A

Project Report

on

SMART IRRIGATION SYSTEM

submitted in partial fulfilment of the requirements for the degree of
B. Tech in Electrical Engineering
by

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CERTIFICATE

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Examiners:

1……

2……

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STUDENT'S DECLARATION

I certify that

- The work contained in the report is original and has been done by myself under the general supervision of my supervisor.
- I have following to the norms and guidelines given in the Ethical Code of Conduct of the Institute.
- Whenever I have used materials (data, theoretical analysis, and text) from other sources,I have given due credit to them by citing them in the text of the report and giving their details in the references.
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ACKNOWLEDGEMENT

First of all, we are thankful to God and our parents who always bless & inspire us to achieve our goal.

It's our great pleasure at the completion of our project on "**SMART IRRIGATION SYSTEM"**. It has given us great joy of working with challenges and complexity of manufacturing system or process &term work. This project work will be really helpful for our carrier.

We have completed our project with great satisfaction. We are very thankful to our head of department, **DR. MUKESH KUMAR** to help us for providing required lab facility to complete our project in college. Also, all of us thankful to the entire electrical department's faculties who directly or indirectly help us.

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For all these, the credit goes to unity and management of our project group. Our group members give their best efforts for it.

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ABSTRACT

The project we have undertaken is "Smart Irrigation System". This project is taken up as India is an agriculture oriented country and the rate at which water resources are depleting is a dangerous threat hence there is a need of smart and efficient way of irrigation. In this project we have implemented sensors which detect the humidity in the soil (agricultural field) and supply water to the field which has water requirement. The project is an I.O.T based design which controls the water supply and the field to be irrigated. There are sensors present in each field which are not activated till water is present on the field. Once the field gets dry sensors sense the requirement of water in the field and send a signal to the microcontroller. Microcontroller then supply water to that particular field which has water requirement till the sensors is deactivated again. In case, when there are more than one signal for water requirement then the microcontroller will prioritize the first received signal and irrigate the fields accordingly. The development of the automated irrigation system based on Arduino and IOT at experimental scale within rural areas is presented. The aim of the implementation was to demonstrate that the automatic irrigation can be used to reduce water use.

In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. So, In This Project We will use Relay detecting System when any fault is being detected the relay detecting system then the relay detecting system automatically cut the power of transmission line so our substation will be saved by any type of faults.

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INTRODUCTION:

1.1 PROJECT OVERVIEW

- Smart Agriculture developing model is a real time monitoring system. This system use sensors to monitor soil moisture levels, temperature, humidity and other environmental factors. This data is then analyzed by an intelligent controller to provide precise amount of water to plants based on their specific needs.
- It is possible to control many operations of the field remotely from anywhere, anytime by IOT.
- Overall, this system offers an effective way to improve the efficiency and sustainability of irrigation practices, while also improving their health and yield.

1.2 OBJECTIVES:

- To minimize manual intervention by the farmers.
- To prevent excessive wastage of water & electricity.
- To protect the plant from instant damage.
- To continuously monitor the status of the sensors and provide signal for taking necessary action.
- To generate positive economic consequences for farmers and their families.
- Minimize year to year yield fluctuations, leading to higher and more stable farm income.

1.3 PROBLEM STATEMENT:

- In the case of traditional irrigation system water saving is not considered. Since, the water is irrigated directly in the land, plants under go high stress from variation in soil moisture, therefore plant appearance is reduced.
- The absence of automatic controlling of the system result in improper water control system.

- The major reason for these limitations is the growth of population which is increasing at a faster rate.
- At present there is emerging global water crisis where managing scarcity of water has become a serious job.
- This growth can be seen in countries which have shortage of water resources and are economically poor. So this is the serious problem in agriculture area.

