A Mini Project (EPICS) Report on

Smart Agriculture Monitoring System

Submitted in the partial fulfillment of the requirements for the award of the degree of

Bachelor of Technology

in

ELECTRONICS AND COMMUNICATION ENGINEERING

by

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VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)

(Approved by AICTE, Affiliated to JNT University-GV, Vizianagaram)

Beside VSEZ, Duvvada, Vadlapudi Post, Visakhapatnam -530 049 .A.P

2022-23

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CERTIFICATE

This is to certify that the Mini project (EPICS) entitled **"SMART AGRICULTURE MONITORING SYSTEM"** that is being submitted by

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in the partial fulfillment forthe award of **Bachelor of Technology in Electronics and Communication Engineering** during **2022-23** , in **Vignan's Institute of Information Technology (A),** is a record of bonafide work carried out by them under our guidanceand supervision. The results embodied in this work have not been submitted to any other University or Institute for the award of any degree or diploma.

Signature of the Project Guide	**Signature of the Head of the Department**
Dr. A. V. Bharadwaja	**Dr. Ch Ramesh Babu**
Associate Professor	**Associate Professor & HoD**
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ABSTRACT

The Smart Agriculture Monitoring System (SAMS) is an innovative solution poised to revolutionize traditional farming practices. By seamlessly integrating advanced sensor technology, data analytics, and remote accessibility, SAMS empowers farmers with real-time insights into their fields' conditions. This system employs an array of strategically placed sensors to gather crucial data on soil moisture, temperature, humidity, light intensity, and crop health. Leveraging machine learning algorithms, SAMS processes this data to provide actionable insights, enabling informed decisions regarding irrigation scheduling, pest control, and crop management. The system's web and mobile applications grant farmers the flexibility to monitor and intervene remotely, optimizing resource usage, increasing yield, and fostering sustainable agricultural practices. SAMS represents a pivotal step towards a technologically enhanced and environmentally conscious agricultural future

In summary, the Smart Agriculture Monitoring System (SAMS) offers a transformative approach to modern farming. Through the amalgamation of sensor technology, data analytics, and remote accessibility, SAMS equips farmers with real-time insights that enhance productivity, reduce resource wastage, and promote sustainable practices. This advancement holds the potential to reshape global agriculture, ensuring efficient food production while mitigating environmental impact.

Keywords: Sensors, Nodemcu ESP8266

CONTENTS

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND AND SIGNIFICANCE OF SMART AGRICULTURE MONITORING SYSTEM

Background: Traditional agriculture practices have long relied on manual labor, guesswork, and static schedules for irrigation, fertilization, and pest control. These practices often lead to inefficient resource utilization, increased production costs, and environmental degradation. With the growing global population and the need to produce more food sustainably, there's a demand for innovative solutions that enhance agricultural efficiency while minimizing negative impacts.

This is where smart agriculture monitoring systems come into play. These systems leverage modern technologies such as sensors, data analytics, and communication tools to provide real-time insights into various aspects of farming. By collecting and analyzing data from fields, crops, and environmental conditions, these systems enable farmers to make informed decisions, optimize their operations, and ultimately increase productivity while reducing resource wastage.

Significance:

1. Resource Efficiency: Smart agriculture monitoring systems enable precise and targeted resource management. By monitoring factors like soil moisture, temperature, and crop health, farmers can tailor irrigation and nutrient application, reducing water and fertilizer usage.

2. Yield Optimization: These systems provide valuable insights into crop health and growth patterns. Early detection of issues such as pest infestations or diseases allows for timely interventions, minimizing crop loss and maximizing yield.

3.Environmental Sustainability: With better control over resources and reduced chemical usage, smart agriculture contributes to sustainable farming practices. This leads to a smaller ecological footprint and healthier ecosystems.

4. Data-Driven Decisions: By analyzing real-time data, farmers can make informed decisions about when to irrigate, when to apply pesticides, and when to harvest. This reduces guesswork and increases overall efficiency.

5.Risk Mitigation: Smart agriculture systems provide alerts about adverse conditions such as extreme weather events or disease outbreaks. This allows farmers to take preventive measures and protect their crops.

6. Remote Monitoring: Farmers can access data and control their systems remotely through web and mobile applications. This flexibility increases convenience and efficiency in managing farms.

7.Economic Benefits: Improved yield, reduced operational costs, and better resource management directly impact a farmer's bottom line, making their operations more economically viable.

8. Technology Adoption: Smart agriculture systems contribute to bridging the gap between traditional farming practices and modern technology. This adoption is crucial for sustaining agriculture in the face of changing global conditions.

9. Data-Driven Research: The data collected by these systems can be invaluable for agricultural research and policy-making. Large-scale data analysis can lead to insights that benefit the entire industry.

In conclusion, the background and significance of smart agriculture monitoring systems lie in their potential to revolutionize traditional farming practices. By harnessing the power of technology to gather, analyze, and act upon data, these systems offer a way forward for sustainable, efficient, and productive agriculture in the face of complex challenges.

