EcoFarm: Fully Automated Sustainable Agriculture Module (April 2023)

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I. Aim

The aim of this project is to create a Fully Automated Sustainable Agriculture Module to provide a convenient and efficient solution for saving water on a large scale and reducing the efforts of farmers.

II. Theory

Imagine a world where water conservation is not just a duty, but a convenience and simple process. Watering plants at the right time and in the right amounts is essential for their growth and health. However, manually watering plants can be time consuming and inefficient, especially if you have a large garden or a large farm. Using sensors and technologies, our system provides a seamless solution for conserving water on a large scale. This project aims to solve this problem by making an automatic system.

Rivers are often divided into canals to provide water for agricultural purposes. However, this process of division can lead to unequal distribution of water, resulting in either water shortage or water excess in certain areas.

The unequal distribution of water can occur due to various reasons such as differences in elevation, soil types, and topography. As a result, some areas receive more water than they require, while others face a shortage of water. This can lead to various environmental and socioeconomic challenges, including reduced crop yields, land degradation, and water conflicts between different user groups.

Moreover, the farms located at the beginning of the canal may consume more water compared to those located at the end of the canal. This is because the farms at the beginning may extract more water than they actually need, and secondly, the water flow may gradually decrease as it moves downstream, making it more difficult for the farms located at the end of the canal to access sufficient water for their irrigation needs. This, in turn, can lead to reduced crop yields and economic losses for these farmers.

To address the issues of equitable and sustainable water distribution in our project, we will implement various measures that promotes efficient water use and management. By using sensors to monitor soil moisture levels and adjusting the watering schedule accordingly, we can ensure that water is distributed in a sustainable and efficient manner.

III. Instruments Required

A. Electrical Instruments:
   1. Ardiono microcontroller
   2. Temperature sensor
   3. Soil Moisture sensor
   4. Water pump
   5. Buzzer
   6. LEDs
   7. Servo motor
   8. Screen
   9. Laser Cutting (used for cut the acrylic sheet)
   10. Glue gun (used for stick the acrylic sheet with plastic box)

A. Other (Material):
   1. Plastic box
   2. Acrylic sheet
   3. Glue stick
   4. Plastic pipe

IV. Procedure

1. Connect the various sensors to the Arduino microcontroller using a breadboard and jumper wires.
2. Connect the water pump and the servo motor to the microcontroller using jumper wires.
3. Write a code that reads the sensor data and works accordingly. Use the analog input pins to read the sensor values and digital output pins to control the water pump and servo motor.
4. Use the soil moisture sensor to detect the soil moisture levels and activate the water supply system when the moisture level falls below a certain threshold.
5. Set threshold value based on the soil type and moisture level of the soil sensor and sun's intensity.
6. Use LDR for calculating the sun's intensity.
7. Write a code that works for all types of soils. The code should be able to adjust the threshold value based on the

soil type and ensure that the plants receive the right amount of water.

8. Use Servo motors to open the gate of the dam and to control the rate of water flow.
9. Connect the water pump to the microcontroller and use it to supply water to the plants from a canal
10. Use the temperature sensors to monitor the weather conditions in the surrounding environment.
11. Use an LCD screen to display the sensor readings in real-time.
12. programmed buzzer in a way that sounds an alarm to alert the user when the water level falls below a certain threshold or when the pump fails.
13. Repeat the process at regular intervals to ensure that the plants receive the right amount of water and nutrients.

V. Results

This fully automated water supply system we have designed and implemented provides an innovative solution to the problem of maintaining optimal soil moisture levels for plants and the problem of water supply to farms.

The system has ability to adjust watering schedules based on various factors such as soil moisture levels, this system offers an efficient and convenient solution for those who want to save time and effort while ensuring their plants receive the right amount of water and nutrients.

One of the key features of the system is the ability to input soil type information, allowing the code to adjust watering schedules and the amount of water supplied as needed. This ensures that the plants receive the right amount of water based on the type of soil they are planted in. Whether the soil is claye, normal, or rocky, the system can be customized to provide the appropriate amount of water required for optimal growth.

Additionally, the system incorporates an LDR to calculate the sun's intensity, allowing the code to adjust watering schedules based on the amount of sunlight the plants receive. This ensures that the plants receive the right amount of water even on days when there is less sunlight than usual, and avoids over-watering on sunny days.

Temperature sensors are included to monitor the weather conditions in the surrounding environment and real-time sensor readings are displayed on an LCD screen, providing the user with up-to-date information on the system's performance.

In case of emergencies, the system is programmed to sound an alarm through a buzzer, alerting the user when the water level falls below a certain threshold or when the pump fails. This ensures that the plants are not left without water for extended periods, which could lead to stunted growth or plant death.

With this system in place, the user can save time and effort while ensuring that their plants receive the right amount of water and nutrients.

VI. Discussion

This Project is a great example of how automation and smart technology can be utilized to solve everyday problems. The system uses various sensors to monitor the growing conditions and adjust watering schedules accordingly.

By incorporating other sensors like CO2 sensors, the system can further optimize plant growth. Additionally, solar panels can be used to power the system, making it more energy-efficient and environment friendly. To enhance the system's capabilities, a machine learning algorithm can be implemented to learn from past watering schedules and adjust future schedules based on the specific needs of each plant species.

One of the most significant advantages of this system is that it can be remotely managed through a smartphone app or a web interface. This feature provides an added level of convenience and flexibility for the user, enabling them to check the plant's status, adjust the watering schedule, and receive alerts if any issues arise.

There are numerous benefits of implementing smart technology and automation in agriculture. These systems can significantly reduce the amount of water and energy used in this process. Additionally, they can improve the health and yield of the plants, leading to higher profits for farmers and gardeners. Furthermore, smart technology and automation can significantly reduce the amount of manual labor required for gardening and agriculture, making these industries more accessible to people who may not have the time or resources.

In summary, this project demonstrates the power and potential of automation and smart technology in agriculture. It highlights how these systems can improve plant growth, conserve resources, and increase productivity while also providing greater convenience and flexibility for the user. As such, we can expect to see more innovative solutions in this area as the demand for sustainable and efficient gardening and agriculture practices continues to grow.