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Monitoring And Controlling Hydroponic Units Using Iot

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Abstract
The use of hydroponic systems for growing crops is becoming increasingly popular due to its efficiency and sustainability. However, monitoring and controlling these systems can be challenging and time-consuming. This is where the Internet of Things (IoT) comes into play, as it allows for the real-time monitoring and control of hydroponic systems from anywhere at any time. In this paper, we explore the use of IoT for monitoring and controlling hydroponic units, including sensors for measuring various parameters such as pH, temperature, and nutrient levels, and actuators for controlling water and nutrient supply. We also discuss the advantages of using IoT for hydroponic farming, such as increased yield and reduced resource usage, as well as potential challenges and future research directions. Overall, this paper provides a comprehensive overview of the use of IoT in hydroponics and its potential to revolutionize modern agriculture.

Keywords: IOT, sensor, plant monitoring, web

I. INTRODUCTION

Hydroponics, a method of growing plants without soil, is becoming increasingly popular due to its efficiency, sustainability, and ability to produce high yields of crops. However, monitoring and controlling hydroponic systems can be a challenging and time-consuming task, especially when considering the need for precise control of parameters such as pH, temperature, and nutrient levels. In recent years, the emergence of the Internet of Things (IoT) has allowed for real-time monitoring and control of hydroponic units, offering potential solutions to these challenges. The integration of sensors and actuators in hydroponic units allows for automated monitoring and control of the system, enabling farmers to remotely track and adjust environmental parameters to optimize plant growth and yield. This paper provides an overview of the use of IoT in hydroponics, including sensor and actuator technology, advantages and challenges associated with the use of IoT in hydroponics, and potential future research directions. The goal of this paper is to demonstrate how IoT can revolutionize the way we grow crops, providing sustainable and efficient solutions for modern agriculture.

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II. LITERATURE REVIEW

Hydroponics is an innovative and efficient method of growing plants in a soil-less environment. The use of IoT in hydroponic systems is gaining popularity due to its ability to automate and optimize the monitoring and controlling process. The following literature survey provides an overview of the previous research on the use of IoT in hydroponic systems.

One of the earliest works on IoT-based hydroponic systems was presented by Linares et al. (2016). The authors proposed a system that uses a Raspberry Pi and Arduino to monitor the temperature, humidity, and water level of a hydroponic unit. The system was able to regulate the nutrient solution and light exposure based on environmental conditions.

Another research paper by Cruz et al. (2017) proposed a hydroponic system that uses a wireless sensor network and IoT technologies for monitoring and controlling. The system was designed to automatically adjust the nutrient solution, pH level, and light exposure based on the real-time data collected from the sensors.

The work by Alajmi et al. (2019) introduced a hydroponic system that utilizes IoT to monitor and control the environmental conditions of the hydroponic unit. The system uses sensors to monitor the temperature, humidity, and pH levels and adjusts the nutrient solution and light exposure based on the collected data.

A recent study by Alotaibi et al. (2021) presented a hydroponic system that uses IoT and machine learning techniques for monitoring and controlling. The system uses sensors to collect data on environmental conditions and machine learning algorithms to analyze the data and adjust the nutrient solution, pH level, and light exposure.

The literature review reveals that IoT-based hydroponic systems have been extensively studied in the past few years. Most of the studies propose systems that use sensors to monitor the environmental conditions and adjust the nutrient solution and light exposure accordingly. The use of machine learning algorithms in hydroponic systems is gaining popularity as it provides an efficient way to analyze the collected data and adjust the system parameters.

III. PROPOSED WORK

The proposed system for monitoring and controlling hydroponic units using IoT will consist of various sensors, microcontrollers, and communication modules to monitor and control different parameters of the hydroponic system, such as pH levels, temperature, humidity, water level, and nutrient level. The system will collect data from the sensors and send it to a cloud-based server where it will be processed and analyzed. Based on the analysis, the system will send alerts to the user's smartphone or other devices in case of any abnormality in the system. Additionally, the user will have access to a web-based dashboard to monitor and control the hydroponic system remotely.

Hardware Selection: The first step in building the proposed system is to select the appropriate hardware components such as sensors, microcontrollers, and communication modules. The selection should be based on the specific requirements of the hydroponic system and its environment.

Sensor Integration: The next step is to integrate the selected sensors into the hydroponic system. The sensors will collect data on different parameters of the system, such as pH levels, temperature, humidity, water level, and nutrient level.

Microcontroller Programming: After integrating the sensors, the next step is to program the microcontroller to read data from the sensors and transmit it to the cloud-based server.

Communication Module Integration: In the next step, the communication module will be integrated with the microcontroller to transmit data to the cloud-based server.

