PLANT WATERING AND MONITORING SYSTEM

A

Skill-Based Mini Project

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

BACHELOR OF ENGINEERING

In

INTERNET OF THINGS

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Madhav Institute of Technology & Science, Gwalior (M.P.)

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to RGPV, Bhopal)

CANDIDATE'S DECLARATION

We hereby declare that the work presented in this skill-based mini-project entitled PLANT WATERING AND MONITORING SYSTEM which is being submitted in the EMBEDDED CONTROL OF ELECRICAL MACHINES (220503) course for the partial fulfillment of the requirement for the award of the degree of Bachelor of Internet Of Things is an authentic record of our own work carried out under the guidance of Dr. Sourabh Kumar Rajput, Assistant Professor, Center For Internet Of Things .

Anushka

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Date:

Place: Gwalior

This is to certify that the above statement made by the candidates is correct to the best of my knowledge and belief.

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CONTENT

ABSTRACT

A The Plant Watering and Monitoring System is an innovative solution designed to address the challenges of efficient and automated plant care in both indoor and outdoor environments. This system combines modern sensor technology, Internet of Things (IoT) connectivity, and automation to ensure the optimal health and growth of plants while minimizing water wastage.

The core components of this system include soil moisture sensors, temperature and humidity sensors, a microcontroller unit (MCU), and a user-friendly mobile or web application. These sensors continuously monitor the environmental conditions and soil moisture levels around the plants. The MCU processes the data collected by the sensors and uses predefined algorithms to make intelligent decisions regarding plant watering.

Here, we are using , soil moisture sensor. This sensor are used to produce the water content on land ; for all the purposes, we are using the sensor to control the environment. This paper introduces a smart plant watering system. By watering plants when needed, the main goal is to minimize human involvement and water waste. With watering the plants, this system's output will meet the needs of both the plants.

Keywords:Plant Watering, MCU, soil moisture sensor

INTRODUCTION :-

We live in a world where everything can be controlled and operated automatically. Plant monitoring is an important part of agriculture in our country as they used to grow plants under controlled climatic conditions for optimum produce. Automating a plant monitoring and controlling of the climatic parameters which directly or indirectly govern the plant growth and hence they produce yields. Automation is a process for controlling industrial machinery and processes, thereby replacing human operations. In this paper, plant watering and monitoring system technology will provide feedback to the user through smart phones or laptops. The automated system will reduce the need of man power hence reducing the error. For large scale areas, it is quite impossible for a farmer to monitor the efficiency of the system by implementing this technology, the farmer can easily monitor the system using their smart devices.

In this system, we can water and monitor the plant using IoT (Internet of Things) . In this system we use different modules such as Arduino as controller, , moisture sensor. By having knowledge of these entire scenarios, one can take action accordingly.

The system's Bluetooth module enables remote monitoring and control through a mobile application, empowering users to customize plant profiles, set watering schedules, and receive alerts, making it a valuable tool for gardeners, greenhouse operators, and agriculture managers.

PLANT WATERING AND MONITORING SYSTEM EQUIPMENT AND LITERATURE SURVEY:-

- **Arduino UNO**
- **Breadboard**
- **Soil Moisture Sensor**
- **DHT 11 Sensor**
- **Single Channel Relay**
- **Two Batteries (9V or 12V)**
- **Water Pump**
- **Bluetooth Module (HC-05)**
- **Switch**
- **Jumper Wire**

Arduino Uno R3:-

It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; by simply connecting it to a computer with a USB cable one can program it. It supports 5V DC to 12V DC. The safe power supply is 9V DC. Arduino controls the whole robot's actions. The motor shield is placed above it. The motor shield's pins are connected to Arduino's pins.

Arduino IDE is used for writing a program and inserting the code into the Arduino is done by USB cable which connects Arduino and computer.

Fig.1: Arduino UNO R3

Hc05 Bluetooth module :-

A Bluetooth module is a compact electronic component that facilitates wireless communication between devices using Bluetooth technology. It is characterized by features such as wireless connectivity, compatibility across various devices, low power consumption, ease of integration, and security mechanisms. These modules are employed in an array of applications, including wireless audio devices, IoT gadgets, healthcare equipment, automotive connectivity, smart home systems, industrial automation, wearable technology, and retail and location-based services. Their versatility and standardized wireless communication capabilities make

Fig.2: Bluetooth module

Dht11Sensor :-

The DHT11 sensor is a commonly used digital temperature and humidity sensor known for its affordability, ease of use, and reliability. It offers digital output for temperature and humidity measurements, making it a popular choice in various applications such as weather stations, smart home systems, indoor climate control, data logging, agriculture, and DIY electronics projects. With a wide operating voltage range and straightforward three-pin connection, it's compatible with many microcontrollers and embedded systems. While not the most precise sensor available, the DHT11 serves as a valuable tool for monitoring and controlling environmental conditions in a wide range of settings, from homes and offices to agricultural and research applications**.**

