

INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY BANGALORE



INTERNET OF THINGS PROJECT REPORT

Sensor Savants

Smart Greenhouse Monitoring System

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Project Objective

This project aims to design and implement a Smart Greenhouse Monitoring System using IoT, enhancing the efficiency and productivity of greenhouse farming. By automating the monitoring and control of environmental conditions, we aim to ensure the healthy growth of crops and make the work of farmers easier and faster.

Motivation

The motivation behind having a smart greenhouse monitoring system is to enhance agricultural efficiency by addressing environmental challenges faced during crop growth. It aims to provide real-time data monitoring that can be accessed remotely with ease, while reducing farmers' effort by automating the entire process.

Project Description

The key features of the project are:

Real-Time Data Monitoring: Develop a network of sensors to continuously monitor environmental conditions within the greenhouse, providing real-time data to the farmer.

Remote Accessibility: Ensure the system allows remote access and control via mobile and web applications, enabling farmers to monitor and manage their greenhouses easily.

Data Analysis and Alerts: Integrate machine learning models and data analytics tools to track trends and predict potential issues. Based on these predictions, an alert system will notify the farmer of critical changes or system failures.

Hardware/Software Used

Hardware:

1. DHT11 Temperature and Humidity Sensor
2. Soil Moisture Sensors
3. LDR Sensor Module
4. MQ-135 and MQ-9 Gas Sensors
5. pH Sensors
6. Rain Sensors
7. ESP32 Microcontroller

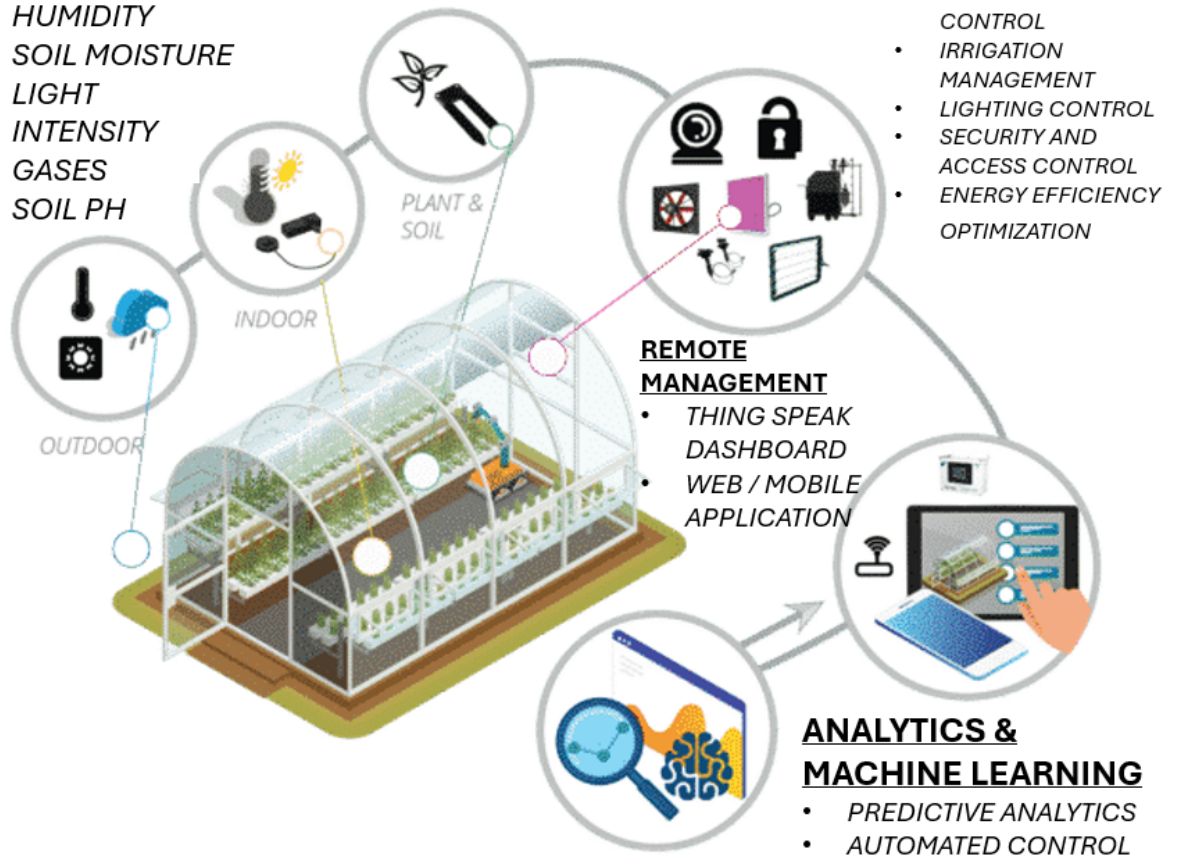
Software:

ThingSpeak

Block Diagram

SENSORS

- TEMPERATURE
- HUMIDITY
- SOIL MOISTURE
- LIGHT INTENSITY
- GASES
- SOIL PH



Working

The smart greenhouse monitoring system integrates advanced sensors, remote management to optimize crop growth and resource usage. Sensors monitor key parameters like

temperature, humidity, soil moisture, light intensity, and gases to provide real-time environmental and soil data. Remote management is facilitated through platforms like the ThingSpeak dashboard and web/mobile applications, enabling farmers to monitor and control the greenhouse from anywhere.

Results

The ThingSpeak dashboard is used to visualize real-time data collected from various sensors in the Smart Greenhouse Monitoring System. It provides an intuitive interface to monitor environmental parameters and system performance remotely. The dashboard can be viewed by using the following link: [ThingSpeak Dashboard](#).

Conclusions and Future Work

Conclusions:

The Smart Greenhouse Monitoring System effectively demonstrates the integration of IoT-based technologies for modern agricultural practices. By utilizing sensors to monitor the parameters, the system ensures real-time data visualization on the ThingSpeak IoT platform. This allows remote monitoring and actionable insights through a dashboard, enhancing plant growth and environmental management.

Future Work:

Several enhancements can be considered for further

development of the system:

- **Predictive Analytics:** Incorporate machine learning models to forecast environmental conditions and optimize irrigation, ventilation, and lighting decisions.
- **Automation:** Develop automated mechanisms for irrigation and other greenhouse operations based on sensor readings using actuators. Actuators include open-close roof mechanism for rain, humidifier to maintain humidity levels, etc. Having an open-roof structure means there will be challenges faced in maintaining temperature, humidity and some other levels. Optimizing the use of actuators keeping in mind the open-roof mechanism will be an interesting challenge to work on.
- **Energy Efficiency:** Integrate renewable energy solutions like solar panels and improve energy management techniques by using rain water harvesting for generating power or using it in irrigation (Using it to generate power means we can optimize the use of power generation using solar panels and rainwater which will be very beneficial for less and better power consumption). Energy efficiency can also involve using the actuators efficiently to have less power usage.
- **Multi-Greenhouse Support and Accessibility:** Extend the system to manage multiple greenhouses through a centralized dashboard. Having mobile/web applications for better accessibility and personalized graphs which can be used to notify the user in real-time and can be better for automated controls.
- **Advanced Sensors:** Upgrade to higher accuracy sensors and incorporate additional sensors for pest and plant health monitoring, etc.

References

- 1 . Smart Greenhouse Solutions: IoT-Based Environmental Monitoring and Control.
- 2 . Avnet's Smart Greenhouse Monitoring Solution.