1.4 **EXISTING SYSTEM:**

- Traditional irrigation methods involve manual or scheduled irrigation, often based on guesswork or historical practices.
- These methods are typically inefficient and can lead to overwatering or underwatering of crops.
- There are many challenges with traditional methods like wastage of water, inconsistent irrigation, crop stress and yield loss.
- High labor requires for traditional irrigation system developed for the irrigational

1.5 PROPOSED SYSTEM:

- This system is a combination of hardware and software components.
- The hardware part consists of different sensors like soil moisture sensor, photocell sensor, etc whereas the software part consists of an android based application connected to the Arduino board and other hardware components using Internet of Things (IoT).
- The application consists of signals and a database in which readings are displayed from sensors and are inserted using the hardware.
- The improvement in irrigation system using wireless network is a solution to achieve water conservation as well as improvement in irrigation process.
- This research tries to automate the process of irrigation on the farmland by monitoring the soil water level of the soil relative to the plant being cultivated and the adaptively sprinkling water to simulate the effect of rainfall

1.6 IOT (INTERNET OF THINGS):

- IoT (Internet of Things) refers to a network of physical devices, vehicles, home appliances, and other objects that are embedded with sensors, software, and connectivity that enables them to collect and exchange data with other devices and systems over the internet.
- This interconnected network of devices can be used to automate processes, monitor and control devices remotely, and gather data for analysis and optimization.
- In simple words, IoT is a system of devices that can communicate with each other over the internet to accomplish tasks more efficiently and effectively.

CHAPTER 2

SYSTEM COMPONENT: HARDWARE AND SOFTWARE

2.1.Node MCU:

- Node MCU is a low-cost, Wi-Fi-enabled microcontroller chip that is widely used in Internet of Things (IoT) devices. It was developed by Espressif Systems, and has become popular for its ease of use, low power consumption, and versatility.
- The ESP8266 can be programmed using the Arduino IDE, making it accessible to many developers and hobbyists. It has a built-in Wi-Fi module that can connect to wireless networks and communicate with other devices over the internet.
- Overall, the ESP8266 is a powerful and versatile microcontroller that has enabled the development of a wide range of IoT devices, from smart home appliances to industrial automation systems.

SPECIFICATIONS:

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1

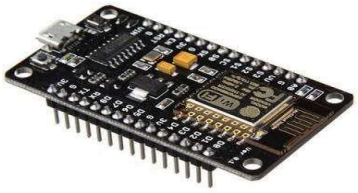


Figure 1: Node MCU

2.2 ARDUINO UNO:

- The Arduino UNO is one of the most used microcontrollers in the industry. It is very easy to handle, convenient, and use.
- The coding of this microcontroller is very simple.
- The program of this microcontroller is considered as unstable due to the flash memory technology.
- The applications of this microcontroller involve a wide range of applications like security, home appliances, remote sensors, and industrial automation.
- This microcontroller has the ability to be joined on the internet and perform as a server too.

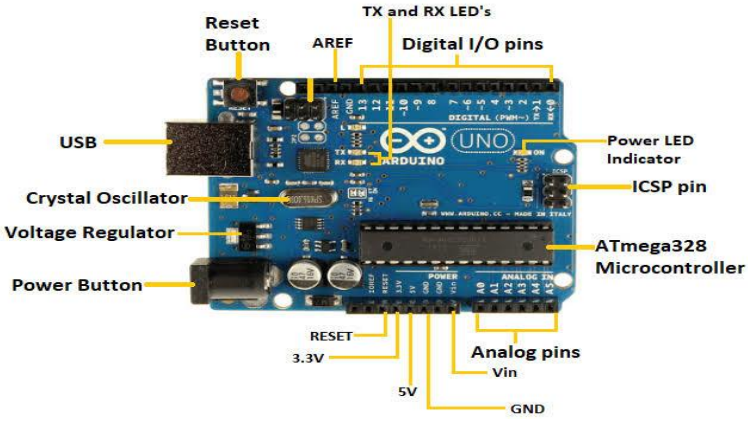


Figure 2 ARDUINO UNO

SPECIFICATIONS:

- Microcontroller: Atmega328
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 14
- Analog Input Pins (ADC): 6