Fig.3: DHT11 Sensor

Soil moisture sensor :-

A soil moisture sensor is an essential electronic device used to measure and monitor the moisture content within the soil. These sensors find widespread applications in agriculture, horticulture, environmental monitoring, and various fields where soil moisture levels are critical for informed decision-making. Their accuracy and efficiency make them invaluable in optimizing irrigation practices in precision agriculture, ensuring the health of plants in landscaping and gardening, contributing to environmental research, aiding weather forecasting, and finding applications in golf course maintenance, wildfire prevention, erosion control, and smart irrigation systems. Soil moisture sensors play a pivotal role in conserving resources, enhancing agricultural practices, and promoting environmental sustainability by facilitating optimal water management and reducing the risks associated with incorrect watering practices in diverse settings.

Fig.4: Soil Moisture Sensor

ARDUINO CODE:-

```
#include <DHT.h>
#include <SoftwareSerial.h>
#define DHTPIN 2 // Pin where the DHT11 sensor is connected
#define DHTTYPE DHT11 // Change to DHT22 if you're using a DHT22 sensor

DHT dht(DHTPIN, DHTTYPE);
const int sensorPin = A0;  // Soil Moisture Sensor Pin
const int relayPin = 7;    // Relay Pin
SoftwareSerial BTSerial(10, 11);
void setup() {
  Serial.begin(9600);
  pinMode(sensorPin, INPUT);
  pinMode(relayPin, OUTPUT);
  dht.begin();
  BTSerial.begin(9600);
}

void loop() {
  int soilMoisture = analogRead(sensorPin);
  Serial.print("Soil Moisture: ");
  Serial.println(soilMoisture);

  if (soilMoisture > 650) {
    Serial.println("No moisture, Soil is dry");
    digitalWrite(relayPin, LOW);  // Turn off the relay
  } else if (soilMoisture >= 300 && soilMoisture <= 650) {
    Serial.println("There is some moisture, Soil is medium");
    digitalWrite(relayPin, HIGH);  // Turn on the relay
  } else {
    Serial.println("Soil is wet");
    digitalWrite(relayPin, HIGH);  // Turn on the relay
  }
  float humidity = dht.readHumidity();
  float temperature = dht.readTemperature();
  if (!isnan(humidity) && !isnan(temperature)) {
    Serial.print("Humidity: ");
```

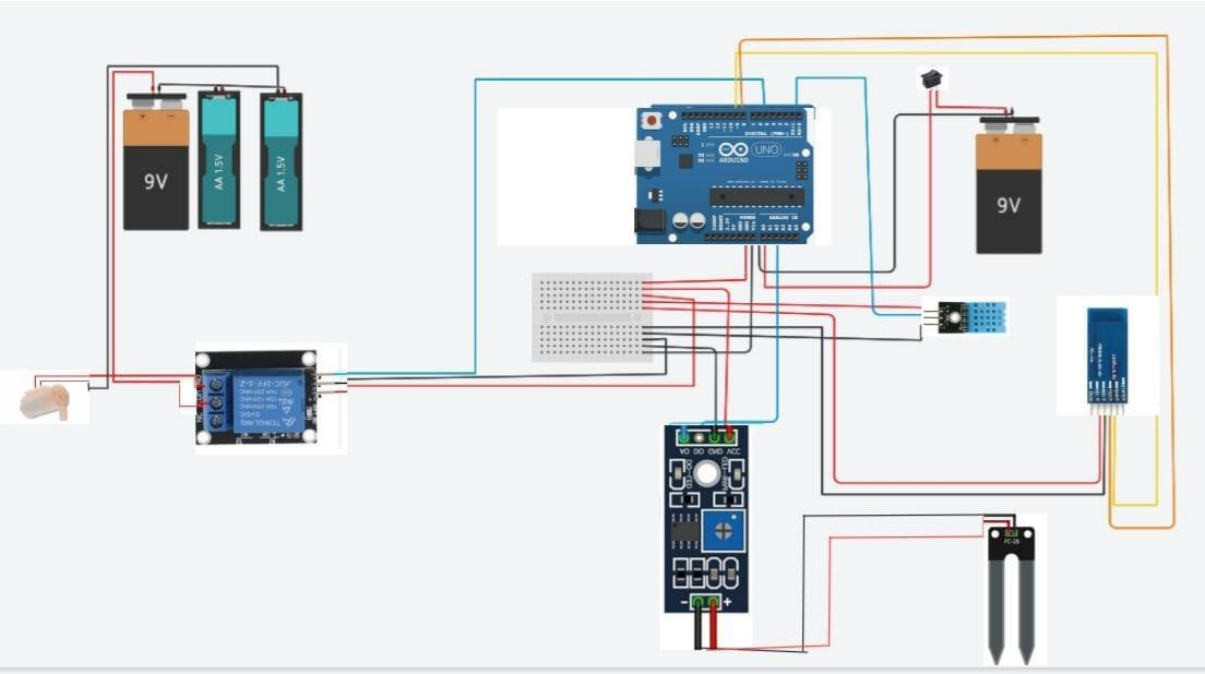
```
    Serial.print(humidity);
    Serial.println("%");
    Serial.print("Temperature: ");
    Serial.print(temperature);
    Serial.println("°C");
    BTSerial.print("Soil Condition: ");
if (soilMoisture > 650) {
  BTSerial.println("No moisture, Soil is dry");
} else if (soilMoisture >= 300 && soilMoisture <= 650) {
  BTSerial.println("There is some moisture, Soil is medium");
} else {
  BTSerial.println("Soil is wet");
}
BTSerial.print("Humidity: ");
BTSerial.print(humidity);
BTSerial.println("%");
BTSerial.print("Temperature: ");
BTSerial.print(temperature);
BTSerial.println("°C");
  } else {
    Serial.println("Failed to read from DHT sensor!");
  }
  delay(1000);  // Wait a moment before the next DHT reading
}
```

