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Design & Development of Smart Flood Irrigation System for Better Irrigation in Agriculture field

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Abstract

A smart flood irrigation system leverages modern technologies to optimize the distribution of water across agricultural fields, ensuring efficiency and sustainability. By integrating IoT devices, sensors, and automated controls, the system monitors soil moisture, water levels, and weather conditions in realtime. Data collected from these sensors enables precise water delivery based on the specific needs of different field zones, reducing water wastage and preventing over-irrigation. This project introduces an intelligent irrigation system designed to efficiently and cost-effectively monitor mint or other plants using smart sensors. By incorporating IoT-based devices and electronic components, the system optimizes water consumption. It features a soil moisture sensor positioned in the plant's root zone, and a water flow sensor connected to a valve that regulates the water pumping motor. These sensors work in conjunction with an Arduino UNO microcontroller, a relay module, a DC water pump, and a rechargeable battery. The system functions by continuously monitoring soil moisture and automatically turning the pump on or off based on real-time soil moisture readings.
Imagine a world where farmers could optimize their irrigation processes, saving water and resources while promoting healthier crops. As global water scarcity becomes an increasing concern, innovative technological solutions in agriculture are crucial. In this paper, we will explore the Arduino Uno Grounded Automatic Factory Saddening system a fascinating project that utilizes soil humidity detectors and electromagnetic sensors to revolutionize irrigation techniques.

INTRODUCTION

Water scarcity is emerging as one of the most pressing issues that humanity faces today, and India is no exception. With a staggering 60-70% of its economy reliant on agriculture, the necessity to modernize conventional farming practices has never been more urgent. Traditional irrigation methods often lead to excessive water usage, which contributes to the depletion of ground water a critical resource. This article explores the significance of efficient water management in Indian agriculture, the challenges posed by water scarcity, and innovative solutions that can be employed to enhance productivity while conserving this precious resource.

The Importance of Water Management

Effective water management can transform the agricultural landscape by:

- Reducing water wastage
- Improving crop yields
- Enhancing resilience to drought
- Promoting sustainable practice

Implementing an efficient water management system ensures that crops receive the right amount of water at the right time, enhancing productivity while conserving resource.

PROBLEM STATEMENT

Flood irrigation is a method where fields are flooded with water to supply the crops. While this technique can be effective in certain contexts, it presents several challenges that need to be addresses Water Wastage, Soil Erosion, Crop Damage, Labor Intensity, Seasonal Limitations, Infrastructure Needs, Environmental Impact, Wild animals.

OBJECTIVES

- To save water and reduce human intervention in the agriculture field.
- Continuously Monitoring the status of sensors and provide signal for taking necessary action.
- To get the output of soil moisture sensor and provide required water to crop.
- To observe other parameters for better yield.

LITERATURE SURVEY

Numerous studies have highlighted the significance of flood irrigation system. Here, we review some key findings from existing literature:

Smart Irrigation System: A reliable smart irrigation system based on the Arduino UNO board was successfully designed and deployed. The system utilizes smart sensors to monitor the soil condition of a mint plant. The microcontroller circuit comprises an Arduino UNO, a relay, soil moisture sensor, temperature sensor, water flow sensor, motor, and battery. This fully operational system employs soil sensing technology to regulate irrigation, preventing both overwatering and under watering. It serves as a potential tool for farmers, helping them save time, reduce manual intervention, and lower costs.

A Study on Smart Irrigation System Using IoT for Surveillance of Crop-Field: The implemented automated irrigation system has proven to be both feasible and cost-effective in optimizing water resources for agricultural production. By enabling cultivation in areas with water scarcity, it enhances sustainability. This system supports farmers by making their work more efficient and intelligent.

With increasing water demand and the necessity to protect aquatic habitats, effective and affordable water conservation practices for irrigation are essential. Utilizing multiple sensors, this system ensures water is supplied only to the required areas, significantly reducing water consumption. Additionally, the system requires minimal maintenance and operates with significantly lower power consumption. As a result, crop productivity increases while crop wastage is greatly minimized.

Design of Automatic Watering System Based on Arduino: The automatic plant watering device utilizes a copper plate sensor as an electrode to measure soil resistance. This resistance is converted into an analog voltage and then into digital data, which is processed by the Arduino Uno. The upper limit for triggering the watering process is determined through trials on various soil conditions. Additionally, the use of solenoid valves is more energy-efficient compared to pumps, which consume higher electrical power.

