Northern University of Business and Technology Khulna

Department of Computer Science and Engineering

[Project Report]

Project Title:
[IoT based Vertical Farming System]

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IoT based Vertical Farming System

Abstract:

This project is about creating a smart vertical farming system using IoT. The system uses sensors to measure soil moisture, temperature, and humidity. Based on the data, it automatically controls water pumps, fans, and lights. The information is also sent to the cloud so users can monitor farming from anywhere. This helps save water, space, and energy while growing more crops in less area.

Introduction:

Farming is important for food production but traditional farming needs more land, water, and care. Vertical farming grows plants in stacked layers, which saves land. IoT makes farming smart by monitoring and controlling everything automatically. Our project builds a low-cost IoT system for vertical farming that saves resources and makes farming easy.

Literature Review:

Many researchers have worked on smart farming using IoT. Previous projects showed automatic irrigation using soil moisture sensors. Some works used cloud systems like ThingSpeak or Blynk to show real-time data. Vertical farming is already popular in cities like Singapore and Japan. But combining vertical farming with IoT monitoring and control is still developing and has great potential.

Methodology:

- **Sensor:** Soil moisture sensor checks the water level in soil.
- **Controller:** ESP8266 reads sensor data and makes decisions.
- **Actuator:** Relay + DC Pump is used to water plants when soil is dry.

 Display: I2C LCD shows soil moisture value and pump ON/OFF status.

 Power: Extra batteries provide backup power for the pump and ESP8266.

 Steps:

- Read soil moisture from the sensor.
- If soil is dry → turn ON pump.
- If soil is wet → turn OFF pump.
- Show soil condition and pump status on LCD.
- (Optional) Send data to cloud (ThingSpeak/Blynk).

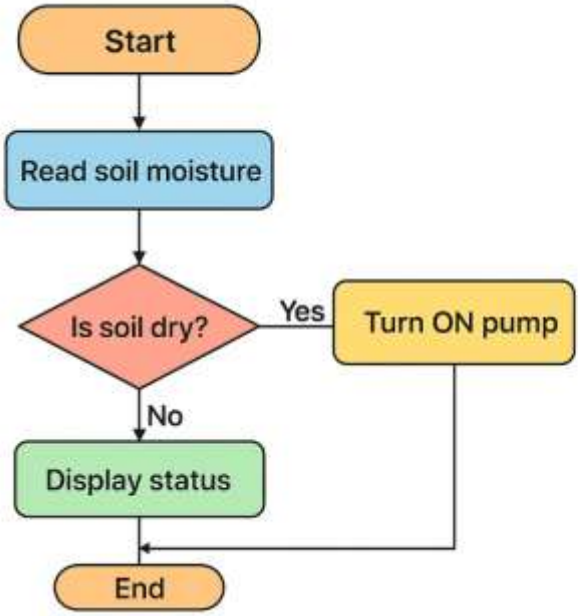

Figure 1: Flowchart 1

Implementation:

The soil moisture sensor continuously monitors the soil condition and sends data to the ESP8266. The ESP8266 compares the sensor reading with the threshold value of 600 to decide whether the soil is dry or wet. If the soil moisture value is less than 600, the system detects the

soil as dry and turns ON the water pump through the relay. If the soil moisture value is greater than or equal to 600, the soil is considered wet and the pump is turned OFF automatically. An I2C LCD is used to display the soil moisture percentage and the current pump status (ON or OFF). The relay ensures safe switching of the pump, protecting the microcontroller from high current. The entire system is powered by extra batteries, which makes it portable and reliable for continuous farming use.

Results and Analysis:

The project was tested successfully with a vertical farming setup. The soil moisture sensor readings were collected and sent to the ThingSpeak server through the ESP8266. Two sample pictures from the ThingSpeak server are shown in the results, which display the variation of soil moisture values over time. When the soil moisture value dropped below the threshold of 600, the pump was automatically turned ON to water the soil. Once the soil moisture level increased above 600, the pump was turned OFF automatically. The I2C LCD also showed the soil moisture percentage and pump status in real-time. These results confirm that the system works reliably, saves water, and reduces the need for manual monitoring.

Figure 2: Graph of Moisture Sensor Value

Figure 3: Graph of Pump Status

Discussion:

This project showed that IoT can make vertical farming smarter and reduce human work. The system works well, but it has some limits such as sensor accuracy and the need for internet. Using better sensors can make it more reliable. In the future, it can be used for bigger farms with more plants and better monitoring.

Conclusion:

This project shows a simple IoT system for vertical farming. It can water plants automatically when the soil is dry. The system saves time, water, and human effort. It is low-cost and useful for small farms or home gardens. In the future, it can be improved with better sensors and used in bigger farms.

References:

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