WEATHER MONITORING & REPORTING SYSTEM

A Project Report

Submitted in partial fulfilment of the Requirements for the award of the Degree of

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

By MISS. RUTUJA BHARAT KAMBLE

IT-23 830**22**

Under the esteemed guidance of

Mr. Ajay Barve

Assistant Professor

DEPARTMENT OF INFORMATION TECHNOLOGY

Kirti M. Doongursee College of Arts, Science & Commerce

(AUTONOMOUS)

KASHINATH DHURU, DADAR(W), MUMBAI, 400 028

MAHARASHTRA

2023- 24

DECLARATION

I here by declare that the project entitled, "WEATHER MONITORING & REPORTING SYSTEM" where the project is done, has not been in any case duplicated to submit to any other university for the award of anydegree. TO the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirement for the award of degree of BACHELOR OF SCIENCE (INFORMATION TECHONOLOGY) to be submitted at final semesterproject as part of our curriculum.

RUTUJA BHARAT KAMBLE [22]

KIRTI M. DOONGURSEE COLLEGE(AUTONOMOUS)

(Affiliated to University of Mumbai)

MUMBAI-400028,MAHARASHTRA

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

CERTIFICATE

This is to certify that the project entitled, **"WEATHER MONITORING & REPORTING SYSTEM"**, is a bonafide work of **Rutuja Bharat Kamble** bearing Seat No **[22]** submitted in partial fulfillment of the requirements for the award of degree of BACHELOR OF SCIENCE in INFORMATION TECHNOLOGY from the University of Mumbai for the academic year 2022-2023.

Dr. Ajay Barve | **Dr. Apurva Yadav**

Project Guide | **H.O.D CS and IT**

External Examiner

ABSTRACT

The IOT based Weather Monitoring and Reporting System project is used to get Live reporting of weather conditions. It will Monitor temperature, humidity, moisture and rain level. Suppose Scientists/nature analysts want to monitor changes in a particular environment like volcano or a rain-forest. And these people are from different places in the world. In this case, SMS based weather monitoring system has some limitations. Since it sends SMS to few numbers. And time for sending SMS increases as the number of mobile numbers increases. In order to know the information about weather of a particular place then they have to visit that particular sites. Where everyone can see it.

AKNOWLEDGEMMENT

It is with great pleasure that we present our project 'Weather Monitoring and Reporting System', which will monitor temperature, humidity, moisture and rain level.

We take this opportunity to express our gratitude to the faculty of Kirti. M. Dongursee College of Arts, Commerce & Science.

We are highly indebted to our project guides Mrs. Neha Ansari for their inevitable guidance and wish to express our deep sense of gratitude and a constant source of giving from and substance to this report. We thank them for being a constant source of inspiration and helping us in our difficulties.

We could like to thank our principal Dr. D. V. Pawar Sir and the department of Information Technology/Computer Science, under Prof. Apurva Yadav for the use of college and department facilities. We thank our staff and colleagues of the department of Information Technology/Computer Science for being with us during this long span, for providing us with information and assistance to prove ourselves in our respective fields.

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CHAPTER 1

INTRODUCTION

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 Arduino UNO 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 wifi 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.

Existing system model is presented IOT based Weather monitoring and reporting system where you can collect, process, analyze, and present your measured data on web server. Wireless sensor network management model consists of end device, router, gateway node and management monitoring center. End device is responsible for collecting wireless sensor network data, and sending them to parent node, then data are sent to gateway node from parent node directly or by router. After receiving the data from wireless sensor network, gateway node extracts data after analyzing and packaging them into Ethernet format data, sends them to the server. Less formally, any device that runs server software.

1.1 BACKGROUND:

The background of loT-based weather monitoring systems lies at the intersection of two major technological advancements: the Internet of Things (IoT) and weather monitoring. Let's explore the background of both these fields:

1. Internet of Things (IoT):

The Internet of Things refers to the network of interconnected devices embedded with sensors, software, and connectivity capabilities that enable them to collect and exchange data. IoT allows physical objects to be connected to the internet, enabling them to communicate, interact, and be remotely controlled or monitored.

loT has witnessed significant growth in recent years due to advancements in wireless communication technologies, miniaturization of sensors, and the increasing availability of high- speed internet. It has found applications in various industries, including healthcare, transportation, agriculture, manufacturing, and environmental monitoring.

2. Weather Monitoring:

Weather monitoring involves the collection, analysis, and predict- ion of atmospheric conditions and weather patterns. Meteorologists and scientists use various instruments and sensors to measure param-eters such as temperature, humidity, wind speed and direc tion, precipit-ation, air pressure, and solar radiation. This data is crucial for weather forecasting, climate studies, and understanding weather patterns.

Traditional weather monitoring systems have typically relied on weather stations equipped with sensors and manned observation. However, these systems are limited in coverage, scalability, and real-time data transmission.

The Emergence of IoT-based Weather Monitoring Systems:

The integration of IoT with weather monitoring has opened up new possibilities in terms of data collection, accuracy, and accessibility By deploying a network of connected weather sensors and leveraging IoT technologies, it has become possible to collect data from multiple locations simultaneously and in real-time.

IoT-based weather monitoring systems offer several advantages over traditional systems. They enable automated data collection, reduce manual intervention, improve data accuracy, and provide more granular and localized information. With IoT connectivity, weather data can be seamlessly transmitted to centralized servers or cloud platforms, where it can be stored, processed, and analyzed using advanced algorithms and machine learning techniques.

Moreover, IoT-based weather monitoring systems can be integrated with other systems and applications, such as smart cities, agriculture, transportation, and emergency management. This integration enables optimized resource allocation, efficient decision-making, and enhanced public safety.

The future of IoT-based weather monitoring systems is expected to witness further advancements in sensor technology, communi- cation protocols, data analytics, and artificial intelligence. These advancements will continue to enhance the accuracy of weather predictions, improve emergency response, and contribute tovario- us industries' sustainable development and resilience to weather- related events.

- Climatic change and environmental monitoring have received much attention recently. Man wants to stay updated about the latest weather conditions of any place like a college campus or any other particular building.
- Since the world is changing so fast so there should be the weather stations. Here in this paper we present a weather station that is very helpful for any places. This weather station is based on IOT (internet of things).

- It is equipped with environmental sensors used for measurements at any particular place and report them in real time on cloud.
- To accomplish this we used Arduino Uno and different environmental sensors like DHT11, soil moisture sensor and rain drop sensor.
- The sensors constantly sense the weather parameters and keeps on transmitting it to the online web server over a wifi connection.
- The weather parameters are uploaded on the cloud and then provides the live reporting of weather information.
- This paper also focuses on the IOT application in the new generation of environmental information and provides a new paradigm for environmental monitoring in future. The system has been development particularly in the view of building smart city by giving the weather update of any particular place like a particular office or room.

1.2 OBJECTIVES:

- The system has been development particularly in the view of building smart city by giving the weather update of any particular place like a particular office or room
- Existing system model is presented IOT based Weather monitoring and reporting system where you can collect, process, analyze, and present your measured data on web server.
- Wireless sensor network management model consists of end device, router, gateway node and management monitoring center.
- End device is responsible for collecting wireless sensor network data, and sending them to parent node, then data are sent to gateway node from parent node directly or by router
- After receiving the data from wireless sensor network, gateway node extracts data after analyzing and packaging them into Ethernet format data, sends them to the server.
- Less formally, any device that runs server software could be considered a server as well. Servers are used to manage network resources.
- The services or information provided through the Internet that are connected through LAN and made available for users via smart phones, web browser or other web browser devices to make the system more intelligent, adaptable and efficient.

1.3 PURPOSES:

The purpose of a weather monitoring system in the context of the Internet of Things (IoT) is to enable real-time and accurate collection, analysis, and dissemination of weather data using interconnected devices and sensors. loT-based weather monitoring systems serve several important purposes: Weather Forecasting and Prediction: The primary purpose of a weather monitoring system is to gather data on various weather parameters such as temperature, humidity, atmospheric pressure, wind speed, rainfall, and more. This data is crucial for weather forecasting and prediction models.

By continuously collecting real-time weather data from multiple locations, IoT-based systems contribute to more accurate and localized weather forecasts, enabling individuals, businesses, and organizations to plan and prepare for changing weather conditions.

Early Warning Systems: Weather monitoring systems in IoT play a vital role in early warning systems for severe weather events such as hurricanes, storms, floods, or heatwaves.By capturing and analyzing weather data in real-time, these systems can trigger alerts and notifications to authorities, emergency response teams, and the public, enabling them to take necessary precautions and mitigate potential risks.

Climate Research and Analysis: loT-enabled weather monitoring systems generate large volumes of weather data over time. This data is valuable for climate researchers, scientists, and environmental agencies to study long-term climate patterns, analyze climate change impacts, and develop strategies for climate adaptation and mitigation, IoT-based systems facilitate the collection of comprehensive and reliable weather data for indepth analysis and research.

Resource Management and Optimization: Weather conditions have a significant impact on various sectors such as agriculture, energy, transportation, and water management. IoT weather monitoring systems provide real-time data that can be used to optimize resource allocation and management. For example, farmers can make informed decisions about irrigation schedules based on rainfall data, energy companies can adjust power generation strategies based on wind and solar radiation data, and transportation companies can optimize routes based on weather conditions.

Personalized Weather Information: IoT-based weather monitoring systems allow individuals to access personalized weather information through mobile applications or web portals. Users can receive real-time weather updates, forecasts, and alerts tailored to their specific location and preferences. This personalized information helps individuals plan outdoor activities, dress appropriately for the weather, and make informed decisions based on the current and predicted weather conditions.

