IOT BASED SMART IRRIGATION SYSTEM USING ESP8266 WI-FI MODULE

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BONAFIDE CERTIFICATE

Certified that this project report entitled "**IOT BASED SMART IRRIGATION SYSTEM USING ESP8266 WI-FI MODULE"** is a bonafide work of **PRASSANTH.A - 19BEC1327, STANLEY KINGSTON.S- 19BEC1254, METHELESH.S – 19BEC1171 and LOKESH.A - 19BEC1345** who carried out the Project work under my supervision and guidance for **ECE3003- MICROCONTROLLERS AND ITS APPLICATIONS.**

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ABSTRACT

Agriculture plays vital role in the development of agricultural country. In India about 70% of population depends upon farming and one third of the nation's capital comes from farming. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Hence the project aims at making agriculture smart using automation and IoT technologies. The highlighting features of this project includes smart irrigation with smart control and intelligent decision making based on accurate real time field data. Controlling of all these operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with micro-controller and Node MCU.

ACKNOWLEDGEMENT

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We thank our parents, family, and friends for bearing with us throughout the course of our project and for the opportunity they provided us in undergoing this course in such a prestigious institution.

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1. INTRODUCTION

1.1 OBJECTIVES AND GOALS

- For centuries, humans considered water as one of the most pre-cious gift of nature which helped life to sustain on this planet earth.
- But in these modern days, water is getting wasted in many sectors of society due to negligence or lack of proper knowledge
- One such sector where water is getting wasted is agriculture which is due to the lack of proper irrigation system
- So, this project aims to overcome this issue by the use of a proper and efficient technology
- In this, soil moisture sensor detects the moisture content in soil and the irrigation system regulates water as per the programming in the Arduino microcontroller

1.2 APPLICATIONS

Farm Irrigation System

- Prevents uneven watering which often causes wastage of water.
- Achieve a Thriving farm while Saving Money and increasing productivity of crops.
- Reduced labor manpower as system is totally automatic and smart.

Domestic Watering System

- No supervision required for a healthy growing condition of plants.
- Save Water while Keeping a Lush Lawn.
- Can also be used to water animals at regular intervals

EXOPLANET LIFE SUPPORT SYSTEM

- This prototype will automatically water plants that are grown in exoplanets without the need of any manpower in certain simulated conditions so that humans can start experimenting life sustenance in with the help of this technology.

SPACESHIP

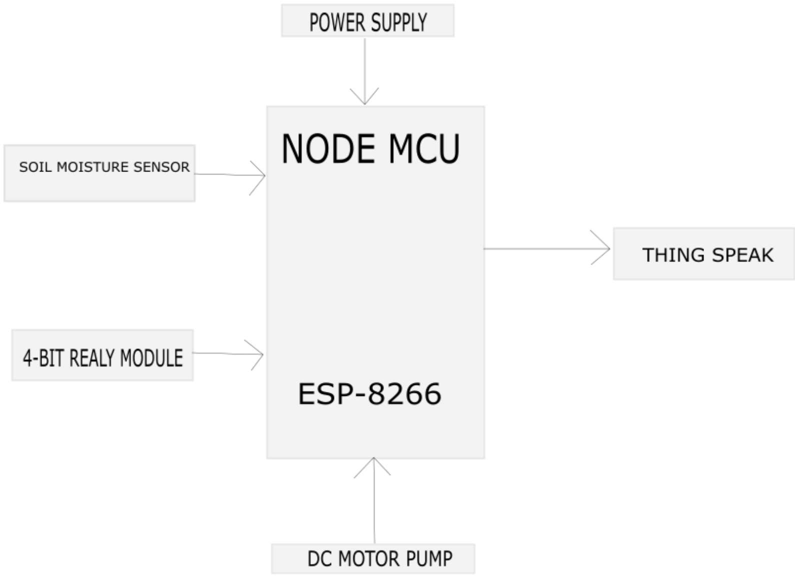
- Scientist can also use this technology in spacecraft so that the astronauts needn't always carry packed food. This is being already experimented for future needs.

