Advantages and Challenges of IoT-Based Greenhouse Monitoring and Management System

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DESCRIPTION

Greenhouses are controlled area environments to grow plants. In order to achieve maximum plant growth and yield, the continuous monitoring and controlling of environmental parameters such as temperature, humidity, soil moisture, light intensity, soil pH etc. are necessary for a greenhouse system. However, manual monitoring and controlling of these parameters can be time-consuming, costly and inaccurate. Therefore, there is a need for an automated system that can collect data from various sensors and control actuators in the greenhouse using the Internet of Things (IoT) technology.

IoT is the network of physical objects or devices that are embedded with sensors, software and other technologies to connect and exchange data with other devices and systems over the internet. IoT can enable various greenhouse automation equipment like computer software and sensors to collect data in the greenhouse environment and boost crop yields. This new innovative technology makes use of numerous sensors linked to a central greenhouse environment climate control computer.

One example of an IoT based greenhouse monitoring and controlling system is using an Arduino platform. Arduino is an open-source hardware and software platform that can be used to create interactive electronic projects. Arduino can be connected to various sensors such as DHT11 sensor (for temperature and humidity), Soil Moisture sensor, LDR (Light Dependent Resistors) sensor (for light intensity) and pH sensor (for soil acidity). These sensors can measure the values of environmental parameters and send them to an Arduino board. The Arduino board can then process the data and control actuators such as cooling fan, exhaust fan, water pump, artificial light and motor pump to adjust the environmental parameters according to the predefined thresholds.

Another example of an IoT based greenhouse monitoring system is using a NodeMCU module. NodeMCU is a low-cost open source IoT platform that integrates an ESP8266 Wi-Fi microcontroller chip. NodeMCU can be connected to similar sensors as Arduino and send the data to smartphones *via* online mode using HTTP protocol (Hypertext Transfer Protocol) or IoT platforms like Telegram bot. The user can monitor the status of their greenhouse parameters at any time and from any place using their smartphones. They can also control the actuators by sending commands through SMS or mobile application.

IoT based greenhouse monitoring and controlling systems benefits

- Improving crop quality and quantity by providing optimal environmental conditions for plant growth
- Reducing labor costs and human errors by automating data collection and actuation
- Saving energy and water resources by optimizing irrigation and ventilation systems
- Enhancing crop security by detecting pests, diseases and intruders
- Providing real-time data analysis and feedback for decision making
- Increasing farmer's income and profitability by reducing operational costs and increasing crop yields

IoT based greenhouse monitoring and controlling systems are one of the applications of smart agriculture that can revolutionize the field of food production. By using IoT technology, farmers can create a smart sensor network that can detect environmental factors such as temperature, light, CO_2 etc. The sensors also detect when certain conditions are ideal for the plants. This way, farmers can optimize their greenhouse management and achieve maximum plant growth and yield.