

Horticulture Management System Using IoT

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ABSTRACT

The Horticulture Managing System using IoT is an advanced solution designed to automate and optimize plant growth conditions. This system integrates various sensors, including temperature, humidity, soil moisture, and light sensors, to monitor environmental parameters in real time. The collected data is transmitted to a microcontroller, which processes the information and triggers automated responses, such as irrigation and artificial lighting, to maintain optimal conditions. The system also includes a cloud-based platform for remote monitoring and data analysis, allowing farmers to make informed decisions. By leveraging IoT, this system enhances productivity, reduces resource wastage, and ensures sustainable horticulture practices.

Keywords:

1. Arduino IDE program software.
2. Development board ESP8266.
3. Communication devices.
4. Sensors.
5. Watering devices.

INTRODUCTION

The integration of the Internet of Things (IoT) into horticulture management systems is revolutionizing agricultural practices by enhancing efficiency, productivity, and sustainability. IoT-based systems utilize sensors to collect real-time data on environmental factors such as soil moisture, temperature, humidity, and light intensity.

This data is then analyzed to provide actionable insights and recommendations. Actuators respond to these insights by automatically adjusting irrigation, lighting, and fertilization, ensuring optimal growing conditions for plants.

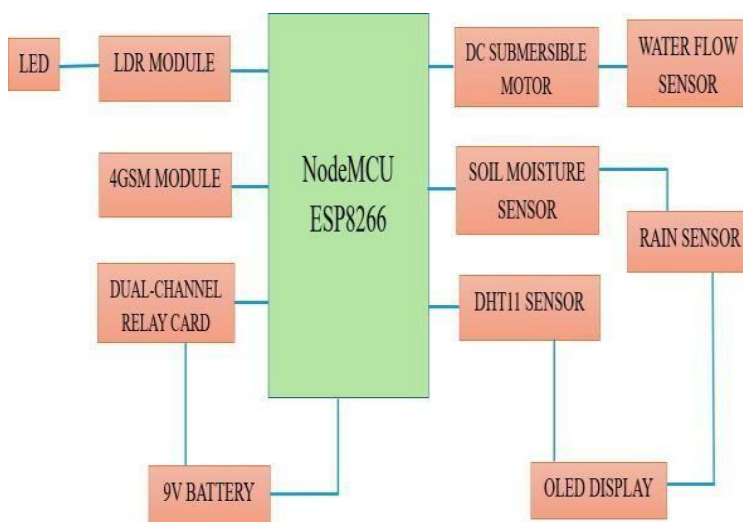
An IoT-based horticulture management system integrates smart sensors, actuators, and cloud-based analytics to optimize plant growth conditions and reduce human intervention. This system leverages sensors like soil moisture sensors, temperature and humidity sensors, and light-dependent resistors (LDRs) to collect real-time environmental data.

METHODOLOGY

- **System Design & Component Selection**
Choose sensors (soil moisture, temperature, humidity), microcontroller (Arduino), and actuators (water pump).
- **Sensor Integration & Data Collection**
Connect sensors to collect real-time environmental data and process it using the microcontroller
- **Automated Decision-Making** Set predefined thresholds (e.g., low soil moisture → water pump ON).
- **IoT Connectivity & Remote Access** Send data to a cloud platform (ThingSpeak) for monitoring via a mobile app/web interface

COMPONENTS OF HORTICULTURE MANAGING SYSTEM

BLOCK DIAGRAM:



The system shown in the diagram is an IoT-based horticulture management system

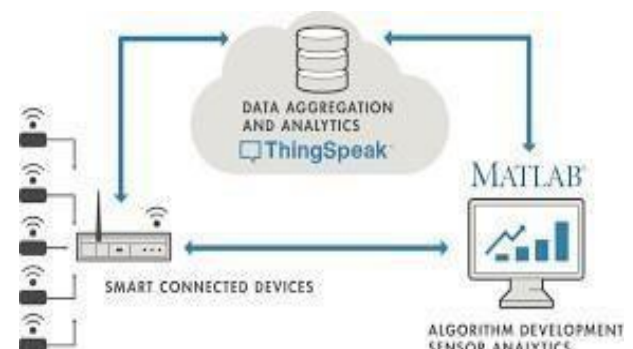
using a NodeMCU ESP8266 microcontroller, designed to automate irrigation, monitor environmental conditions, and provide real-time data to users. The system is powered by a 9V battery and integrates multiple sensors and actuators to optimize plant growth.

The DHT11 sensor measures temperature and humidity, displaying the data on an OLED screen, while a soil moisture sensor monitors the moisture level in the soil, triggering the water pump via a Dual-channel relay module when necessary. The LDR module detects light intensity and controls LEDs accordingly for artificial lighting.

A water flow sensor ensures proper water distribution, while a water turbine motor and DC submersible motor manage water circulation. A GSM module sends updates and alerts to the user via SMS, and all sensor data is uploaded to ThingSpeak for remote monitoring. This fully automated system enhances agricultural efficiency by reducing manual intervention and ensuring optimal irrigation and environmental conditions for plant growth.

