Title of the project

Smart Agriculture Monitoring System Using IoT

Project Team

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ABSTRACT

Agriculture Monitoring is seen as one of the most important task in any agriculture based environment. In order to monitor the agriculture conveniently by using our smartphone, integration of ambient intelligent system farming easier.
So, an automated agriculture monitoring system is implemented which monitors the temperature, humidity, intensity of light and maintains the desired soil moisture content via automatic watering. Wifi module NodeMCU is used to implement the control unit. The setup uses the following –

- **Soil moisture sensor which measures the exact moisture level in the soil.**
- **LDR sensor for measuring intensity of light.**
- **DHT sensor for measuring the environment humidity and temperature.**

The value obtained from soil moisture sensor enables the system to use appropriate quantity of water which avoids over or under irrigation. IoT is used to keep the farmers updated about the status of water pump. Information from the sensors is regularly updated on a mobile app through which a farmer can check whether the water pump is are ON or OFF at any given time.

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CHAPTER 1

INTRODUCTION:

In the era of the internet and connected devices Internet of Things (IoT) is the next big thing for the industry. On the other hand, it is anticipated that by the next 30 years, the population of the world will exceed 6 billion, and the incremental throughput needed to produce food for this population is 70%. Incorporating IoT based smart agriculture systems is essential to cope up with this need.

One of the primary sector of Indian economy is agriculture. Inorder to maintain these agricultural land and yield the crops farmers have to visit these lands, plant the crops required, maintain them by providing proper water supply, fertilizers, etc. There is a chance that the water consumption will be higher or that the time it takes for the water to reach the destination will be longer, resulting in crop dryness. Real-time temperature and humidity monitoring is crucial in many agricultural disciplines. However, the old method of wired detection control is inflexible, resulting in several application limitations. So, there is a growing need to resolve this issue. So, this can be accomplished using IoT technology. IoT is a network of interconnected devices that can transmit and receive data over the internet and carry out tasks without human involvement. Agriculture provides wealth of data analysis parameters, resulting in increased crop yields. The use of IoT devices in smart farming aids in the modernization of information and communication. Also, with the help of these devices farmers can monitor their crops very easily through their smartphones. For crop growth moisture, mineral, light and other factors can be assumed.

This project achieves agriculture automation as a crucial answer to this problem. This is accomplished with the aid of a NodeMCU (A low-cost open source IoT platform), moisture sensor, LDR sensor, DHT sensor, water pump and Blynk IoT mobile app.

CHAPTER 2

OBJECTIVE AND PROBLEM FORMULATION:

The main problems in agriculture are overirrigation, underirrigation leading to improper use of water, there by affecting the growth of crop. Other major problem is the monotonous task of monitoring the parameters such as moisture, humidity, temperature etc. and regulating the irrigation system which is done manually.

2.1 Over irrigation

2.2 Under irrigation

2.3 Manual Motoring

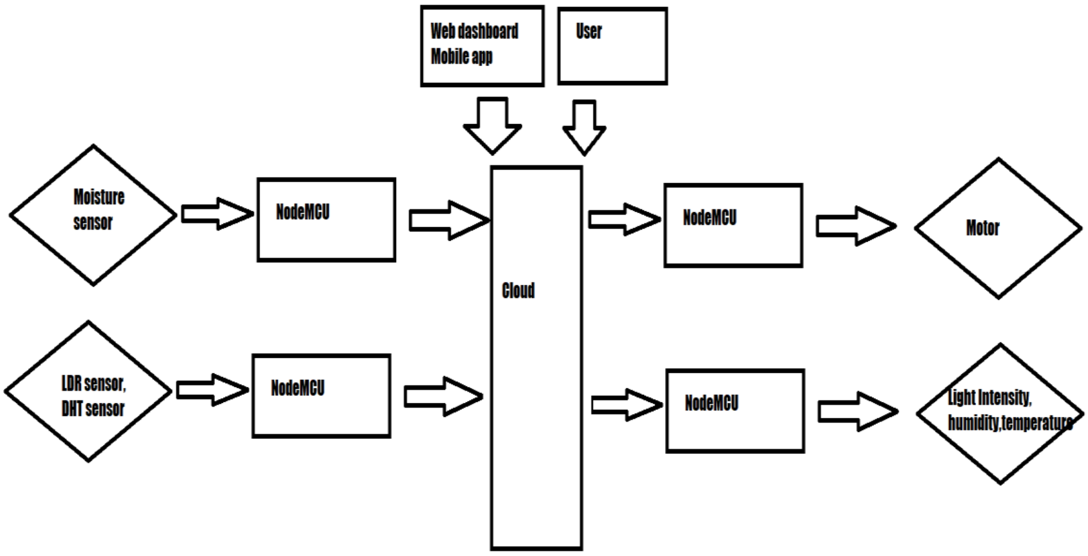
2.4 Power Management

Therefore, the main objective of our project is to reduce the complexity of supervision and to avoid the continuous monitoring. We can accomplish smart agriculture using our system and automate the process of irrigation. This system includes IoT-based agricultural monitoring. The Internet of Things (IoT) is transforming the agriculture business and addressing the enormous difficulties and huge obstacles that farmers confront today in the field. The soil moisture sensor is put into the soil to determine whether the soil is wet or dry, and if the moisture level in the soil is low, the relay unit attached to the water pump switch must be monitored on a regular basis. When the soil is dry, it will turn on the motor, and when the soil is moist, it will turn off the water pump. The DHT sensor measures the environment humidity and temperature while the LDR sensor measures the intensity of the environmental light falling on the crops.

