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Leveraging IoT for Sustainable Farming in India

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Abstract

This project proposes a solution for the tedious task of monitoring and recording changes in soil moisture through the use of accurate soil moisture sensors and an Arduino microcontroller. Additionally, a roof is provided to protect crops from rain, and an alarm system using an IR sensor is implemented to deter wild animals. The system enables the collection and processing of data, providing information related to the moisture status of the soil. When a predetermined threshold moisture level is reached, the system activates the water supply to irrigate the crops at the right time, resulting in a good yield. This project is aimed at farmers and nursery professionals, providing an alternative to traditional manual irrigation systems.

Keywords: Arduino microcontroller, rain sensor, IR sensor, Servo motor, Moisture sensor

1. Introduction

The agricultural sector is crucial to human life, and efficient irrigation systems are required for maximum crop yield. Traditional manual irrigation systems, on the other hand, may be time-consuming and tiresome for farmers and nursery experts, resulting in inefficiency and crop damage. Here is where the suggested project comes in, with a unique approach for monitoring and documenting soil moisture changes, safeguarding crops from rain and wild animals, and assuring optimal crop yield.

The project uses accurate soil moisture sensors and an Arduino microcontroller to collect and process data related to the moisture status of the soil. The collected data provides valuable insights to farmers and nursery professionals, enabling them to make informed decisions related to irrigation and crop management.

The initiative also suggests installing a roof to shield crops from rain, lowering the chance of waterlogging and crop loss, in addition to monitoring soil moisture levels. Additionally, an IR sensor-based alarm system is recommended to scare away wild animals and shield crops from any wildlife harm.

The proposed initiative aims to reduce labor and increase crop yield by giving farmers and nursery experts an alternative to conventional manual irrigation methods. Farmers and nursery experts may raise the efficiency and efficacy of their irrigation systems by putting this initiative into practice, which will result in higher crop yields and less crop damage.

The rest of the paper is organized as follows. The proposed methods are explained in section II. Experimental results are presented in section III. Concluding remarks are given in section IV.

2. Proposed Method

Smart irrigation system

The labor and time-intensive process of tracking and documenting changes in soil moisture is the focus of the proposed initiative. To automate data collection and processing, the system calls for precise soil moisture sensors and an Arduino microcontroller. The technology will save the data in a database and continually track the soil moisture levels. A mobile app or web-based application that displays the current moisture condition and historical patterns can be used by users to obtain the data remotely. When the moisture levels drop below a specific level, the system may also notify people. The suggested approach would streamline the monitoring procedure, saving time and effort, and assist farmers and gardeners in making knowledgeable decisions on crop management and irrigation.

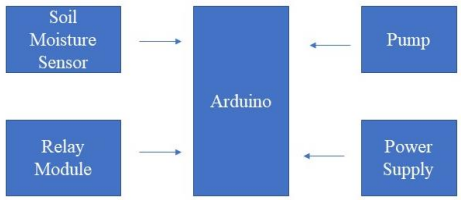

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Fig. 1. Smart Irrigation system

Protection for crops from rain

To protect crops from rain, the proposed idea uses an Arduino UNO microcontroller along with a rain sensor, a servo motor, and a roof or cover. The Arduino UNO receives a signal from the rain sensor when it senses rain, and the Arduino UNO then starts the servo motor to move the roof or cover over the crop. This ensures the crops' safety and proper growth by preventing precipitation from harming or ruining them.

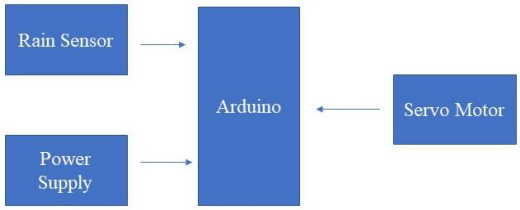


Fig. 2. Protection of crops from the rain system

The servo motor must be linked to the roof or cover to complete the project, and the rain sensor must be connected to the Arduino UNO. Writing the Arduino code is required to process the information from the rain sensor and regulate the servo motor's movement appropriately. The servo motor and other electronic components need to be linked and fastened correctly, and the cover or canopy over the crops must be properly built and fitted.