1.3 FEATURES

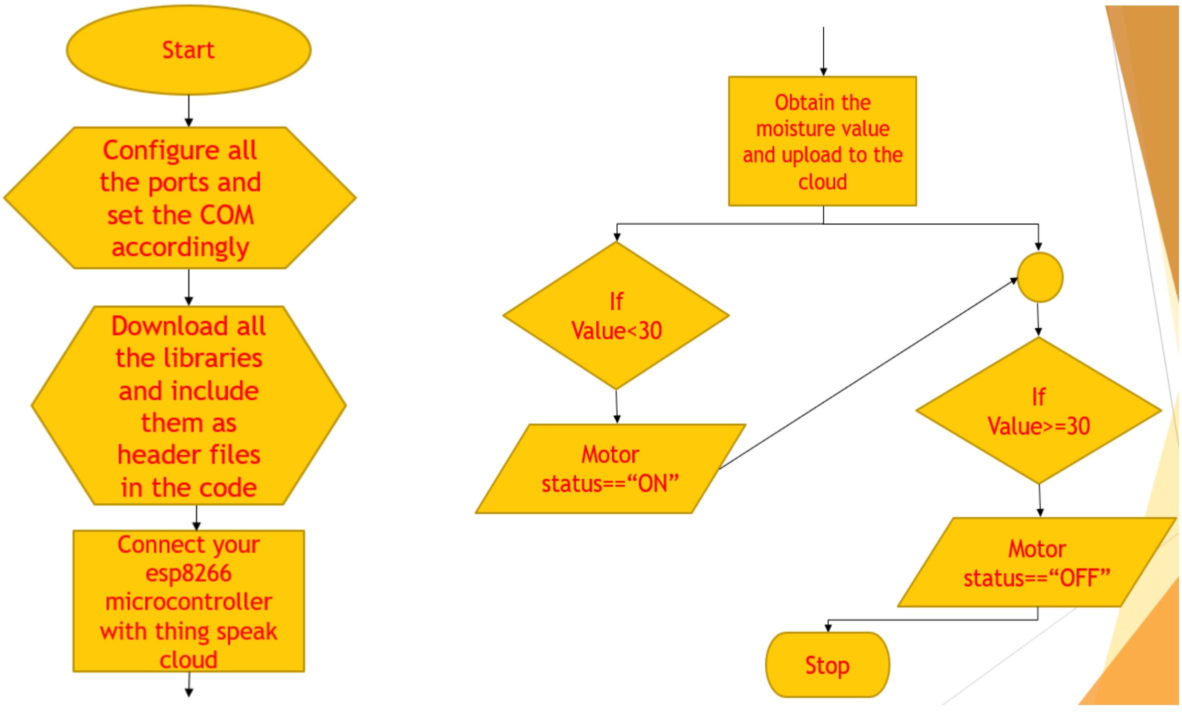
- Highly efficient usage of water as a result of it's smart sensing technology.
- Less cost as manual labour doesn't come into picture.
- Data stored in cloud so, can be accessed from anywhere anytime for future reference.
- Also, can be used to experiment crop growth in uninhabitable places on earth as an experimental observation.