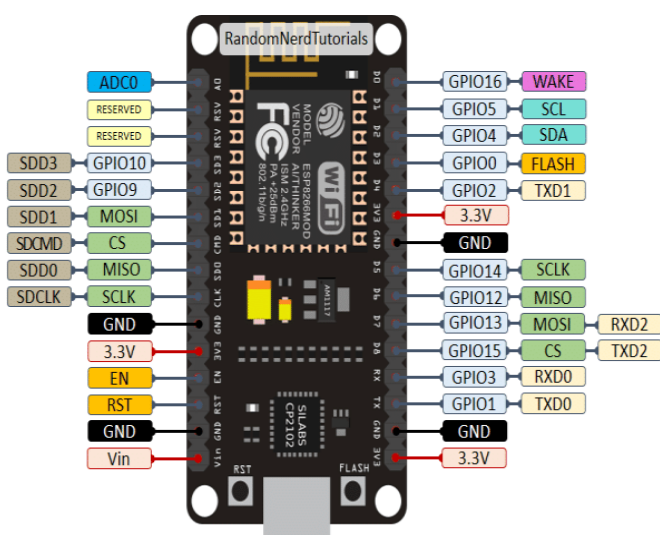
1. Thingspeak software:

ThingSpeak is a powerful cloud- based platform designed for the Internet of Things (IoT).



- It provides real-time data collection, visualization, analysis, and control of IoT devices using a simple and efficient interface.
- The platform enables users to send sensor data to the cloud, visualize it in real-time through customizable charts, and even apply analytics using MATLAB to derive meaningful insights.

2. Development board ESP8266:



Sensor Integration: You can connect various sensors to the ESP8266, such as soil moisture sensors, DHT11, Soil pH sensor, or rain sensor. The ESP8266 can collect data from these sensors, providing real-time information about soil conditions and weather forecasts.

Automation: Using the data collected from sensors, the ESP8266 can implement automation rules to optimize irrigation. For example, it can trigger irrigation only when soil moisture levels drop below a certain threshold or when rain is not expected.

Power efficiency: Implement power-saving features to ensure the ESP8266 operates efficiently and conserves energy, especially if the system relies on battery.

Connectivity: The ESP8266 can connect to Wi-Fi networks and GSM, enabling the irrigation system to access the internet. This connectivity can be used for remote monitoring, control, and data exchange.

3. Communication devices:



Data Communication: The ESP8266 connects to a GSM module, typically via UART communication. The GSM module has a SIM card for cellular data access.

Internet Connectivity: Once connected, the ESP8266 can access the internet through the GSM module. It can send and receive data from a central server or cloud platform for real-time monitoring and control.

Remote Control: Smart irrigation systems can be controlled remotely via SMS or through a web interface hosted by the ESP8266. Users can change irrigation schedules, turn the system on or off, or receive system status updates.

Data Logging: The ESP8266 can log sensor data and upload it to a central server for historical analysis and decision-making. This data may include soil moisture levels, weather forecasts, and irrigation schedules.

Energy Efficiency: To conserve power in remote areas, the ESP8266 and GSM module can be configured to enter sleep mode when not in use, reducing energy consumption.

Scalability: GSM connectivity makes smart irrigation systems more versatile and suitable for remote locations where Wi-Fi or wired internet.

Notifications: The system can send SMS or push notifications to users for alerts, such as low soil moisture or system malfunctions. Users can be informed of important events in real-time.

We can control and monitor the smart irrigation system using GSM from all over India.

Advantages:

- **Efficient Water Usage** – The system optimizes irrigation based on real-time soil moisture levels, reducing water wastage.
- **Automated Monitoring** – Sensors continuously track environmental conditions, minimizing manual intervention.
- **Increased Crop Yield** – By providing precise water and nutrient levels, the system enhances plant health and productivity.
- **Remote Control & Monitoring** – IoT integration allows users to monitor and control the system from anywhere via the internet.

- **Energy Efficient** – Smart scheduling reduces unnecessary pump operation, conserving power.

Disadvantages:

- **Initial Setup Cost** – The installation of IoT-based sensors, controllers, and actuators can be expensive.
- **Internet Dependency** – Requires a stable internet connection for remote monitoring and control.
- **Maintenance Challenges** – Sensors and components require periodic maintenance and calibration for accuracy.
- **Power Supply Limitations** – Continuous power is needed for system operation; rural areas may require backup solutions.
- **Technical Knowledge Required** – Users need basic knowledge of IoT, sensors, and troubleshooting.

Result:



Conclusion:

The Horticulture Managing System using IoT is an innovative solution that enhances agricultural efficiency by automating Irrigation, monitoring and environmental conditions, and optimizing resource usage. By integrating sensors, controllers like ESP8266,

and real time data processing, the system ensures precise water management, reducing wastage and improving crop health and yield.

This technology enables remote monitoring and control, making it highly beneficial for farmers and horticulturists, especially in water-scarce regions. Though challenges such as initial setup costs, maintenance, and internet dependency exist, the long-term benefits outweigh the drawbacks, leading to cost savings, increased productivity, and sustainable farming practices.

REFERENCE:

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