Integration with Smart Systems: IoT weather monitoring systems can be integrated with other smart systems, such as smart homes, smart cities, or agricultural automation systems. For example, based on weather conditions, a smart home system can automatically adjust temperature settings or close windows. In smart cities, weather data can be used for intelligent traffic management or optimizing energy consumption.

1.4. APPLICABILITY:

- This application is an educational based application, so it can be used in college, schools and educational institutes.
- The system is used for maintaining the temperature and humidity in a room.
- The monitoring of weather parameters in an industry and also in a room can be done by using the weather monitoring system.
- It does not require any human attention.
- We can get prior alert of weather conditions..
- The low cost and efforts are less in this system.
- Accuracy is high.
- Self Protection.
- Smart way to monitor Environment Efficient.

CHAPTER 2

REQUIREMENT AND ANALYSIS

2.1 Problem Definition:

- Weather monitoring system being very hand for better performance of the solar plants has the issue of higher cost.
- The hard drive based data logging facility requires a separate computer setup for its operation and many a times, the data stored cannot be manipulated in a useful mean.
- These two problems are the primary concerns when you consider a weather monitoring system and we have come up with cost effective innovative solution to provide the layman's weather monitoring system.

2.2 Requirement Specification:

- 2.2.1 Arduino
- 2.2.2 Rain Level Sensors
- 2.2.3 Temperature & Humidity Sensor
- 2.2.4 LCD Display
- 2.2.5 Soil Moisture Sensor
- 2.2.6 WiFi module

2.3 Software Requirement:

ARDUINO IDE 2.1.0

CHAPTER 3

THEORY

3.1. loT (Internet of Things) :

Data Collection

This software manages sensing, measurements, light data filtering, light data security, and aggregation of data. It uses certain protocols to aid sensors in connecting with real-time, machineto-machine networks. Then it collects data from multiple devices and distributes it in accordance with settings. It also works in reverse by distributing data over devices. The system eventually transmits all collected data to a central server.

Device Integration

Software supporting integration binds (dependent relationships) all system devices to create the body of the loT system. It ensures the necessary cooperation and stable networking between devices. These applications are the defining software technology of the loT network because without them, it is not an IoT system. They manage the various applications, protocols, and limitations of each device to allow communication.

Real-Time Analytics

These applications take data or input from various devices and convert it into viable actions or clear patterns for human analysis. They analyze information based on various settings and designs in order to perform automation-related tasks or provide the data required by industry.

Application and Process Extension

These applications extend the reach of existing systems and software to allow a wider, more effective system. They integrate predefined devices for specific purposes such as allowing certain mobile devices or engineering instruments access. It supports improved productivity and more accurate data collection.

3.1.1. Internet of Things - Technology and Protocols:

IoT primarily exploits standard protocols and networking technologies. However, the major enabling technologies and protocols of loT are RFID, NFC, low-energy Bluetooth, lowenergy wireless, low- energy radio protocols, LTE-A, and WiFiDirect. These technologies support the specific networking functionality needed in an loT system in contrast to a standard uniform network of common systems.

- **NFC and RFID**

  RFID (radio-frequency identification) and NFC (near-field communication) provide simple, lowenergy, and versatile options for identity and access tokens, connection bootstrapping, and payments.

  RFID technology employs 2-way radio transmitter-receivers to identify and track tags associated with objects. NFC consists of communication protocols for electronic devices, typically a mobile device and a standard device.

- **Low-Energy Bluetooth**

  This technology supports the low-power, long-use need of IoT function while exploiting a standard technology with native support across systems.

- **Low-Energy Wireless**

  This technology replaces the most power hungry aspect of an IoT system. Though sensors and other elements can power down over long periods, communication links (i.e., wireless)
  must remain in listening mode. Low-energy wireless not only reduces consumption, but also extends the life of the device through less use.

- **Radio Protocols**

  ZigBee, Z-Wave, and Thread are radio protocols for creating low-rate private area networks. These technologies are lowpower, but offer high throughput unlike many similar options. This increases the power of small local device networks without the typical costs.

- **LTE-A**

  LTE-A, or LTE Advanced, delivers an important upgrade to LTE technology by increasing not only its coverage, but also reducing its latency and raising its throughput. It gives IoT a tremendous power through expanding its range, with its most significant applications being vehicle, UAV, and similar communication.

- **WiFi-Direct**

  WiFi-Direct eliminates the need for an access point. It allows P2P (peer-to-peer) connections with the speed of WiFi, but with lower latency. WiFi-Direct eliminates an element of a network that often bogs it down, and it does not compromise on speed or throughput.

3.1.2. Internet of Things - Common Uses:

IoT has applications across all industries and markets. It spans user groups from those who want to reduce energy use in their home to large organizations who want to streamline their operations. It proves not just useful, but nearly critical in many industries as technology advances and we move towards the advanced automation imagined in the distant future.

Engineering, Industry, and Infrastructure:

Applications of IoT in these areas include improving production, marketing, service delivery, and safety. IoT provides a strong means of monitoring various processes; and real transparency creates greater visibility for improvement opportunities.

The deep level of control afforded by IoT allows rapid and more action on those opportunities, which include events like obvious customer needs, nonconforming product, malfunctions in equipment, problems in the distribution network, and more.

Government and Safety :

IoT applied to government and safety allows improved law enforcement, defense, city planning, and economic management. The technology fills in the current gaps, corrects many current flaws, and expands the reach of these efforts. For example, IoT can help city planners have a clearer view of the impact of their design, and governments have a better idea of the local economy.

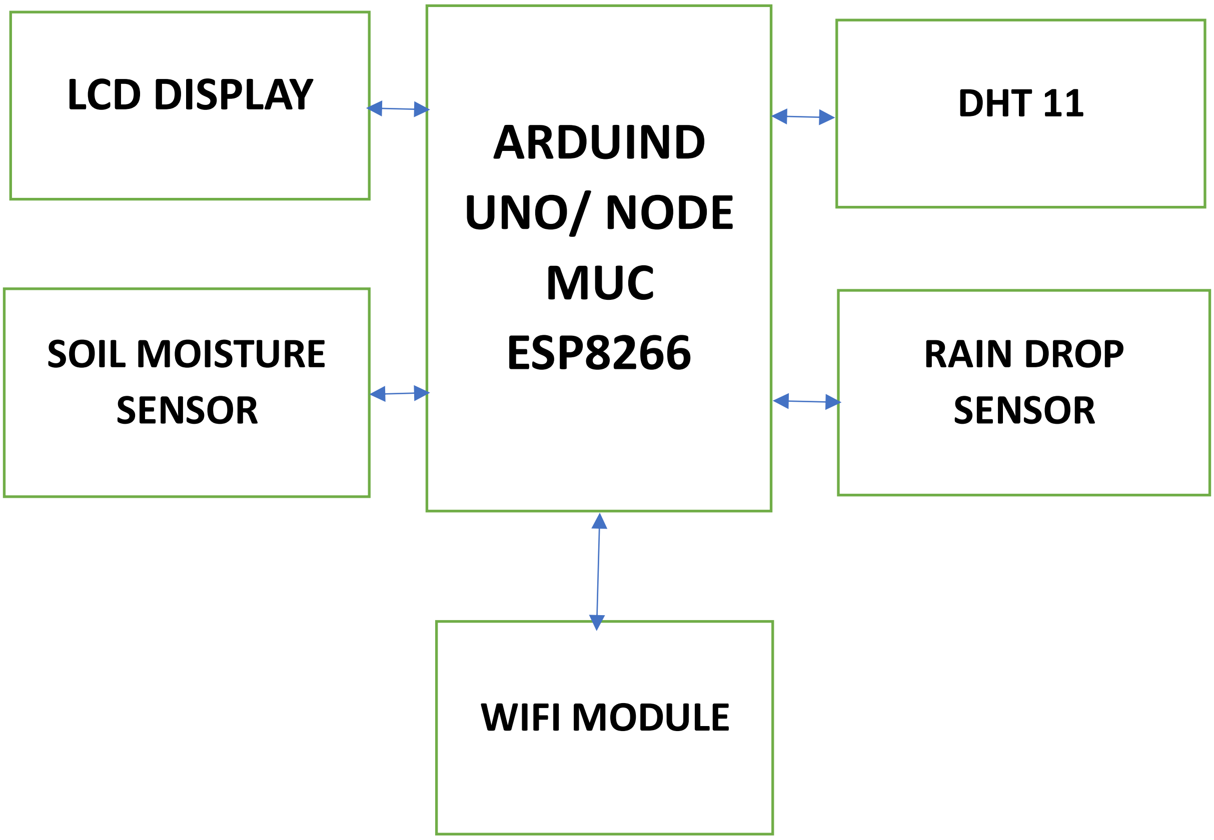
Home and Office:

