SMART PLANT MONITOR REPORT

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1. Introduction

Imagine this:

You're away on vacation. The sun is scorching, humidity is dropping, and your favorite indoor plant is silently crying for water. Meanwhile, your smart system is at work. It feels the dry soil, checks if there's water in the tank, and then activates the pump — all without you lifting a finger.

This project turns that imagination into reality.

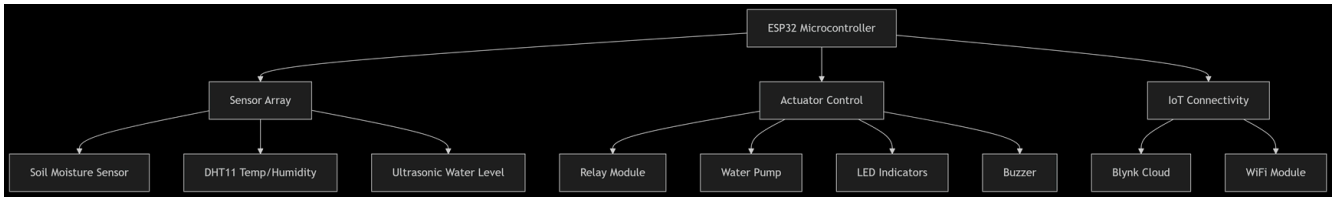
Goal:

Build a smart, connected, energy-efficient system that monitors plant health and irrigates only when needed, all while updating you in real-time.

2. Project Components

Component Function

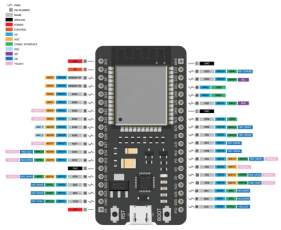
ESP32 Central controller	for sensors, display, Blynk, and pump logic
Soil Moisture Sensor	Detects if the plant's soil is dry or wet
Ultrasonic Sensor	Monitors the water tank level to ensure pump safety
DHT11	Measures ambient temperature and humidity
Relay Module	Safely switches the water pump ON/OFF
Water Pump	Pumps water to irrigate the plant when necessary
Buzzer	Gives audible warnings for critical conditions
LCD Display (I2C)	Shows live sensor readings and system messages
LEDs (Red & Green)	Visual status indicators for system state
Blynk Mobile App	Sends real-time updates and allows manual control from phone



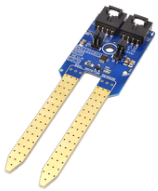
2. Project Components

Components

ESP32 Central controller



Soil Moisture Sensor



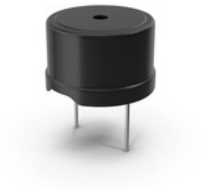
Ultrasonic Sensor

DHT11

Relay Module

Water Pump

Buzzer



LCD Display (I2C)

LEDs

🧠 3. Working Principle

🌀 The system continuously monitors the soil using a moisture sensor.

🧠 The ESP32 decides if irrigation is needed based on:

