitor is known as bypass capacitor and is employed to bypass extremely tiny duration spikes to the ground with no distress the other components.
2	GROUND	In this pin where the ground is given. This pin is neutral for equally the input and output.
3	OUTPUT	The output of the regulated 5V volt is taken out at this pin of the IC regulator.

Table 4.1 voltage regulator pin description

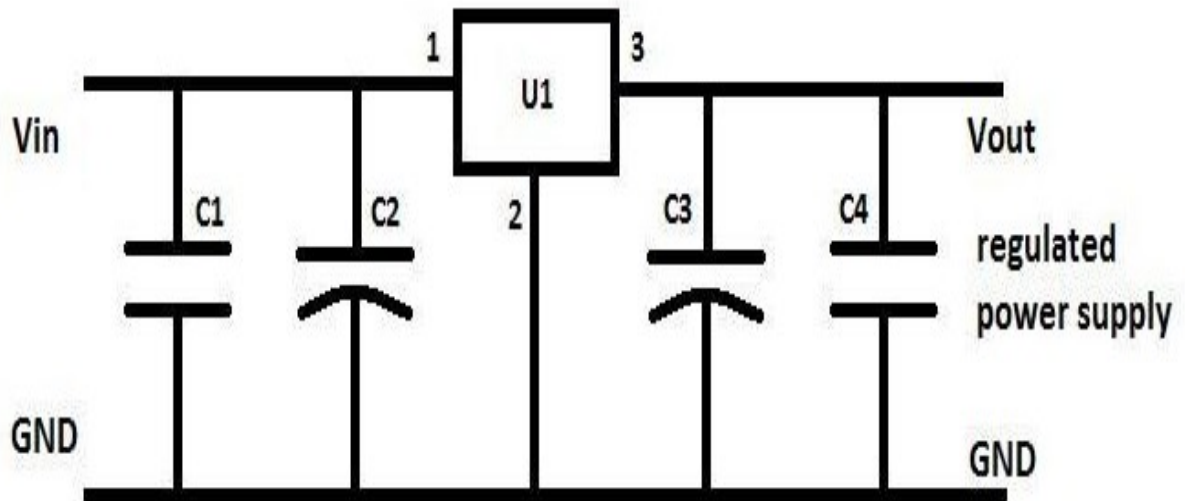


Fig: 4.11:voltage regulator circuit diagram

When the power supply filter is far away from the regulated IC capacitor C2 is used. Ripple rejection in the regulator is been improved by C4 capacitor(35uf) by avoiding the ripple voltage to be amplified at the regulator output. The output voltage is strengthening and deduction of the output voltage is done capacitor C3(0.1uF). To avoid the chance of the input get shorted D5 diode is used to save the regulator. If D5 is not presented in the circuit, the output capacitor can leave its charge immediately during low impedance course inside the regulators as shown in the Fig: 4.20

In the circuit diagram C2 as well as C3 are filter capacitor while bypass capacitors are the C1 and C4. The electrolytic polarized capacitors are employed for this purpose. For the purpose of filter capacitors normally 10mfd value of the capacitor used. And in these projects we also used 100mfd value of the capacitor. While in all kinds of circuit the value of bypass capacitor is 0.1 mfd. And in generally un-polarized mainly disc capacitors employed for this purpose. Currently we have the circuit for the 5V DC positive regulation and we are also familiar with the component values used in the circuit. In the table below we have mentioned the value in detail of all the components used in the circuit of 5V DC positive regulator.

Component	Function
C1	This capacitor is known as bypass capacitor and is employed to bypass extremely tiny duration spikes to the ground with no distress the other components.
C2	C2 is the filter capacitor employed to steady the slow changes in the voltage applied at the input of the circuit. Escalating the value of the capacitor amplify the stabilization as well as the declining value of the capacitor reduces the stabilization. Moreover this capacitor is not alone capable to ensure very constricted period spikes emerge at the input.
C3	C3 is known as a filter capacitor employed in the circuit to steady the slow alterations in the output voltage. Raising the value of the capacitor enlarges the stabilization furthermore declining the value of the capacitor declined the stabilization. Moreover this capacitor is not alone capable to ensure very fine duration spikes happen at the output.
C4	C4 is known as bypass capacitor and worked to bypass very small period spikes to the earth with no influence the other components.
U1	U1 is the IC with positive DC and it upholds the output voltage steady exactly at a constant value even although there is major deviation in the input voltage.

Table 4.2 : voltage regulator component and function

4.2.4.1 OPERATION PRINCIPLE OF VOLTAGE REGULATOR

The surface resistance of the sensor R_s is obtained through effected voltage signal output of the load resistance R_L which series-wound. The relationship between them is described: $R_s/R_L = (V_c - V_{RL}) / V_{RL}$

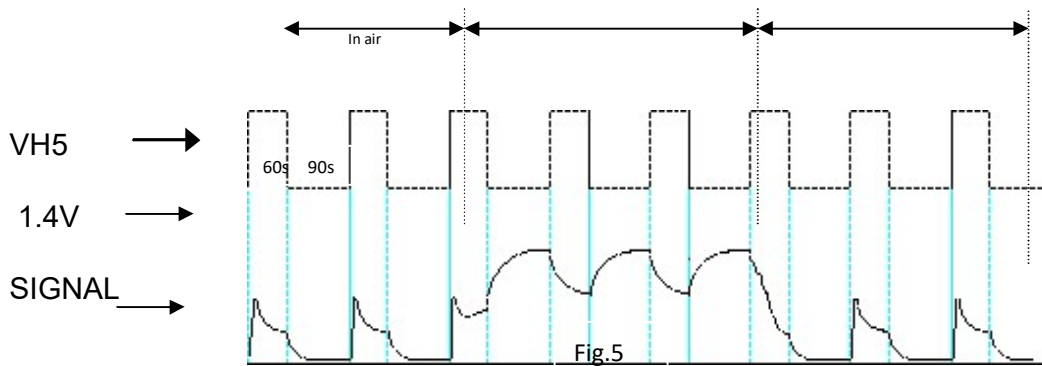


Fig.4.12 shows alterable situation of RL signal output measured by using

signal when the sensor is shifted from clean air to carbon monoxide (CO), output signal measurement is made within one or two complete heating period (2.5 minute from high voltage to low voltage).

Sensitive layer of MQ-7 gas sensitive components is made of SnO_2 with stability, So, it has excellent long term stability. Its service life can reach 5 years under using condition.

4.2.4.2 SENSITIVITY ADJUSTMENT of voltage regulator

Resistance value of MQ-7 is difference to various kinds and various concentration gases. So, When using this components, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 200ppm CO in air and use value of Load resistance that(R_L) about 10 K Ω (5K Ω to 47 K Ω).

When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence. The sensitivity adjusting program:

- Connect the sensor to the application circuit.
- Turn on the power, keep preheating through electricity over 48 hours.
- Adjust the load resistance R_L until you get a signal value which is respond to a certain carbon monoxide concentration at the end point of 90 seconds.

- d. Adjust the another load resistance R_L until you get a signal value which is respond to a CO concentration at the end point of 60 seconds .

4.2.5 WATER LEVEL INDICATOR

The water level indicator circuits are used in factories, chemical plants, and electrical substations and in other liquid storage systems. There are many possible uses for this simple system, examples include monitoring a sump pit (to control pump activation), rainfall detection, and leakage detection. Electronic water level circuits have the capability of alerting if there is a water leak somewhere in the factory. When the water level is too high or too low or exceeds the higher limit, it can detect the water level easily by hearing an alarm sound or from different colors of a light bulb. We can also measure the fuel level in motor vehicles and the liquid level containers which are huge in the companies. The water level alert system in industries can notify the user with an alarm when the water level reached is too high or too low; systems may be wired or wireless. They are used in factories such as electrical substations and in other liquid storage systems which have many uses like flood warning, management of water wells, and locating water. Smart Cities on the east coast of the USA deploy flood warning systems that monitor water levels using Industrial IoT sensors.