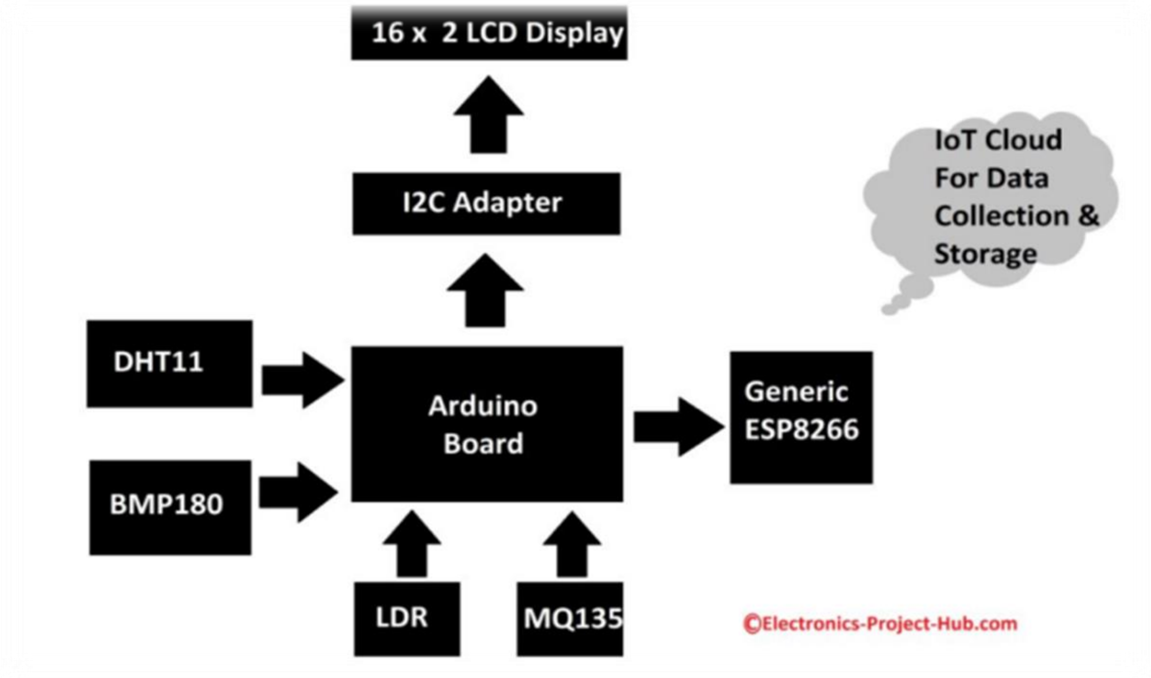
In our daily lives, IoT provides a personalized experience from the home to the office to the organizations we frequently do business with. This improves our overall satisfaction, enhances productivity, and improves our health and safety. For example, IoT can help us customize our office space to optimize our work.

Health and Medicine:

loT pushes us towards our imagined future of medicine which exploits a highly integrated network of sophisticated medical devices. Today, IoT can dramatically enhance medical research, devices, care, and emergency care. The integration of all elements provides more accuracy, more attention to detail, faster reactions to events, and constant improvement while reducing the typical overhead of medical research and organization.

3.2 BLOCK DIAGRAM :





Block diagram with Arduino

CHAPTER 4

PURPOSED SYSTEM AND ARCHITECTURE

4.1. Features of purposed system :

In IOT enabled weather monitoring system project, Arduino Uno measures 4 weather parameters using respective 4 sensors. These sensors are a temperature sensor, humidity sensor, light sensor, and rain level sensor. These 4 sensors are directly connected to Arduino Uno since it has an inbuilt Analog to digital converter. The weather monitoring system gives high accuracy and reliability for weather monitoring and climate changing. It uses the renewable energy source like solar panel for charging the connected battery. Through the web, it access real time weather information and data. This system can be communicated over general packet radio service (GPRS) network. Low maintenance is required for end users. It is capable for storing data and providing it to the users as required.

4.2. Purposed Hardware Architecture :

The implemented system consists of a microcontroller (ESP8266) 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 with via blynk app then we can measure temperature, humidity, pressure and rain fall.

4.3. Circuit Diagram :

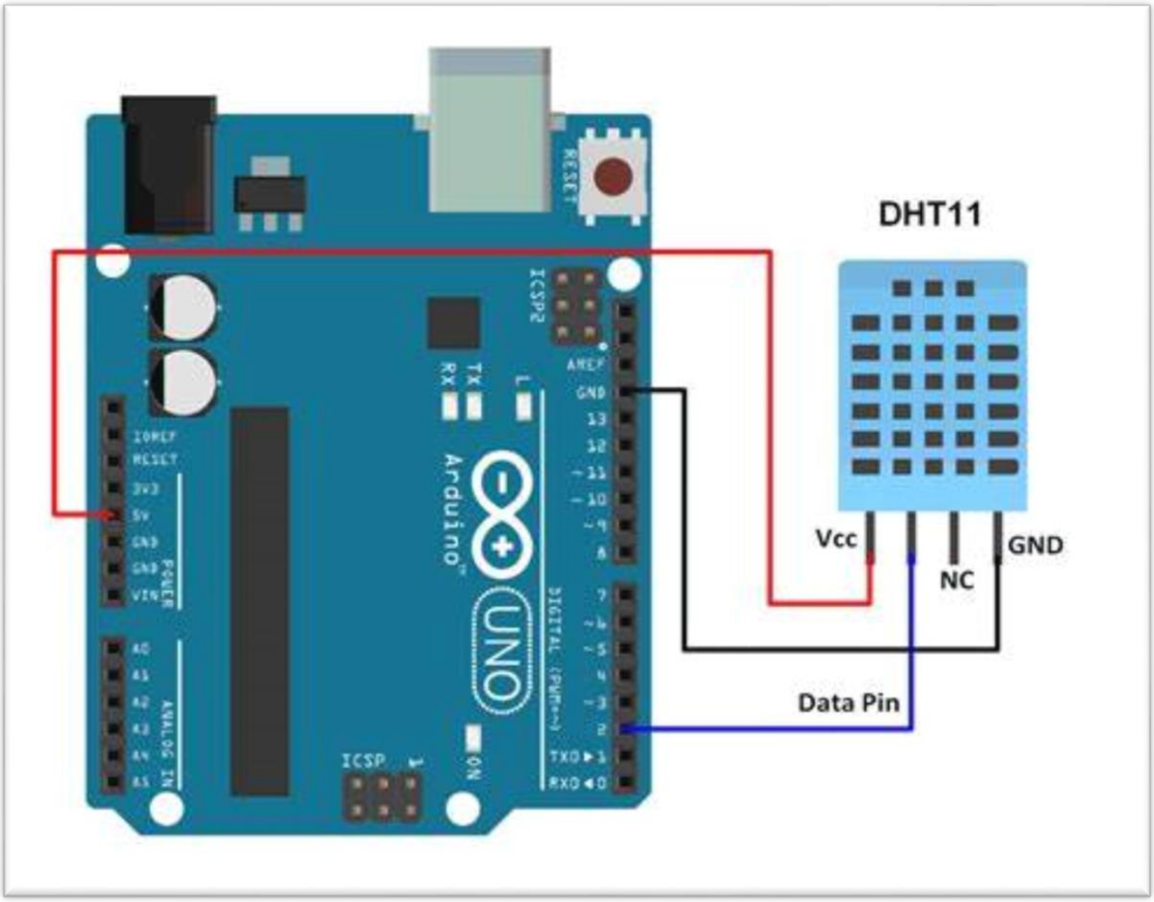


Fig – 1 Circuit diagram of DHT11 with Arduino

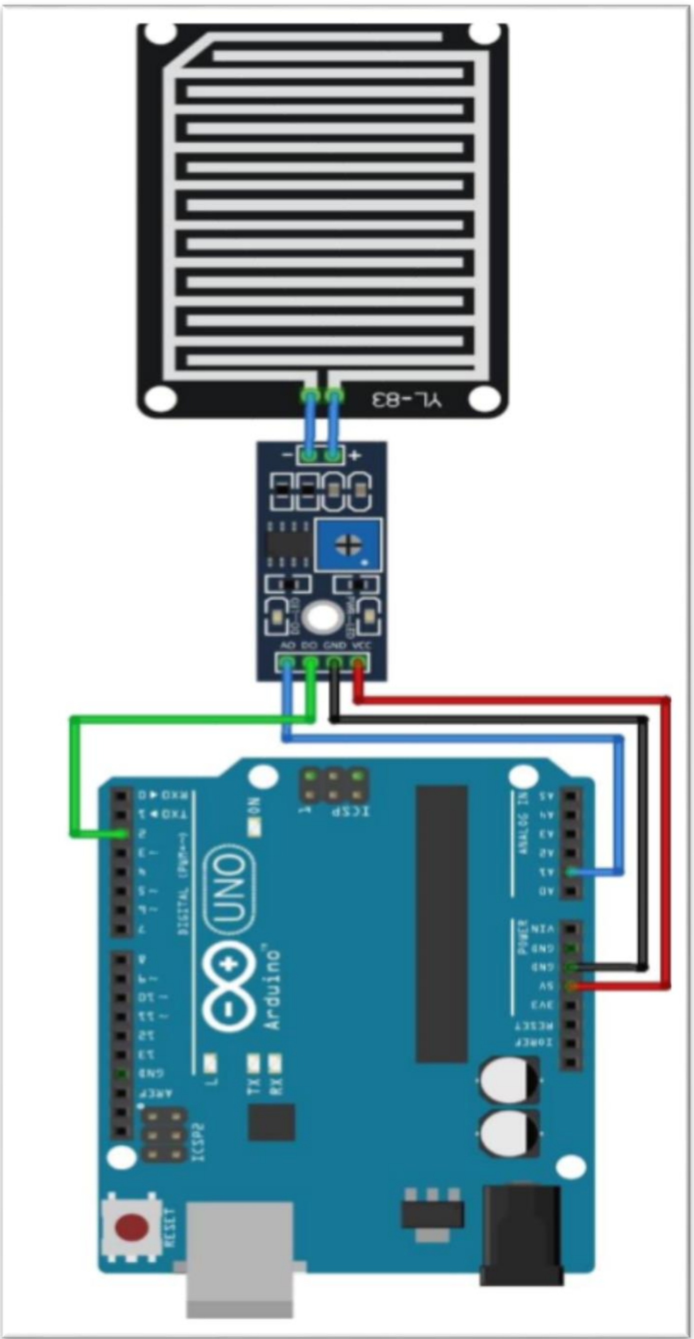


Fig – 2 Circuit diagram of Rain sensor with Arduino

4.4. List of required hardware components:

Serial No.	Name of the components
1.	Arduino UNO
2.	ESP8266 WiFi Module
3.	DHT11
4.	Rain Sensor
5.	16 2 LCD Display
6.	Beard Board
7.	Jumper Wire
8.	Data Cable