1.2 Objectives of the Smart Agriculture Monitoring System

Objectives:

1.Enhance Resource Efficiency: The primary objective of the smart agriculture monitoring system is to optimize the utilization of key resources such as water, fertilizers, and pesticides. By continuously monitoring environmental parameters and crop conditions, the system aims to provide real-time insights that enable farmers to apply these resources precisely where and when they are needed, minimizing waste and maximizing efficiency.

2. Improve Crop Health and Yield: Another key objective is to enhance crop health and yield through early detection and prevention of pest infestations, diseases, and unfavorable environmental conditions. By providing timely alerts and actionable recommendations, the system helps farmers take proactive measures to protect their crops and ensure a bountiful harvest.

3. Enable Data-Driven Decision-Making: The smart agriculture monitoring system seeks to empower farmers with data-driven decision-making capabilities. By analyzing data collected from sensors placed across the field, the system generates meaningful insights that guide farmers in making informed choices about irrigation schedules, nutrient applications, and other critical aspects of crop management.

4. Promote Sustainability: Sustainability is a significant objective of the system. By reducing the use of chemicals, conserving water, and minimizing environmental impact, the system contributes to environmentally friendly farming practices. This aligns with global efforts to promote sustainable agriculture that can meet the needs of present and future generations.

5. Facilitate Remote Monitoring and Control: The system aims to provide farmers with the ability to monitor and control their fields remotely. Through user-friendly web and mobile applications, farmers can access real-time data, receive alerts, and adjust settings from anywhere, enabling efficient management even when physically distant from their fields.

1.3 COMPONENTS

A. NodeMCU ESP8266: NodeMCU ESP8266 is a compact and versatile Wi-Fi development board. It combines the ESP8266 module with an open-source firmware, allowing easy programming through Lua or Arduino IDE. With built-in Wi-Fi capabilities, GPIO pins, and a user-friendly interface, it's widely used for IoT projects and prototyping. Its affordability and flexibility make it a popular choice for connecting devices to the internet and enabling smart applications.

B. Soil Moisture Sensor: A soil moisture sensor is a device that measures the moisture content of soil. It helps farmers and gardeners assess when to water plants by providing real-time data on soil moisture levels. These sensors are essential for optimizing irrigation practices and promoting efficient water usage in agriculture and landscaping.

C. DHT11 Sensor: The DHT11 sensor is a compact and affordable device used to measure temperature and humidity. It provides accurate readings with a digital output, making it suitable for various applications like weather monitoring, home automation, and indoor climate control. Its simplicity and cost-effectiveness make it a popular choice for hobbyists and projects requiring basic environmental sensing.

D. PIR Motion Sensor: The PIR (Passive Infrared) motion sensor is a motion detection device that identifies human or animal movement through changes in infrared radiation. Widely used in security systems and automation, it triggers actions like turning on lights or alerting alarms when motion is detected. Its ability to detect heat-based movement makes it valuable for applications ranging from home security to energy-efficient lighting control.

E. Relay Module: A relay module is an electrical switch that uses an electromagnet to control the opening or closing of circuits.

CHAPTER 2

METHODS AND METHODOLGY

2.1 INTRODUCTION TO THE PROPOSED SYSTEM

The Smart Agriculture Monitoring System revolutionizes traditional farming by seamlessly integrating advanced technologies. This innovative system combines sensors, data analytics, and remote accessibility to empower farmers with real-time insights into their fields. By monitoring crucial parameters such as soil moisture, temperature, and crop health, the system enables informed decisions, efficient resource utilization, and improved yield. Through its transformative capabilities, the Smart Agriculture Monitoring System addresses the challenges of modern agriculture and paves the way for sustainable and technologically enhanced farming practices.

