DESIGN AND DEVOLOP THE AGRICULTURE BASED APPLICATION

SOIL MOISTURE AND AIR MOISTURE DETECTOR

Project Report

submitted by

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Project No:03	DESIGN AND DEVOLOP THE AGRICULTURE BASED APPLICATION
Date:	Soil moisture and air moisture detector

OBJECTIVE

- To detect and provides real-time soil moisture data, allowing for precise irrigation scheduling and effective crop management, thereby enhancing agricultural productivity and conserving water resources.
- To develop the product that helps in developed the 13^{th} SDG (climate action).

AIM

To provide accurate measurements of moisture levels in soil and air environments, aiding in efficient water management, agriculturaloptimization, and indoor air quality control.

INTRODUCTION

Soil moisture and air moisture play crucial roles in various natural processes and ecosystems. Soil moisture refers to the amount of water present in the soil, influencing plant growth, nutrient availability, and overall soil health. On the other hand, air moisture, also known as humidity, measures the water vapor content in the atmosphere, affecting weather patterns, human comfort levels, and the distribution of precipitation. Understanding the dynamics of soil moisture and air moisture is essential for agricultural practices, weather forecasting, and environmental conservation efforts. Through advanced monitoring techniques and scientific research, we can better comprehend the intricate interplay between these moisturefactors and their impacts on the planet.

Circuit Diagram

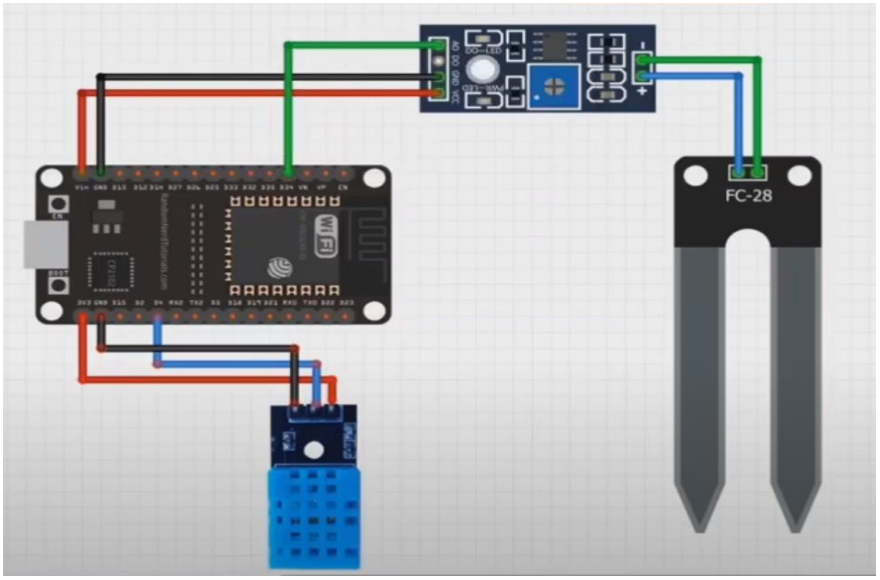

Figure 3.5: Circuit Diagram for Soil And Air Moisture Sensor

WORKING

Soil moisture detectors employ either resistive or capacitive sensing principles. Resistive sensors measure changes in electrical resistance as soil moisture fluctuates, while capacitive sensors gauge changes in capacitance due to varying soil moisture levels. Air moisture detectors, or hygrometers, operate based on resistive, capacitive, or gravimetric principles to assess humidity levels in the air. Resistive hygrometers usea moisture-sensitive material whose electrical resistance changes with humidity, whilecapacitive hygrometers measure changes in capacitance as air moisture varies. Gravimetric hygrometers rely on the weight change of a moisture-absorbing material exposed to air. These detectors translate physical properties of moisture into electrical signals, enabling accurate monitoring essential for agriculture, weather forecasting, andenvironmental control.

Soil moisture detectors typically operate on resistive or capacitive sensing principles. Resistive sensors measure the soil's electrical resistance, which decreases as moisture content rises. Capacitive sensors, on the other hand, detect changes in capacitance caused by variations in soil moisture levels. Air moisture detectors, commonly known as hygrometers, utilize resistive, capacitive, or gravimetric methods to measure humidity levels in the atmosphere. Resistive hygrometers use a moisture-sensitive material whose electrical resistance changes with humidity, while capacitivehygrometers measure changes in capacitance as air moisture fluctuates. Gravimetric grometers assess humidity by monitoring the weight change of a

moisture-absorbing material exposed to air. These detectors provide valuable data for applications like agriculture, meteorology, and indoor air quality control by translating moisture's physical properties into electrical signals.