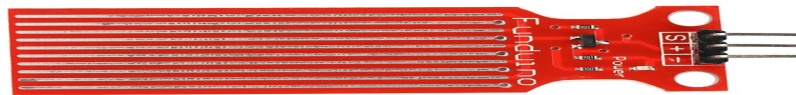


Fig 4.13 WATER LEVEL SENSOR

This is simple and small portable water level/water droplet identification, detection sensor water that have high cost performance. Complete water yield and analog conversion, the output value apply to your custom function. It is low power consumption and high sensitivity. It can make better performance with NodeMcu ESP8366 controller..

Water Sensor water level sensor is an easy-to-use, cost-effective high level/drop recognition sensor, which is obtained by having a series of parallel wires exposed traces measured

droplets/water volume in order to determine the water level. It will easily convert analog voltage conversion and gives analog voltage values

4.2.6 MQ-2 SENSOR

Sensitive material of MQ-2 gas sensor is SnO_2 , which with lower conductivity in clean air. When the target combustible gas exist, The sensor's conductivity is more higher along with the gas concentration rising. Please use simple electrocircuit, Convert change of conductivity to correspond output signal of gas concentration.

MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

Character

- * Good sensitivity to Combustible gas in wide range
- * High sensitivity to LPG, Propane and Hydrogen
- * Long life and low cost
- * Simple drive circuit

Configuration

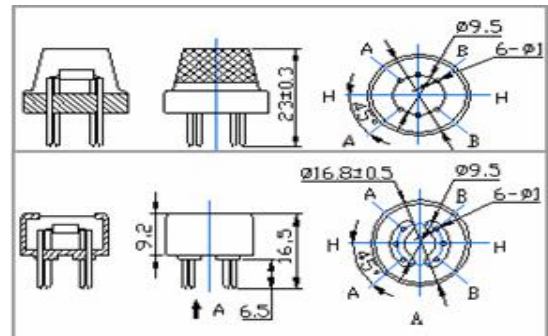


Fig 4.14 MQ-2 DIAGRAM

Application

- * Domestic gas leakage detector
- * Industrial Combustible gas detector
- * Portable gas detector

Basic test loo

The above is basic test circuit of the sensor. The sensor need to be put 2 voltage, heater voltage (VH) and test voltage (VC) . VH used to supply certified working temperature to the sensor, while VC used to detect voltage (VRL) on load resistance (RL) whom is in series with sensor. The sensor has light polarity, Vc need DC power. VC and VH could use same power circuit with precondition to assure performance of sensor. In order to make the sensor with better performance, suitable RL value is needed: Power of Sensitivity body(Ps):

$$P_s = V_c^2 \times R_s / (R_s + R_L)^2$$

sensitivity Characteristics

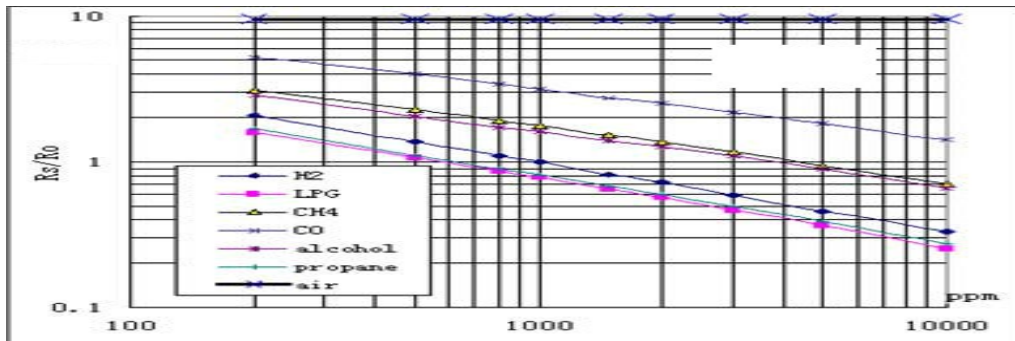


Fig.4.15 shows the typical sensitivity characteristics

The MQ-2, ordinate means resistance ratio of the sensor (R_s/R_o), abscissa is concentration of gases. R_s means resistance in different gases, R_o means resistance of sensor in 1000ppm Hydrogen. All test are under standard test condition.

Structure and configuration of MQ-2 gas sensor is shown as Fig. 3, sensor composed by micro AL_2O_3 ceramic tube, Tin

Dioxide (SnO_2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel

net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-2 have 6 pin, 4

of them are used to fetch signals, and other 2 are used for providing heating current.

4.2.7 MQ-7 SENSOR

Sensitive material of MQ-7 gas sensor is SnO_2 , which with lower conductivity in clean air. It make detection by method of cycle high and low temperature, and detect CO when low temperature (heated by 1.5V). The sensor's conductivity is more higher along with the gas concentration rising. When high temperature (heated by 5.0V), it cleans the other gases adsorbed under low temperature. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ-7 gas sensor has high sensitivity to Carbon Monoxide. The sensor could be used to detect different gases contains CO, it is with low cost and suitable for different application

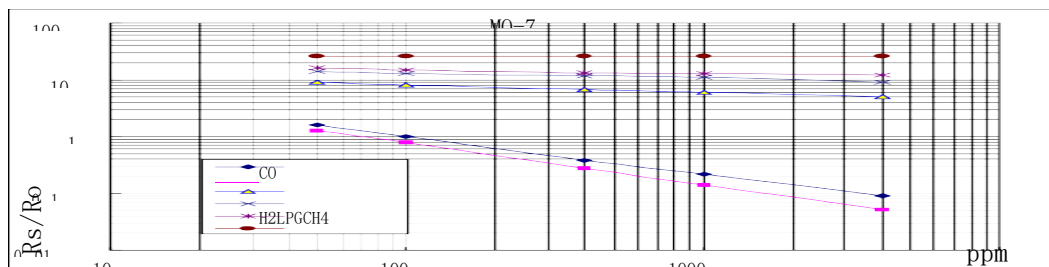


Fig..4.16 It shows the typical sensitivity characteristics of the MQ-7 for several gases.

in their: Temp: 20°C、Humidity: 65%、 O_2 concentration 21% $R_L=10\text{K}\Omega$ R_0 :

sensor resistance at 100ppm CO in the clean air. R_s : sensor resistance at various concentrations of gases.

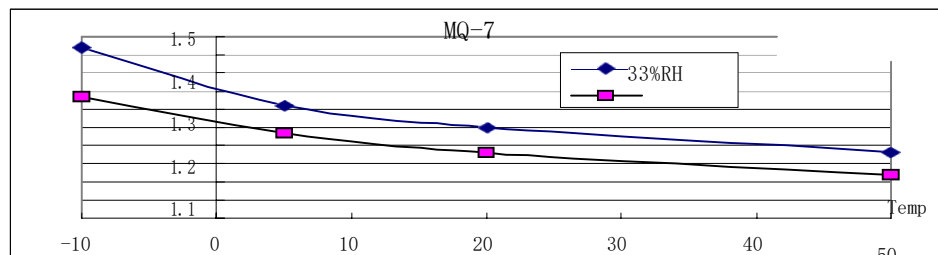


Fig.4.17 is shows the typical dependence of the MQ-7 on temperature and humidity

.Ro: sensor resistance at 100ppm CO in air at 33%RH and 20degree.

Rs: sensor resistance at 100ppm CO at different temperatures and humidities.