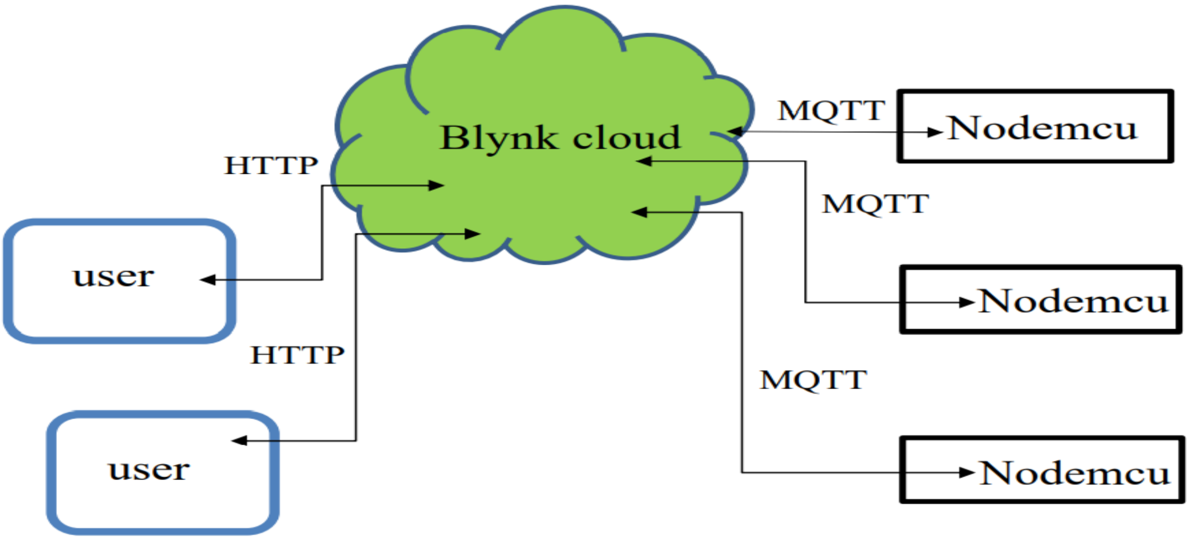
CHAPTER 3

ARCHITECTURE:

3.1 PROCESS FLOW



3.2 CLOUD ARCHITECTURE



CHAPTER 4

4.1 HARDWARE

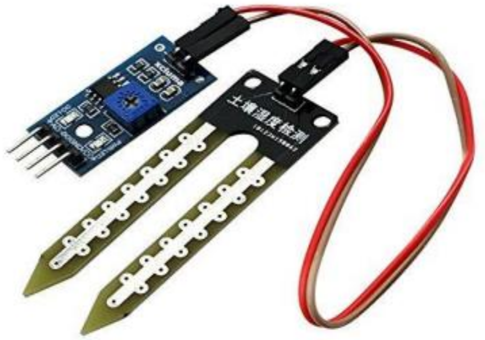
a) NodeMCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 wifi 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 dev kits.

PIN Diagram

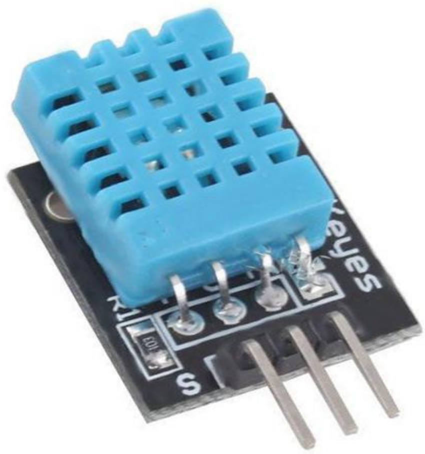
b) Moisture Sensor

This soil moisture sensor uses two probes to pass current through the soil, and then it reads that resistance to get the moisture level. More water makes the soil conduct electricity more easily (less resistance), while dry soil conducts electricity poorly (more resistance).