2.DESIGN

2.1 BLOCK DIAGRAM

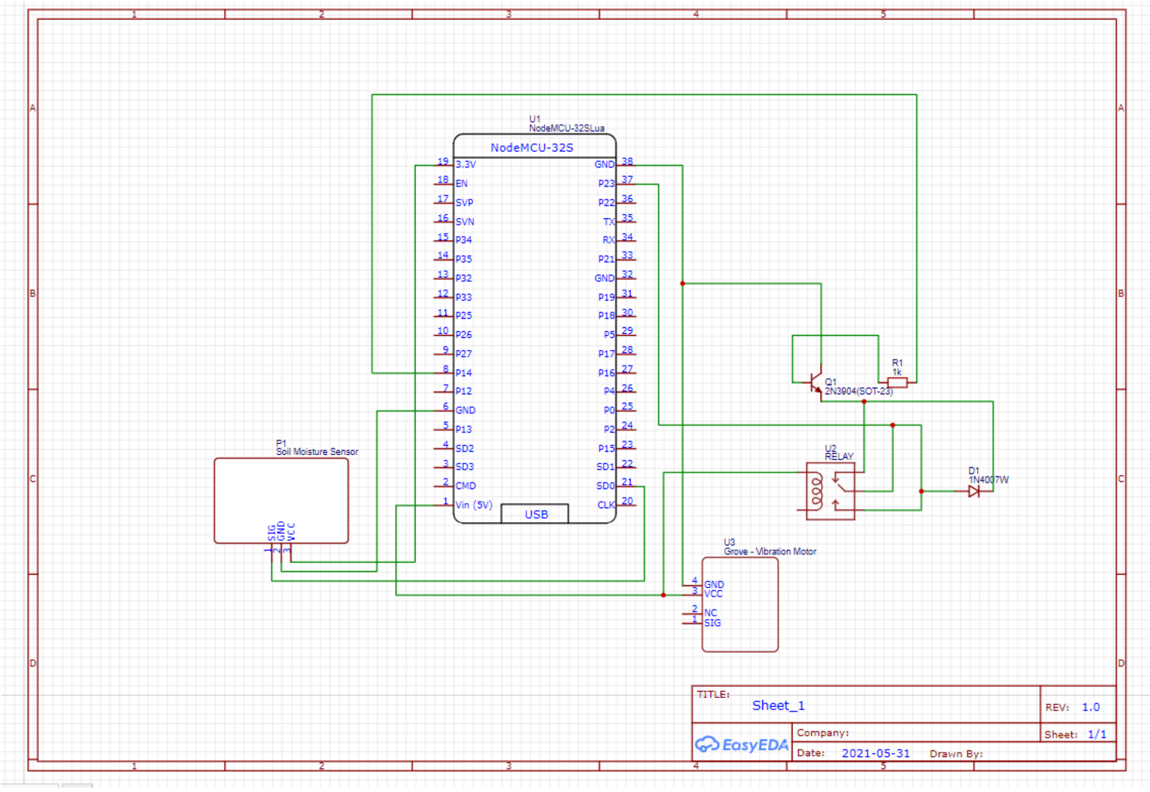


2.2 ALGORITHM

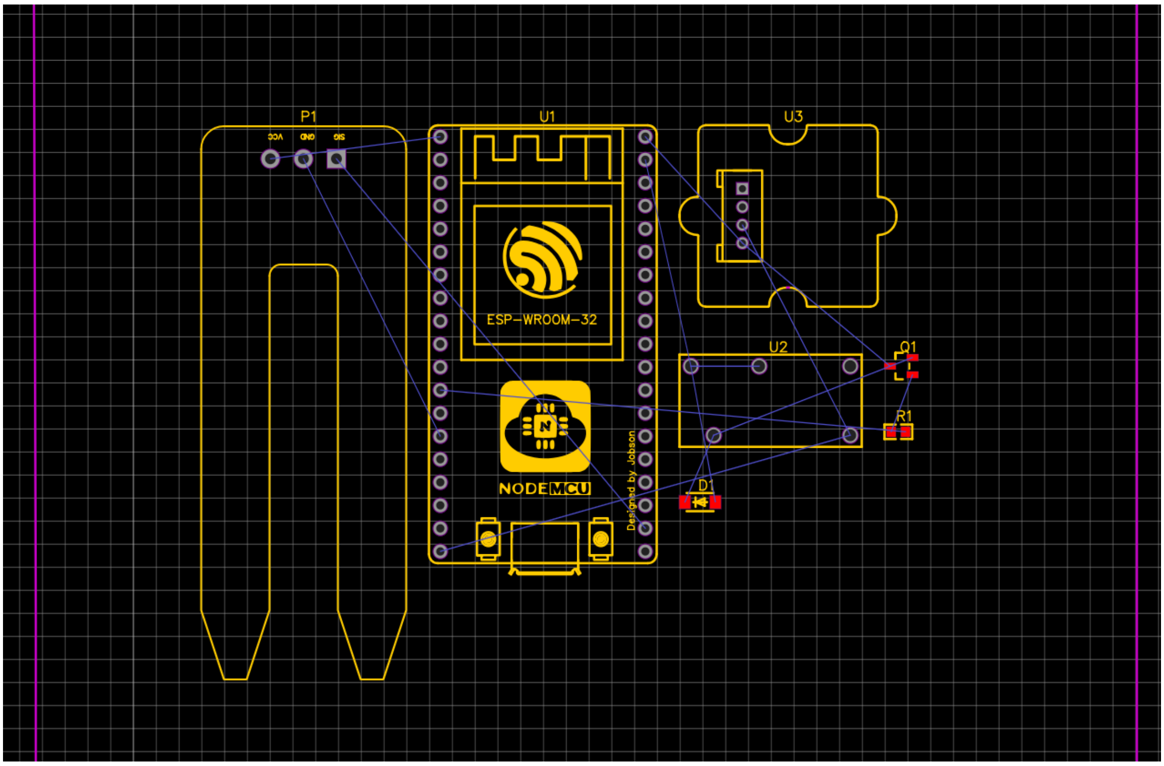


2.3 PCB DESIGN

SCHEMATIC



BOARD

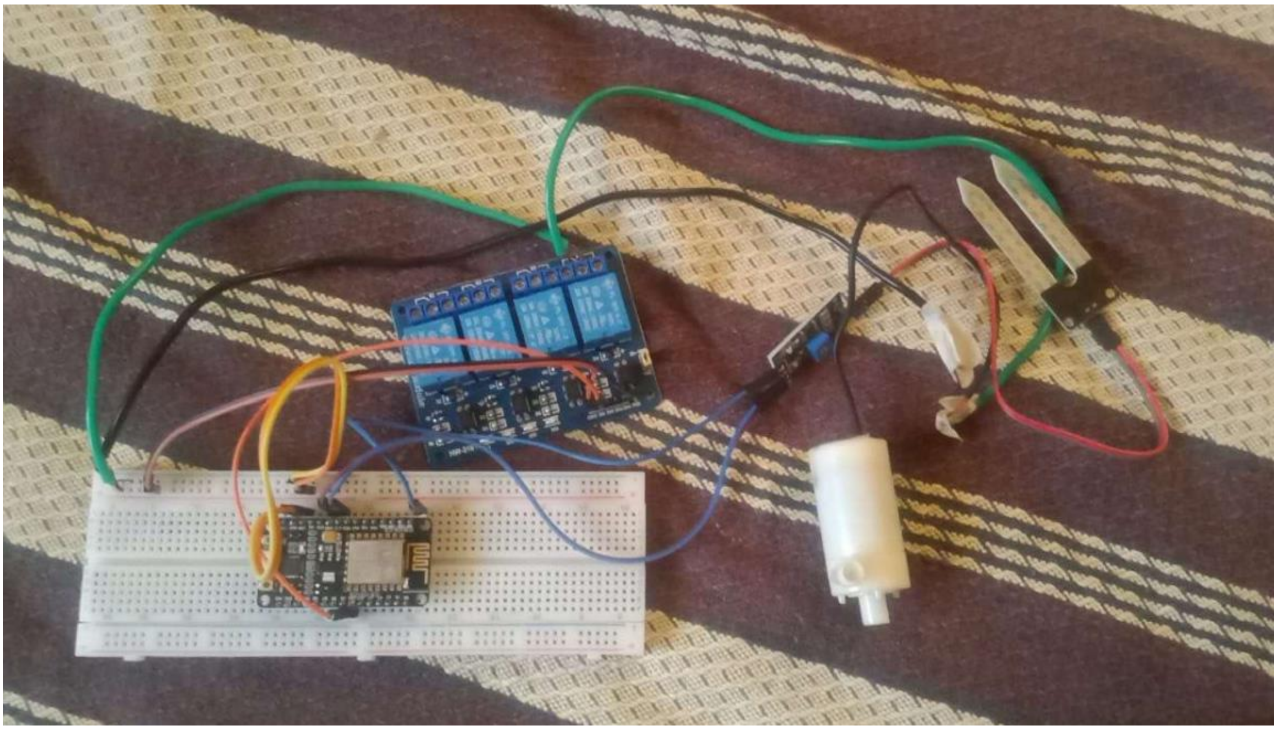


2.4 HARDWARE ANALYSIS

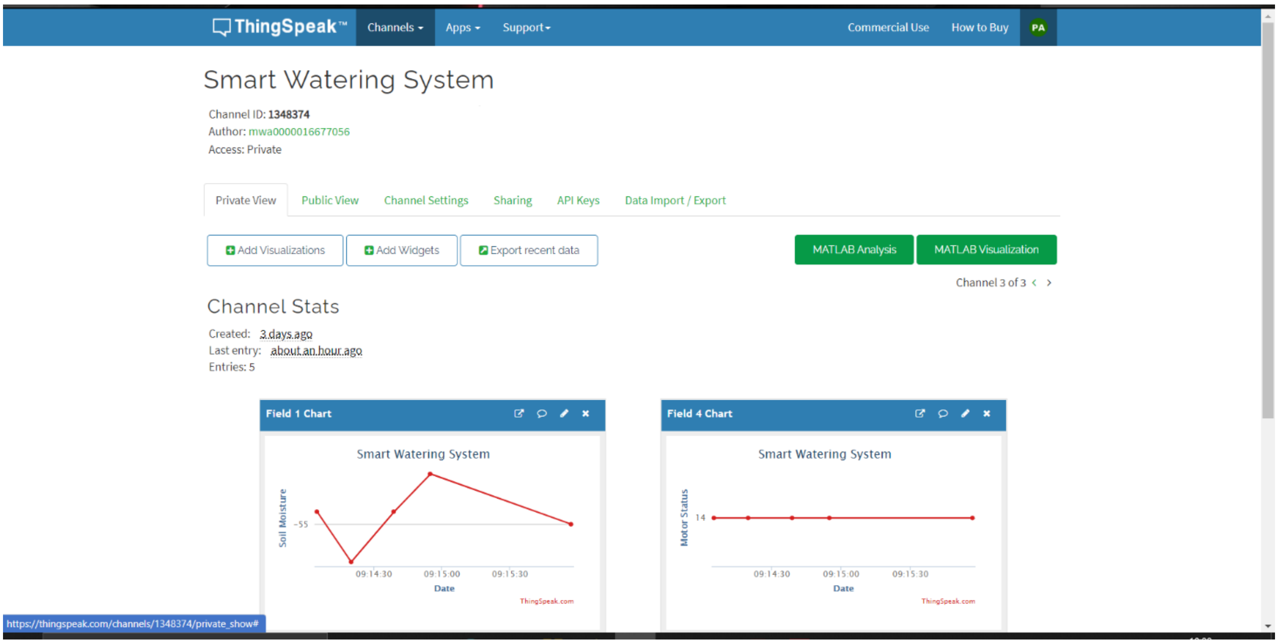
- **ESP-8266-** It is a low cost iot platform which is an open-source software which contain TCP/IP protocol stack that can give access to any microcontroller to our wi-fi network. Works well with thingspeak which we will use ase IOT cloud.
- **SOIL MOISTURE SENSOR -** This is an analog capacitive soil moisture sensor which measures soil moisture levels by capacitive sensing. This means the capacitance is varied on the basis of water content present in the soil. You can convert the capacitance into voltage level basically from 1.2V minimum to 3.0V maximum. The advantage of Capacitive Soil Moisture Sensor is that they are made of a corrosion-resistant material giving it a long service life.
- **4-BIT RELAY MODULE-** convenient board which can be used to control high voltage, high current load such as motor, solenoid valves, lamps and AC load. It is designed to interface with microcontroller such as Arduino, PIC and etc.
- **DC-WATER PUMP-** The DC 3-6 V Mini Micro Submersible Water Pump is a low cost, small size Submersible Pump Motor. It operates from a 2.5 ~ 6V power supply. It can take up to 120 litres per hour with a very low current consumption of 200mA
- **BREADBOARDS AND JUMPER WIRES -** Jumper wires are simply wiring that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed.