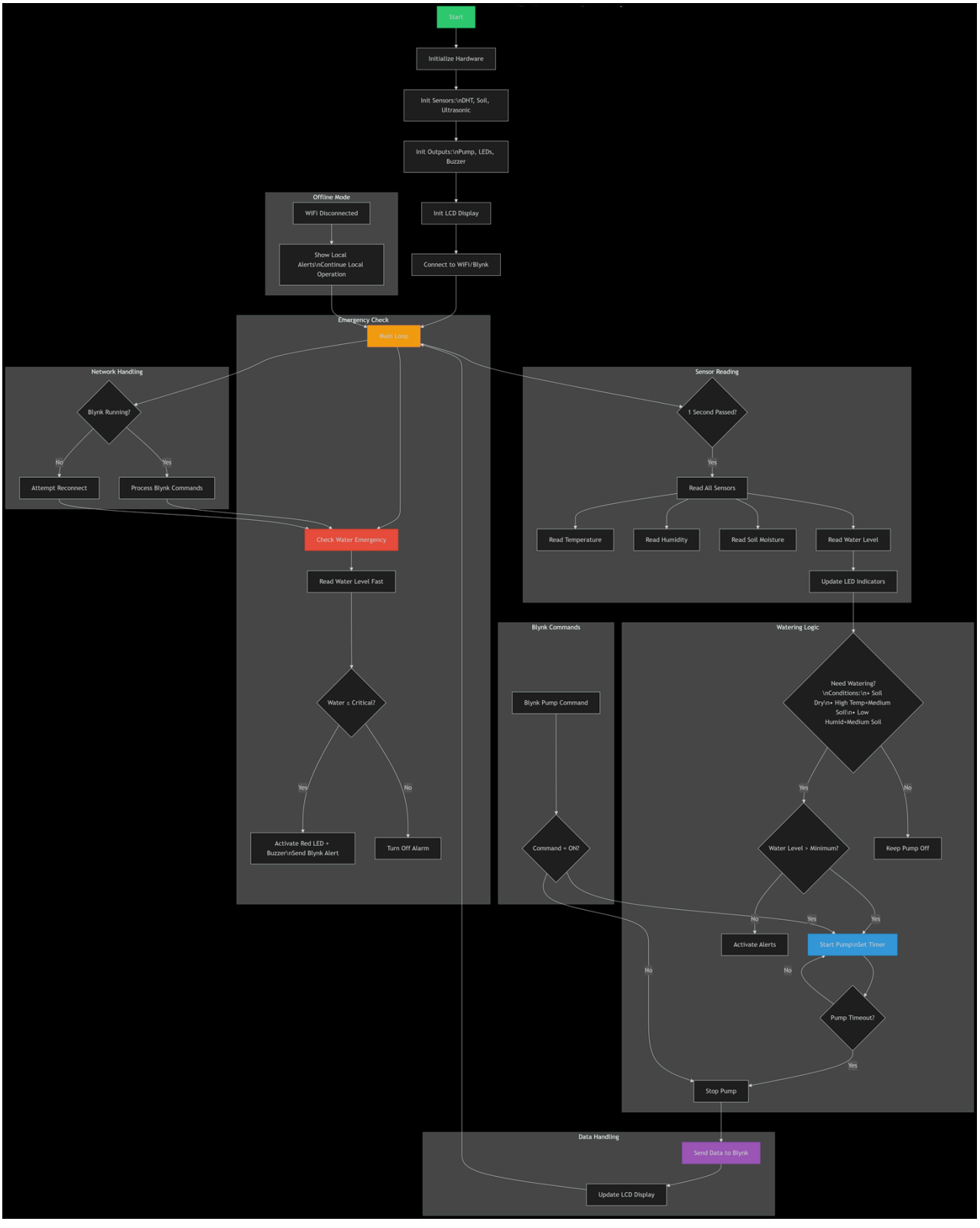
- Soil moisture level
- Ambient temperature
- Humidity
- Water availability in the tank

💧 If watering is needed, the system activates the pump (via relay) for a fixed time to avoid overwatering.

📲 Data is sent to the Blynk app, where users can:

- View live sensor readings
- Receive alerts (like low water level)
- Manually control the system

4. System Workflow



📲 5. Blynk App Integration

Feature	Description
Live Dashboard	Displays soil, temp, humidity, water level
Manual Buttons	Trigger pump manually
Notification	Sends alerts for dry soil or low tank

Sample Alert Messages:

- "🚨 Water Tank is LOW — Please Refill!"
- "✅ Watering Completed Automatically"
- "⚠️ Soil Dry & Temp High — Pump Triggered!"

🧪 6. Technical Design Details

✅ Setup Phase (setup())

- Initialize:
  - LCD display
  - Sensor pins
  - Blynk connection
  - Relay and buzzer

🔁 Main Loop (loop())

- Read all sensors every 1 second
- Show readings on LCD
- Send values to Blynk
- Check for watering conditions
- Evaluate Blynk commands
- Control pump based on safety and logic

🛑 Pump Safety

- Prevent dry run if no water in tank
- Buzzer + red LED alert when tank is empty
- Timeout to stop pump after N seconds

7. LCD Display & App Monitor

LCD Display scrolls between:

- "Smart Irrigation System"
- "Soil: 76% | Temp: 32°C"
- "Humidity: 48% | Water: 5.3cm"

Messages update every 2 seconds based on sensor input.

Application Monitor (Blynk App) displays:

- Real-time soil moisture
- Real-time temperature
- Real-time humidity
- Pump status (ON/OFF)
- Alerts (low water, sensor error)
- The app allows you to manually control the pump

  or let the system handle watering automatically.

🔔 8. Buzzer + LED Alerts

-->The system uses a buzzer and tri-color LEDs to indicate tank water levels and system status:

Condition	Buzzer / LED Action
🚫 Tank Empty	🔔 Buzzer ON continuously + 🔴 Red LED ON
⚠️ Tank Medium Level	🟡 Yellow LED ON
💧 Tank Full	🟢 Green LED ON
🕹️ Manual Override	🔔 Single short beep

🌱 9. Use Cases

The IoT Smart Plant Watering System is versatile and suitable for various real-world applications:

- 🏡 Home Gardening
- Automatically waters indoor or balcony plants while you're busy or away.
- 🌾 Agricultural Fields
- Supports farmers by maintaining ideal soil moisture, saving water, and improving crop health.
- 🌿 Greenhouses
- Ensures stable and efficient watering in controlled environments with minimal human effort.
- 🏢 Office Plant Maintenance
- Keeps office plants healthy and green without daily attention.
- ✈️ Vacation or Travel Time
- Offers peace of mind by watering your plants while you're away from home.
- 👴 For the Elderly or Busy Lifestyles
- Helps individuals who may forget or have difficulty managing plant care regularly.

💻 10. Code

Github Repo Link : [GITHUB REPO]