4.5. Details of Hardware Component:

4.5.1 Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16MOV53-RO), and a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with an ACto-DC adapter or battery to get started.. You can tinker with Your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

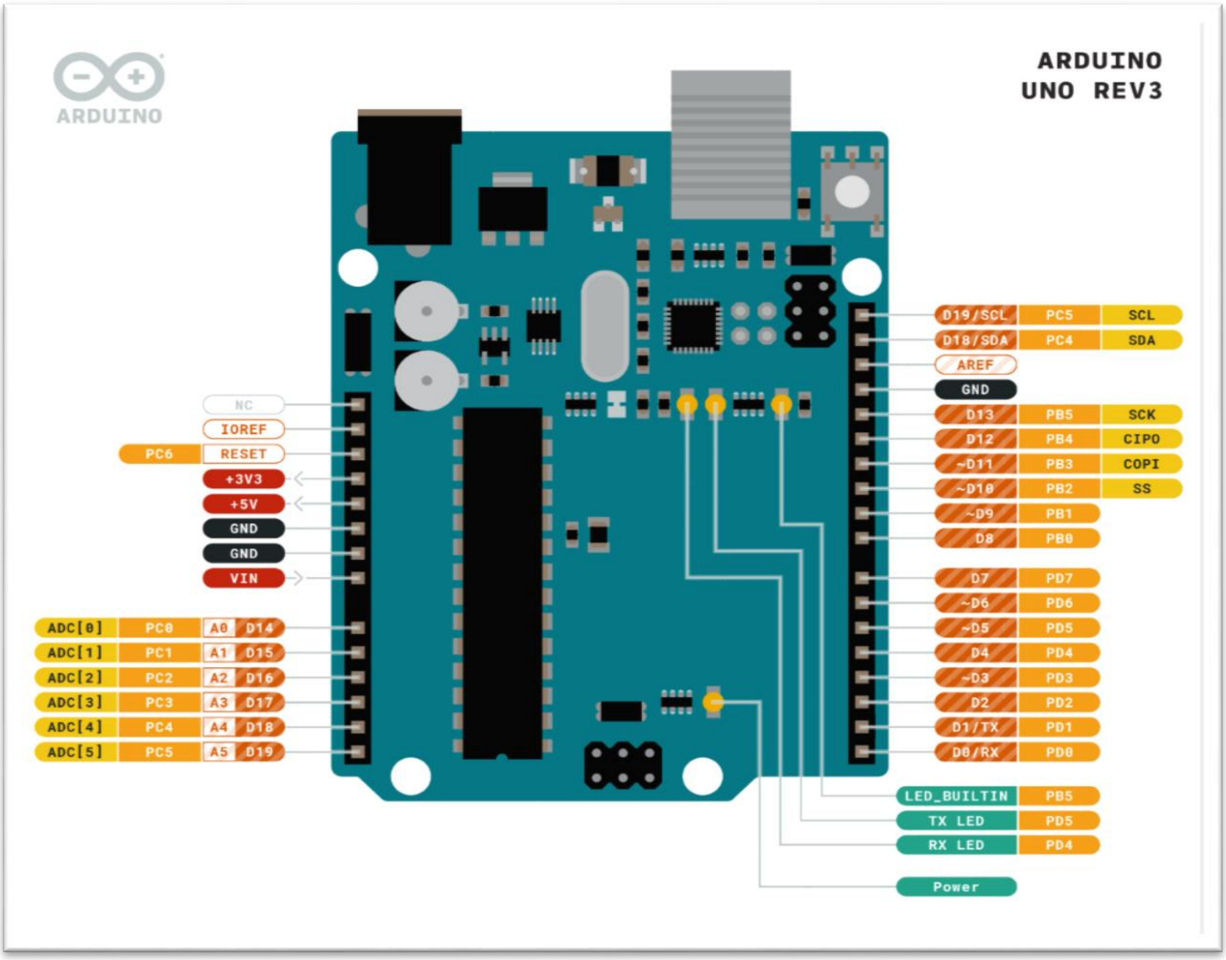


Fig -3 Ardunio UNO

- **Pin Configuration of Arduino UNO**

- **.Vin**- This is the input voltage pin of the Arduino board used to provide input supply from an external power source.
- .**5V** - This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.
- .**3.3V** - This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board.
- .**GND**-This pin of the board is used to ground the Arduino board.
- **.Reset** - This pin of the board is used to reset the microcontroller.

It is used to Resets the microcontroller.

- **Analog Pins** - The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.
- **Digital Pins** - The pins 0 to 13 are used as a digital input or output for the Arduino board.
- **Serial Pins** - These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.
- **External Interrupt Pins** - This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

- **PWM Pins**-These pins of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.
- **SPI Pins** - This is the Serial Peripheral Interface pin, it is used to maintain SPI communication with the help of the SPI library. SPI pins include:

1. **DSS:** Pin number 10 is used as a Slave Select
2. **MOSI**: Pin number 11 is used as a Master Out Slave In
3. **MISO**: Pin number 12 is used as a Master In Slave Out
4. **SCK**: Pin number 13 is used as a Serial Clock

- **LED Pin**: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.
- **AREF Pin**: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

4.5.2. ESP8266- Wi-Fi Module

The ESP8266 WiFi Module is a self-contained SOC with in an integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely costeffective board with a huge, ever-growing, community.

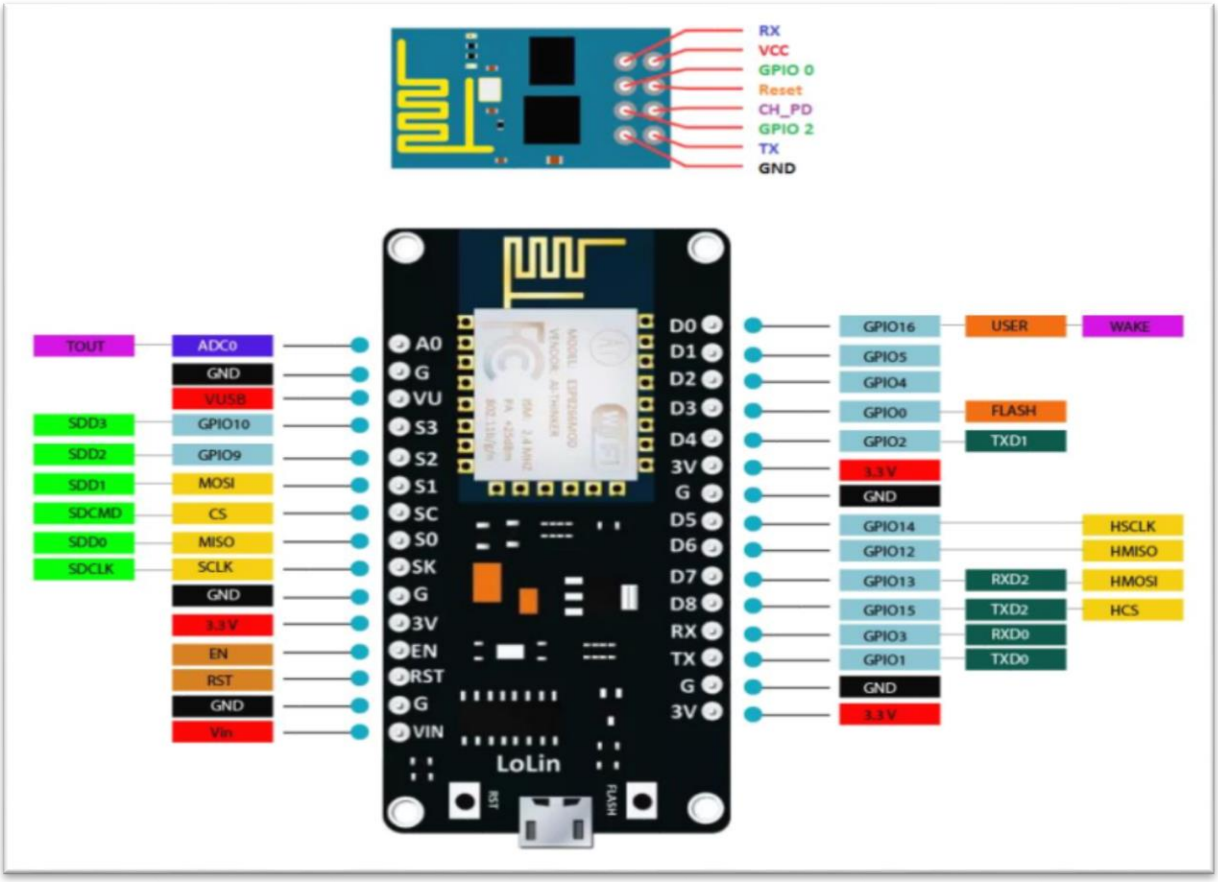


Fig – 4 ESP8266- Wi-Fi Module

Pin configuration of ESP8266

Pin Number	Pin Name	Alternate Name	Normally used for	Alternate Purpose
1	**GPIO0**	Flash	General purpose Input/output pin	Takes module into serial programming when held low during start up
2	**GPIO2**	-	General-purpose Input/output pin	-
3	**TX**	GPIO-1 (Transmit pin)	Transmit pin for serial communication.	Can act as a General purpose Input/output pin when not used as TX
4	**RX**	GPIO-3 (Receive pin)	Receive pin for serial communication.	Can act as a General purpose Input/output pin when not used as RX
5	**RESET**	Reset pin	Resets the module	Reset pin for resetting the module.
6	**CH_PD**	Chip Enable	Chip Enable-Active high	Chip enable pin, typically connected to VCC for normal operation
7	**VCC**	Power supply pin	Connect to +3.3V only	Power supply pin (3.3V)
8	**GND**	Ground pin	Connected to the ground of the circuit.	-

Some features of ESP8266

- Low cost, compact and powerful Wi-Fi Module
- Power Supply: +3.3V only
- Current Consumption: 100mA
- 1/0 Voltage: 3.6V (max)
- I/O source current: 12mA (max)
- Built-in low power 32-bit MCU @ 80MHz
- 512kB Flash Memory
- Can be used as Station or Access Point or both combined0
- Supports Deep sleep (<10uA)
- Supports serial communication hence compatible with many
- development platform like Arduino
- Can be programmed using Arduino IDE or AT-commands or Lua Script

4.5.3.DHT11(Temperature & Humidity sensor)

The DHT-11 Digital Temperature and Humidity Sensor is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed).