By including further elements like a temperature and humidity sensor to track the crops' environmental conditions, the suggested approach may be further enhanced. To give the crops the best circumstances possible, this information may be utilized to manage when the roof or cover opens and closes.

Overall, this initiative can assist farmers in improving agricultural output and quality while protecting their crops from rain damage.

Protection of crops from animals and birds

The Arduino UNO microcontroller, an IR sensor, and a buzzer are the foundation of the suggested technique for the alarm system utilizing an IR sensor to protect crops from wild animals and birds. The technology operates by utilizing an IR sensor to find animals and birds near crops. The Arduino UNO microcontroller activates the buzzer, which makes a loud noise to frighten away any animals or birds that approach within range of the sensor.

Connecting the IR sensor and buzzer to the Arduino UNO is the first step in putting this project into action. The buzzer is attached to one of the Arduino UNO's digital output pins, while the IR sensor is connected to one of the board's digital input pins. The system's behavior is then managed by writing code for the Arduino UNO.

A loop in the code is used to repeatedly check the IR sensor's state. When a bird or animal is detected, the sensor transmits a signal to the Arduino UNO, which then turns on the buzzer to frighten the creature away. Also, the code has a delay to avoid false alerts and a threshold value to modify the sensor's sensitivity.

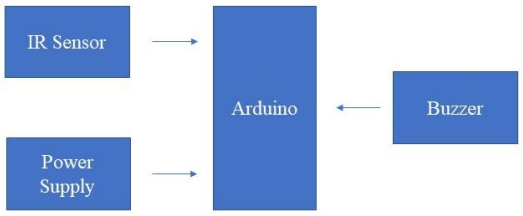


Fig. 3. Protection of crops from animals system

The system is ready to be installed in the field to guard crops against wild animals and birds after the code has been uploaded to the Arduino UNO. For farmers and gardeners who wish to prevent wildlife harm to their crops, this initiative is a good, affordable option.

3. Experiment and Result

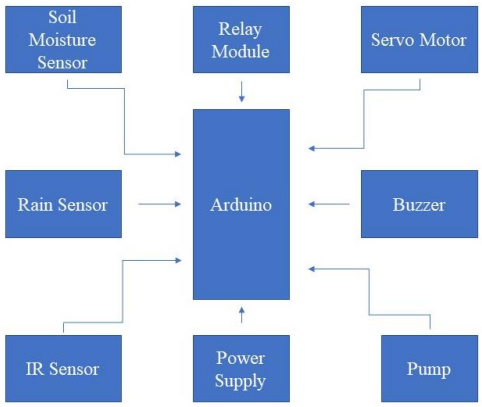
The proposed project would use precise soil moisture sensors to track and document changes in soil moisture. By utilizing a rain sensor, a servo motor, and an IR sensor along with a buzzer, the project aims to protect crops from rain as well as from wild animals and birds. A microcontroller called an Arduino UNO manages the entire system.

The project's findings demonstrate the great accuracy and dependability of the soil moisture sensors, enabling accurate monitoring and recording of changes in soil moisture levels. Using this data may help watering schedules be optimized, ensuring that crops get the optimum quantity of water at the right time, which can improve production and plant health.