2.2 BLOCK DIAGRAM OF PROPOSED SYSTEM

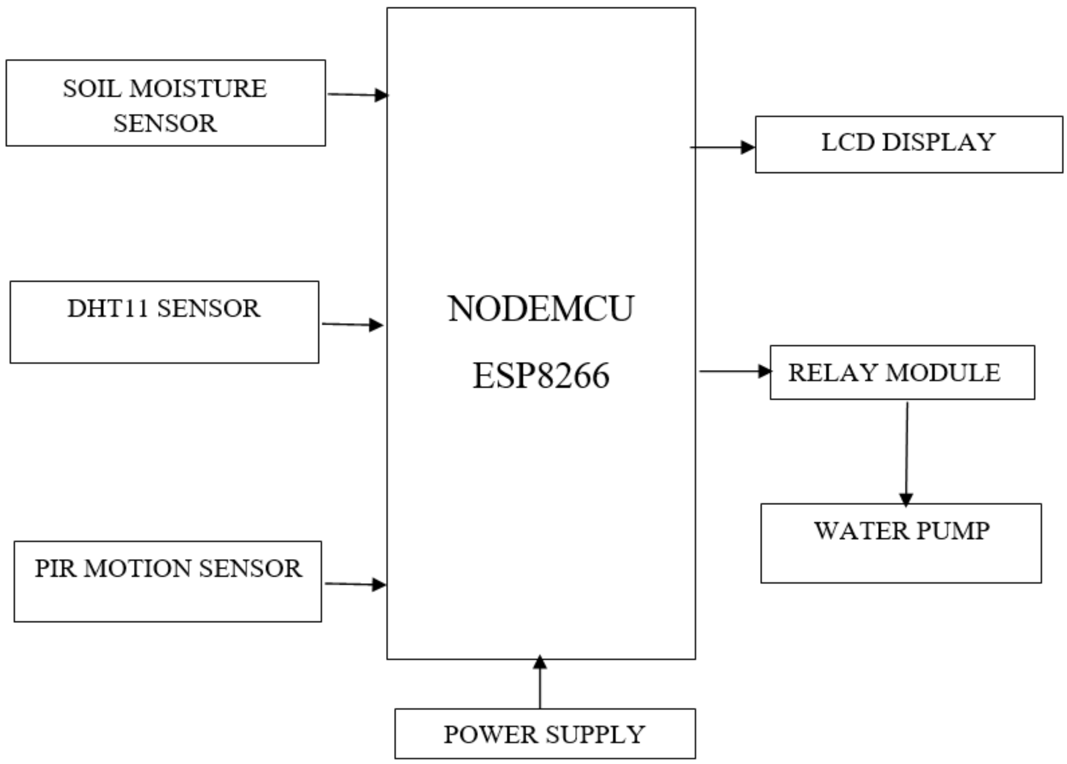


Fig 2.1 Block Diagram of Proposed System

2.3: BLOCK DIAGRAM EXPLANATION

A. NODEMCU ESP8266: The NodeMCU ESP8266 plays a crucial role in a Smart Agriculture Monitoring System due to its capabilities as a versatile and connected microcontroller.
Data Collection, Wireless Connectivity, Remote Monitoring, Alert Generation

B. SOIL MOISTURE SENSOR: When the soil is dry, it doesn't conduct electricity well. But when it's wet, it becomes a better conductor because water helps electricity move. The sensor sends a tiny bit of electricity between its probes into the soil. Based on how easily the electricity moves through the