SYSTEM ARCHITECTURE

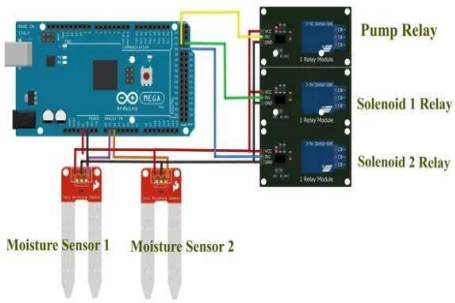

Figure1 : System Design

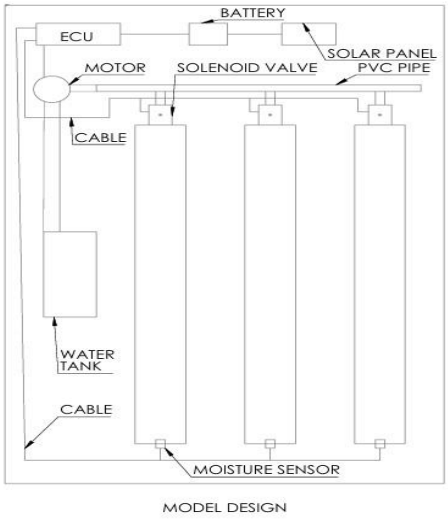

Figure 2: CAD Model

METHODOLOGY

1.Identification of Problem: Flood irrigation is a technique where fields are submerged in water to provide moisture to crops. While effective in certain situations, this method comes with several challenges, including water wastage, soil erosion, crop damage, high labor requirements, seasonal limitations, environmental concerns, and the attraction of wild animals. Addressing these issues is essential to improving irrigation efficiency and sustainability.

2.Data Available: The smart irrigation system available in the market, but this system mostly for the drip irrigation. We can adapt this system for use in a flood irrigation system.

DESIGNING THE MECHANISM

Hardware Design: In our model, we are demonstrating watering of three fields, so three soil moisture sensors are used. Depending on the number of fields the number of moisture sensors will vary. The soil moisture sensor is interfaced with the Arduino. The relay is connected with the output pins of the Arduino, the motor will turn on using relay when the value is less than the threshold value. The vice versa is applicable when value is greater than the threshold value.

Software Design: The software used in this project is Arduino. It offers various libraries that simplify programming. In our prototype, the AtMega328 controller is programmed using Arduino. The program is Arduino designates a preset range of resistance value in digital format (ranging from 0 to 1023) for all the moisture sensor. Any aberration from the set range switches ON/OFF the pump, to water the plants.

Process:

Start
↓
Read Soil Moisture Sensor
↓
Is Soil Dry? (Below Threshold)
┌──────Yes──────┐
↓ ↓
Open →Solenoid Valve No → Close Solenoid Valve
(Start Irrigation) (Stop Irrigation)
↓ ↓
Monitor Soil Moisture Again
↓
Repeat Process

4.Testing

1.Soil Moisture Sensor Testing: Insert the sensor into dry and moisturize soil and record readings. Compare sensor values with a reference moisture meter.

2. Water Flow Control Testing: Send a signal to activate the valve and check the water flows properly. Turn off the valve and verify the water stops flowing.

3.Microcontroller Testing: Test digital/analog input and output ports for correct operation. Simulate different moisture levels and check the controller triggers the irrigation system correctly.

RESULT

The system will automatically irrigate each field based on soil moisture levels. The irrigation becomes easy and accurate. Our project is only for 3 field, but we can upgrade it more fields for farmer and investors. With the help of this project, consistent moisture levels lead to better growth and higher yield. Reduced water stress means less plant disease and faster growth.

CONCLUSION

This system serves as a promising solution to the challenges of manual irrigation in farming. A moisture monitoring system has been designed to track soil moisture levels. The proposed system can automatically turn off the water supply or motor based on these moisture levels, effectively automating the irrigation process one of the most time-consuming tasks in agriculture.

By utilizing data from soil moisture sensors, the system ensures optimal irrigation, preventing both over-irrigation and under-irrigation, thus reducing the risk of crop damage. This project demonstrates

that integrating IoT and automation in farming can lead to significant advancements. Ultimately, the system enhances water resource efficiency, offering a practical alternative to traditional manual irrigation methods.

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