2.5 SNAPSHOTS- (PROJECT, TEAM, RESULTS)

IMPLEMENTED HARDWARE MECHANISM



THINGSPEAK IOT CLOUD



3. SOFTWARE

3.1 CODE

```
#include <WiFi.h>
#include<WiFiClient.h>
#include<ThingSpeak.h>
#include <SPI.h>
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>

String apiKey = "KK1OP2PVIS3I9TZX"; // Enter your Write API key from ThingSpeak
char ssid[] = "Realme 3";     // replace with your wifi ssid and wpa2 key
const char* pass = "20202020";
const char* server = "api.thingspeak.com";

const int AirValue = 790;   //you need to replace this value with Value_1
const int WaterValue = 390;  //you need to replace this value with Value_2
const int SensorPin = 36;
int soilMoistureValue = 0;
int soilmoisturepercent=0;
int relaypin = 14;

WiFiClient client;

void setup() {
  Serial.begin(115200); // open serial port, set the baud rate to 9600 bps
```

```
  display.begin(SSD1306_SWITCHCAPVCC, 0x3C); //initialize with the I2C addr 0x3C (128x64)
  display.clearDisplay();
  pinMode(relaypin, OUTPUT);

  WiFi.begin(ssid, pass);
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
    Serial.println("");
    Serial.println("WiFi connected");
    delay(4000);
}
void loop()
{
  float h = dht.readHumidity();
  float t = dht.readTemperature();
  Serial.print("Humidity: ");
  Serial.println(h);
  Serial.print("Temperature: ");
  Serial.println(t);

  soilMoistureValue = analogRead(SensorPin);  //put Sensor insert into soil
  Serial.println(soilMoistureValue);

  soilmoisturepercent = map(soilMoistureValue, AirValue, WaterValue, 0, 100);
```

```
if(soilmoisturepercent > 100)
{
  Serial.println("100 %");

  display.setCursor(0,0);  //oled display
  display.setTextSize(2);
  display.setTextColor(WHITE);
  display.print("Soil RH:");
  display.setTextSize(1);
  display.print("100");
  display.println(" %");
  display.setCursor(0,20);  //oled display
  display.setTextSize(2);
  display.print("Air RH:");
  display.setTextSize(1);
  display.print(h);
  display.println(" %");
  display.setCursor(0,40);  //oled display
  display.setTextSize(2);
  display.print("Temp:");
  display.setTextSize(1);
  display.print(t);
  display.println(" C");
  display.display();

  delay(250);
```

```
  display.clearDisplay();
}

else if(soilmoisturepercent <0)
{
  Serial.println("0 %");


  display.setCursor(0,0);  //oled display
  display.setTextSize(2);
  display.setTextColor(WHITE);
  display.print("Soil RH:");
  display.setTextSize(1);
  display.print("0");
  display.println(" %");
  display.setCursor(0,20);  //oled display
  display.setTextSize(2);
  display.print("Air RH:");
  display.setTextSize(1);
  display.print(h);
  display.println(" %");
  display.setCursor(0,40);  //oled display
  display.setTextSize(2);
  display.print("Temp:");
  display.setTextSize(1);
  display.print(t);
  display.println(" C");
  display.display();
```

```
  delay(250);
  display.clearDisplay();
}

else if(soilmoisturepercent >=0 && soilmoisturepercent <= 100)
{
  Serial.print(soilmoisturepercent);
  Serial.println("%");
  display.setCursor(0,0);  //oled display
  display.setTextSize(2);
  display.setTextColor(WHITE);
  display.print("Soil RH:");
  display.setTextSize(1);
  display.print(soilmoisturepercent);
  display.println(" %");
  display.setCursor(0,20);  //oled display
  display.setTextSize(2);
  display.print("Air RH:");
  display.setTextSize(1);
  display.print(h);
  display.println(" %");
  display.setCursor(0,40);  //oled display
  display.setTextSize(2);
  display.print("Temp:");
  display.setTextSize(1);
  display.print(t);
```

```
  display.println(" C");
  display.display();
  delay(250);
  display.clearDisplay();
}
  if(soilmoisturepercent >=0 && soilmoisturepercent <= 30)
  {
    digitalWrite(relaypin, HIGH);
    Serial.println("Motor is ON");
  }
  else if (soilmoisturepercent >30 && soilmoisturepercent <= 100)
  {
    digitalWrite(relaypin, LOW);
    Serial.println("Motor is OFF");
  }

  if (client.connect(server, 80)) // "184.106.153.149" or api.thingspeak.com
  {
    String postStr = apiKey;
      postStr += "&field1=";
      postStr += String(soilmoisturepercent);
      postStr += "&field2=";
      postStr += String(h);
      postStr += "&field3=";
      postStr += String(t);
      postStr += "&field4=";
      postStr += String(relaypin);
```

```
  postStr += "\r\n\r\n\r\n\r\n";

 client.print("POST /update HTTP/1.1\n");
 client.print("Host: api.thingspeak.com\n");
 client.print("Connection: close\n");
 client.print("X-THINGSPEAKAPIKEY: " + apiKey + "\n");
 client.print("Content-Type: application/x-www-form-urlencoded\n");
 client.print("Content-Length: ");
 client.print(postStr.length());
 client.print("\n\n");
 client.print(postStr);}
client.stop();}
```

3.2 SOFTWARE ANALYSIS

- **ARDUINO IDE (CONTROLLER EMBEDDED C CODING):** The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

- **THINGSPEAK (IOT CLOUD):** ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyse live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. ... ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.

- **FRITZING (SCHEMATIC DESIGN):** Fritzing is an open-source initiative to develop amateur or hobby CAD software for the design of electronics hardware, to support designers and artists ready to move from experimenting with a prototype to building a more permanent circuit. It was developed at the University of Applied Sciences Potsdam.