soil, the sensor can tell if the soil is dry or wet. It gives you a signal, like a number, that helps you know how much water is in the soil.

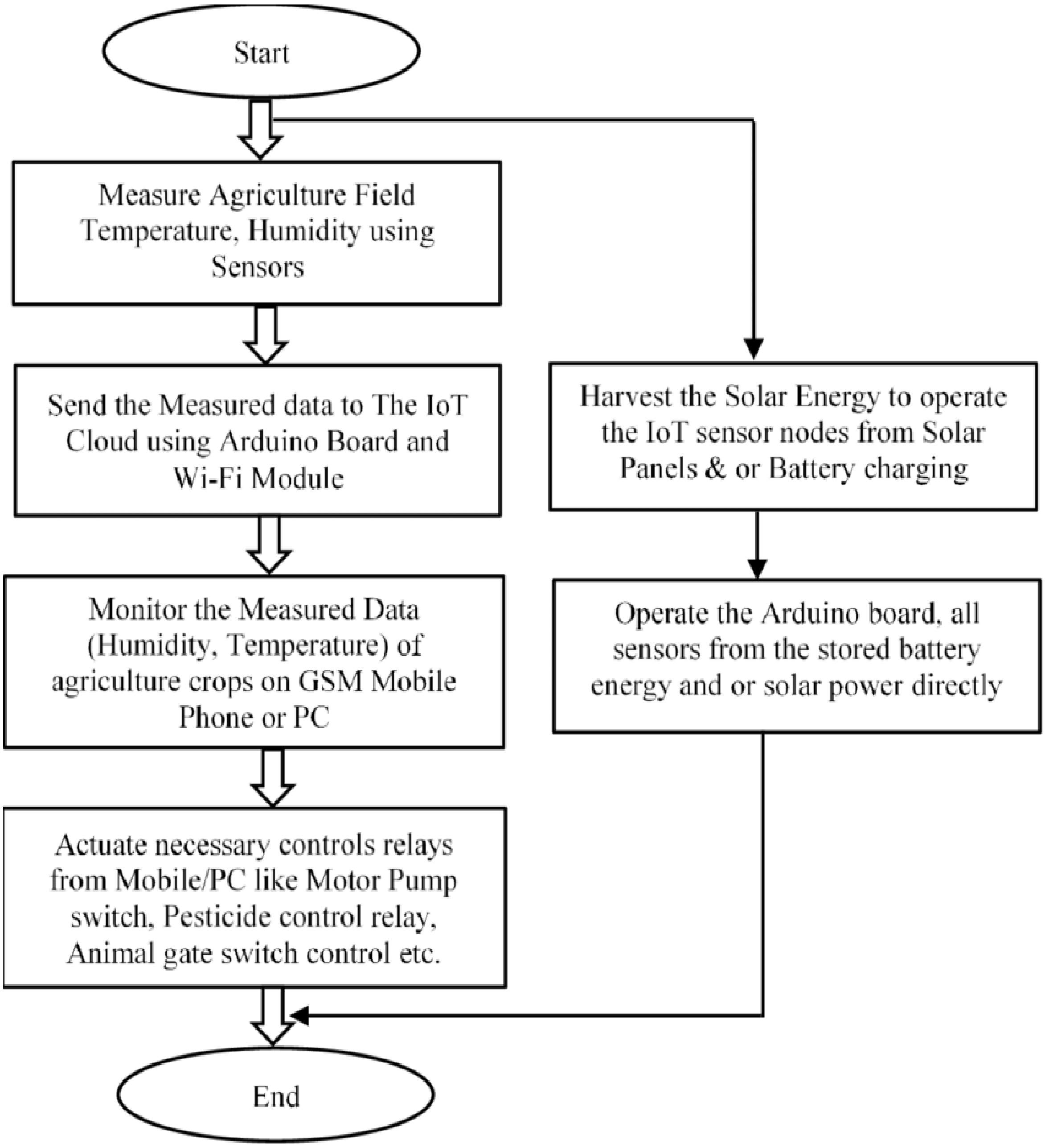
C. DHT11 SENSOR: DHT11 sensor is a little gadget that can feel temperature and humidity. It has a tiny special material inside that changes when it's hot or humid. When you want to know the temperature or humidity, the sensor sends a small signal to NODEMCU ESP8266. This reads the signal and tells you the temperature (how hot or cold it is) and the humidity (how damp or dry the air is) in the place where you put the sensor. It's like having a tiny weather reporter that tells you about the conditions right where you are.