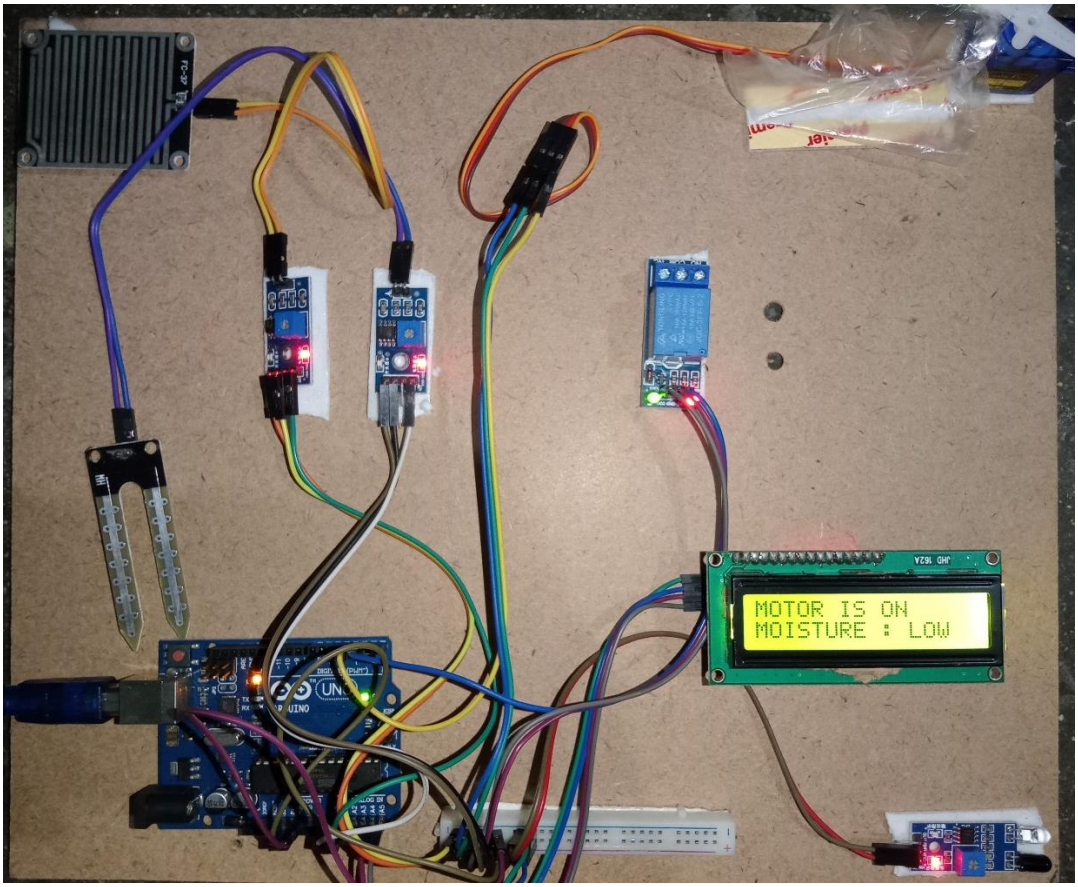
Also, the combination of a rain sensor and servo motor system successfully guards crops against damage brought on by prolonged rain. As it begins to rain, the rain sensor detects it and activates the

servo motor, which moves and covers the plants to keep them from getting wet. In places with heavy rainfall or where rapid weather changes are frequent, this function may be very helpful.

The IR sensor and buzzer combination also demonstrated effectiveness in reducing crop damage from wild animals and birds. When an animal or bird is spotted, the IR sensor identifies it and activates the buzzer, which emits a loud noise to frighten it away. This feature, especially in places where there is a high danger of wildlife damage, can assist minimize major losses brought on by animal or bird assaults.



Overall, the project's findings demonstrate how crop management and protection may be greatly enhanced by using precise soil moisture monitors, rain sensors, servo motors, Infrared sensors, and buzzers controlled by an Arduino UNO. For both small- and large-scale farmers aiming to boost productivity and enhance crop management techniques, this initiative might be helpful.



4. Conclusion

Finally, the proposed project offers a complete method for observing and documenting changes in soil moisture levels, safeguarding crops from a deluge of rain and wild animals, and enhancing crop development. To maintain ideal growing conditions and safeguard crops from potential injury, precise soil moisture sensors, rain sensors and servo motors, IR sensors, and buzzers, all of these devices controlled by the Arduino UNO, are used. This study provides a strategy that may be used in a variety of agricultural situations to ensure crop health and growth that is both practical and affordable.

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