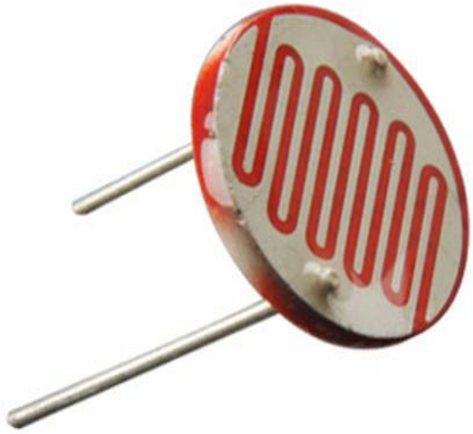
c) DHT sensor

The DHT is a commonly used Temperature and humidity sensor for prototypes monitoring the ambient temperature and humidity of a given area. The DHT sensors are made of two parts, a capacitive humidity sensor and a thermistor. There is also a very basic chip inside that does some analog to digital conversion and spits out a digital signal with the temperature and humidity.



d) LDR sensor

Light dependant resistor sensor is also known as photo resistor. It is a one type of resistor whose resistance varies depending on the amount of light falling on its surface. When the light falls on the resistor, then the resistance changes. These resistors are often used in many circuits where it is required to sense the presence of light.



e) Mini Water Pump

This is a compact size submersible water pump .
It is built by a brushless motor providing smooth
and quiet operation than a non-brushless water pump.

f) Relay

A relay is electrically operated switch. Current flowing
through the coil of the relay creates a magnetic field
which attracts a lever and changes the switch contacts.

4.2 SOFTWARE

a) Arduino IDE

- Arduino is Opensource hardware and software company, project, and user community that designs and manufactures single board microcontrollers and microcontroller kits for building digital devices.
- Arduino IDE is the software provided by the Arduino which is open source and is mainly used for writing and compiling the code into the Arduino Module.
- The IDE environment mainly contains two basic parts. “Editor” and “Compiler” where former is used for writing the required code and later is used for compiling and uploading the code into the given microcontroller boards
- Nodemcu can be programmed using Arduino IDE by installing the required “ESP8266” libraries.
- Also, Blynk libraries are installed to connect to the Blynk cloud and mobile app.