OPERATION PRINCIPLE

. The surface resistance of the sensor Rs is obtained through effected voltage signal output of the load resistance RL which series-wound. The relationship between them is described:

$$R_s \backslash R_L = (V_c - V_{RL}) / V_{RL}$$

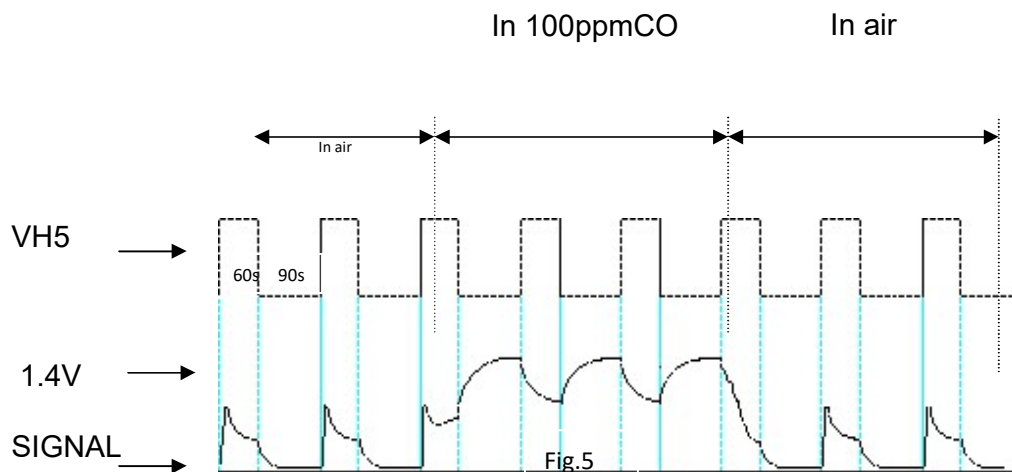


Fig.4.18 circuit output

signal when the sensor is shifted from clean air to carbon monoxide (CO) , output signal measurement is made within one or two complete heating period (2.5 minute from high voltage to low voltage).

Sensitive layer of MQ-7 gas sensitive components is made of SnO₂ with stability, So, it has excellent long term stability. Its service life can reach 5 years under using condition.

SENSITIVITY ADJUSTMENT

Resistance value of MQ-7 is difference to various kinds and various concentration gases. So, When using this components, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 200ppm CO in air and use value of Load resistance that(R_L) about 10 KΩ(5KΩ to 47 KΩ).

When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence. The sensitivity adjusting program:

- a. Connect the sensor to the application circuit.
- b. Turn on the power, keep preheating through electricity over 48 hours.
- c. Adjust the load resistance R_L until you get a signal value which is respond to a certain carbon monoxide concentration at the end point of 90 seconds.

Adjust the another load resistance R_L until you get a signal value which is respond to a CO concentration at the end point of 60 seconds

4.2.8 BUZZER

Its a gadget used to create a sound which gives alert sign of reaching the threshold level of gas sensor. The buzzer connected to digital pin of NodeMcu

1. Dwelling the signal hooked on the bread board, consequently the deuce mains are on euce distinct columns.
2. By means of show jumper ropes, interface Arduino computerized pin no. 8 to the positive lead.
3. Attach the second main to the 100-ohm device, trailed by a ground association

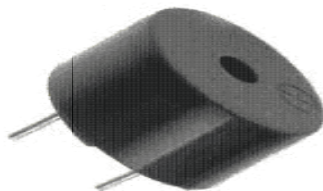


Figure 4.19 : Buzzer

4.2.9 BMP180 SENSOR

The BMP180 is the function compatible successor of the BMP085, a new generation of high precision digital pressure sensors for consumer applications. The ultra-low power, low voltage electronics of the BMP180 is optimized for use in mobile phones, PDAs, GPS navigation devices and outdoor equipment. With a low altitude noise of merely 0.25m at fast conversion time, the BMP180 offers superior performance. The I2C interface allows for easy system

integration with a microcontroller. The BMP180 is based on piezo-resistive technology for EMC robustness, high accuracy and linearity as well as long term stability.

4.2.9.1 General description OF BMP180

The BMP180 is designed to be connected directly to a microcontroller of a mobile device via the I2C bus. The pressure and temperature data has to be compensated by the calibration data of the E2PROM of the BMP180.



Fig 4.20 BMP180 SENSOR

4.2.9.2 General function and application schematics OF BMP180

The BMP180 consists of a piezo-resistive sensor, an analog to digital converter and a control unit with E2PROM and a serial I2C interface. The BMP180 delivers the uncompensated value of pressure and temperature. The E2PROM has stored 176 bit of individual calibration data. This is used to compensate offset, temperature dependence and other parameters of the sensor. • UP = pressure data (16 to 19 bit) • UT = temperature data (16 bit)

4.2.9.3 MEASUREMENT OF PRESSURE AND TEMPERATURE OF BMP180

For all calculations presented here an ANSI C code is available from Bosch Sensortec ("BMP180_API").

The microcontroller sends a start sequence to start a pressure or temperature measurement. After converting time, the result value (UP or UT, respectively) can be read via the I²C interface. For calculating temperature in °C and pressure in hPa, the calibration data has to be used. These constants can be read out from the BMP180 E²PROM via the I²C interface at software initialization.

The sampling rate can be increased up to 128 samples per second (standard mode) for dynamic measurement. In this case, it is sufficient to measure the temperature only once per second and to use this value for all pressure measurements during the same period.

4.2.9.4 I²C Protocol

The I²C interface protocol has special bus signal conditions. Start (S), stop (P) and binary data conditions are shown below. At start condition, SCL is high and SDA has a falling edge. Then the slave address is sent. After the 7 address bits, the direction control bit R/W selects the read or write operation. When a slave device recognizes that it is being addressed, it should acknowledge by pulling SDA low in the ninth SCL (ACK) cycle. At stop condition, SCL is also high, but SDA has a rising edge. Data must be held stable at SDA when SCL is high. Data can change value at SDA only when SCL is low.

At stop condition, SCL is also high, but SDA has a rising edge. Data must be held stable at SDA when SCL is high. Data can change value at SDA only when SCL is low.

Even though V_{DDIO} can be powered on before V_{DD} , there is a chance of excessive power consumption (a few mA) if this sequence is used, and the state of the output pins is undefined so

that the bus can be locked. Therefore, V_{DD} *must* be powered before V_{DDIO} unless the limitations above are understood and not critical.

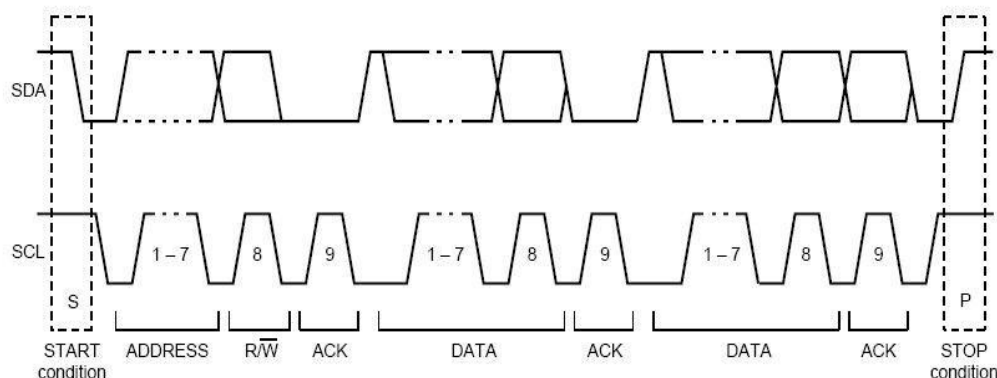


Figure 4.21 I²C protocol

Start temperature and pressure measurement

The timing diagrams to start the measurement of the temperature value UT and pressure value UP are shown below. After start condition the master sends the device address write, the register address and the control register data. The BMP180 sends an acknowledgement (ACKS) every 8 data bits when data is received. The master sends a stop condition after the last ACKS.

Abbreviations:

S Start

S Start

P Stop

ACKS Acknowledge by Slave

NACKM Not Acknowledge by Master

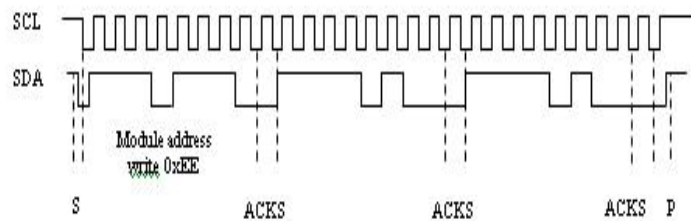


Figure 4.22: Timing diagram for starting pressure measurement

Read A/D conversion result or E²PROM data :

To read out the temperature data word UT (16 bit), the pressure data word UP (16 to 19 bit) and the E²PROM data proceed as follows:

After the start condition the master sends the module address write command and register address.