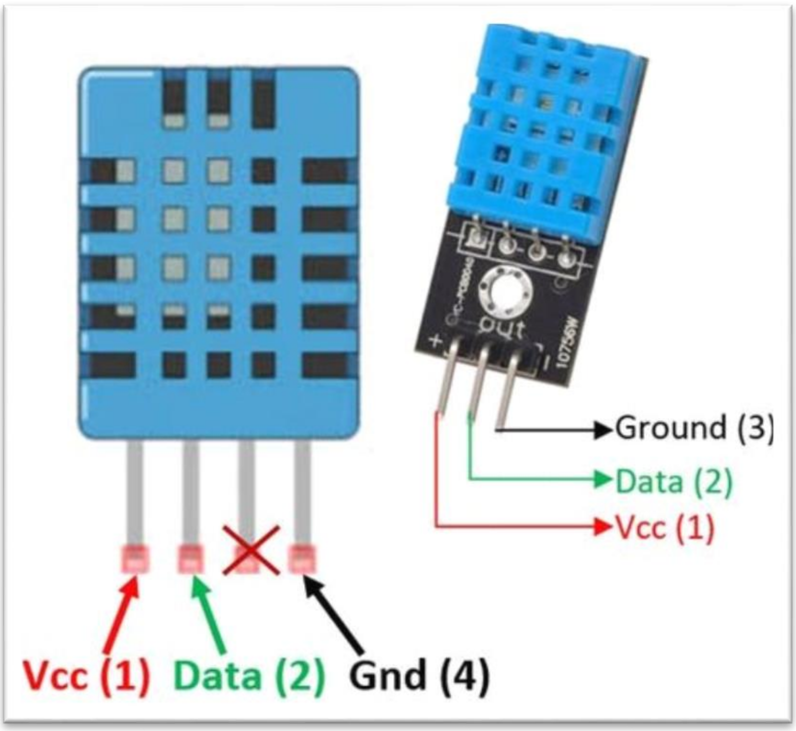


Fig – 5 DHT11

Pin Configuration of DHT11

Vcc	Power supply 3.5V to 5.5V
Data	Outputs both Temperature and Humidity through serial Data
NC	No Connection and hence not used
Ground	Connected to the ground of the circuit

DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

4.5.4.BMP180 (Pressure Sensor)

BMP180 is one of sensor of BMP XXX series. They are all designed to measure Barometric Pressure or Atmospheric pressure. BMP180 is a high precision sensor designed for consumer applications. Barometric Pressure is nothing but weight of air applied on everything. The air has weight and wherever there is air its pressure is felt. BMP180 sensor senses that pressure and provides that information in digital output. Also, the temperature affects the pressure and so we need temperature compensated pressure reading. To compensate, the BM180 also has good temperature sensor.

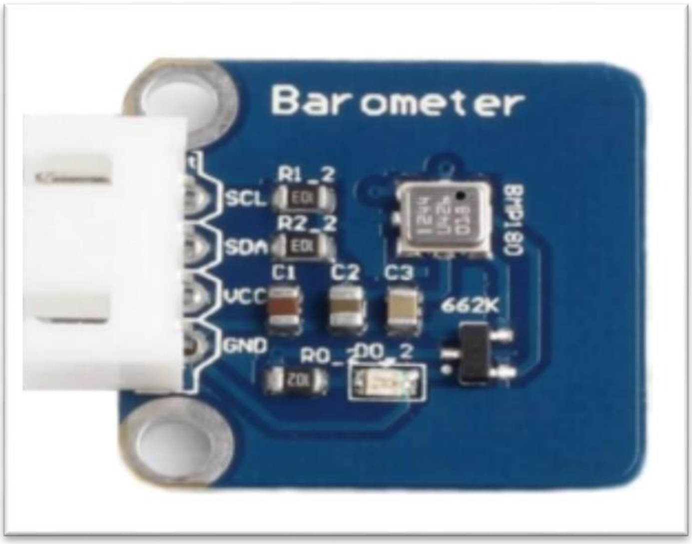


Fig – 6 BMP180

Pin Configuration of BMP180

Pin name	Description
VCC	Connected to +5V
GND	Connected to ground
SDA	Serial Data pin (12C interface)
SCL	Serial Clock pin (12C interface)
3.3V	If +5V is not present. Can power module by connecting -3.3V to this pin

Some features of BMP180 Module

- Can measure temperature and altitude.
- Pressure range: 300 to 1100hPa
- High relative accuracy of ±0.12hPa
- Can work on low voltages
- 3.4Mhz 12C interface
- Low power consumption (3uA)
- Pressure conversion time: 5msec
- Potable size

Specification of BMP180 Module

- Operating voltage of BMP180: 1.3V-3.6V
- Input voltage of BMP180MODULE: 3.3V to 5.5V
- Peak current: 1000uA
- Consumes 0.1uA standby
- Maximum voltage at SDA, SCL: VCC +0.3V Operating temperature: -40°C to +80°C

4.5.5. Rain Sensor

A rain sensor is one kind of switching device which is used to detect the rainfall. It works like a switch and the working principle of this sensor is, whenever there is rain, the switch will be normally closed.

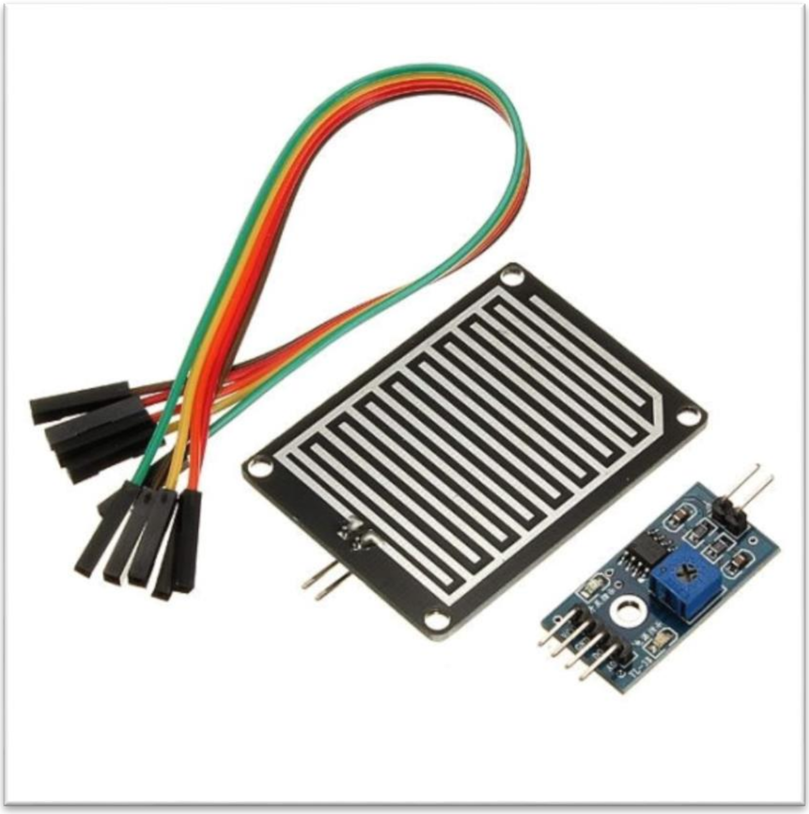


Fig – 7 Rain Sensor with Module

4.5.1. Rain Sensor Module

The rain sensor module/board is shown below. Basically, this board includes nickel coated lines and it works on the resistance principle. This sensor module permits to gauge moisture through analog output pins & it gives a digital output while moisture threshold surpasses. This module is similar to the LM393 IC because it includes the electronic module as well as a PCB. Here PCB is used to collect the raindrops. When the rain falls on the board, then it creates a parallel resistance path to calculate through the operational amplifier.