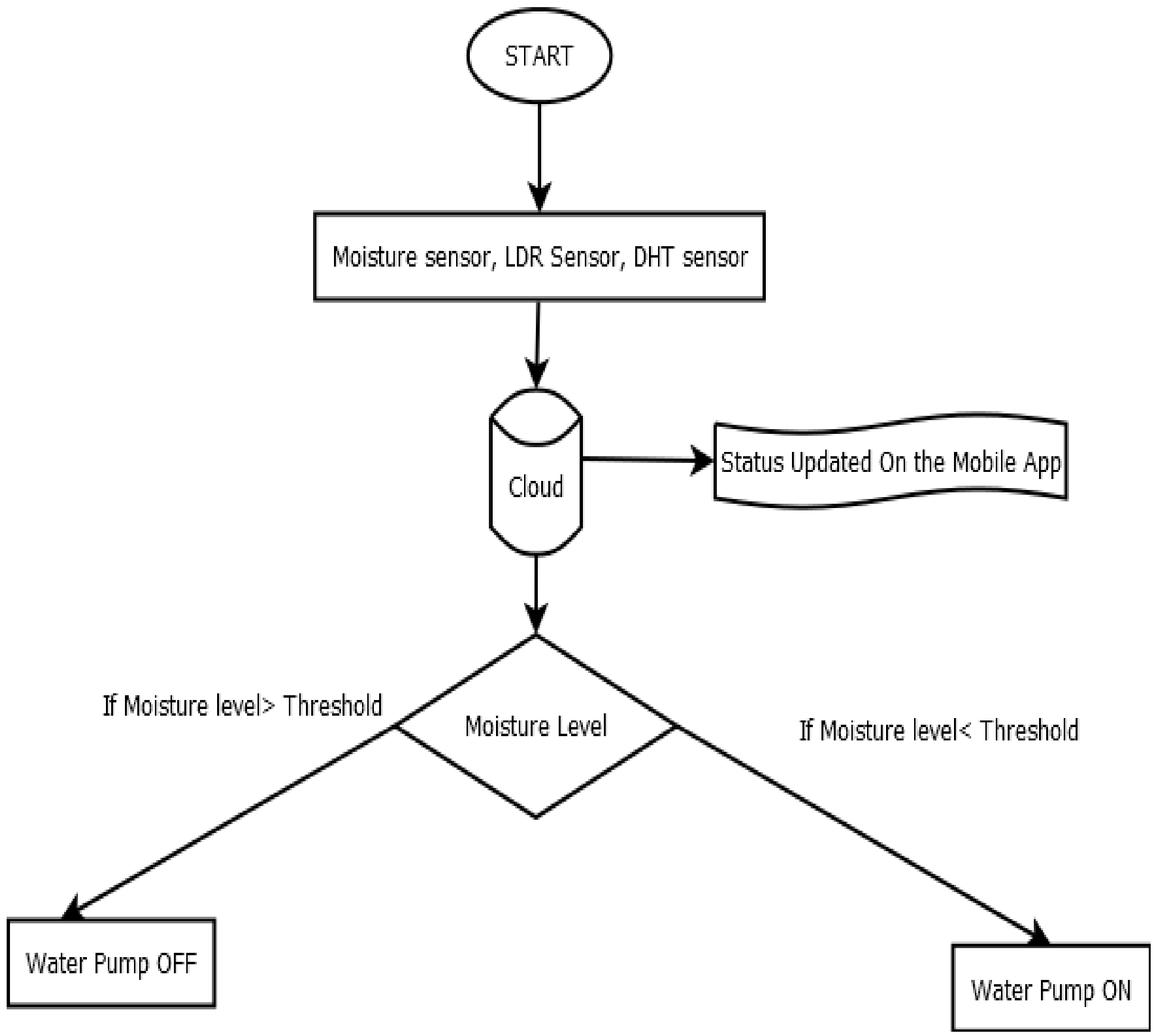
b) Blynk Cloud and Mobile App

- Blynk Cloud provides a software as a service. It allows to create a product over a cloud and link the product to the connecting device.
- Blynk provides website “Blynk.io” to create the template of the product and also provides a web dashboard to create nice user interface with customizable widgets for representing different parameters.
- The interesting part is that Blynk also provides an Blynk IoT mobile app for both android and IOS which can be downloaded on app stores for free.
- This app comes with the template which is already created on the website.
- The wifi credentials are fed into the device using the app.
- It also comes with lot of customizable widgets to represent the various parameters and actions such as gauges for temperature, moisture etc. Switch for controlling switching action etc.

