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DIGITAL IRRIGATION METHOD USING IMAGE PROCESSING TECHNIQUES

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ABSTRACT

The irrigation system with digital image processing technique using leaf measurement and IoT is a cutting-edge approach to regulating water usage in agriculture. By integrating digital image processing technology with IoT devices, this system provides accurate and timely data on plant water requirements, allowing farmers to adjust water supply according to their needs. The benefits of this system include optimizing water usage, reducing water wastage, promoting healthy plant growth, and reducing the risk of diseases caused by overwatering or underwatering. However, the cost of the system components and the accuracy of the image analysis software are limitations that need to be considered. Overall, this system offers a reliable and cost-effective way to monitor and regulate water usage in agriculture.

KEYWORD: IoT, Irrigation, Digital image processing, leaf measurement

INTRODUCTION:

The advancement of digital image processing and IoT technology has revolutionized many fields, including agriculture. The irrigation system with digital image processing technique using leaf measurement and IoT is a promising approach to regulating water usage in agriculture. This system integrates digital image processing technology with IoT devices, such as humidity sensors, soil moisture sensors, 5V DC relay modules, pumping motors, data sets, and output consoles, to provide accurate and timely data on plant water requirements. By analyzing leaf size and color through digital image processing, this system can accurately measure a plant's water requirements and provide the necessary water supply through the 5V DC relay module and pumping motor. Nevertheless, with continued advancements in digital image processing and IoT technology, the irrigation system with digital image processing technique using leaf measurement and IoT has the potential to revolutionize agriculture and help farmers worldwide in achieving

Sustainable water usage practices. In this paper, we will delve deeper in to the system's components and explore its potential applications in modern agriculture. The benefits of this system are numerous, including optimizing water usage, reducing water wastage, promoting healthy plant growth, and reducing the risk of diseases caused by overwatering or underwatering. Additionally, the integration with IoT devices allows for remote monitoring and data management, saving time and effort for farmers.

LITERATURE SURVEY

Sanku Kumar Roy, Sudip Misra , Narendra Singh Raghuwanshi, and Sajal K. Das [2021] proposed the design of (Agrisen) an IOT based dynamic irrigation scheduling for water management in a crop field. Whereas this provides real time, automatic dynamic irrigation treatment based on their different growth phase of crops life cycle. They proposed an algorithm for dynamic manual irrigation based on the farmers requirements. It has farmer friendly interface which provides information of the field in multiple manner such as visual display, cell phones and web portal. This will increase the crop productivity rate by at most 10.21% over the existing manual irrigation method and increase the network time 2.5 times more than existing system.

Et-Taibi Bouali; Mohamed Riduan Abid; El- Mahjoub Boufounas; Tareq Abu Hamed [2020] presented an integral smart agricultural solution that leverages cost effectiveness where the commercial solutions are costly and thus it is impossible to adopt by small and medium farmers so they given a solution that revolves around the major axes smart water metering which promotes the optimal usage and conservation of water table via real time data Collection and monitoring using a cloud based IOT. They had shown an result that reduction of water consumption of crops reduced up to 71.8% compared with traditional irrigation system.

Keyurbhai A. Jani; Nirbhay Kumar Chaubey [2021] proposed a smart agriculture framework to monitor different types of low-cost IoT sensors devices, which collects data from soil, air, water, and insect and appropriate decisions based on the analysis of sensors data. Their novel contribution of our proposed approach is to automate task of irrigation, pest detection spray in a scientific way with minimal farmer's intervention in one framework.

Asif Siddiq, Annum Zehra, Muhammed Owais Tariq, Salman Malik [2020] , "A Sensor Based System For Automatic Environmental Control in Hydroponics" have designed ACHPA, a sensor based system for automatic environmental control in hydrophonics. ACHPA controls environmental parameters i.e., temperature, humidity and soil moisture using sensors

placed at convenient distances and a centralized controller to achieve a controlled environment for the production of crops. The operational ranges of the environmental parameters to be controlled are pre-fed in the controller. Environmental parameters received from the sensors are than compared with the pre-fed values for controlling action.

OBJECTIVE:

The objective of this irrigation system with digital image processing technique using leaf measurement and IoT is to optimize water usage in agriculture by providing accurate and timely data on plant water requirements. The system aims to achieve this by integrating digital image processing technology with IoT devices such as humidity sensors, soil moisture sensors, 5V DC relay modules, pumping motors, data sets, and output consoles. The system aims to reduce water wastage, promote healthy plant growth, and reduce the risk of diseases caused by overwatering or underwatering. Additionally, the system allows for remote monitoring and data management, making it easier and more efficient for farmers to manage their crops.