D. PIR MOTION SENSOR: A PIR motion sensor is like a little "eye" that can see heat. When someone moves, they give off a little bit of heat. The PIR sensor can "see" this heat. When it senses a sudden change in heat, like when someone walks into a room, it knows that something is moving. It then tells your lights to turn on, or maybe an alarm to go off, so you know that someone's there. It's like a secret heat detective that helps your gadgets know when there's movement around.

E. LCD: It displays the information which is received from the NODEMCU ESP8266.

F. RELAY MODULE: Relay module is like a switch that you can control with a small signal. So, even though you're far away, you can still control powerful things with just a tiny signal.

METHODOLGY:



Start
Measure Agriculture Field Temperature, Humidity using Sensors
Send the Measured data to The IoT Cloud using Arduino Board and Wi-Fi Module
Monitor the Measured Data (Humidity, Temperature) of agriculture crops on GSM Mobile Phone or PC
Actuate necessary controls relays from Mobile/PC like Motor Pump switch, Pesticide control relay, Animal gate switch control etc.
Harvest the Solar Energy to operate the IoT sensor nodes from Solar Panels & or Battery charging
Operate the Arduino board, all sensors from the stored battery energy and or solar power directly
End

CHAPTER 3

IMPLEMENTATION

3.1: ALGORITHM

1. Initialize Components:

   - Initialize the LCD display.

   - Set Wi-Fi credentials and Blynk authentication token.

   - Initialize the DHT11 temperature and humidity sensor.

   - Define pins for various components like soil moisture sensor, PIR motion sensor, and relay module.

2. Setup Function:

   - Begin serial communication.

   - Initialize LCD backlight and components like PIR motion sensor, relay module, and push button.

   - Connect to Blynk server using Wi-Fi credentials and Blynk authentication token.

   - Initialize DHT11 sensor and display initialization progress on the LCD.

   - Set up Blynk timer intervals for soil moisture and DHT11 sensor readings, and physical button checks.

3. Read DHT11 Sensor:

   - Read humidity and temperature values from the DHT11 sensor.

   - If sensor readings are valid, send them to Blynk and display on the LCD.

4. Read Soil Moisture Sensor:

   - Read analog value from the soil moisture sensor.

   - Map the value to a moisture level and send it to Blynk.

   - Display the moisture level on the LCD.

- Check if moisture is too low or high and trigger alerts and LED widget accordingly.

5. Read PIR Motion Sensor:

   - Read digital value from the PIR motion sensor.

   - If motion is detected, log an event and turn on a Blynk LED widget.

6. Handle Blynk Callbacks:

   - Handle Blynk virtual pin write event for the PIR motion sensor toggle.

7. Handle Blynk Connection:

   - Request the latest state of the relay button from the server.

8. Handle Relay Button State:

   - Update the relay state based on the virtual pin value.

   - Control the relay module accordingly.

9. Check Physical Button:

   - Monitor the physical push button's state.

   - If the button is pressed, toggle the relay state, update the Blynk button widget, and avoid sequential toggles.