CHAPTER 5

Design and Implementation

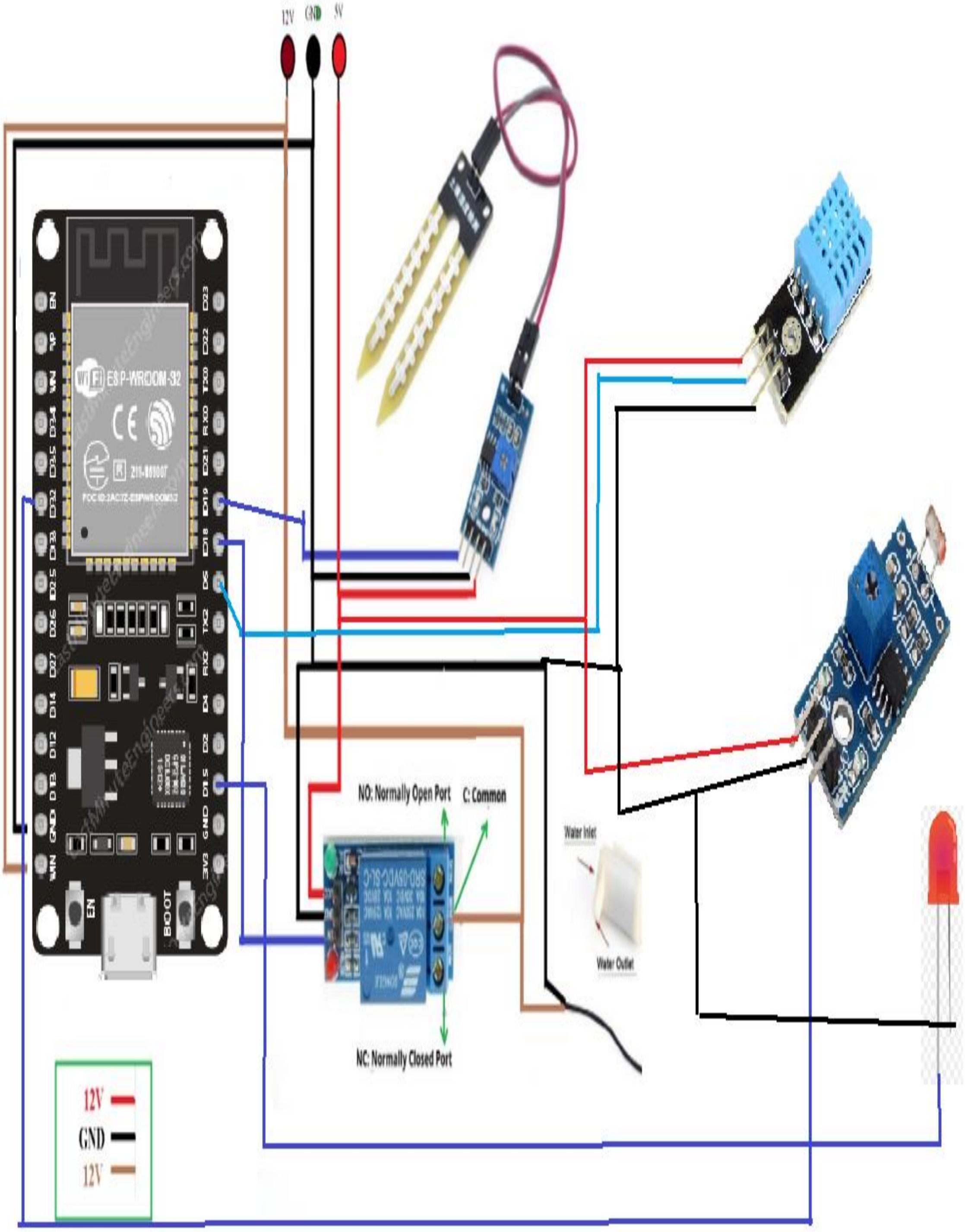
5.1 Methadology



5.2 Working

- Power the Nodemcu with the 5V supply ,glowing on board LED indicates the ON state of the Nodemcu.
- LDR sensor will measure the intensity of light from the environment and the DHT sensor will measure the humidity and temperature of the environment.
- Soil moisture sensor will check the water content in the soil, it is measured as the resistance between the probes of the sensor , this value is sent to the Analog input Pin(A0) of the Nodemcu.
- The values ranges between 0 – 1023.
- These values are then converted in to percentage(%) to make sense.
- The percentage is compared with the constraint put by the user, in this case "percentage > 80" will indicate the high water content, and "percentage < 20" will indicate the low water content in the soil.
- These values are sent to the cloud by the Nodemcu ,and cloud will update these values in the Blynk app of the connected mobile device.
- Inside the app interface , the moisture level will be indicated by the Gauge widget , and the status of the "Water pump" will be indicated by the LED widget and displayed on the LCD widget on the app.
- If the values measured to be > 80% ,indicating high water content , the status of the pump will be displayed on the LCD widget as "Water Pump OFF" and on app LED will be in off state .
- If the values measured to be < 20% ,indicating low water content then nodemcu sets the waterpump "ON" there by automatically supply the water.
- Status of the pump will be displayed on the LCD widget as "Water Pump ON" and on app LED will start glowing.
- This working cycle continues and plants get the water at the time of their need the there by saving them by under irrigation and improve their growth.

5.3 CIRCUIT DESIGN



5.4 CODE

```
#define BLYNK_TEMPLATE_ID "TMPLm22-DcDd"
#define BLYNK_DEVICE_NAME "Smart Agriculture"
#define BLYNK_AUTH_TOKEN "ge5NtTf4UAlzSb77XIfo_s9NsbrWfPQU"

// Comment this out to disable prints and save space
#define BLYNK_PRINT Serial

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
#include <DHT.h>


char auth[] = BLYNK_AUTH_TOKEN;

// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "puneeth";
char pass[] = "01234567";

int buzzer=2;

#define DHT11_PIN 5
//DHT11 data pin to D4
DHT dht(DHT11_PIN,DHT11);

#define ledpin 15
#define pump 19

BlynkTimer timer;
#include <LiquidCrystal_I2C.h>

#define soil 18
#define light 32


//String long_lat;
// initialize the library with the numbers of the interface pins
LiquidCrystal_I2C lcd(0x27, 16, 2);


void setup()
{
  //Init serial
  Serial.begin(115200);
```