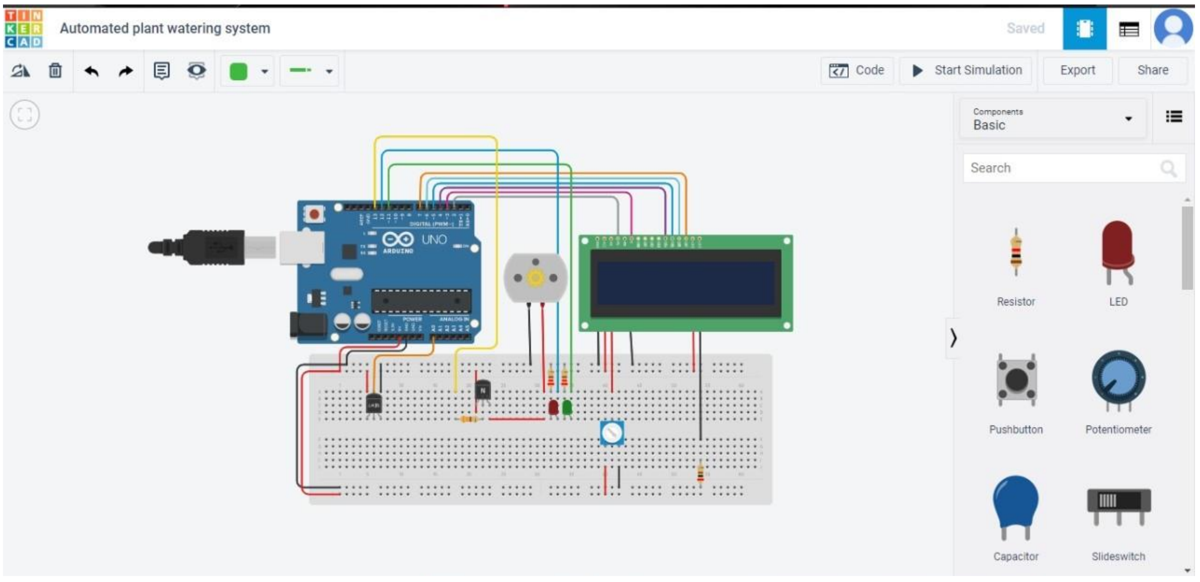
- **TINKERCAD (SOFTWARE SIMULATION):** Tinkercad is an online collection of software tools from Autodesk that enable complete beginners to create 3D models. This CAD software is based on constructive solid geometry (CSG), which allows users to create complex models by combining simpler objects together.

- **EASYEDA (PCB DESIGN):** EasyEDA is a web-based EDA tool suite that enables hardware engineers to design, simulate, share - publicly and privately - and discuss schematics, simulations and printed circuit boards. ... Registered users can download Gerber files from the tool free of charge; but for a fee, EasyEDA offers a PCB fabrication service.