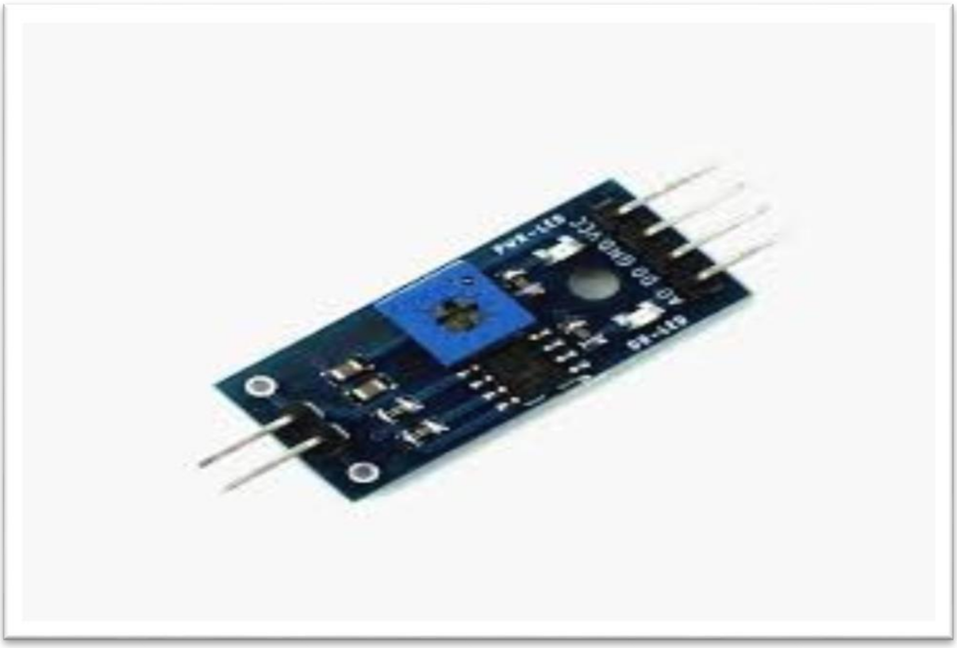


Fig – 8 Rain Sensor Module

Pin Configuration

The pin configuration of this sensor is shown below.

This sensor includes four pins which include the following.

- Pin1 (VCC): It is a 5V DC pin
- Pin2 (GND): it is a GND (ground) pin
- Pin3 (DO): It is a low/ high output pin
- Pin4 (AO): It is an analog output pin

Specification of Rain Sensor

- This sensor module uses good quality of double-sided material.
- Anti-conductivity & oxidation with long time use
- The area of this sensor includes 5cm x 4cm and can be built with a nickel plate on the side
- The sensitivity can be adjusted by a potentiometer
- The required voltage is 5V
- The size of the small PCB is 3.2cm x 1.4cm
- For easy installation, it uses bolt holes
- It uses an LM393 comparator with wide voltage
- The output of the comparator is a clean waveform and driving capacity is above 15mA.

4.5.6. LCD DISPLAY

A Liquid Crystal Display commonly abbreviated as LCD is basically a display unit built using Liquid Crystal technology. When we build real life/real world electronics - based projects, we need a medium/device to display output values and messages.

The most basic form of electronic display available is 7 Segment displays - which has its own limitations. The next best available option is Liquid Crystal Displays which comes in different size specifications. Out of all available LCD modules in market, the most commonly used one is 16x2 LCD Module which can display 32 ASCII characters in 2 lines. To establish a good communication between human world and machine world, display units play an important role. And so, they are an important part of embedded systems. Display units - big or small, work on the same basic principle. Besides complex display units like graphic displays and 3D display, one must know working with simple displays like 16x1 and 16x2 units.

Fig – 8 LCD DISPLAY

BLOCK DIAGRAM :

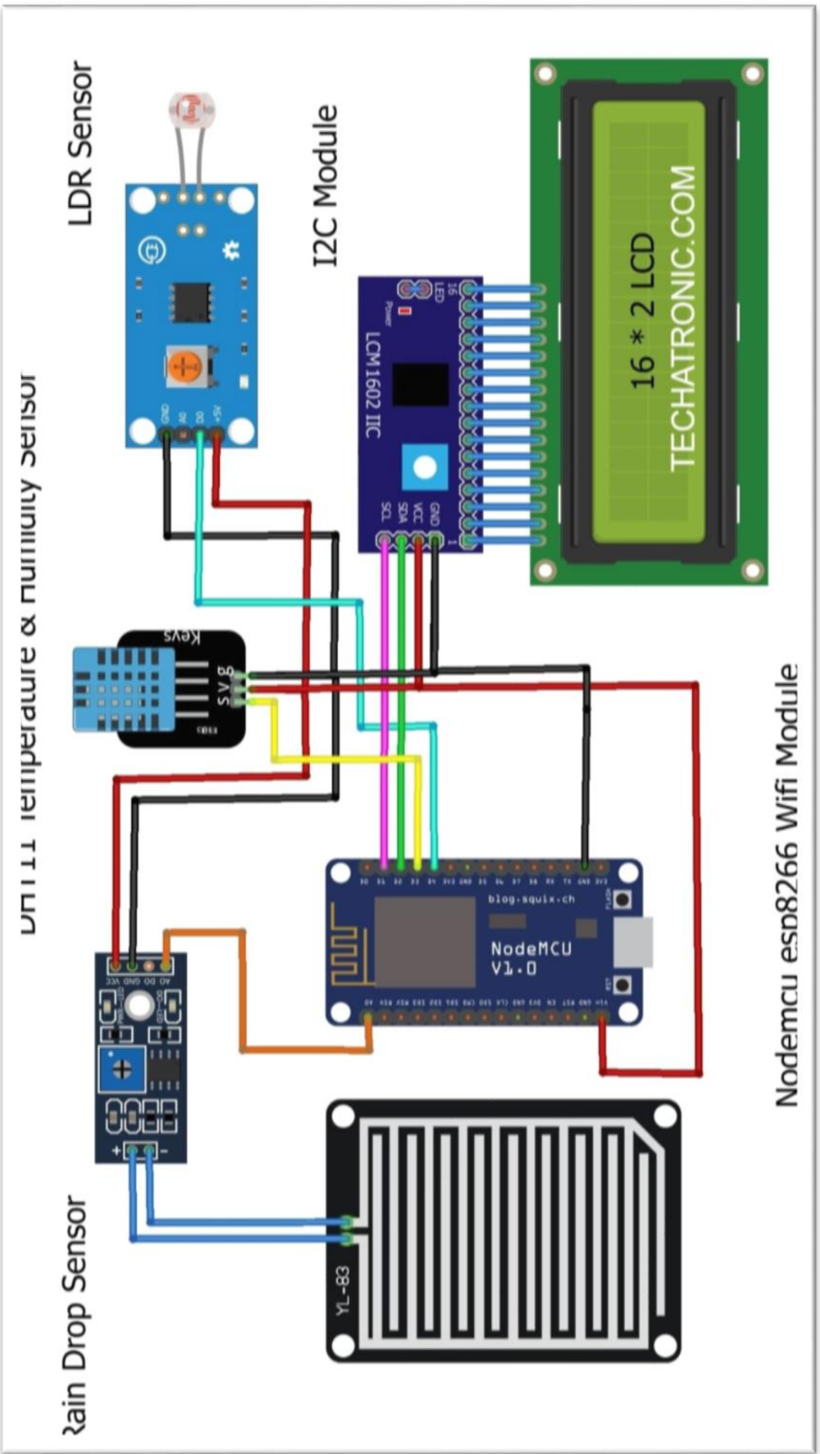
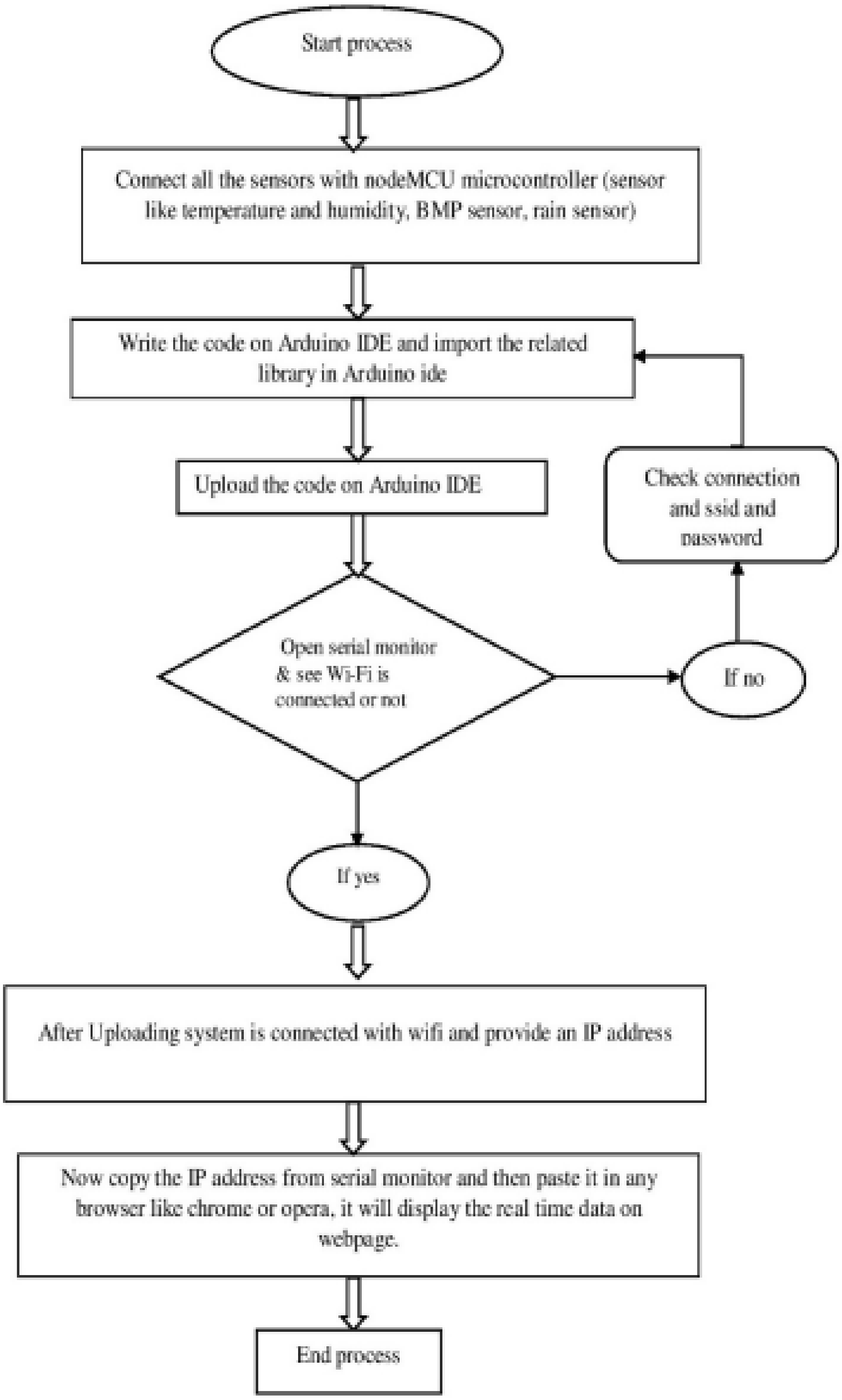