10. Main Loop

   - Check PIR_ToggleValue to determine if motion detection is enabled.

   - Display motion detection status on the LCD and call PIRsensor function if enabled.

   - Display relay status on the LCD and control the relay and LED widgets accordingly.

   - Run Blynk and Blynk timer tasks.

3.1. CODE

```
#define BLYNK_TEMPLATE_ID "TMPL3a3CWeIfO"

#define BLYNK_TEMPLATE_NAME "IoT Plants Monitor"

#define BLYNK_AUTH_TOKEN "BIzhAEPrGeZcT35LQmhI3CSu-kRkHrTu"

#include <LiquidCrystal_I2C.h>

#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>

#include <DHT.h>

//Initialize the LCD display

LiquidCrystal_I2C lcd(0x3F, 16, 2);

char auth[] = BLYNK_AUTH_TOKEN;

char ssid[] = "Project";

char pass[] = "123@Apple";

DHT dht(D4, DHT11);//(DHT sensor pin,sensor type)  D4 DHT11 Temperature Sensor

BlynkTimer timer;

//Define component pins

#define soil A0     //A0 Soil Moisture Sensor

#define PIR D5      //D5 PIR Motion Sensor

int PIR_ToggleValue;

void checkPhysicalButton();

int relay1State = LOW;

int pushButton1State = HIGH;
```

```
int Interupt = 0;
#define RELAY_PIN_1      D6   //D6 Relay
#define PUSH_BUTTON_1    D7   //D7 Button
#define VPIN_BUTTON_1    V4
//Create three variables for pressure
double T, P;
char status;
void setup()
{ Serial.begin(9600);
  lcd.begin();
  lcd.backlight();
  pinMode(PIR, INPUT);
 pinMode(RELAY_PIN_1, OUTPUT);
 digitalWrite(RELAY_PIN_1, LOW);
  pinMode(PUSH_BUTTON_1, INPUT_PULLUP);
 digitalWrite(RELAY_PIN_1, relay1State);
 Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
 dht.begin();
 lcd.setCursor(0, 0);
 lcd.print("  Initializing  ");
 for (int a = 5; a <= 10; a++)
  {lcd.setCursor(a, 1);
    lcd.print(".");
 delay(500); }
```

```
  lcd.clear();

  lcd.setCursor(11, 1);

  lcd.print("W:OFF");

  //Call the function

  timer.setInterval(100L, soilMoistureSensor);

  timer.setInterval(100L, DHT11sensor);

  timer.setInterval(500L, checkPhysicalButton);

}//Get the DHT11 sensor values

void DHT11sensor()

{float h = dht.readHumidity();

  float t = dht.readTemperature();

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

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

    return;

  }

  Blynk.virtualWrite(V0, t);

  Blynk.virtualWrite(V1, h);

  lcd.setCursor(0, 0);

  lcd.print("T:");

  lcd.print(t);

 lcd.setCursor(8, 0);

  lcd.print("H:");

  lcd.print(h); } //Get the soil moisture values

void soilMoistureSensor()
```

```
{ int value = analogRead(soil);
  value = map(value, 0, 1023, 120, 0);
  int Moisture = value;
  Blynk.virtualWrite(V2, value);
  lcd.setCursor(0, 1);
  lcd.print("S:");
  lcd.print(value);
  lcd.print(" ");
  if (Moisture < 20 && Interupt == 0)
  {Interupt = 1;
    Blynk.logEvent("moisture_alert","WARNNG! Low Moisture Detected!"); //Enter your Event Name
   WidgetLED LED(V3);
    LED.on();}
 else if (Moisture > 50 && Interupt == 1)
  {Interupt = 0;
    WidgetLED LED(V3);
    LED.off();} } //Get the PIR sensor values
void PIRsensor()
{ bool value = digitalRead(PIR);
  if (value)
  { Blynk.logEvent("pir_motion","WARNNG! Motion Detected!"); //Enter your Event Name
    WidgetLED LED(V5);
    LED.on();}
  else
```

```
  { WidgetLED LED(V5);
    LED.off(); }  }
BLYNK_WRITE(V6)
{ PIR_ToggleValue = param.asInt(); }
BLYNK_CONNECTED()
{ // Request the latest state from the server
  Blynk.syncVirtual(VPIN_BUTTON_1); }
BLYNK_WRITE(VPIN_BUTTON_1)
{ relay1State = param.asInt();
  digitalWrite(RELAY_PIN_1, relay1State);
}
void checkPhysicalButton()
{ if (digitalRead(PUSH_BUTTON_1) == LOW)
  {// pushButton1State is used to avoid sequential toggles
    if (pushButton1State != LOW)
    { // Toggle Relay state
      relay1State = !relay1State;
      digitalWrite(RELAY_PIN_1, relay1State);
       // Update Button Widget
      Blynk.virtualWrite(VPIN_BUTTON_1, relay1State);  }
    pushButton1State = LOW;
  } else
  {pushButton1State = HIGH;}}
void loop()
```

```
{
  if (PIR_ToggleValue == 1)
  {lcd.setCursor(5, 1);
  lcd.print("M:ON ");
    PIRsensor();}
   else
   {lcd.setCursor(5, 1);
  lcd.print("M:OFF");
  WidgetLED LED(V5);
  LED.off();}
if (relay1State == HIGH)
{lcd.setCursor(11, 1);
 lcd.print("W:ON ");
  WidgetLED LED(V7);
  LED.on();  }
 else if (relay1State == LOW)
 {lcd.setCursor(11, 1);
  lcd.print("W:OFF");
  WidgetLED LED(V7);
  LED.off();}
 Blynk.run();//Run the Blynk library
 timer.run();//Run the Blynk timer}
```