SUPPORTING SYSTEM – SOFTWARE DETAILS/HARDWARE DETAILS SOFTWARE DETAILS

Arduino IDE

Arduino Integrated Development Environment (IDE) is an open source IDE that allows users to write code and upload it to any Arduino board. Arduino IDE is written in Java and is compatible with Windows, macOS and Linux operating systems.

Wokwi

The wokwi is an online Electronics simulator. You can use it to simulate Arduino, ESP32, STM32, and many other popular boards, parts and sensors. Here are some quick examples of things you can make with Wokwi: Arduino Uno "Hello World".

Proteus (for circuit diagram and simulation)

Proteus incorporates many functions derived from several other languages: C, BASIC, Assembly, Clipper/dBase; it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation.

HARDWARE DETAILS

ESP32

The ESP32 is a highly versatile microcontroller renowned for its dual-core processor and built-in Wi-Fi and Bluetooth connectivity. It is widely used in IoT projects due to its low power consumption and rich set of peripherals. With its robust performance and compatibility with multiple programming languages, the ESP32 is suitable for a wide range of applications, from home automation to industrial monitoring.

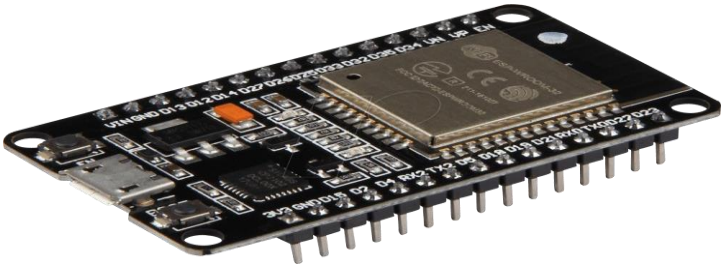

Figure 3.1: ESP32 Development Board

PIN CONFIGURATION

Figure 3.2: ESP32 Pin Diagram

- **GPIO Pins:** Typically labeled GPIO0 to GPIO39, these pins can be configured as digital inputs or outputs.
- **Analog Pins**: Usually labeled A0 to A# (depending on the board), these pins support analog input.
- **Power Pins:** Includes VCC (3.3V) and GND pins for power supply connections.
- **Communication Interfaces:** Pins dedicated to SPI, I2C, UART, and other communication protocols.
- **Special Function Pins:** Such as EN (enable), BOOT (boot mode selection), and RST (reset).

DHT22

The DHT22 is a digital temperature and humidity sensor renowned for its accuracy and reliability. It utilizes a capacitive humidity sensor and a thermistor to measure humidity and temperature, respectively. With its wide operating voltage range and simple interface, the DHT22 is commonly used in various IoT applications, weather stations, and environmental monitoring systems. It provides accurate readings with a resolution of 0.1°C for temperature and 0.1% for humidity, making it suitable for precise measurements in diverse settings.

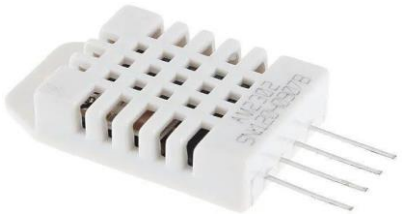

Figure 3.3: DHT22 Air Moisture Sensor

SOIL MOISTURE SENSOR

A soil moisture sensor measures soil moisture levels by detecting changes in capacitance. It consists of two electrodes that measure the dielectric constant of the soil, correlating it with moisture content. These sensors are non-corrosive, making them suitable for long- term use in various soil types. They offer high accuracy and low power consumption, making them ideal for battery-powered applications. soil moisture sensors are widely used in agriculture, irrigation systems, and research for efficient water management and crop optimization.

