

## Smart Plant Monitoring System using ESP32 + Blynk + Bluetooth

This project is a Smart Plant Monitoring System built using an ESP32, designed to monitor real-time soil moisture, temperature, humidity, and motion detection. It uses Blynk over Bluetooth to display sensor data on a mobile app and control watering automatically.

### Features:

- Monitors temperature and humidity using a DHT22 sensor
- Measures soil moisture with analog soil sensor
- Automatically activates water pump using a relay if soil is dry
- Detects motion using PIR sensor, and triggers buzzer + LED
- Sends live data to the Blynk app via Bluetooth
- Displays data on an I2C LCD (16x2)

### Components Used:

- ESP32: Microcontroller
- DHT22: Temperature & Humidity Sensor
- Soil Moisture: Analog Moisture Sensor
- PIR Sensor: Motion Detection
- Relay Module: Controls pump/motor
- LCD 16x2 (I2C): Display for T/H & Soil data
- Buzzer + LED: Alert on motion detection
- Bluetooth: ESP32 built-in SerialBT
- Blynk App: Mobile interface

### How It Works:

1. ESP32 reads sensor data (temp, humidity, soil moisture, motion).
2. Data is sent to the Blynk app via Bluetooth.
3. If motion is detected: Buzzer and LED are turned on.
4. If soil moisture is below threshold: Water pump is activated via relay.
5. Sensor data is displayed on LCD screen and Serial Monitor.

#### Blynk Setup:

- Install Blynk legacy app.
- Create new project (Bluetooth type).
- Add widgets and link to these virtual pins:

V0: Soil Moisture (%)

V1: Temperature (°C)

V2: Humidity (%)

V3: Motion (On/Off indicator)

- Get Auth Token and paste in code:

```
char auth[] = "YourAuthToken";
```

#### Required Libraries:

- Blynk
- DHT sensor library
- LiquidCrystal\_I2C
- BlynkSimpleSerialBLE
- BluetoothSerial (ESP32 built-in)

#### Common Issues:

1. Compilation Error:

```
#error "Please specify your BLYNK_TEMPLATE_ID and BLYNK_TEMPLATE_NAME"
```

Fix: Add lines in code:

```
#define BLYNK_TEMPLATE_ID "YourTemplateID"
```

```
#define BLYNK_TEMPLATE_NAME "SmartPlant"
```

## 2. LCD Library Warning:

WARNING: LiquidCrystal I2C claims to run on avr architecture(s)

Fix: Use LCD libraries compatible with ESP32 (e.g. LiquidCrystal\_I2C\_Esp32)

## Code Overview:

- sendToBlynk(): Reads sensors, updates Blynk, LCD, and controls outputs.
- setup(): Initializes all devices and starts Bluetooth.
- loop(): Runs Blynk and timer every 2 seconds.

## Future Improvements:

- Add real-time clock (RTC) for logging.
- Add water level sensor.
- Extend connectivity using Wi-Fi (instead of BLE).

## License:

MIT License