PYTHON CODE :-

```
import serial
import pandas as pd
from datetime import datetime
# Replace 'COMX' with the correct COM port where your Bluetooth device is connected
ser = serial.Serial('COM5', 9600)
# Create an empty list to store the data
try:
    existing_data = pd.read_csv('sensor_data.csv')
    data_list = existing_data.to_dict(orient='records')
except FileNotFoundError:
    data_list = []
while True:
    try:
        soil_condition, humidity, temperature = None, None, None

        while not (soil_condition and humidity is not None and temperature is not None):
            data = ser.readline().decode('utf-8').strip()
            print("Received Data: " + data)

            if data.startswith("Soil Condition"):
                soil_condition = data.replace("Received Data: Soil Condition: ", "")
            elif data.startswith("Humidity"):
                humidity = float(data.split(":")[1].strip().replace("%", ""))
            elif data.startswith("Temperature"):
                temperature = float(data.split(":")[1].strip().replace("°C", ""))

        # Get the current timestamp
        timestamp = datetime.now()

        # Extract date and time from the timestamp
        date = timestamp.strftime("%Y-%m-%d")
        time = timestamp.strftime("%H:%M:%S")

        # Append the data to the list
        data_list.append({
            "Date": date,
            "Time": time,
            "Temperature": temperature,
```

```
            "Humidity": humidity,
            "SoilCondition": soil_condition
        })
      # Save the data to a CSV file (update the file with the new data)
        df = pd.DataFrame(data_list)
        df.to_csv('sensor_data.csv', index=False)

    except Exception as e:
        print(f"Error: {e}")

# Close the serial port when done (you can add this after a certain condition or key press)
# ser.close(
```

CIRCUIT DIAGRAM: -



METHODOLOGY :-

The methodology for developing a Plant Watering and Monitoring System with a Bluetooth module involves a systematic approach. It begins with clearly defining project objectives and gathering detailed requirements. This is followed by the selection of appropriate hardware components, circuit design, sensor integration, and the development of an algorithm for automated watering. Bluetooth connectivity is implemented to enable remote control and monitoring through a user-friendly mobile application. System integration, extensive testing, user feedback, and calibration are essential steps to ensure the system's accuracy and reliability. Comprehensive documentation, presentations, deployment, and maintenance plans are created, ultimately leading to the successful development and implementation of a Bluetooth-enabled plant monitoring and watering system.

Blynk application for monitoring :-

1. First of all, open the blynk application
2. set the project name as Soil Moisture.
3. Click on the choose device and select Nodemcu and make sure you set the connection type to wifi and then click on the create button, an authentication token will be sent on your email id, which will be then used in programming, simply copy and paste it in programming.
4. Click anywhere on the screen and search for the gauge and add it, click on the gauge and set the name as Soil Moisture. now click on the pin and select virtual