EXISTING SYSTEM

Drip irrigation is an existing irrigation system that delivers water directly to the plant's roots using a network of pipes with small emitters that allow water to drip slowly and steadily onto the soil. This method is known for its high efficiency and water conservation, as it reduces water waste through evaporation and runoff. Drip irrigation can be used for a variety of crops and can be customized to provide precise amounts of water to different areas of the field based on the plant's specific needs. One major issue is requirement of frequent monitoring and maintenance to prevent clogging of the emitters and ensure uniform water distribution, which can add to the overall cost and labor required.

EXISTING PROBLEM

One of the main problems with drip irrigation is the potential for clogging of the emitters, which can significantly reduce the system's efficiency and increase maintenance costs. Clogging can be caused by various factors, such as sediment buildup, algae growth, and chemical deposits from fertilizers or pesticides. In addition to reducing water delivery, clogging can also lead to uneven distribution of water and the development of dry spots in the field, which can negatively affect plant growth and yield. While regular maintenance and filtration can help prevent clogging, this can also add to the overall cost and labor required for drip irrigation. Therefore, finding more effective and cost- efficient solutions to prevent clogging remains a challenge for drip irrigation systems.

PROPOSED SYSTEM

The proposed system is a smart irrigation system that utilizes digital image processing

and IoT-enabled leaf measurement to optimize irrigation practices. The system includes a camera-based leaf measurement module that captures images of the plants and analyzes them to determine the leaf area index (LAI) and leaf water potential (LWP) of the plants. These measurements are then used to determine the irrigation requirements of the plants. The operation of the proposed system is as follows:

- The camera-based leaf measurement module captures images of the plants and analyzes them to determine the LAI and LWP of the plants.
- The IoT-enabled soil moisture sensor measures the moisture content of the soil and sends this information to the microcontroller.
- The microcontroller processes the data from the camera-based leaf measurement module and the IoT-enabled soil moisture sensor to determine the irrigation requirements of the plants.
- The microcontroller controls the irrigation system accordingly, adjusting the flow of water to the plants as needed.
- The system continues to monitor the plants and adjust the irrigation as necessary to ensure that the plants receive the optimal amount of water.

Benefits of the proposed system:

- Optimal irrigation: The system ensures that the plants receive the optimal amount of water, which maximizes their growth and productivity.
- Reduced water wastage: The system only delivers the amount of water that is required by the plants, reducing water wastage and conserving water resources.
- Improved plant health: The system's ability to monitor the LWP of the plants ensures that they are not over or under watered, which improves their overall health and reduces the risk of disease.
- Cost-effective: The system's use of digital image processing and IoT-enabled sensors allows for accurate measurement of plant water requirements, reducing the need for manual monitoring and saving on labor costs.
- Overall, the proposed system provides an efficient and cost-effective solution for optimizing irrigation practices

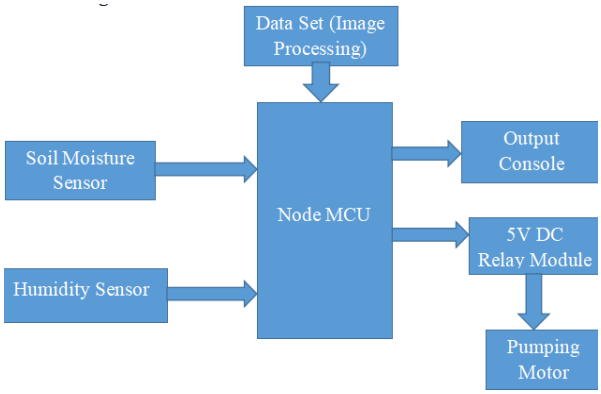

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Fig.No.1 BLOCK DIAGRAM FOR PROPOSED SYSTEM

HARDWARE REQUIREMENT

Humidity sensor

Fig.No.2 Humidity sensor

A humidity sensor is a device that measures the amount of moisture or water vapor present in the air or in a gas Humidity sensors can be used in irrigation systems to measure the moisture level in the soil and determine when to water plants. These sensors can help ensure that plants receive the right amount of water, which can improve plant growth, reduce water waste, and save money on water bills. This is because the irrigation system will only turn on when the soil moisture level reaches a certain threshold, rather than on a set schedule. Additionally, by ensuring that plants receive the right amount of water, the system can help improve plant growth and overall crop yield.