LDR Sensor
I2C Module
LCM1602 IIC
16 * 2 LCD
TECHATRONIC.COM
NodeMCU
V1.0
Nodemcu esp8266 Wifi Module
YL-83

Fig -9

CHAPTER 5

ALGORITHM

5.1. Flow chart of the system



5.2. SOURCE CODE

5.2.1. DHT11 with Arduino

```
#include <SimpleDHT.h>

// for DHT11,

//VCC: 5V or 3V

//GND: GND

//DATA: 3

Int pinDHT11 = 3;

SimpleDHT11 dht11 (pinDHT11);

void setup() {

// start working...

Serial.println("Temperature and Humidity Data");

Serial.begin(9600);

}

void loop() {

// read without samples.

byte temperature = 0;
```

```
byte humidity = 0;

int err = SimpleDHTErrSuccess;

if ((err = dht11.read(&temperature, &humidity, NULL)) !=

SimpleDHTErrSuccess) {

Serial.print("Read DHT11 failed, err=");

Serial.print(SimpleDHTErrCode(err));

Serial.print(",");

Serial.println(SimpleDHTErrDuration(err));

 delay(1000);

 return;

}

Serial.print((int)temperature);

Serial.print(" *C, ");

Serial.print((int)humidity);

Serial.println("H");

 // DHT11 sampling rate is 1HZ.

delay(1500);

}
```

5.1.2. Rain Sensor With Arduino

```
void setup() {
// initialize serial communication at 9600 bits per second:
Serial.begin(9600);
}
// the loop routine runs over and over again forever:
void loop() {
// read the input on analog pin 0:
 int sensorValue = analogRead(A0);
 //print out the value you read:
Serial.println(sensor Value);
delay(1);        // delay in between reads for stability
```

5.1.3.BMP180 (Pressure)

```
#include <Wire.h>
#include <Adafruit_Sensor.h>
#include <Adafruit_BMP085_U.h>
```

/*This driver uses the Adafruit unified sensor librar (Adafruit_Sensor), which provides a common 'type' for sensor data and some helper functions.

To use this driver you will also need to download the Adafruit_Sensor library and include it in your libraries folder.

You should also assign a unique ID to this sensor for use with the Adafruit Sensor API so that you can identify this particular sensor in In any data logs, etc. To assign a unique ID, simply provide an appropriate value in the constructor below (12345 is used by default in this example).

Connections

===========

Connect SCL to analog 5

Connect SDA to analog 4

Connect VCC to 3.3V DC

Connect GROUND to common ground

History

===========

```
2013/JUN/17 - Updated altitude calculations (KTOWN)

2013/FEB/13 - First version (KTOWN)

/*


Adafruit_BMP085_Unified bmp = Adafruit_BMP085_Unified(10085);


/*************************/

/*

Displays some basic information on this sensor from the unified

sensor API sensor_t type (see Adafruit_Sensor for more information)

*/

/************************/

Void display Sensor Details(void)

{

 sensor_t sensor;

bmp.getSensor(&sensor);

Serial.println("------------------------------------");

Serial.print  ("Sensor:    "); Serial.println(sensor.name);
```

```
Serial.print  ("Driver Ver:   "); Serial.println(sensor.version);

Serial.print ("Unique ID:   "); Serial.println(sensor.sensor_id);

Serial.print ("Max Value:   "); Serial.print(sensor.max_value); Serial.println(" hPa");

Serial.print ("Min Value:   "); Serial.print(sensor.min_value); Serial.println(" hPa");

Serial.print ("Resolution:   "); Serial.print(sensor.resolution); Serial.println(" hPa");

Serial.println("----------------------------------------");

Serial.println("");

delay(250);

}


/**********************/

/*

Arduino setup function (automatically called at startup)

/*
```

5.1.4. ESP8266 with Rain Sensor via Blynk

```
#include <SoftwareSerial.h>

#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>
```

```
char auth[] = "P4pODDBKIyHrzw2YJW5g6Bfc8- H1bWqa";

char ssid[] = "ASUS_X00TD";

char pass[] = "suvadip 1998";


Blynk Timer timer;


void moisture() {

int rainSensor = analogRead(A0);

rainSensor = map(rainSensor, 0, 1023, 0, 350);

Blynk.virtualWrite(V5, rainSensor);

Serial.println(rainSensor);

}


void setup() {

  Serial.begin(9600);

  Blynk.begin(auth, ssid, pass);

  timer.setInterval(350, moisture);


}
```

```
void loop()
{
 Blynk.run();
 timer.run();
```

5.1.5. ESP8266 with BMP180 via Blynk App

```
#include <Wire.h>
#include <Adafruit_BMP085.h>
#include <Blynk.h>
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

Adafruit_BMP085 bmp;

float temp, pressure, Altitude, Sealevel;

char auth[] =”8LU16ReplbHVm0gt7-9-XMz9L-rwXjsS”;

char ssid[] = "Dlink";
char pass[] ="Pabitra 1999";
```

```
void setup()

{

Serial.begin(115200);

WiFi.begin(ssid, pass);

Serial.print("Connecting.....");


while(WiFi.status() != WL_CONNECTED)

{

 delay(500);

 Serial.print("Waiting to connect WiFi\n");

}

Serial.print("WiFi is connected \n");

Serial.print(WiFi.localIP());


Blynk.begin(auth, ssid, pass);


if (!bmp.begin())

{

Serial.println("Could not find a valid BMP085 sensor, check wiring!");
```

```
while (1)

{


}

 }

}


void loop()

{

   Blynk.run();


    temp = bmp.read Temperature();

   pressure = bmp.readPressure();

   Sealevel = bmp.readSealevelPressure();

   Altitude = bmp.readAltitude();


   Blynk.virtualWrite(V6, temp);

  Blynk.virtualWrite(V7, pressure);

  Blynk.virtualWrite(V8, Sealevel);

  Blynk.virtualWrite(V9, Altitude);
```

```
Serial.print("Temperature = ");
Serial.print(bmp.read Temperature());
Serial.println("*C");

Serial.print("Pressure = ");
Serial.print(bmp.readPressure());
Serial.println(" Pa");

Serial.print("Altitude = ");
Serial.print(bmp.readAltitude());
Serial.println(" meters");

Serial.print("Pressure at sealevel (calculated) = ");
Serial.print(bmp.readSealevelPressure());
Serial.println(" Pa");

Serial.println();
}
```

5.1.6. ESP8266 with DHT11 via Blynk App

```
#define BLYNK_TEMPLATE_ID "TemplateID"

#define BLYNK_DEVICE_NAME "Temperature Alert"

#define BLYNK_AUTH_TOKEN "Auth Token"


#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>


#include <DHT.h>


char auth] = BLYNK_AUTH_TOKEN:


char ssid [] = "WiFi Username";    // type your

wifi name char pass = "WiFi Password";  //type your wifi password


#define DHTPIN 2          // Mention the digital pin where you Connected

#define DHTTYPE DHT11       // DHT 11
```

```
DHT dht(DHTPIN, DHTTYPE);

Blynk Timer timer;


void sendSensor() {

  float h = dht.readHumidity();

  float t = dht.read Temperature();    // or dht.readTemperature(true) for Fahrenheit

  if (isnan(h) || isnan(t))  {

    Serial.println("Failed to read from DHT sensor!");


 return;

}


Serial.println(t);

Blynk.virtualWrite(V6, h);

Blynk.virtualWrite(V5, t);

  Serial.print("Temperature: ");

  Serial.print(t);

  Serial.print(" Humidity: ");

  Serial.println(h);
```

```
if(t>30) {
// Blynk.email("shameer50@gmail.com", "Alert", "Temperature
over 28C!");
Blynk.logEvent("temp_alert", "Temp above 30 degree");
  }
}

void setup(){
Serial.begin(115200);
Blynk.begin(auth, ssid, pass);
dht.begin();
timer.setInterval(2500L, sendSensor);
}

void loop(){
  Blynk.run();
  timer.run();
}
```