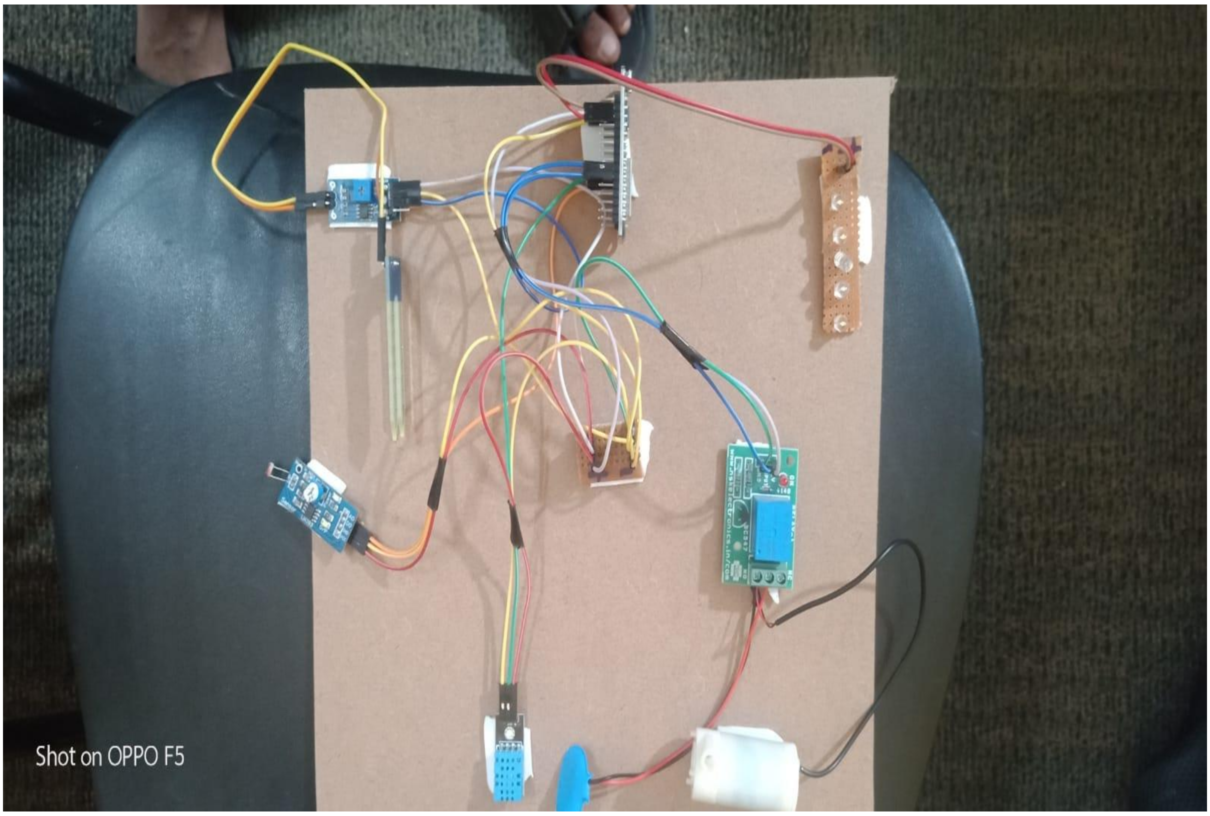
```
  lcd.init();
  lcd.backlight();

  //Blynk.begin(auth, ssid, pass);
  Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
   lcd.begin(16, 2);
   pinMode(buzzer,OUTPUT);
      pinMode(pump,OUTPUT);
         pinMode(ledpin,OUTPUT);
   pinMode(soil,INPUT);
   pinMode(light,INPUT);
   dht.begin();
}


void loop()
{

Blynk.run();
timer.run();


   float h = dht.readHumidity();
   float t = dht.readTemperature();
   Serial.print("Current humidity = ");
   Serial.print(h);
   Serial.print("%  ");
   Serial.print("temperature = ");
   Serial.print(t);
   Serial.println("C  ");

  lcd.setCursor(0,0);
  lcd.print("T:");
  lcd.print(t);

  lcd.setCursor(7,0);
  lcd.print("H:");
  lcd.print(h);

   Blynk.virtualWrite(V2,t);
   Blynk.virtualWrite(V3,h);

  int soilval=digitalRead(soil);
  if(soilval==1)
  {
  Blynk.virtualWrite(V0,"NO SOIL MOISTURE DETECTED");
  lcd.setCursor(0,1);
```

```
 lcd.print("DT");
 digitalWrite(pump,HIGH);
 }

 else
 {
    Blynk.virtualWrite(V0,"SOIL MOISTURE DETECTED");
 lcd.setCursor(0,1);
 lcd.print("S:ND");
   digitalWrite(pump,LOW);

  }

 int lightval=digitalRead(light);
 if(lightval==1)
 {
 Blynk.virtualWrite(V1,"NO LIGHT DETECTED");
  lcd.setCursor(7,1);
 lcd.print("L:DT");
digitalWrite(ledpin,HIGH);

}
else
{
 Blynk.virtualWrite(V1,"LIGHT DETECTED");
 lcd.setCursor(7,1);
 lcd.print("L:ND");
  digitalWrite(ledpin,LOW);
 }
}
```

CHAPTER 6

RESULTS:

PROTOTYPE MODEL

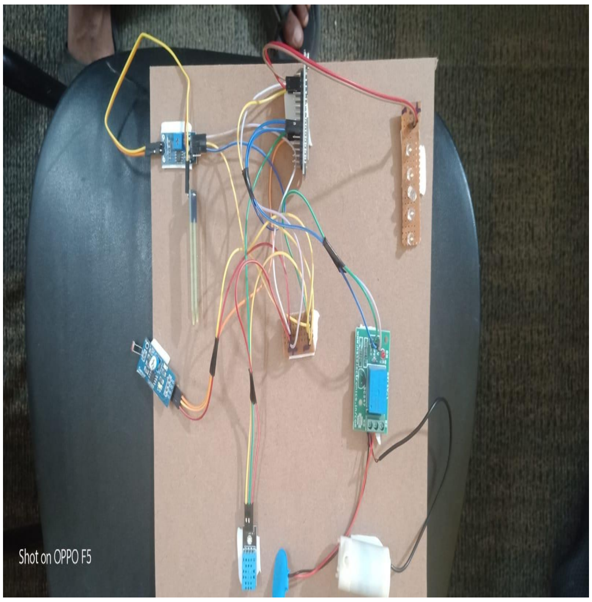


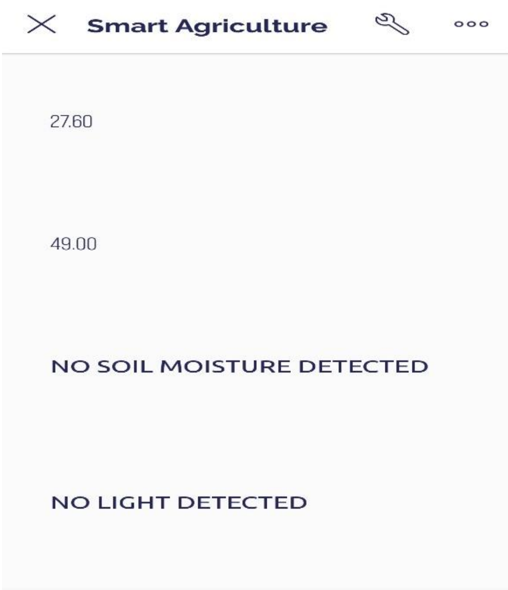
Results

- The project was completed with the working model.
- Implementation worked as proposed.
- The moisture sensor, LDR sensor, DHT sensor readings transmitted by the cloud to mobile app were approximately accurate.
- Sensor data were displayed on the app in real time And the status of the water pump was correctly indicated on the app.
- One can monitor and check the status remotely.