- DC Current per I/O Pin: 20mA
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed:16 MHz
- Flash Memory: 32 KB (ATmega328P)

2.3 DHT11 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).

SPECIFICATIONS:

- Supply Voltage: +5 V
- Temperature range :0-50 °C error of ± 2 °C
- Humidity :20-90% RH ± 5% RH error
- Interface: Digital

Figure 3 DHT 11

2.4. SOIL MOISTURE SENSOR:

- The fork-shaped probe with two exposed conductors acts as a variable resistor (similar to

a potentiometer) whose resistance

- moisture content.
- This resistance varies inversely with soil moisture: The more water in the soil, the better the conductivity and the lower the resistance. The less water in the soil, the lower the conductivity and thus the higher the resistance.
- The sensor produces an output voltage according to the resistance, which by measuring we can determine the soil moisture level.

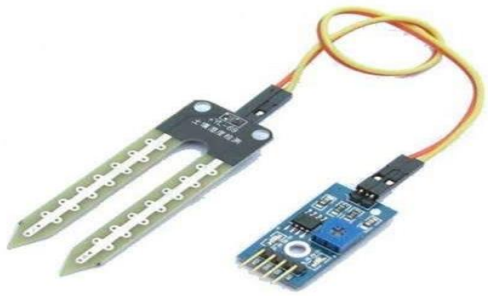


Figure 4 SOIL MOISTURE SENSOR

SPECIFICATION:

- Operating voltage (Vcc): 3.3V to 5V
- Analog Output voltage: 0 to 4.2V@ Vcc = 5V
- Digital Output Voltage: 0V or 5V @ Vcc=5v
- Current consumption: 32mA

2.5. MOTOR PUMP:

- Motor Pump is a rotary electrical machines that converts direct current electrical energy into mechanical energy.

- When the water hits the rotating impeller, energy of the impeller is transferred to the water, forcing the water out (centrifugal force)

SPECIFICATION:

- (Vcc): 3V to Operating voltage 12V
- Pumping Height: between 40 to 110 cm.

Figure 5 MOTOR PUMP

2.6. RELAY MODULE:

- A 5v relay is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.
- The relay uses the current supply for opening or closing switch contacts.
- Usually, this can be done through a coil to magnetize the switch contacts & drags them jointly once activated.
- A spring drives them separately once the coil is not strengthened.

SPECIFICATION:

- Current consumption: 20mA maximum
- AC load voltage: upto 250V

- DC load voltage: upto 30V
- Load current: upto 10A

Figure 6- 5V. relay module

2.7. JUMPER WIRES:

- Jumper wires are simply wires 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.
- In fact, it doesn't get much more basic than jumper wires

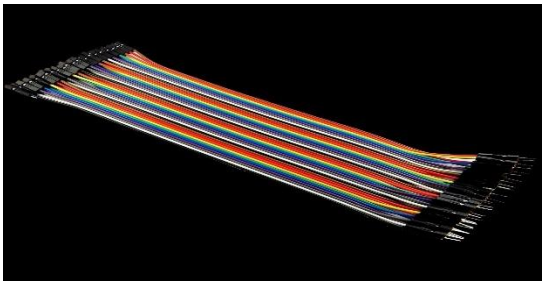


Figure 8 JUMPER WIRE

2.8. BREADBOARD:

- Breadboards are one of the most fundamental pieces when learning how to build circuits.
- In this tutorial, you will learn a little bit about what breadboards are, why they are called

breadboards, and how to use one.

- Once you are done you should have a basic understanding of how breadboards work and be able to build a basic circuit on a breadboard.