Soil moisture sensor

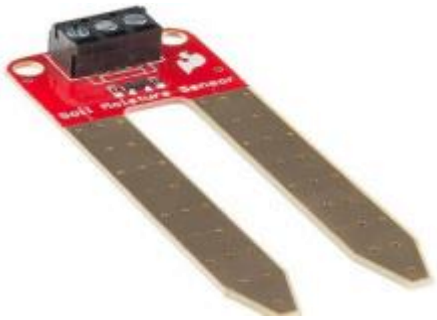

Fig.No.3 Soil moisture sensor

The moisture of the soil plays an essential role in the irrigation field. A soil moisture sensor is an essential component of an irrigation system that measures the water content in the soil and provides feedback to the system controller to adjust the watering schedule accordingly. The sensor works by measuring the electrical resistance of the soil, which is inversely proportional to its moisture content

5V DC relay

Fig.No.4 5V DC relay

The 5V DC relay is commonly used in electronic circuits and microcontroller projects to control higher voltage or current loads, such as motors, lights, or other electrical devices. The relay provides electrical isolation between the control circuitry and the load, allowing the control circuitry to switch the load without directly connecting to it.

A 5V DC relay can be used in an irrigation system to control the operation of the water pump or valve based on the input from a soil moisture sensor or a timer. The relay can act as a switch that connects or disconnects the power supply to the pump or valve, allowing the irrigation system to turn on or off automatically

NodeMCU

Fig.No.5 NodeMCU

NodeMCU is an open-source firmware and development board based on the ESP8266 Wi-Fi module. It allows for easy programming and interaction with the internet through Wi-Fi connectivity. NodeMCU can be used in an irrigation system to provide a Wi-Fi-enabled control

system for automatic watering based on soil moisture level data. The board can interface with soil moisture sensors and a water pump or valve via digital and analog input/output pins. NodeMCU's Wi-Fi capability allows remote monitoring and control of the irrigation system through a web interface or mobile application

WORKING

The working of the proposed irrigation system with digital image processing technique using leaf measurement and IoT involves the following steps:

Image capture: A camera captures high- resolution images of the plant leaves.

Image processing: Digital image processing techniques extract features related to leaf size, shape, and color. This is done using software tools such as OpenCV, Python, and TensorFlow.

Data collection: The extracted features are collected and stored in a dataset. The dataset is used to analyze the water requirements of the plants.Data analysis: The collected data is analyzed to determine the water requirements of the plants. The analysis involves comparing the extracted features to pre-determined thresholds to identify the plants that require water.

Humidity and soil moisture sensing: A humidity sensor measures the relative humidity of the air, while a soil moisture sensor measures the moisture content of the soil. These sensors are connected to an IoT device such as Raspberry Pi or Arduino.

Water supply control: A 5V DC relay module controls the water supply to the plants based on their water requirements. The pumping motor pumps water from the water source to the plants. The water supply control is managed by an IoT device.

Output console: The data collected by the system is displayed on an output console. This allows farmers to monitor the water requirements of their crops in real-time.

IoT integration: The system is integrated with IoT devices such as Raspberry Pi, Arduino, or other microcontrollers, and connected to the internet via Wi-Fi or cellular network to allow for remote monitoring and data management.

Overall, the system uses digital image processing techniques, humidity and soil moisture sensors, and IoT devices to optimize water usage and reduce the risk of diseases caused by overwatering or underwatering. The integration with IoT devices allows farmers to remotely monitor and manage their crops, which increases efficiency and reduces labor costs

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RESULTS

GIVEN DATAS

Fig.No.6 Data set of crops

Fig.No.7 Data set of leaf

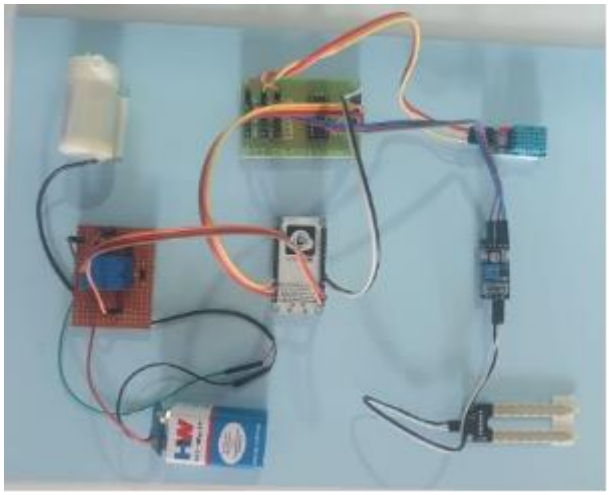

Fig.No.8 image proccessing kit using IoT

The results of the irrigation system with digital image processing technique using leaf measurement and IoT are highly promising. By analyzing the features of the plant leaves, the system can accurately determine the water requirements of individual plants. This allows for targeted watering and efficient water usage, which can lead to significant cost savings for farmers.

The integration with IoT devices allows for remote monitoring and management of crops, which can save time and reduce labor costs. Additionally, the system can detect and alert farmers to potential problems such as water stress or disease outbreaks, allowing for early intervention and prevention.

Overall, the irrigation system with digital image processing technique using leaf measurement and IoT has the potential to revolutionize agriculture by optimizing water usage, reducing costs, and improving crop yields.

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