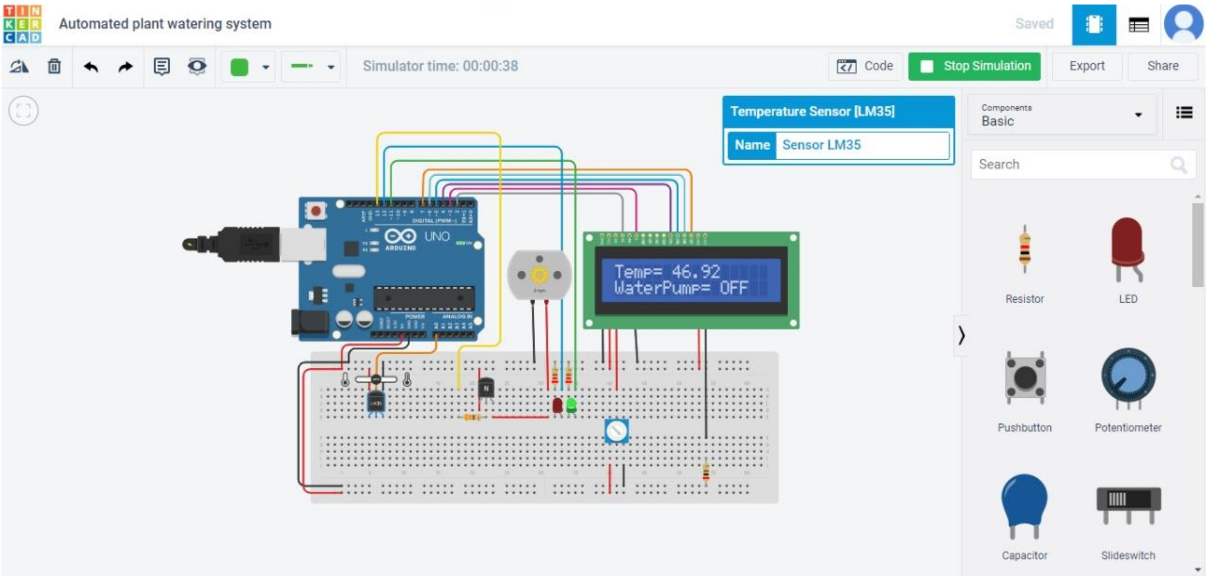
3.3 SNAPSHOTS, RESULTS

Case 1 - When the setup is in initial condition

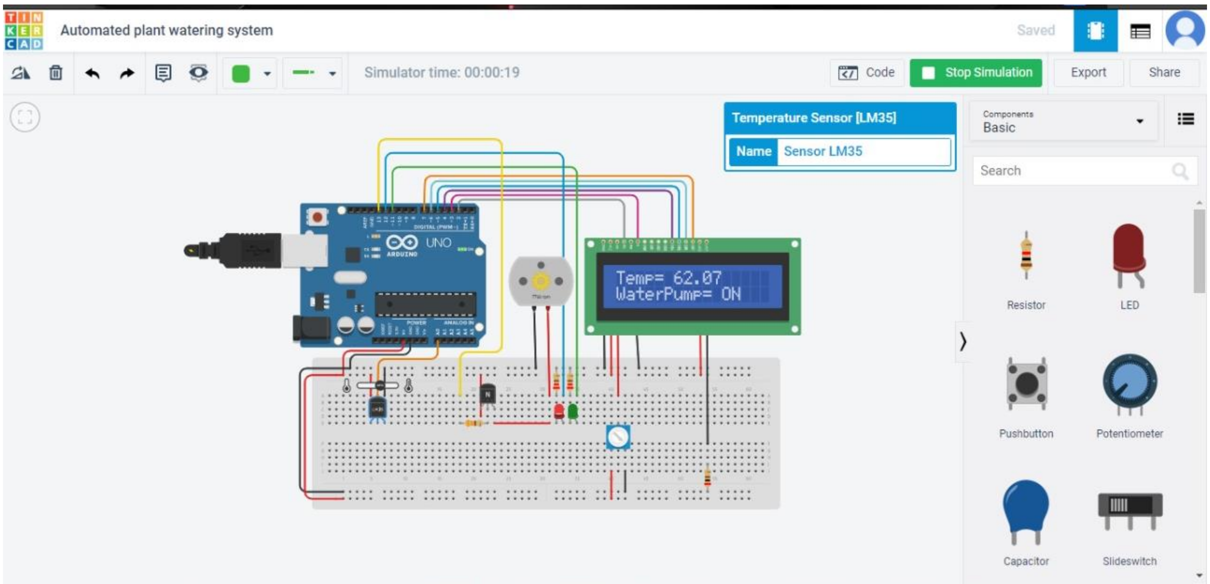
(Before Simulation)



Case 2 – When the temperature is less than the threshold value (Motor remains switched off)



Case 3 – When the temperature is less than the threshold value (Motor switches on)



4. CONCLUSION AND FUTURE WORK

4.1 RESULT, CONCLUSION AND INFERENCE

Thus the “IOT BASED SMART PLANT WATERING SYSTEM” has been designed and tested

successfully. It has been developed by integrated features of all the hardware components used. Presence of every

module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Thus, the Arduino

Based Automatic Plant Watering System has been designed and tested successfully. The system has been tested to

function automatically. The moisture sensors measure the moisture level (water content) of the different plants. If the

moisture level is found to be below the desired level , the moisture sensor sends the signal to the Arduino board which

triggers the Water Pump to turn ON and supply the water to respective plant using the Rotating Platform/Sprinkler.

When the desired moisture level is reached, the system halts on its own and the Water Pump is turned OFF. Thus, the

functionality of the entire system has been tested thoroughly and it is said to function successfully.

4.2 FUTURE WORK

In the near future there is a lot of scope for automated technology mainly involving IOT which helps to update data in the cloud for future and an easy access. IOT based industries are blooming because of this convenient and smart data storage technology they provide to their users. This is also now finding many applications in the space technology which would be the only resort for human beings if this planet goes uncapable of living.

4.3 COST

COMPONENT	COST
ESP8266 Node MCU (Wi-Fi Module)	**₹350**
Soil Moisture Probe + Comparator	**₹150**
4-bit Relay Module	**₹200**
Push/Pump Water Motor + Hoss Pipe	**₹150**
Breadboard	**₹100**
Jumper Wires + Connecting Wires	**₹50**
Total	**₹1000(Approx.)**

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