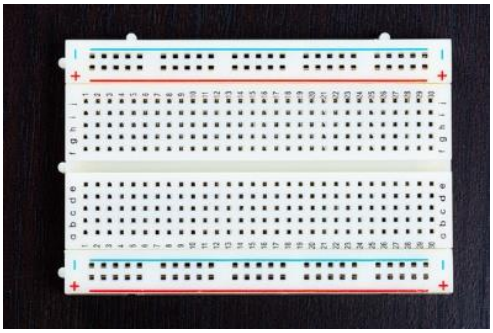


Figure 9 BREADBOARD

2.9. BATTERY:

- Battery, in electricity and electrochemistry, any of a class of devices that convert chemical energy directly into electrical energy.
- Here we are using a rechargeable li-ion battery for operation of Arduino, pump & other components.

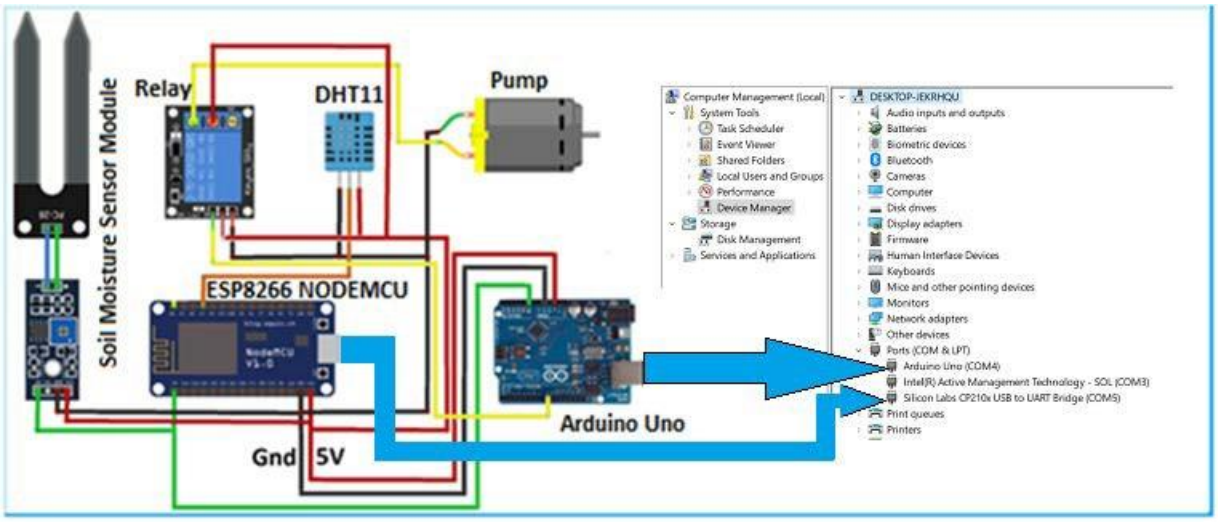
Figure 10 9 V BATTERY

2.10.THINGSPEAK:

- THINGSPEAK is a Platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets.
- THINGSPEAK is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. After downloading the app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen

CHAPTER 3

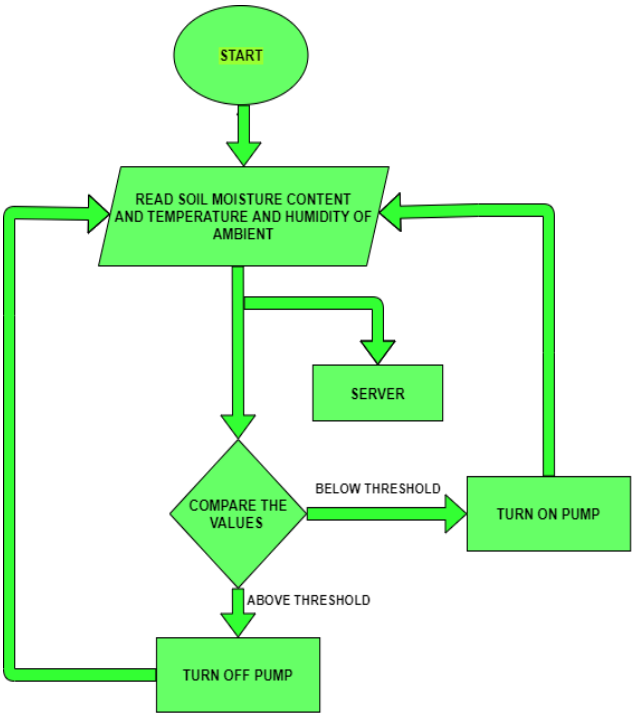
3.1. CIRCUIT DIAGRAM:



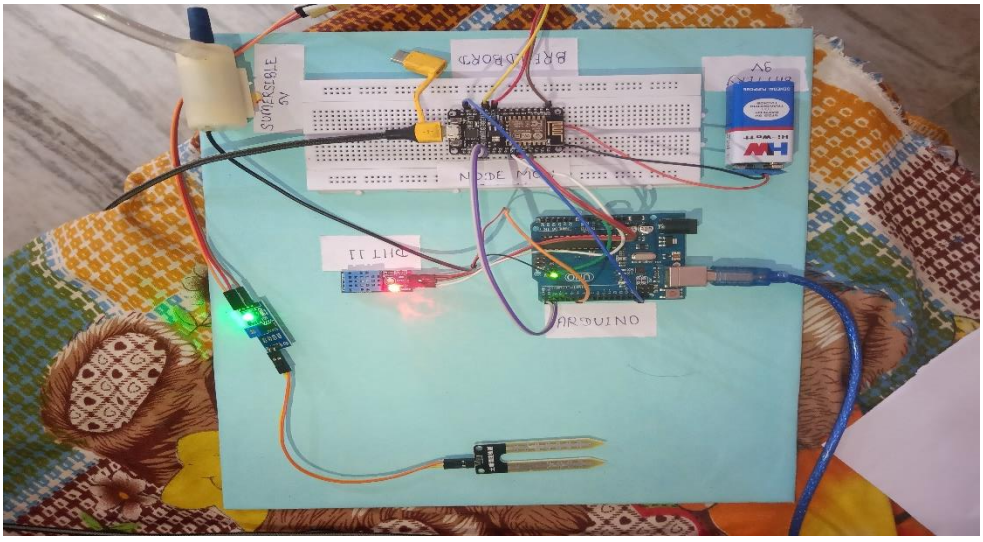
3.2. WORKING:

- The soil moisture content and environmental factors like temperature and humidity are read by the microcontroller of the transmitter module.
- These values are sent to the cloud through internet for every 15 seconds. The logged data is represented in the ThingSpeak cloud in the form of graphs.
- When the sensors values go beyond the threshold, an alert message is sent to the farmer.
- Android Application enables farmer to turn on the water motor by controlling the relay connected to coordinator module through internet.
- When the desired environmental parameters are met an alert is sent again to the farmer to turn off the motor.