The register address selects the read register:

E²PROM data registers 0xAA to 0xBF

Temperature or pressure value UT or UP 0xF6 (MSB), 0xF7 (LSB), optionally 0xF8 (XLSB).

Then the master sends a restart condition followed by the module address read that will be acknowledged by the BMP180 (ACKS). The BMP180 sends first the 8 MSB, acknowledged by the master (ACKM), then the 8 LSB. The master sends a "not acknowledge" (NACKM) and finally a stop condition.

Optionally for ultra high resolution, the XLSB register with address 0xF8 can be read to extend the 16 bit word to up to 19 bits;.

4.2.10 ADS115

ADS1115 has an onboard reference and oscillator. Data is transmitted through an I2C compatible serial interface; 4 I2C slave addresses can be selected. ADS1115 uses a single working power supply ranging from 2.0V to 5.5V.

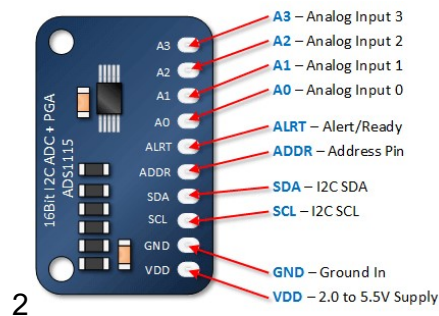


Fig 4.23 ADS1115 ADC CONVERTER

The ADS1115 can perform conversion operations at a rate of up to 860 samples per second (SPS). The ADS1115 has an onboard programmable gain amplifier (PGA) that can provide an input range as low as $\pm 256\text{mV}$ from the power supply voltage, thus enabling the measurement of large and small signals with high resolution. In addition, the ADS1115 also has an input multiplexer (MUX), which can provide 2 differential inputs or 4 single-ended inputs.

ADS1115 can work in continuous conversion mode or single trigger mode, the latter will automatically power off after a conversion is completed, thereby greatly reducing the current consumption in the idle state. ADS1115 has a specified temperature range from -40°C to $+125^{\circ}\text{C}$.

Product features of ADS1115

- Low power consumption: 150uA in continuous mode
- Conversion rate: 8Bps to 860Bps
- Internal oscillator
- Built-in reference voltage: The internal reference voltage can be set by configuring the internal register.
- IIC interface: Address can be programmed through pins, and there are typically three operating modes for communication frequency
- ADS1115 supports the following 3 modes:
 - **Standard mode:** Maximum 100KHz
 - **Fast mode:** maximum 400KHz
 - **High-speed mode:** up to 3.4MHz
- Four single-channel inputs or two differential inputs
- Reference input positive and negative pressure: ADS1115 can collect positive and negative pressure.
- Reference input positive pressure digital acquisition output range: 0-32767 (from small to large)
- Reference input negative pressure digital acquisition output range: 32768-65535 (from small to large)

If the internal reference voltage of ADS1115 is set to 4.096V, the positive voltage acquisition accuracy is $4.096V/2^{15} = 0.125mV$.

- Initialization: ADS1115 related registers are initialized when power is on.
- Operation mode: a single conversion and a continuous conversion.

4.3 SOFTWARE REQUIRED

- Arduino IoT Cloud platform
- Experimental Setup
- Power Management

4.3.1 ARDUINO IOT CLOUD PLATFORM

Connected devices around the world are increasing by billions every year. The Arduino IoT Cloud is a platform that allows **anyone** to create IoT projects, with a user friendly interface, and an all in one solution for **configuration, writing code, uploading** and **visualization**.

STEPS TO FOLLOW

4.3.1.1 Creating an Arduino Account

To starting using the Arduino IoT cloud, we first need to log in or sign up to Arduino.

4.3.1.2 Go to the Arduino IoT Cloud

After we have signed up, you can access the Arduino IoT Cloud from any page on arduino.cc by clicking on the four dots menu in the top right corner. You can also go directly to the Arduino IoT Cloud.

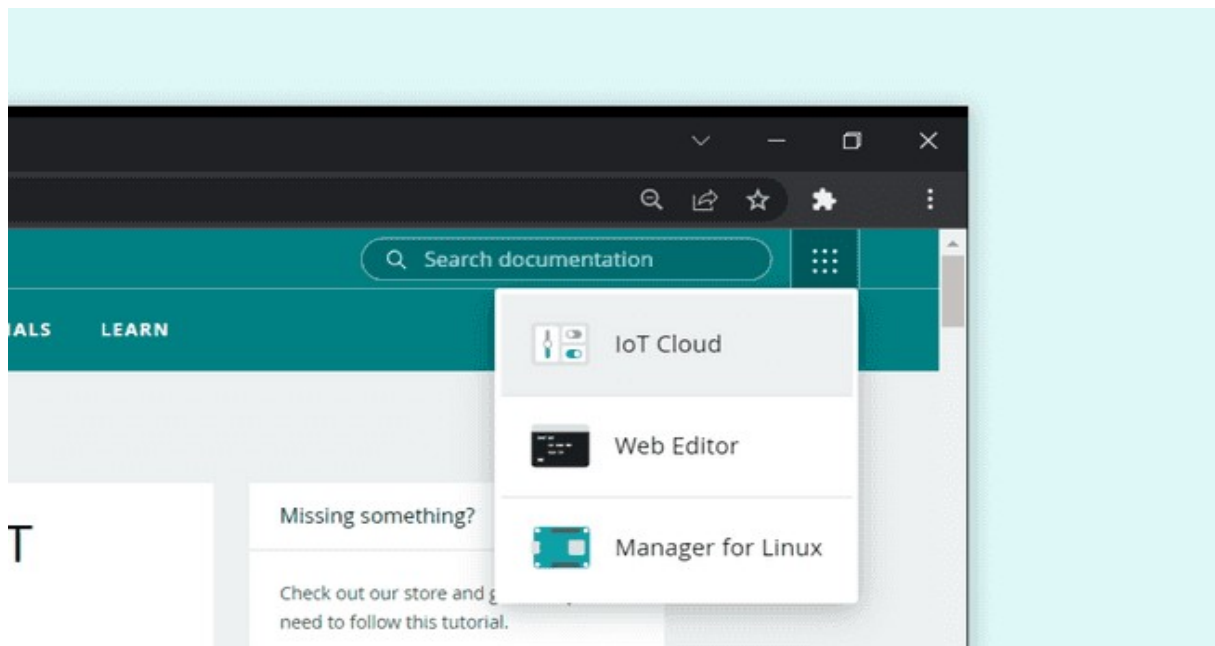


Figure 4.24 Options Page of cloud

4.3.1.3 Creating a Thing

The journey always begin by creating a new **Thing**. In the Thing overview, we can choose what device to use, what Wi-Fi network we want to connect to, and create variables that we

can monitor and control. This is the main configuration space, where all changes we make are automatically generated into a **special sketch file**.