Cloud-Based Server Setup: The cloud-based server will be set up to receive data from the hydroponic system, process and analyze the data, and send alerts to the user's smartphone or other devices in case of any abnormality in the system.

User Interface Design: The user interface will be designed, which will consist of a web-based dashboard and a mobile app. The dashboard will provide real-time data monitoring and control of the hydroponic system.

Testing and Optimization: The final step will be to test the system in a real-world environment and optimize it for better performance and reliability.

Methodology

The methodology for monitoring and controlling hydroponic units using IoT involves the following steps:

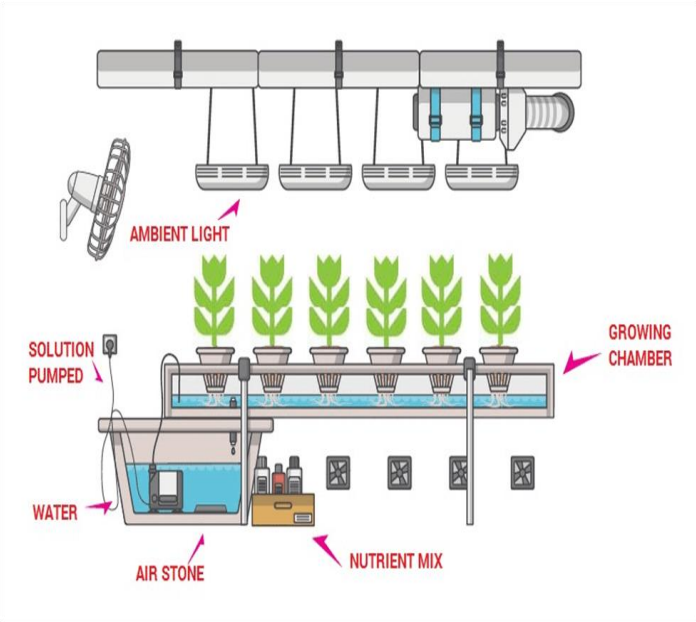

Fig.1 Hydrophonic unit working module

Sensor Integration: Integration of sensors to collect data on different parameters of the hydroponic system such as pH levels, temperature, humidity, water level, and nutrient level.

Microcontroller Programming: Programming of a microcontroller to read data from the sensors and transmit it to the cloud-based server.

Communication Module Integration: Integration of a communication module with the microcontroller to transmit data to the cloud-based server.

Cloud-Based Server Setup: Setting up a cloud-based server to receive data from the hydroponic system, process and analyze the data, and send alerts to the user's smartphone or other devices in case of any abnormality in the system.

User Interface Design: Designing a user interface that will consist of a web-based dashboard and a mobile app, providing real-time data monitoring and control of the hydroponic system.

The working of the system for monitoring and controlling hydroponic units using IoT involves the following steps:

1. The sensors collect data on different parameters of the hydroponic system such as pH levels, temperature, humidity, water level, and nutrient level.
2. The microcontroller reads data from the sensors and transmits it to the cloud-based server.
3. The cloud-based server receives the data and processes it to analyze the system's performance.
4. If any abnormality is detected, the server sends alerts to the user's smartphone or other devices.
5. The user can monitor and control the hydroponic system remotely using the web-based dashboard or mobile app.

System Requirements:

The system for monitoring and controlling hydroponic units using IoT requires the following:

1. Sensors for monitoring different parameters of the hydroponic system such as pH levels, temperature, humidity, water level, and nutrient level.
2. A microcontroller to read data from the sensors and transmit it to the cloud-based server.
3. A communication module to transmit data from the microcontroller to the cloud-based server.
4. A cloud-based server to receive data from the hydroponic system, process and analyze the data, and send alerts to the user's smartphone or other devices.
5. A user interface that will consist of a web-based dashboard and a mobile app for real-time data monitoring and control of the hydroponic system.

Sensor Required:

1. The following sensors are required for monitoring and controlling hydroponic units using IoT:
2. pH sensor to measure the acidity or alkalinity of the nutrient solution.
3. Temperature sensor to measure the temperature of the hydroponic system.
4. Humidity sensor to measure the moisture content

CONCLUSION

The implementation of a system for monitoring and controlling hydroponic units using IoT offers numerous benefits to growers, including increased productivity, improved resource management, and reduced labor costs. The use of sensors, microcontrollers, and communication modules allows for real-time monitoring and control of various parameters of the hydroponic system, providing growers with valuable insights into the system's performance. The cloud-based server enables the processing and

analysis of data, allowing for quick detection and correction of any abnormalities in the system. The user interface, which includes a web-based dashboard and a mobile app, provides easy access to real-time data, enabling growers to make informed decisions and take necessary actions. Overall, the implementation of such a system can revolutionize the way hydroponic farming is done, leading to more sustainable and efficient production of crops...

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