3.3. FLOW DIAGRAM:



3.3. WORKING DIAGRAM:



3.5. CODING:

NODE MCU CODE

Arduino File Edit Sketch Tools Help

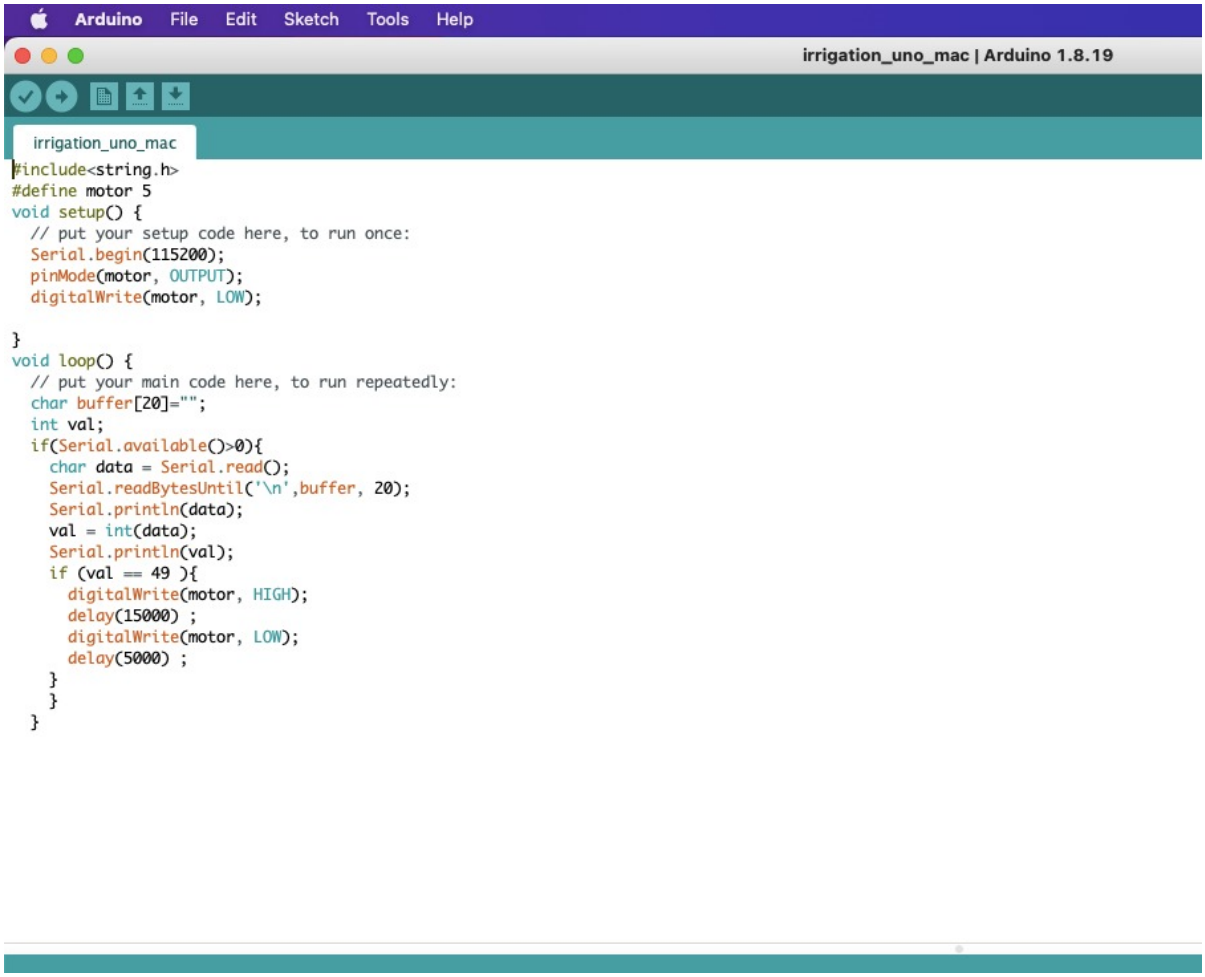
Irrigation | Arduino 1.8.19

Irrigation

```
#include <ESP8266WiFi.h>
#include <DHT.h>

String apiKey = "2UXZXFQA1RFYO16R";     //  Enter your Write API key from ThingSpeak

const char *ssid =  "Mr.Kr";     // replace with your wifi ssid and wpa2 key
const char *pass =  "";
const char *server = "api.thingspeak.com";

#define DHTPIN D3          //pin where the dht11 is connected
#define MOI A0         //pin where moisture snesor is connected
#define RELAY D2         //pin where relay is connecter

DHT dht(DHTPIN, DHT11);

WiFiClient client;

void setup()
{
  Serial.begin(115200);
  delay(10);
  dht.begin();

  pinMode (MOI,INPUT);
  pinMode (RELAY,OUTPUT);


  Serial.println("Connecting to ");
  Serial.println(ssid);

  WiFi.begin(ssid, pass);

  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  }
  Serial.println("");
  Serial.println("WiFi connected");

}

void loop()
{

  float h = dht.readHumidity();
  float t = dht.readTemperature();

  float moisture_output = analogRead(MOI) / 1023.00;
  float moisture_percentage = ( 100.00 - (moisture_output) * 100.00 );

if (moisture_percentage < 40){
    digitalWrite(RELAY, HIGH);
    }

  if (client.connect(server, 80))  //   "184.106.153.149" or api.thingspeak.com
  {

    String postStr = apiKey;
    postStr += "&field1=";
    postStr += String(t);
    postStr += "&field2=";
    postStr += String(h);
    postStr += "&field3=";
    postStr += String(moisture_percentage);
    postStr += "\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);

    if (moisture_percentage < 45){
    Serial.println("1");

}

  }
  client.stop();


  // thingspeak needs minimum 15 sec delay for updates
  delay(1000);
}
```

