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Sustainable Smart Polyculture Irrigation System Using IoT for Effective Precision Farming

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Agriculture, IT and communication, farming

ABSTRACT:
Precision Agriculture with IoT is a recent aid for sustainable horticulture focusing on IT and communication devices like sensors. Irrigation i.e., watering is a more labor-intensive task in daily operations relating to farming or gardening. The main goal of this effort is to help farmers keep track of numerous changes in the agricultural industry. The objective is to create an efficient precision farming system for horticulture that is smart and sustainable through the use of IoT. The precise condition of the monitored land can be found online when several sensors are linked to the Nodemcu and the sensor values are saved in an IOT webpage. This style is primarily intended to assist farmers in monitoring the various changes in the agriculture field. Keywords—sensors, precision farming, IOT , smart agriculture, irrigation.

INTRODUCTION

Agriculture is irreplaceable and requires dedicated human resource, and it is one of the key elements that determines a nation's economy. Farmers and horticulture enthusiasts must water plants as part of their plant-care duties. Watering plants properly is crucial because it directly affects the health of the crops and plants. Plants can become dry or go rotten due to a lack of water or excess of water. Farmers now face significant challenges when it comes to watering their crops. It's because they are unaware of the power availability. If water is available, they have to pump it and wait for the field to get sufficiently irrigated, which means they have to stop doing other equally important jobs. They thereby squander important time and energy doing nothing. Our concept to create an Internet of Things-based automated irrigation system for precision farming benefits gardeners as well as farmers. Plants can be watered manually or mechanically using gadgets. This work focuses on maintaining plant moisture. The usage of the Internet of Things is made possible by the recent rise of numerous modern technologies, which allows us to reduce the amount of manual labour performed by farmers while still utilising the right technology for high production and satisfying their needs. The most effective and significant method for creating remedies to issues is the Internet of Things. Without involving humans, IOT enables networked data exchange. The idea is to develop an IOT device that can water plants automatically when their moisture content falls below a predetermined threshold. The farmers water their crops at regular intervals. They waste water by using methods that cause water logging and increase water use. The tension associated with manual labor will be fully eliminated by the solution we devise. It only functions when the soil is dry. Here, the farmer can use an application on their smartphone to monitor all of these field parameters remotely.

EXISTING SYSTEM

Issues in Existing System The primary issue with the current method is that the water level pumped to the plants is unpredictable, which results in less water being pumped than what is necessary, which causes a number of issues. Because the current irrigation system is unable to irrigate several crops, only one crop can be watered at a time. The current system is unable to tell the user, how much water is in the source.

Problem statement The fundamental issue with the current system is that the water level supplied to the plants is not known, which means that the plants do not

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receive the right quantity of water. The current technology cannot irrigate numerous crops since the water level for each plant can change; it can only irrigate one crop. Water can be fed to crops above or below what they need. The fact that the current technology does not guarantee that the amount of water to be pumped will correspond to the amount of water required for each and every plant species in the cultivation area is another problem. The user cannot see how much water is in the container with the current technology.