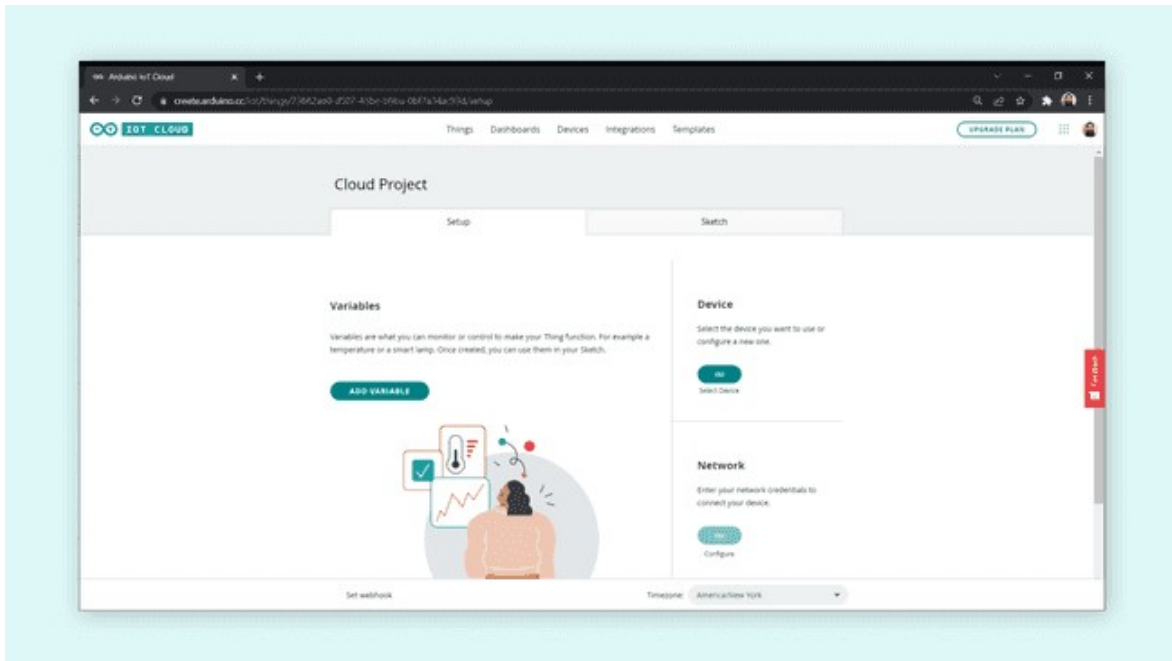


Figure 4.25 The Overview

4.3.1.4 Configuring a Device

Devices can easily be added and linked to a Thing. The Arduino IoT Cloud requires your computer to have the Arduino Agent installed. The configuration process is quick and easy, and can be done by clicking on the “**Select device**” button in the Thing overview. Here, we can choose from any board that has been configured, or select the “**Configure new device**” option.

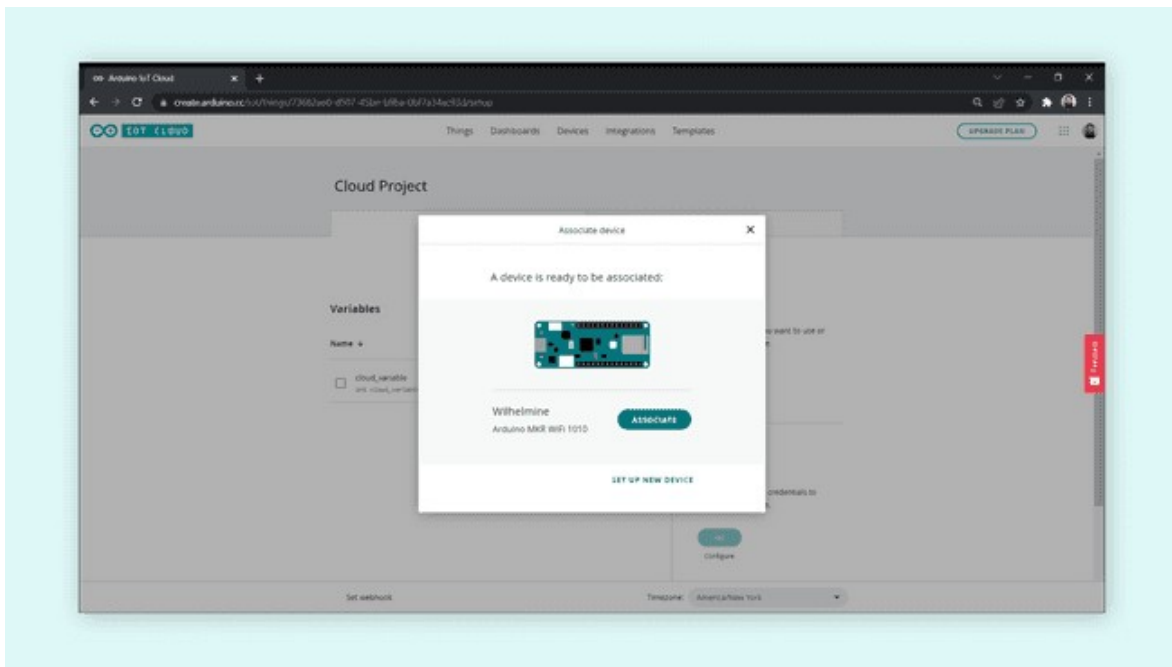


Figure 4.26 Configuring a device.

We can also get a complete overview of our devices by clicking the **"Devices"** tab at the top of the Arduino IoT Cloud interface. Here we can manage and add new devices.

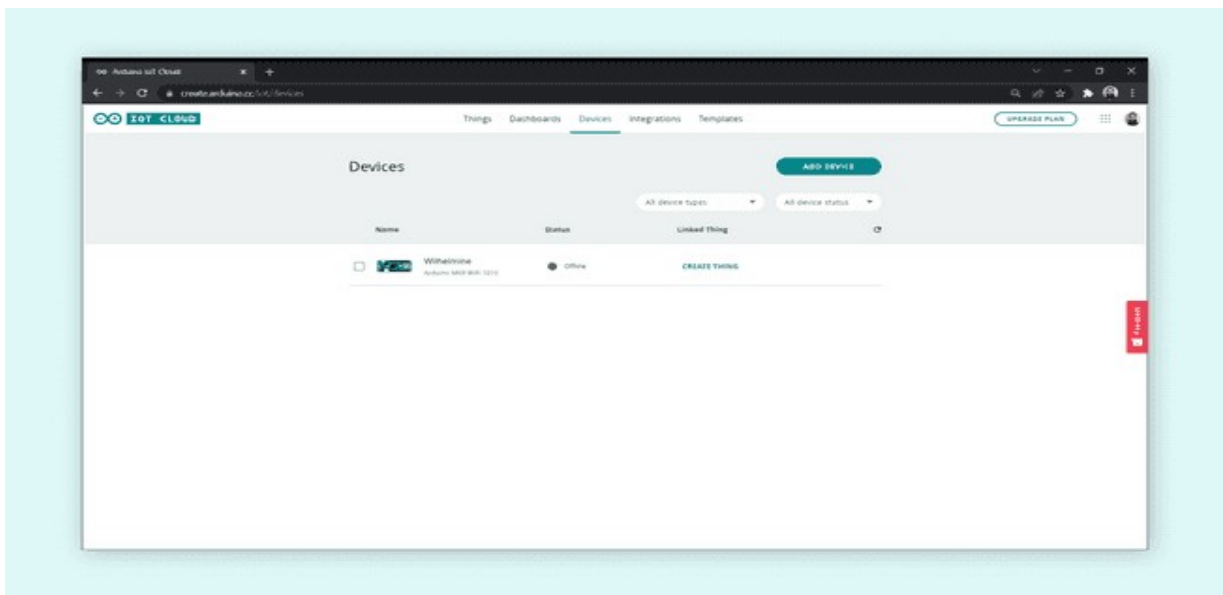


Figure 4.27 The device tab.

4.3.1.5 Creating Variables of Aurdino

The variables we create are automatically generated into a sketch file. There are several data types we can choose from, such as **int**, **float**, **boolean**, **long**, **char**. There's also special variables, such as **Temperature**, **Velocity**, **Luminance** that can be used. When clicking on the “**Add variable**” button, we can choose name, data type, update setting and interaction mode.