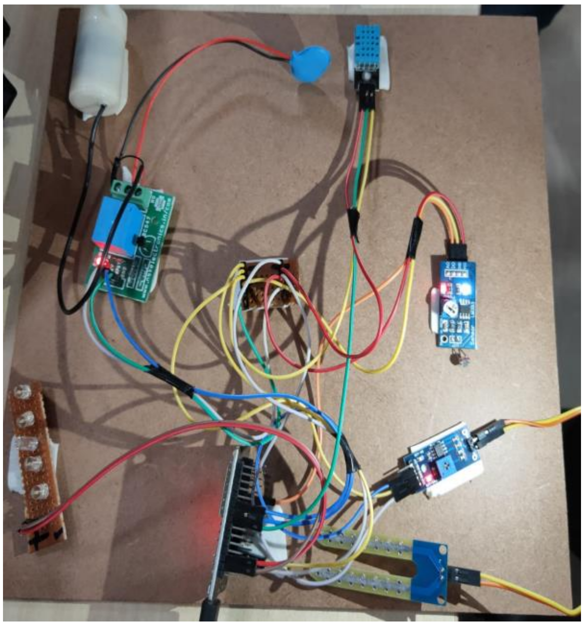
Output

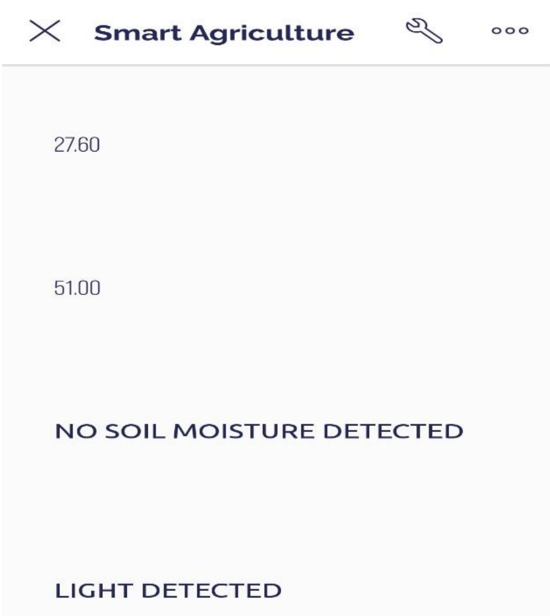
a) Image shows TEMPERATURE AND HUMIDITY READING



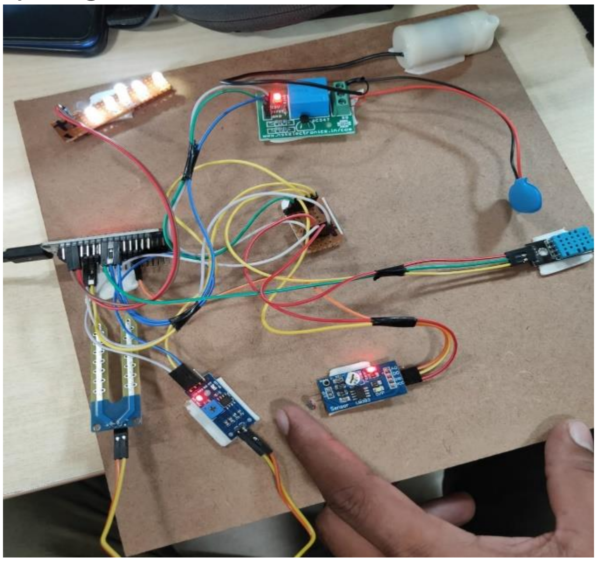


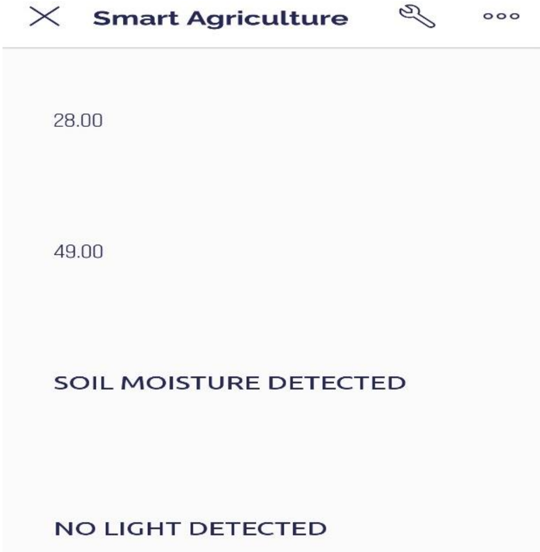
b) Image shows SUNLIGHT DETECTED where LED’s remain OFF