CHAPTER 4

TESTING & EXPERIMENTAL RESULT

4.1 TESTING

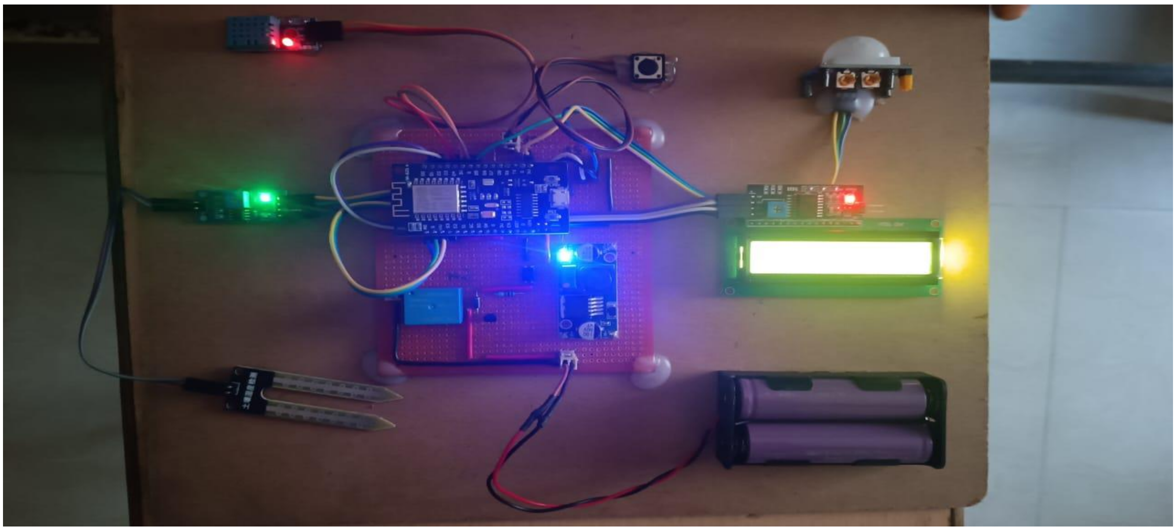


Fig 4.1.a: Power Supply

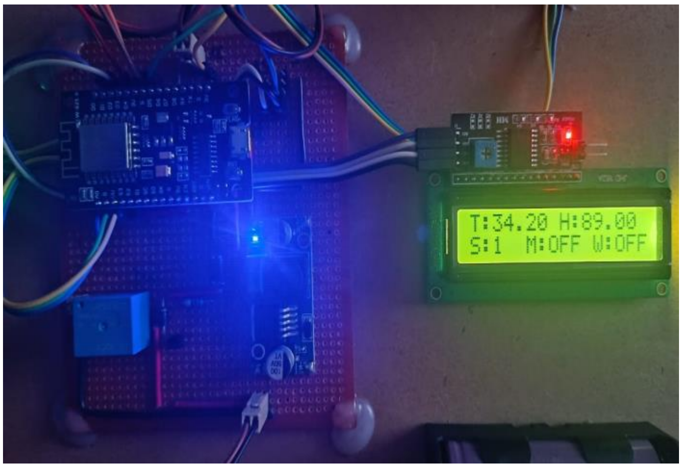


Fig 4.1.b: Information on LCD

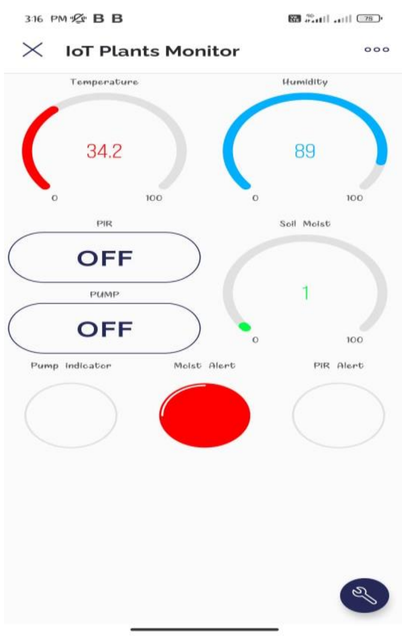


Fig 4.1.c: Information on Blynk IoT

Fig 4.1.d: PIR Sensor OFF

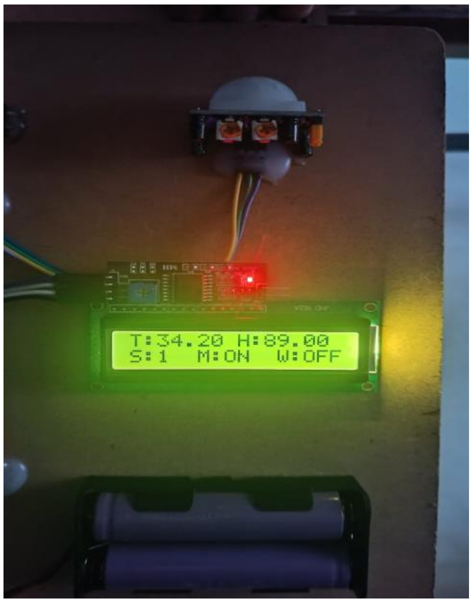


Fig 4.1.e: PIR Sensor ON

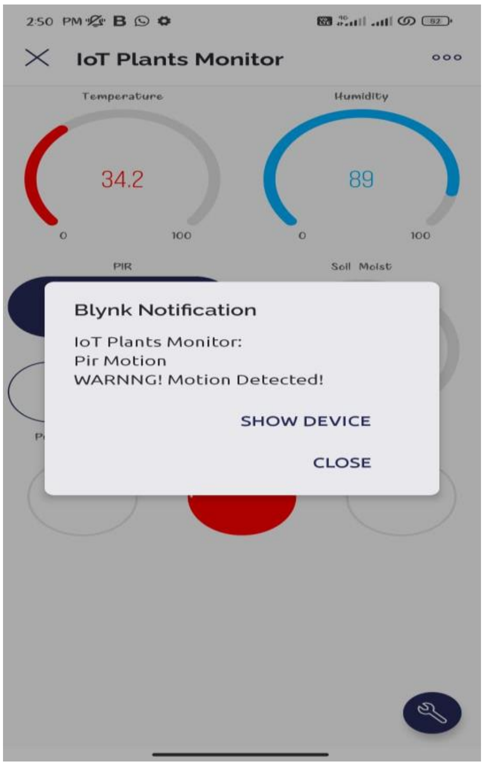


Fig 4.1.f: PIR Alert in Blynk IoT

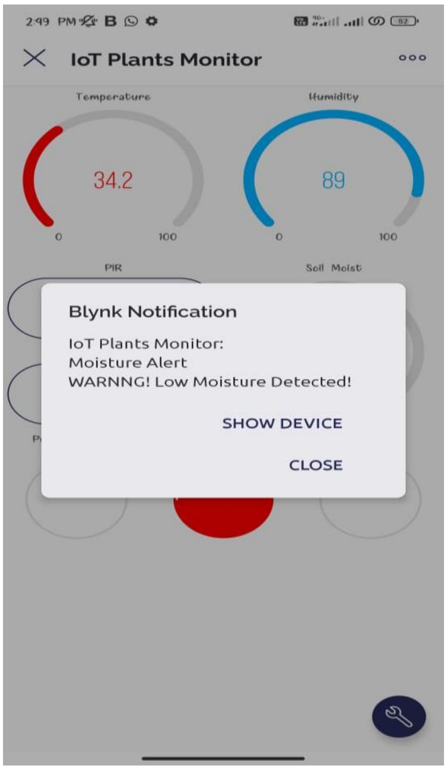


Fig 4.1.g: Moisture Alert in Blynk IoT

4.2: RESULT:

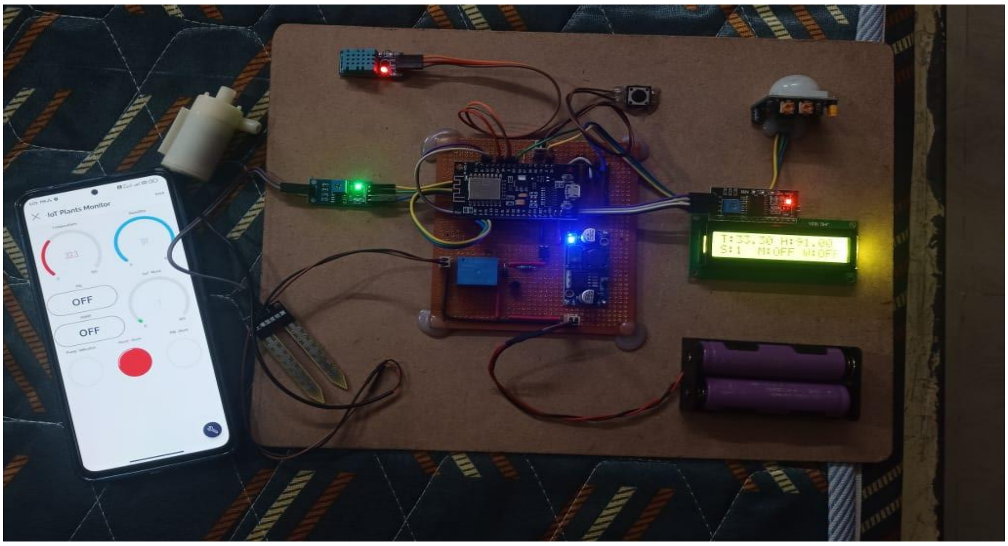


Fig 4.2.a: Output on LCD and Blynk IoT

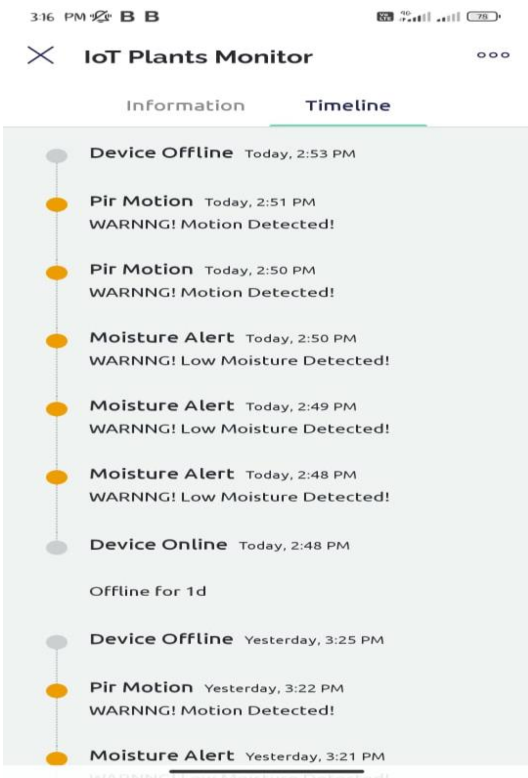


Fig 4.2.b: Blynk IoT Notifications

CHAPTER 5

CONCLUSION & FUTURE SCOPE

5.1: Conclusion:

To conclude, the smart agriculture monitoring system offers a transformative solution for modern farming. By harnessing sensor data on soil moisture, temperature, and motion, it empowers farmers with real-time insights for optimized irrigation, climate control, and resource allocation. With remote control features and timely alerts, the system enhances productivity, conserves resources, and fosters sustainable agricultural practices, marking a significant step towards a more efficient and resilient farming future.

5.2: Future Scope:

The future scope of the smart agriculture monitoring system holds promising avenues for transformative growth. Incorporating advanced technologies such as artificial intelligence, machine learning, and data analytics can enable predictive and prescriptive insights, allowing farmers to optimize resource utilization, enhance yield predictions, and proactively manage pests and diseases. Furthermore, the integration of drones and satellite imagery can provide real-time field mapping and precision analysis, enabling precise interventions based on nuanced spatial information. These advancements have the potential to drive greater sustainability, productivity, and resilience in agriculture, contributing to food security and sustainable practices.

Moreover, the evolution of the smart agriculture monitoring system can extend beyond the farm gate, fostering a holistic agri-tech ecosystem. Collaboration among farmers, agribusinesses, researchers, and policymakers can lead to the development of standardized data-sharing platforms, ensuring transparent supply chains, efficient logistics, and fair market practices. This interconnected approach, combined with emerging technologies, holds the key to revolutionizing agriculture on a global scale, promoting innovation, minimizing waste, and addressing the challenges of a rapidly changing agricultural landscape.

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Project Title: Smart Agriculture Monitoring System

Batch No: 8

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Project Course Outcomes:

CO1: Students will be able to comprehend the basic principles of smart agriculture and its role in sustainable agriculture.

CO2: Students will be able to design and develop smart agriculture monitoring systems using various sensors and communication technologies.

CO3: Students will be able to analyze the data collected from smart agriculture monitoring systems and interpret the results.

CO4: Students will be able to evaluate the performance of smart agriculture monitoring systems and suggest improvements.

CO5: Students will be able to apply smart agriculture monitoring systems to practical applications in various agricultural fields to increase crop yield and reduce water consumption.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	3	3	-	3	-	-	3	-	3
CO2	3	-	3	-	2	3	3	3	-	3	-	-	-	3
CO3	-	-	2	2	2	2	3	3	-	-	-	-	-	3
CO4	-	-	-	-	-	2	2	3	3	3	3	-	-	3
CO5	3	-	-	-	2	2	2	-	-	-	3	3	-	3

Output:


GPS Map Camera
Visakhapatnam, Andhra Pradesh, India
P568+798, Block D, Visakhapatnam, Andhra Pradesh 530046, India
Lat 17.710589°
Long 83.166013°
06/08/23 06:07 PM GMT +05:30