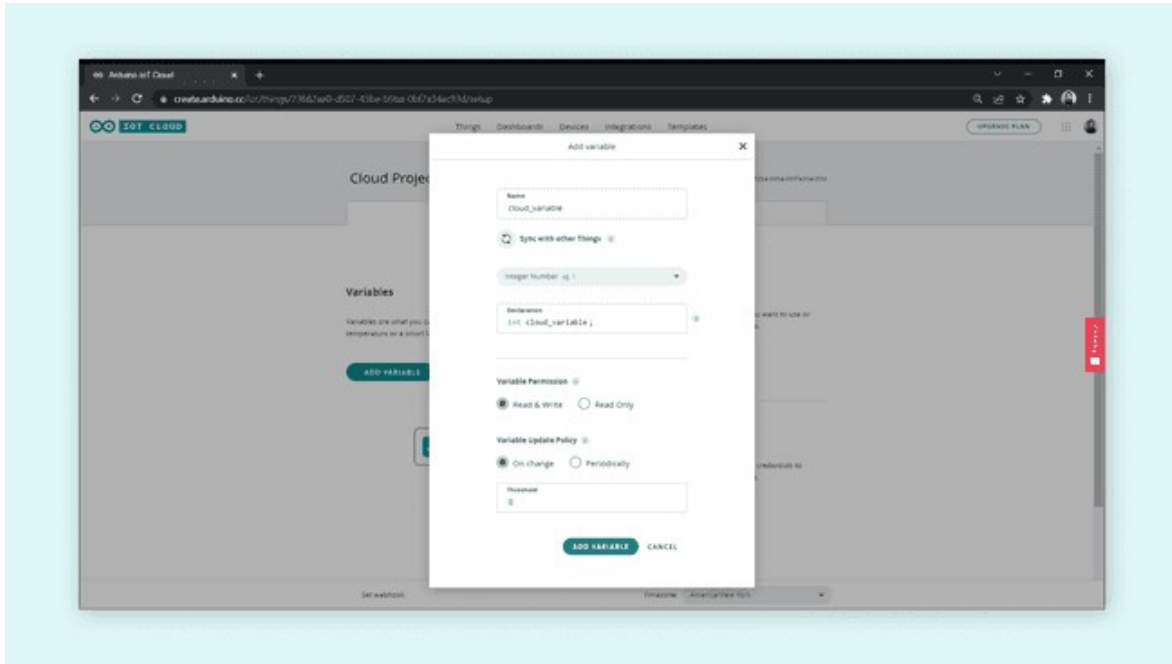


Figure 4.28 Creating variables.

4.3.1.6 Connecting to a Network

To connect to a Wi-Fi network, simply click the “**Configure**” button in the network section. Enter the credentials and click “**Save**”. This information is also generated into your sketch file!

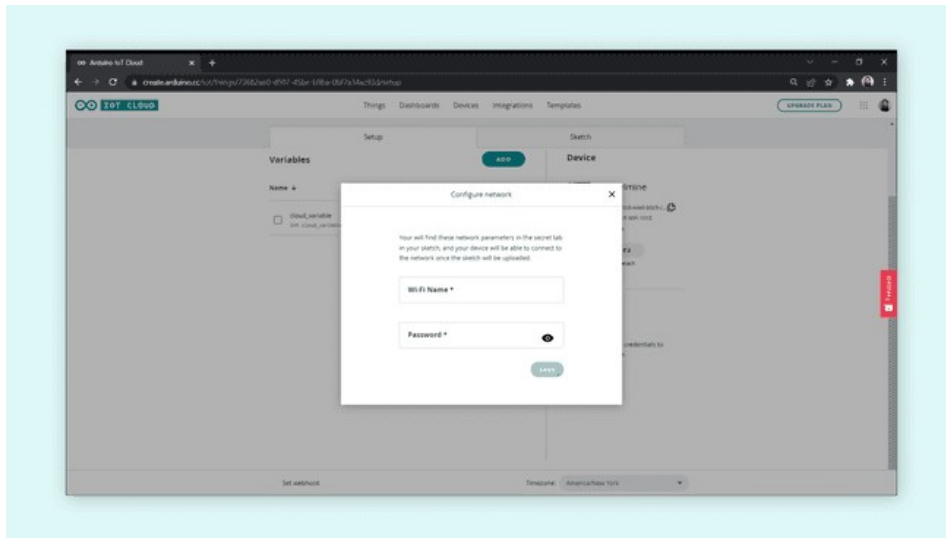


Figure 4.29 Entering network credentials.

4.3.1.7 Editing the Sketch

Now that we have configured variables, devices and network settings, we can get to programming our devices!

An automatically generated sketch file can be found in the **"Sketch"** tab. It has the same structure as a typical

.ino

file, but with some additional code to make the connection to your network and to the cloud.

A sketch that, for example, reads an analog sensor, and use the **cloud variable** to store it. When the sketch has been uploaded, it will work as a regular sketch, but it will also update the cloud variables that we use!

Additionally, each time we create a variable that has the **Read & Write** permission enabled, a function is also generated, at the bottom of your sketch file. Each time this variable changes, it will execute the code within this function! This means that we can leave most of the code out of the **loop()** and only run code when needed.

To upload the program to our board, simply click the **"Upload"** button.

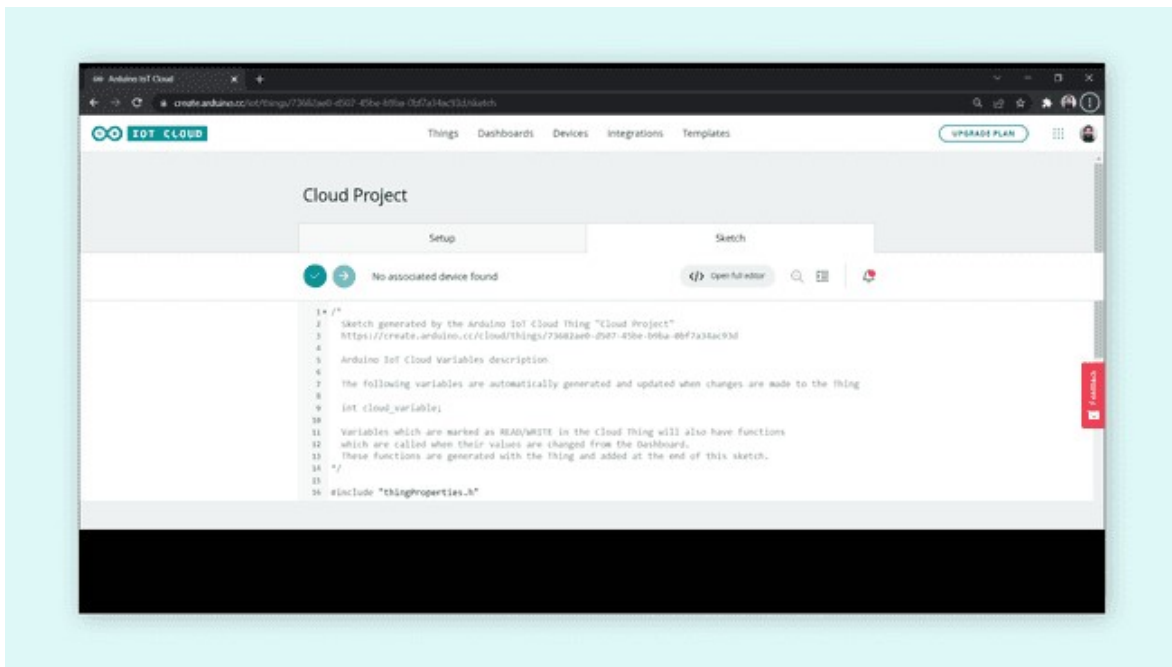


Figure 4.30 Editing a sketch in the cloud editor.

The editor also has a **Serial Monitor Tool**, which can be opened by clicking the magnifying glass in the toolbar. Here you can view information regarding your connection, or commands printed via