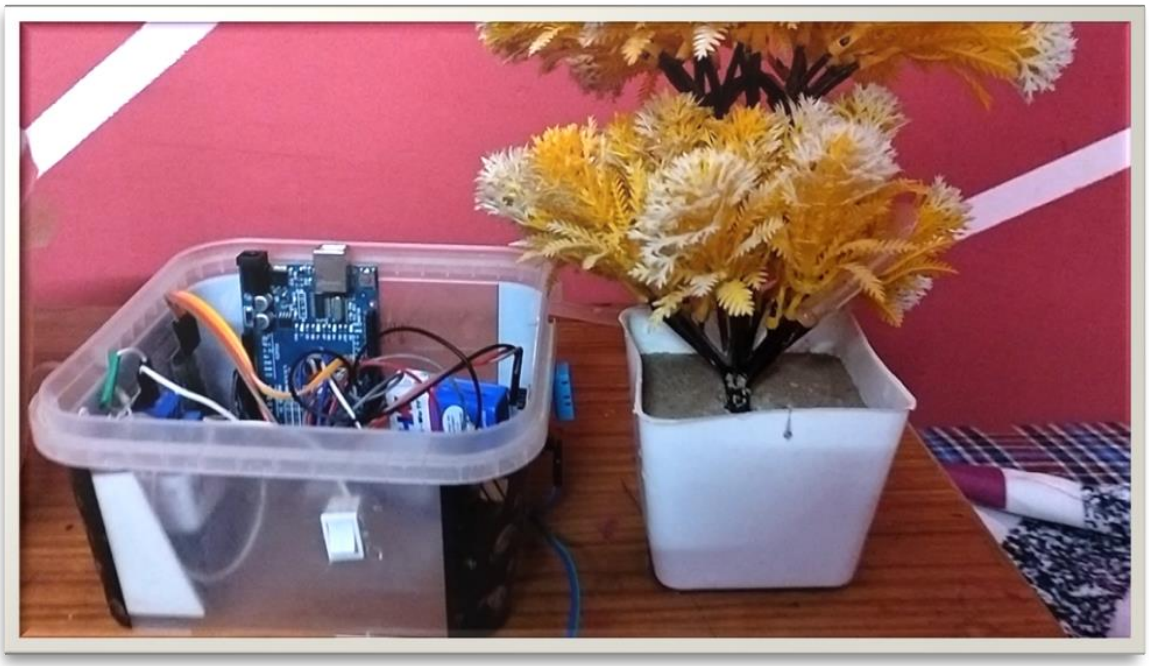
and select v2. Set the maximum value to 1023, change the font then click on the push and select 1 second.

5. now click on the screen and add two numeric input buttons which will be used for controlling the solenoid valve and water pump……click on the numeric input…set the name as solenoid valve….click pin and select the virtual pin10…set the minimum value to 10 and the maximum value to 11.these 10 and 11 values will be used to control the relay connected with pin13 of the Arduino. …now repeat the same steps for other numeric input button.

HOW ITS WORK :-

Soil Moisture Monitoring:	The project starts by monitoring soil moisture levels using a soil moisture sensor. This sensor is inserted into the plant's soil, and it measures the moisture content.
Arduino Data Collection:	The Arduino Uno collects and processes the data from the soil moisture sensor, determining the current soil moisture level.
Temperature and Humidity Monitoring:	Simultaneously, the DHT11 sensor measures the ambient temperature and humidity in the plant's environment.
Control of Water Pump:	The Arduino checks if the soil moisture level falls below a preset threshold. If it does, the Arduino activates the relay module, then the relay controls the water pump to irrigate the plant.
Battery-Powered Operation:	To power the components, two separate batteries are used: one 9-volt battery for the Arduino and sensors, and another 12-volt battery to power the water pump through the relay.
Data Transmission:	The Arduino communicates with a Bluetooth module (HC-05) to transmit both the soil moisture data and the DHT11 sensor data to a laptop.
Data Logging with Python:	A laptop with Bluetooth capability receives data from the HC-05 module. A Python script running on the laptop logs this data into a CSV file. The script continuously collects and logs the soil moisture data.
Power BI Data Visualization:	The CSV file with combined data is imported into Power BI, a data visualization tool. Here, it is transformed into an interactive dashboard, presenting real-time data on soil moisture, temperature, and humidity.
User Interaction:	Users can access the Power BI dashboard to monitor plant conditions, customize soil moisture thresholds, and make informed decisions about watering and plant care based on both soil moisture and environmental factors.
Efficient Plant Care:	The system automates plant watering, ensuring plants receive water when necessary, thereby conserving water and promoting optimal plant health.

RESULT & DISCUSSION :-



CONCLUSION: -

In conclusion, the Plant Watering and Monitoring System with a Bluetooth module represents a remarkable fusion of technology and nature, providing an efficient and sustainable solution for plant care. This system, equipped with soil moisture sensors, temperature and humidity sensors, and the convenience of Bluetooth connectivity, revolutionizes the way we nurture our plants. It optimizes plant health and growth, minimizes water wastage, and empowers users with remote monitoring and control through a user-friendly mobile application. As we move towards a future where technology and environmental responsibility go hand in hand, this system emerges as a vital tool for both novice and experienced gardeners, commercial agriculture, and ecological conservation efforts. By leveraging data-driven decision-making and the ease of wireless control, it not only simplifies plant care but also contributes to a greener and more sustainable world, where technology and nature coexist harmoniously.

REFRENCES: -

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