LITERATURE SURVEY

[1] provides information on how to use IOT to maintain the desired soil moisture content. By automatically supplying water, this sensor system checks and maintains the correct soil moisture level. To accurately ascertain the soil's moisture content, the system makes use of soil moisture sensors. By ensuring that the systems are active, excessive or insufficient irrigation is prevented. [2] The water level in the container is determined by an ultrasonic sensor in this study. Innovative technology that will notify users of the liquid level and prevent overflow is IOT-based water level monitoring devices. [3] This article discusses how automation technology is developing at an ever-increasing rate. For ease of handling and other reasons, manual systems are being replaced by automatic systems in numerous industries and fields. One new Internet technology is the Internet of Things (IOT), is essential in the field of automation. [4] Multiple crop species can be produced at once in polyculture farming, which has the potential to use less pesticide and water while better utilizing the nutrients in the soil. Contrary to monoculture, it is significantly more difficult to automate. in preparation for the creation of automation. [5] Because it can water the plants that are in the pots or tanks, this idea uses a watering sprinkler system. This utilizes the ARM cortex-based RPI board (64 pins). It is configured such that it will detect the plants' moisture content and give water as required. This type of system is commonly used for regular crop upkeep in both mid-size small and huge landscapes. [9] In this system sensor sends signal ton rpi, on the water pump and supplies water using rotating/ sprinkler system. It is possible to program centre pivot systems to start and stop at predetermined angles or times. The foliage of a crop may become scalloped. Water of insufficient quality can cause sprinkler nozzles to clog. Sprinkler systems typically run according to time, so if we program one to turn on at 9am, even if it's raining, it will turn on at that time. [6] The paper has been worked on testing the 16 different chilli pot plants which have different soil moisture which works on supplying enough water according to the moisture level of different soil varieties. The developed system is only applicable for cayenne pepper plant. [7] When moisture levels are low, the sprinkler will activate depending on weather information, according to the system's briefing on sprinkler systems. Each crop may need a different amount of watering, and there may be multiple soils. due to the system's single crop restriction. Watering systems, such as dripper wires or sprinklers are installed in orchids or agricultural farms to water them and reduce the human intervention requirement. Sprinklers normally run on a scheduled plan, therefore even in the event of rain at 9 am, our programmed system will still activate. Water is a crucial and limited resource, and hence must be used genuinely. With this prelude, we propose a concept for a smart sprinkler system that blends automation and human communication. [12] Soil sensor is used to measure the moisture level in the soil. If the moisture level drops below a certain recommended threshold, the sprinkler gets activated automatically. In order to improve the system, we have now added a current weather report. If rain is predicted in the coming days, watering the plants may need to wait a few days, according to weather data. [8] This project shows how, along with technological advancement, food and plantation needs are rising in today's society. Similar to how water is both the most crucial resource and the hardest task to complete in a greenhouse on a daily basis. When plants need water, watering systems make it simpler to give them what they need. [10] The amount and time of watering are important aspects in this process. The purpose of the automatic irrigation system was to simplify gardening efforts for the homeowner. This design makes use of a watering sprinkler system so that it may irrigate the plants that are housed in pots. It is set up to determine the moisture content of the plants and provide water as required. This type of technology is commonly used for general plant upkeep in both mid-sized and huge farms or orchards [11].

SYSTEM OVERVIEW

Utilizing this application, users of the suggested approach can keep an eye on the crops and plants from any location. By detecting the moisture level, the technology aids the user in automatically watering plants. The technology also works to water different crops according to how much water they need. Proposed system This approach will cut down on the amount of

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time farmers must spend regularly and continuously keeping an eye on the field. It significantly reduces the demand for manpower by a large amount. The system is adopted for multiple crops from a single container source. By using the dataset of the plants we can calculate the water requirement of the plants This system will ensure the level of water to be pumped depending on the water level needed for each and every plant species in the cultivating area. Here polycropping (also called multi-cropping) is practiced when water is pumped to plants of different types based on the different water levels required by the plants. In this, the moisture in the soil will be indicated to the user and the user also has a control not to pump water. The arrangement is set up so that a soil moisture sensor can determine the crop's moisture content. The plant will receive the appropriate amount of water until it reaches the threshold value if the moisture level of the sensor is below the specified level for that particular plant. This system uses humidity and temperature sensors to monitor the system's present atmosphere and control when watering occurs. Upon receiving the data from the moisture sensor, the microcontroller triggers the solenoid valve in accordance with the required situation, controlling the water flow in the system. Additionally, the system will update its status and send a message to the users through the mobile application. The user can also have control to stop watering the plants. This system also includes the water level sensor which senses the water level in the container source. In some cases, the user may forget to refill the water container in this case the plants/crops may get an inadequate amount of water. In order to allow the user to refill the container, the suggested system also functions to show the user the quantity of water content of the container.