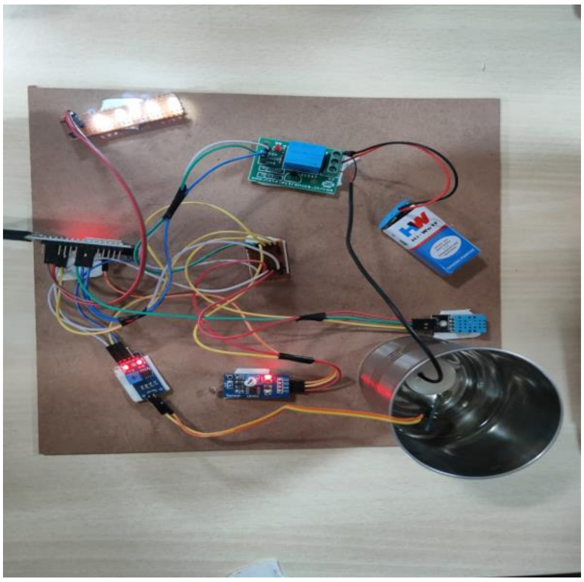


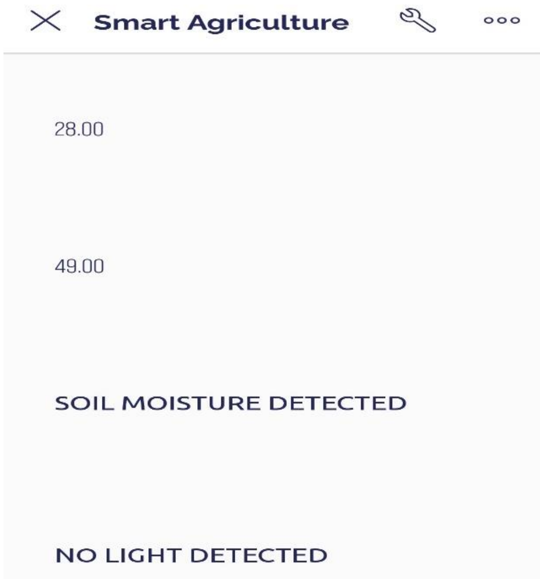
c) Image shows NO SUNLIGHT DETECTED where LED's remain ON



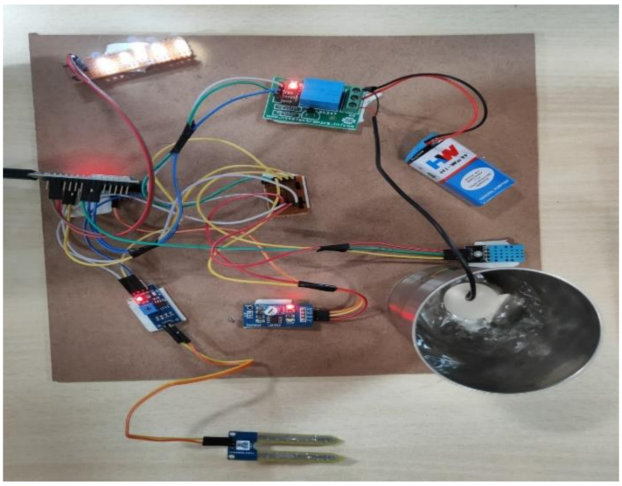


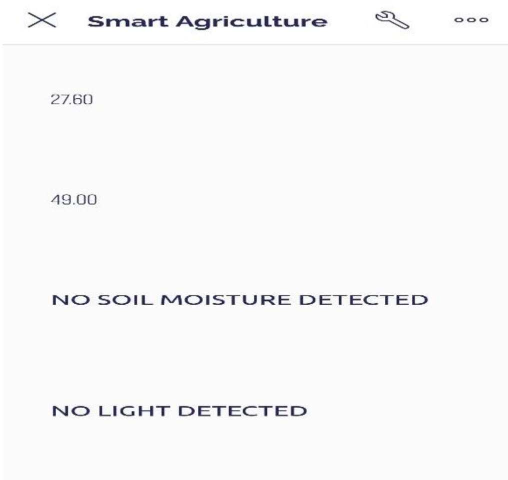
d) Image shows SOIL MOISTURE DETECTED with sensor dipped in water and motor remains OFF





e) Image shows NO SOIL MOISTURE DETECTED and motor remains ON





CONCLUSION

A system to monitor intensity of light, humidity and temperature, moisture levels in the soil was designed and the project provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch ON or OFF the water pump according to soil moisture levels thereby automating the process of irrigation which is one of the most time-consuming activities in farming. Agriculture is one of the water consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding the crop damage. The farm owner can monitor the process online through a mobile app. Through this project it can be concluded that there can be considerable development in farming with the use of IoT and automation.

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4. M.Brajovic, S. Vujovic and S. Dukanovic, "An overview of smart irrigation software", 2015 4th Mediterranean Conference on Embedded Computing (MECO), Budva, 2020.