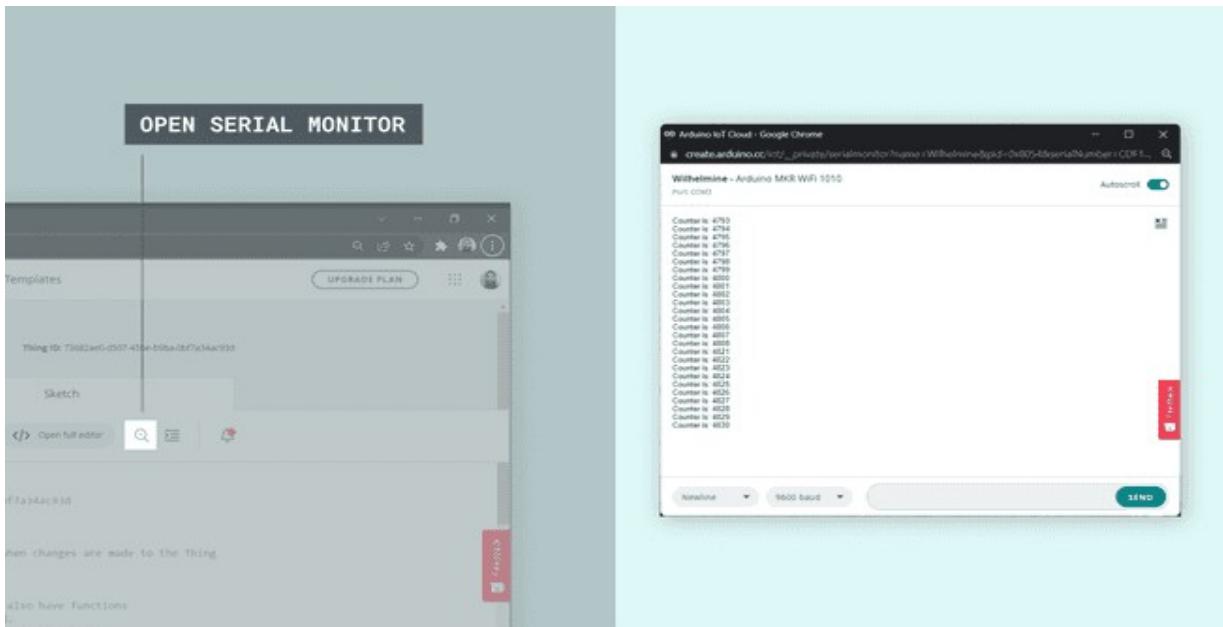


Figure 4.31 The Serial Monitor Tool.

After we have successfully uploaded the code, we can open the **“Serial Monitor”** tab to view information regarding our connection. If it is successful, it will print **“connected to network_name”** and **“connected to cloud”**. If it fails to connect, it will print the errors here as well.

4.3.1.8 Creating a Dashboard

Now that we have configured the device & network, created variables, completed the sketch and successfully uploaded the code, we can move on to the fun part: **creating dashboards!**

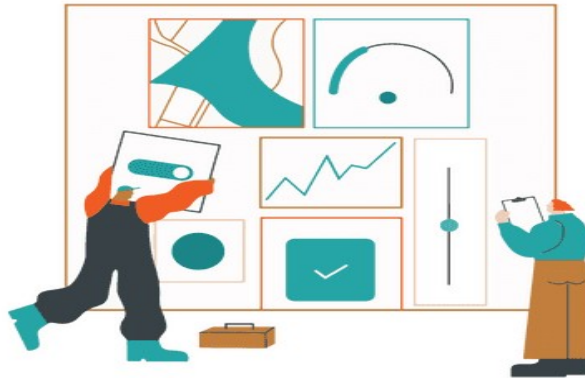


Figure 4.32 Visualize your data.

Dashboards are visual user interface for interacting with your boards over the cloud, and we can setup many different setups depending on what your IoT project needs.

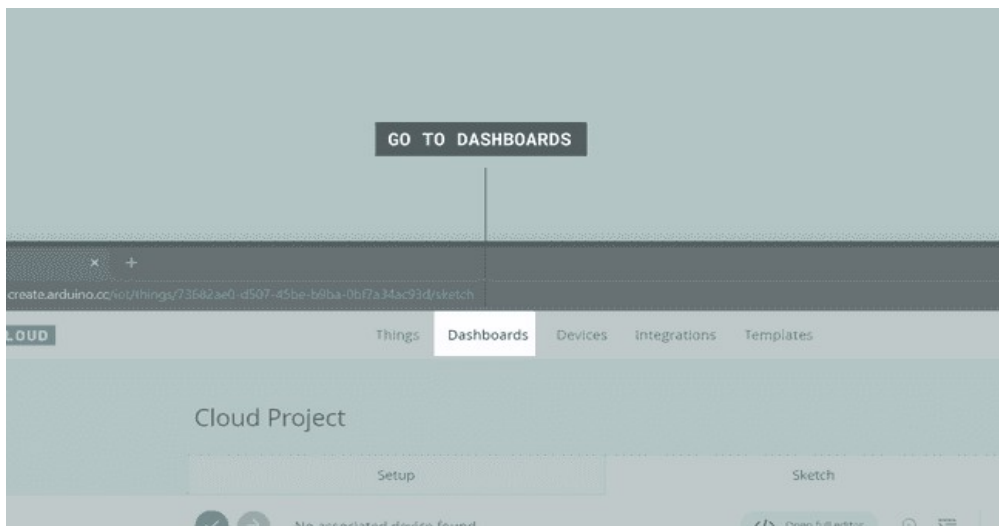


Figure 4.33 Navigating to dashboards.

If we click on **“Create new dashboard”**, we enter a dashboard editor. Here, we can create something called **widgets**. Widgets are the visual representation of our variables we create, and there are many different to choose from. Below is an example using several types of widgets.

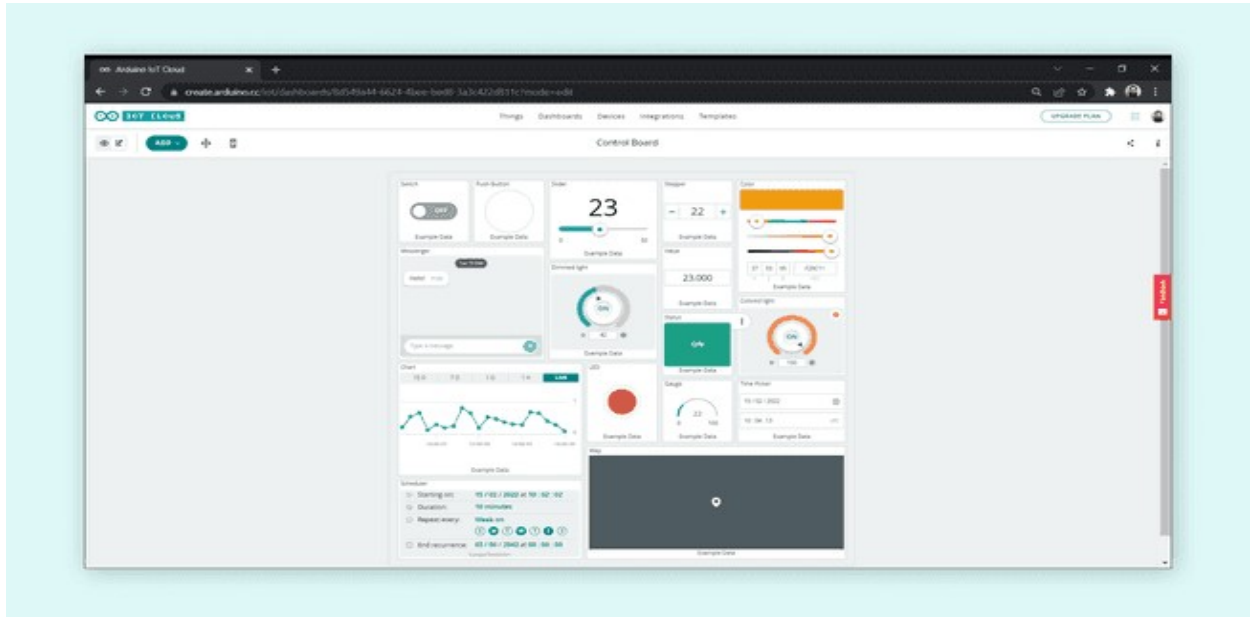


Figure 4.34 The different widgets available.

When we create widgets, we also need to **link them to our variables**. This is done by clicking on a widget we create, select a Thing, and select a variable that we want to link. Once it is linked, we can either interact with it, for example a button, or we can monitor a value from a sensor. As long as our board is connected to the cloud, the values will update!

Let's say we have a **temperature widget** that we want to link to the **temperature** variable inside the **Cloud project** thing.