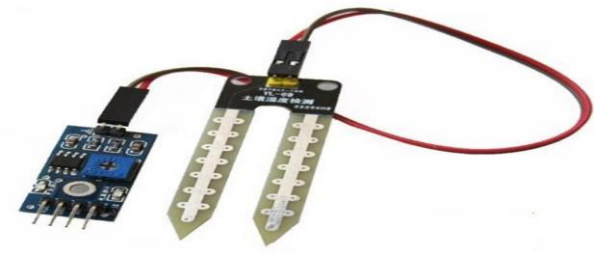

Figure 3.4: Soil Moisture Sensor

PROGRAM

```
#define BLYNK_TEMPLATE_ID"TMPL3RR8REVUt"
#define BLYNK_TEMPLATE_NAME
  "Soil Moisture and Temperature Monitor withESP32"
#define BLYNK_AUTH_TOKEN
  U_ihYIDja_3bcWsdflNfdh0A
```

```
690dksjnRVhSfrosqhgjsdfu"

#define BLYNK_PRINT Serial#include <WiFi.h>
#include
  <BlynkSimpleEsp32.h>#include <DHT.h>

char auth[] = BLYNK_AUTH_TOKEN;

char ssid[] = "WiFi Username";
// type your wifi name
char pass[] = "WiFi Password";
  // type your wifi passwordBlynkTimer timer;

#define DHTPIN 4 // Connect DHT sensor to GPIO 4 (D2) inESP32
#define SOIL_MOISTURE_PIN34 // Connect soil moisture sensor to GPIO 34 (ADC1_CH6) in
ESP32
#define DHTTYPE DHT11

DHT dht(DHTPIN,DHTTYPE);

void sendSensor()
{
int soilmoisture = analogRead(SOIL_MOISTURE_PIN); // Read from the soilmoisture sensor
int soilmoisturepercentage = map(soilmoisture, 3500, 4095,
100, 0);
float h = dht.readHumidity(); float t = dht.readTemperature();
// or dht.readTemperature(true)for Fahrenheit
if (isnan(h) || isnan(t)) { Serial.println("Failed to read from DHT sensor!");
return;
}
// You can send any value atany time.
// Please don't send more than10 values per second.
Blynk.virtualWrite(V0, soilmoisturepercentage); Blynk.virtualWrite(V1, t);
Blynk.virtualWrite(V2, h); Serial.print("Soil Moisture : ");

Serial.print(soilmoisturepercentage);
Serial.print(" Temperature : ");Serial.print(t);
Serial.print("  Humidity : ");Serial.println(h);
}

void setup()
{
Serial.begin(115200);
```

```
Blynk.begin(auth, ssid, pass);dht.begin(); timer.setInterval(100L, sendSensor);
}

void loop()
{
Blynk.run();
timer.run();
}
```

OUTPUT

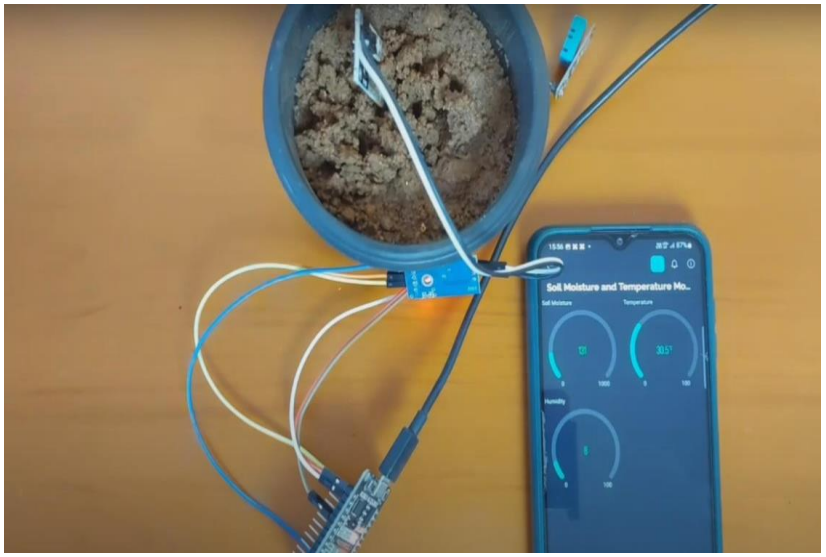

Figure 3.6: Output for Soil And Air Moisture Sensor

RESULT

Thus, the ESP32-based soil and air moisture detector provides accurate, real-time data on moisture levels, enabling informed decisions for irrigation scheduling and cropmanagement. By delivering precise moisture measurements, this detector enhances agricultural productivity, optimizes water usage, and promotes healthier living environments.

CONCLUSION AND FUTURE SCOPE

Future advancements in soil moisture and air moisture detectors are expectedto focus on improving accuracy, integrating IoT for real-time monitoring, harnessing machine learning for predictive modeling, enhancing miniaturization, and increasing accessibility for various applications.