Advantages of the proposed system

• The system is adopted for multiple crops from a single container source

• This system will ensure the level of water to be pumped depending on the water level needed for each and every plant species in the cultivating area

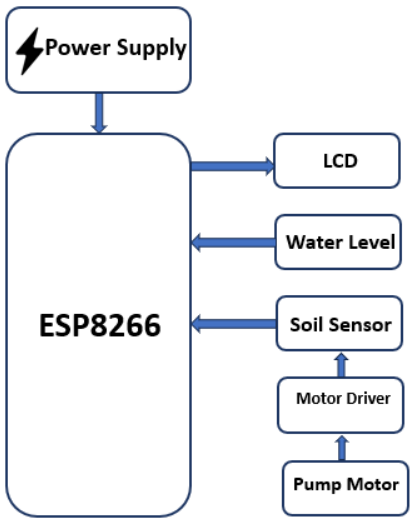
• Here multi-cropping is practiced where the water is pumped into the plants of different types based on the water level required by the plants

• It will notify the user to refill the container if there is insufficient water in it.

• The user will be shown the amount of moisture in the soil and has the option to forego pumping water to the plants.

DIAGRAM

A. Workflow Diagram



REQUIREMENTS

A. Hardware Requirements

• Soil moisture sensor: A soil wetness sensor's capacity to measure the moisture level in the soil or ascertain whether the surface around the sensor is wet or dry.

• Water level sensor The level of liquid inside a tank can be determined using a sensor. A pump, an alarm, an indicator, or other devices may use this indicate water level

• Water Pump Motor: A DC motor transforms electrical power into mechanical power. In a magnetic field, a conductor that carries current suffers torque and has a propensity to move. A DC, or direct current, motor functions in this way.

• LCD There are several applications for an LCD screen, an electronic display module. An LCD display that is commonly used in many different devices. Seven-segment LEDs and multi-segment LEDs are not as effective as these modules.

• ESP : Based on the ESP8266 microprocessor, Espressif Systems developed the microcontroller. The ESP8266 is a stand-alone Wi-Fi networking device that bridges Wi-Fi and current microcontrollers. It is capable of running solo programmes.

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B. Software Requirements

• Integrated C : Embedded C with language extensions of C. A popular application for C is "system programming," which includes the implementation of programs, because it combines a number of advantageous properties, A reduced the time of execution demand on system resources, code portability and efficiency, and the capacity to access certain hardware locations. Over-interpreted languages such as C have the advantages of stability, speed, and near universal availability.

• Web Application This system is used to monitor and control multiple agriculture areas at a time.

CONCLUSION

Using a microprocessor, numerous sensors, and other electrical instruments, an automatic plant irrigation system for precision agriculture has been developed. The proposed methodology was found to control and maintain the moisture content of soil based on the plant variety. The system is adopted for multiple crops from a single container source. This system will ensure the level of water to be pumped depending on the water level needed for each and every plant species in the cultivating area. The system will indicate all the data from the sensor to the user. The user will also receive information on the water level in the water pump, so refilling can be initiated. The system is great for reducing human intervention in irrigation system for polycrop horticulture. Further to this, farmers will be able to incorporate many field parameters to make wise judgements based on the circumstances. Applications with remote data storage and retrieval capabilities can be easily connected to the cloud.

FUTURE ENHANCEMENT

The technology works with minimal labour and offers a number of advantages. Watering is only guaranteed by the system when the soil's humidity falls below the set threshold. Water conservation is accomplished and, to a larger extent, the moisture-to-soil ratio at the root zone is kept constant due to the direct transport of water to the roots. As a result, the system is effective and adaptable to the rapidly evolving agricultural landscapes allowed by technology. The idea can be improved in the future by using image processing techniques to water the plants according to their developmental stages. In essence, this idea depends on the results of the implementation and sensing architecture.

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