CHAPTER 6

IMPLEMENTATION

6.1. Prototype mode of the system –

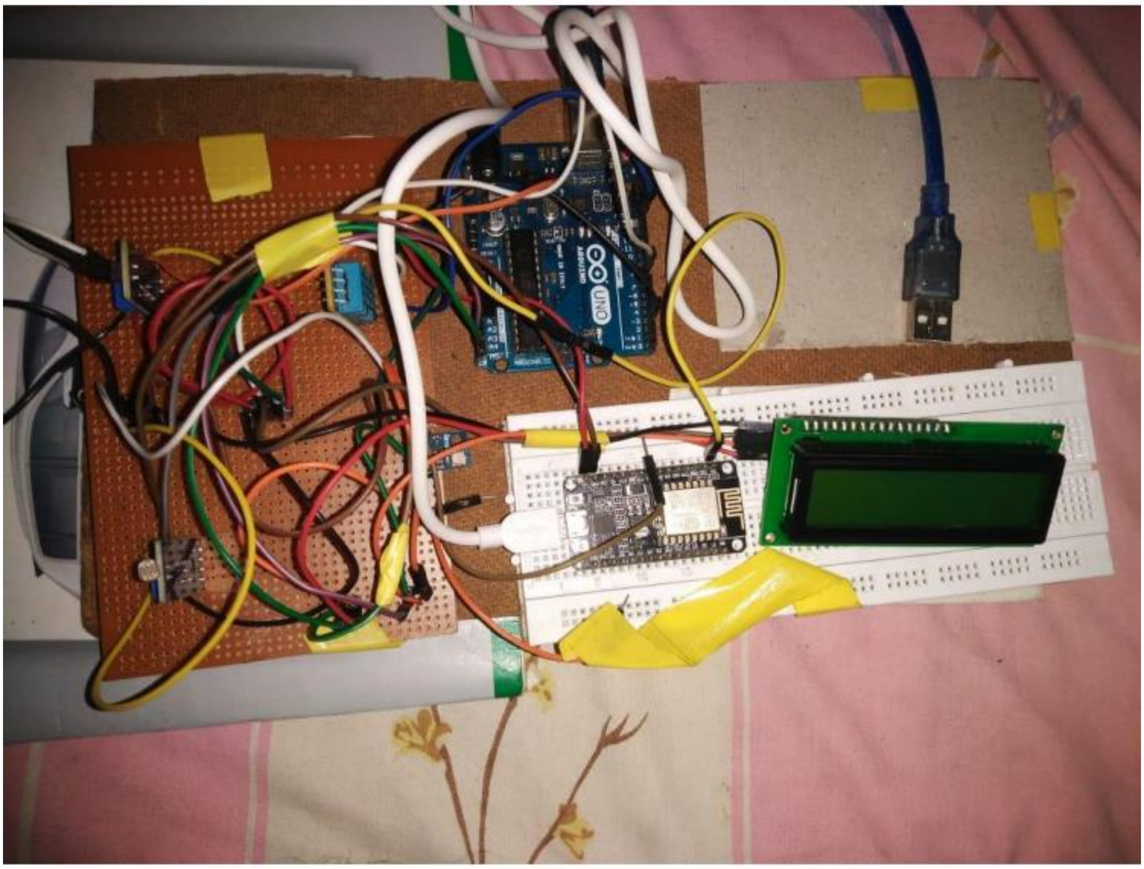


Fig – 10 Hardware Circuit

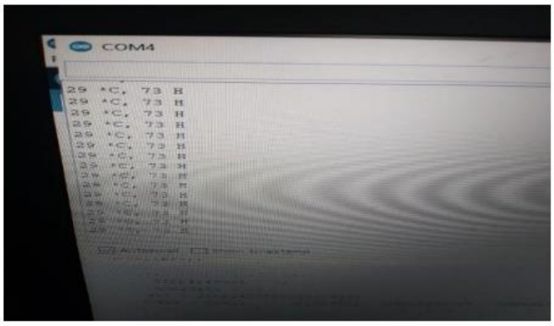
6.2.Implementaion of Hardware –

Ease of monitoring your local weather conditions in real time from anywhere in the world. For storing weather and environment data for short and long term for studying weather pattern changes and to understand how human induced climate change affected your local weather.Easy deployment of the setup for monitoring local atmospheric conditions and microclimates for weather forecasting and prediction. Farmers need to know the temperature, relative humidity, soil moisture, rain fall etc. to enhance their crop production and the following type of sensors are utilized to obtain the data:Temperature sensor.Humidity / hygrometer sensor.Soil moisture sensor.Rain sensor etc. For an airplane pilot he/she needs to know wind speed, wind direction, atmospheric pressure, precipitation, visibility etc. before they takeoff and they use the following sensors: Barometric sensor – for measuring atmospheric pressure. Anemometer – for measuring wind speed. Rain sensor.

CHAPTER -7

OBSERVATION & RESULT

7.1. Experimental Analysis along with Results



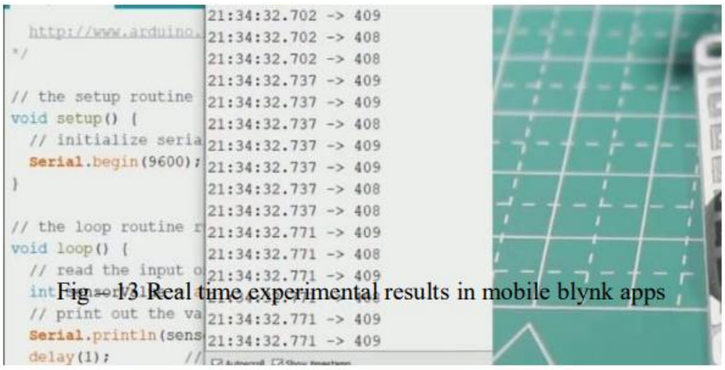


Fig - 13 Real time experimental results in mobile blynk apps

Real Time Experimental Result

Date	Temperature	Humidity	Pressure
June - 12	29.1	95%	999 mbar
June - 12	29.4	95%	100 mbar
June - 12	29.5	95%	1003 mbar
June - 12	29.6	95%	999 mbar
June - 12	29.7	95%	998 mbar
June - 12	29.8	95%	997 mbar
June - 12	29.9	95%	999 mbar

CHAPTER – 8

CONCLUSION AND FUTURE SCOPE

8.1. Conclusion

In conclusion, weather monitoring and reporting systems play a crucial role in providing accurate and timely information about weather conditions. Over time, these systems have evolved sgnificantly, leveraging advancements in technology such as the nternet of Things (IoT) to enhance their capabilities.

IOT-based weather monitoring systems offer several advantages, Including increased data accuracy and granularity, real-time monitoring and early warnings, integration with smart cities, data- driven decision making, environmental monitoring, and wearable weather monitoring devices. These advancements have the potential to revolutionize how we collect, analyze, and utilize weather data.

By leveraging IoT technologies, weather monitoring systems can provide highly accurate and localized information, enabling Individuals, businesses, and authorities to make informed decisions related to safety, agriculture, urban planning, energy management, and more. Real-time data transmission allows for immediate updates on changing weather conditions, improving emergency response and public safety.

Furthermore, the integration of weather monitoring systerns into smart city infrastructures can optimize various services, making cities more efficient and sustainable. The abundance of data collected through these systems can be analyzed using advanced analytics and machine learning techniques, providing valuable insights for decision making and supporting climate studies.

In addition, the future may see the incorporation of weather monitoring capabilities into wearable devices, making weather information easily accessible to individuals for personalized planning and monitoring.

Overall, weather monitoring and reporting systems, particularly those based on IoT, have a promising future. With ongoing advancements in technology, we can expect even more accurate, comprehensive, and innovative solutions that contribute to better weather predictions, emergency preparedness, and sustainable development.

By keeping the weather station in the environment for monitoring enables self-protection (i.e., smart environment) to the environment. To implement this need to use the sensor devices in the environment for collecting the data and analysis. By using sensor devices in the environment, we can bring the environment into real life.

Then the collected data and analysis results will be available to the user through the Wi-Fi. The smart way to monitor the environment an efficient, low-cost embedded system is presented in this paper. It also sent the sensor parameters to the cloud. This data will be helpful for future analysis and it can be easily shared to other users also. This model can be expanded to monitor the developing cities and industrial zones for pollution monitoring. To protect the public health from pollution, this model provides an efficient and low-cost solution for continuous monitoring of environment.

8.2. FUTURE SCOPE:

The future scope of weather monitoring systems based on the Internet of Things (IoT) is quite promising. As technology continues to advance, IoT-based weather monitoring systems have the potential to revolutionize how we collect and analyze weather data. Here are some key aspects of their future scope:

Increased Data Accuracy and Granularity: IoT-based weather monitoring systems can offer highly accurate and granular data collection. By deploying a network of connected sensors, it becomes possible to gather data from various locations simultaneously. This extensive data collection enhances the accuracy of weather predictions and provides detailed information about localized weather patterns.

Real-time Monitoring and Early Warnings: IoT enables real-time data transmission, allowing for instant weather monitoring and early warnings. By integrating weather sensors with IoT platforms, meteorologists and relevant authorities can receive immediate updates on changing weather conditions, including severe storms, hurricanes, or other natural disasters. This real- time monitoring capability can significantly improve emergency response and public safety.

Integration with Smart Cities: IoT-based weather monitoring systems can be seamlessly integrated into smart city infrastru- ctures. The collected weather data can be utilized to optimize various city services, such as intelligent traffic management, energy consumption, irrigation systems, and waste management. This integration enhances the overall efficiency of cities and contributes to sustainable development.

Data-driven Decision Making: With the abundance of data collected through loT-based weather monitoring systems, advanced analytics and machine learning techniques can be applied to extract valuable insights. These insights can be used for making data-driven decisions in multiple sectors, including agriculture,transportation, urban planning, and renewable energy. For example, farmers can receive accurate weather forecasts to optimize irrigation schedules and increase crop yields. Environmental Monitoring and Climate Studies: IoT-based weather monitoring systems can play a vital role in environmental monitoring and climate studies.

By continuously collecting data on temperature, humidity, air quality, and other environmental parameters, scientists can analyze long-term trends and patterns This data can contribute to better understanding climate change,facilitating research, and supporting initiatives aimed at mitigating its impact.

Wearable Weather Monitoring Devices: With the advancement of wearable technology, loT-based weather monitoring devices can be incorporated into everyday accessories like watches, bracelets , or clothing. Individuals can receive personalized weather upd- ates, monitor their health in relation to weather conditions, and plan outdoor activities accordingly. These wearable devices can provide a convenient and accessible way for people to stay informed about weather changes.

CHAPTER – 9

REFERENCE

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