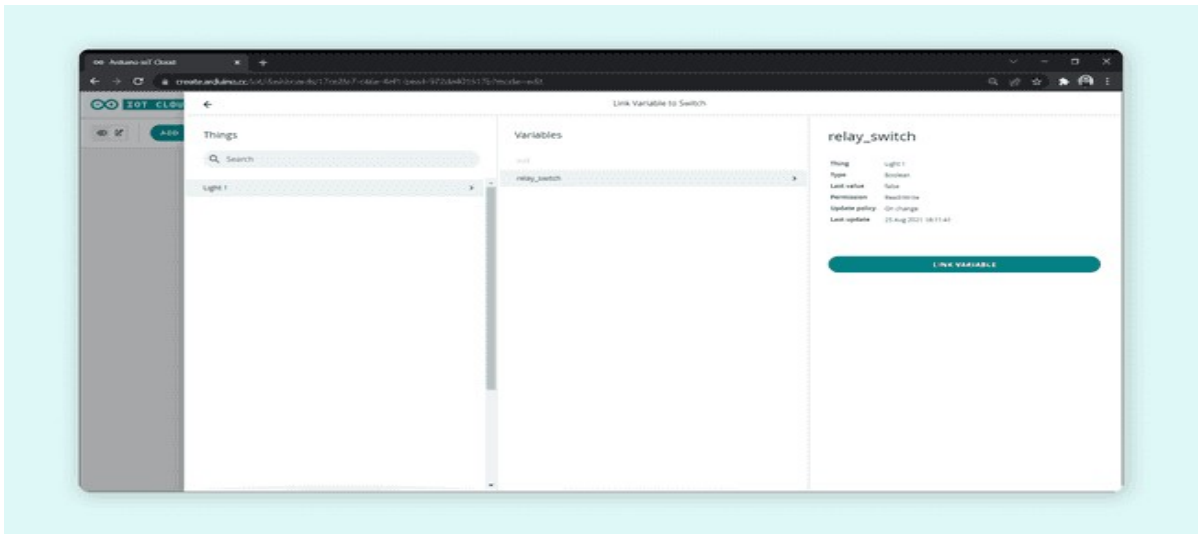


Figure 4.35 Linking a variable to a widget.

Note- that not all widgets and variables are compatible. A switch and an integer can for example not be linked, and will not be an option while setting up your dashboard.

We can also have several things running at once, depending on your Arduino IoT Cloud plan, which we can include in the same dashboard. This is a great feature for tracking multiple boards in for example a larger sensor network, where boards can be connected to different networks around the world, but be monitored from the same dashboard.

4.3.2 Experimental setup

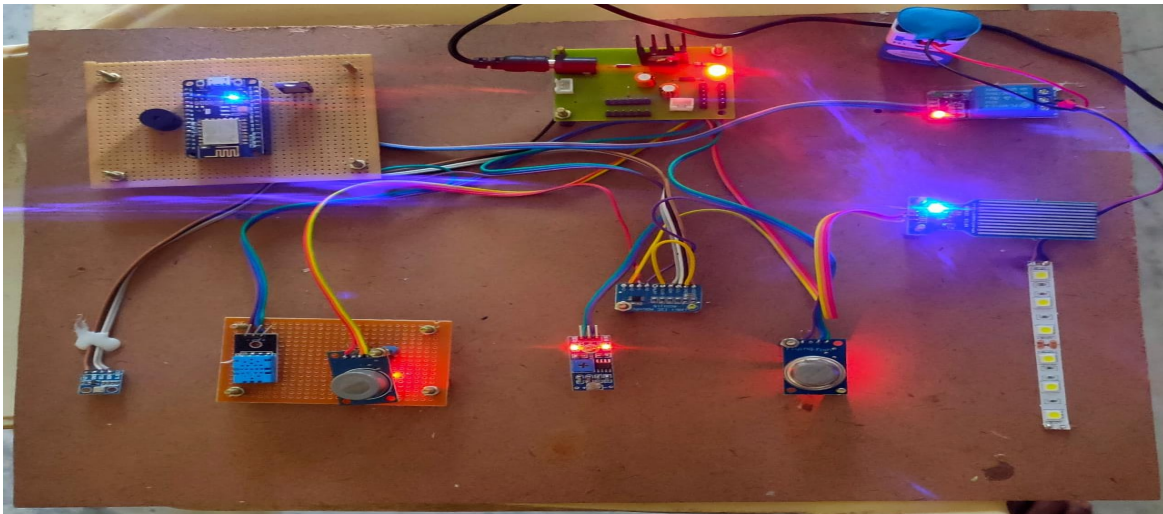


Figure 4.36 Circuit Connection

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 RESULTS

The Weather Monitoring with NodeMcu has the special sensor for detecting the carbon monoxide which is used to know the co level at our surrounding to live in quality air it will perform sensing of gases,rainfall,pressure,etc

It works on 5volt power supply and microcontroller has fastest among other wifi modules and less cost efficient also. when any one of the sensor not working it gives an error.when the power went off and come back it will automatically boot the sensor and resume working without operator. This System starts recording the values from sensor and stores analyze in cloud

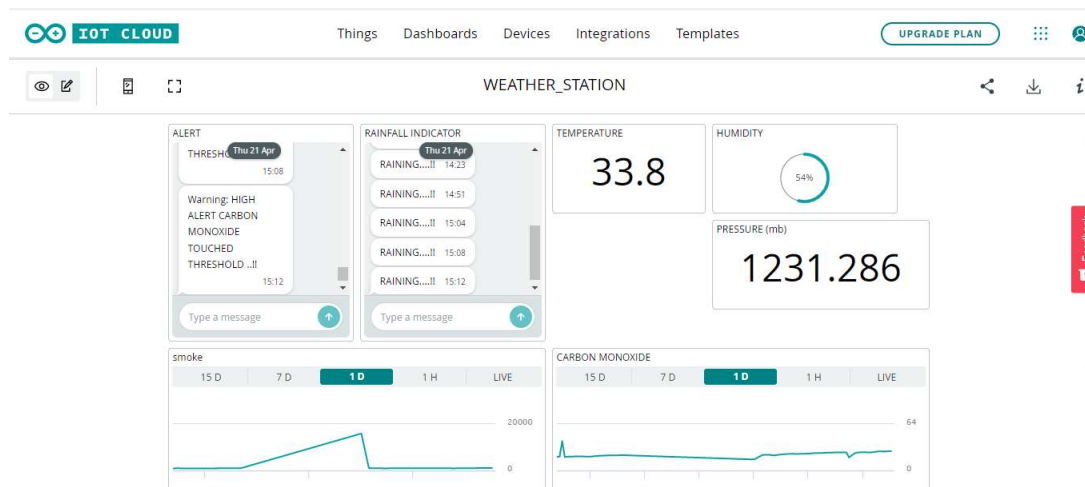


Fig 5.1 Dashboard of weather station

5.2 DISCUSSION

This weather monitoring arrangement is placed on top of roof which is located on the building, it has portable and adjustable. According to the weather monitoring system which senses the physical and chemical characteristics. In-

between if there any disturbance in the system automatically stops and starts indications.

After connecting, it starts giving required power supply to sensors based on operation defined by program. Humidity is continuously taken by the sensor and given to the NodeMcu and then it will show the value given by the sensor with some mathematical manipulations like this all sensors working perfectly

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

The design and development weather monitoring system is very challenging this system has been tested successfully in different areas with various terrain, in various conditions. The performance and efficiency of weather monitoring is increased by the help of this NodeMcu. This NodeMcu has a good capturing capability, so that the Big number values are easily manipulated, because of this the quality of values increased. This can be used throughout day and night which reduces the labor cost. Since it was designed to be user friendly, the operator can control the Weather monitoring system easily .In this paper, a comparative analysis on various systems developed for the controlling and monitoring system for the industry is proposed. Design and implementation of the existing system is also discussed. After reviewing the existing studies, a cost efficient system has been proposed for industrial monitoring and controlling based on IoT framework. In our system various parameters are continuously monitored remotely that to without any human interference. The system ensures a safety work environment for the worker. Facial recognition based logging system is designed to prevent the network intrusion.

6.2FUTURE SCOPE

- By using the artificial intelligence the weather monitoring system can be modified with greatfeatures.
- This will conclude that the real time data successfully helpful because of low agriculture crops and wrong prediction of weather.
- The future of this system is very wide. Internet of Things is just opening its arms, Same system can be applicable to the variety of applications like Data monitoring ,sending and controlling of data at remote location.

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