ARDUINO ACTUATION CODE:




```
#include<string.h>
#define motor 5
void setup() {
  // put your setup code here, to run once:
  Serial.begin(115200);
  pinMode(motor, OUTPUT);
  digitalWrite(motor, LOW);

}
void loop() {
  // put your main code here, to run repeatedly:
  char buffer[20]="";
  int val;
  if(Serial.available()>0){
    char data = Serial.read();
    Serial.readBytesUntil('\n',buffer, 20);
    Serial.println(data);
    val = int(data);
    Serial.println(val);
    if (val == 49 ){
      digitalWrite(motor, HIGH);
      delay(15000) ;
      digitalWrite(motor, LOW);
      delay(5000) ;
    }
    }
  }
```

CHAPTER 4

4.1ADVANTAGES:

- Increase in productivity.
- Reduced water consumption.
- Safe to operate.
- No Manpower required.
- Reduced soil erosion and nutrient leaching.
- Require small water sources.
- Highly sensitive.
- Works according to the soil condition.
- Complete elimination of manpower.
- System can be switched into manual mode whenever required.
- Irrigation in small places too like parks, garden.
- Very useful for common people who do not have time to water their plant because of busy life schedule.
- This project is very economical in term of cost and power.

4.2. CHALLENGES:

- The smart farming based equipment require farmer to understand and learn the use of technology.
- The smart agriculture need availability on internet continuously.
- Fault sensor or data processing engines can cause faulty decisions which may lead to over use of water, fertilizers and other wastage of resources.
- It also has some issues which have to be tracked properly in order to attain the full benefit of

it.

4.3 APPLICATIONS:

- Useful in Irrigation Field
- Useful in Parks and Grounds
- It is also helpful in paddy areas and rice fields
- It is beneficial in Pisciculture
- Roof of garden.
- Lawn
- Agriculture land.
- Green city buildings.
- Home gardens.
- Indoor farming (vertical farming).

CHAPTER 5

5.1 FUTURE SCOPE:

- Generator can be added to this to water the very small area or pot plants.
- The functions of detecting nutrient deficiency can be added so that the farmer comes to know Using this system as framework, the system can be expanded to include various other options which could include mobile application control of motor and wifi controlled monitoring. These will expand the working capability and efficiency of this prototype.
- This system can be further expanded to automatic control of water pumps in residential houses and large parks and gardens where there is a lot of wastage of water is happening currently, so this system proposes an solution to avoid those wastages and lead us towards water and energy conservation.
- It has a vast scope when it is mixed with IOT .Automation will get a new dimension through this.
- It can be used with the Solar Panels.
- An Atmospheric Water about the fertilizer to be used using the nutrient sensor like NPK sensor.

5.2 CONCLUSION:

- The proposed system provides the efficient and reliable method of irrigation.
- Due to regular updates of the soil conditions and environmental factors, it becomes easy to analyze the data and get knowledge about what amount of water is required at what interval of time in a day.

- Moreover in dry areas where there is inadequate rainfall, the system can efficiently manage water and ensure better yield of crops by precisely watering.
- The system reduces human intervention.
- It enables the farmer to know about the crops and surrounding environment and control the water pump and monitor the field by accessing the data from anywhere.

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