IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 2, August 2023

Automated Irrigation System for Crop Based Agriculture

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Abstract: *The use of irrigation in agriculture is crucial for ensuring crop growth and productivity. However, traditional manual irrigation methods employed by farmers in India often lead to inefficient water usage and crop damage. This paper aims to address these challenges by developing a sensor-based automated irrigation system. The proposed system aims to reduce water requirements and enhance productivity, making it particularly suitable for regions where water scarcity is a pressing concern. The current manual control irrigation process often results in excessive water consumption, delayed water supply, and detrimental effects such as increased energy usage and higher water costs. By implementing a sensor-based automated irrigation system, precise control over water management can be achieved. The system utilizes sensors to monitor soil moisture levels, weather conditions, and crop water requirements in real-time. Additionally, the system promotes crop health and yield by maintaining optimal soil moisture levels, minimizing the risk of crop stress and damage.*

Keywords: Sensor based irrigation, moisture levels, crop health

I. INTRODUCTION

Irrigation is an essential practice in agriculture, and different types of irrigation systems are available, ranging from traditional methods to modern equipment and techniques. Each system has its own advantages and disadvantages, but the overall objective is to provide efficient water management that helps farmers irrigate their crops and improve yields. However, several challenges arise during the irrigation process, such as snake bites, electric cable tripping, and nocturnal animal attacks, which not only impact farmers' sleep cycles but also pose risks to their well-being. Additionally, the scarcity of electricity in rural areas often compels farmers to irrigate their land predominantly at night. To address these issues, this paper proposes an adjustable irrigation system that takes into account seasonal variations. By implementing an automatic irrigation system with predefined threshold values, the proposed solution ensures that crops receive adequate water without human intervention. This automation not only simplifies the irrigation process but also eliminates potential damage to plants. Moreover, by utilizing the system's adaptability to different seasons, farmers can cultivate a diverse range of crops throughout the year, maximizing their agricultural output. This paper presents the design and implementation of the proposed irrigation system, highlighting its benefits in mitigating common challenges faced by farmers, optimizing water usage, and protecting crops from fungal infections.

II. LITERATURE REVIEW

The authors in [1-3] present an automatic irrigation system based on the Arduino UNO microcontroller board. The Arduino UNO board serves as the central controller, receiving inputs from various sensors such as soil moisture sensors and temperature sensors. Based on the sensor readings, the system determines the water requirements of the plants and triggers the irrigation process accordingly. The authors in [4] present an automatic irrigation system based on Arduino for monitoring and controlling irrigation processes using SMS(Short Messaging Service) communication. The system aims to provide a convenient and efficient way to monitor and irrigation system remotely.

Automatic irrigation system proves to be very helpful for those who go in the fields to check if irrigation has been done properly at nights in rural areas. If designed properly, automatic irrigation systems can be very effective and can help in water conservation. The farmer can leave his farm without any hassles and ensure optimum irrigation of his crops. The problem with irrigation using a pipe or with sprinkler system is, it wastes lot of water and none of these methods target the roots of the plants, and the water moisture absorption happens through roots. Automatic irrigation systems can be designed in a way which gives required amount of water in a targeted area, and which will also promote water conservation. To overcome this challenge, an automated irrigation system is proposed for crop farming that is low-cost, user-friendly. The rest of the paper discusses the proposed system, hardware and software requirements, implementation and results.

2.1 Background

A. **Traditional Irrigation Methods:**

1. Level Basin Method: In this technique the top end of the field is applied with water where it will flow over the whole field. After the water reaches the end of field it starts to run ofto pond.
2. Furrow irrigation method: This irrigation basin is used in the production of vegetables. The whole field is not filled with water rather than water is applied in furrows. Furrows are sloping channels which are formed in the soil.

Disadvantages of using traditional irrigation methods:

- Large amount of water is used in above irrigation techniques.
- Requires high labor.
- Net yield or productivity is also not high.
- Disrupts the ground water table.

B. Modern Irrigation Methods:

1. Sprinkler Irrigation Method: Sprinkler irrigation is a method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then spread into the air through sprinklers so that it breaks up into small water drops which fall into the ground.
2. Drip Irrigation Method: In this irrigation system, a small amount of water is applied at frequent intervals in the form of water droplets through perforations in plastic pipes or through nozzles attached to tubes spread over the soil to irrigate a limited area around the plant. A precise amount of water equal to the daily consumptive use or the depleted soil water needs to be applied. The soil water can be maintained at the field capacity during the crop growing period. Deep percolation losses can be completely prevented and the evaporation loss is also reduced. Drip irrigation requires about half of the water needed by sprinkler or surface irrigation. When compared with overhead sprinkler systems, drip irrigation leads to less soil and wind erosion.

2.2 Proposed System

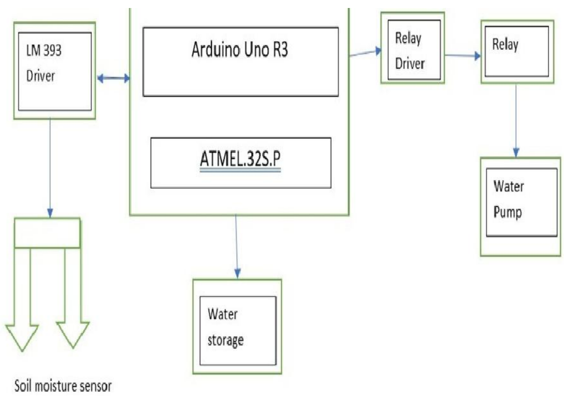

Fig 1 : Block Diagram

The sensors are mounted at a depth of 1 feet near crops in the farm. The supply is connected to a 9V battery. The moisture sensor after sensing the output provides the analog output to check the water level in the ground. These measured values then are fed to the controller in the form of voltages. An average threshold value will be set according

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to the seasonal requirement and the requirements of the crops with help of conduction charts and thus the water requirement will be defined. Then the moisture sensor connected to the circuit will display the message regarding the soil moisture content, availability of water in the tank etc. Placing of water level detectors in the water body like tanks, wells etc. will be done with indications of high, medium and low values. If the value is below medium level, the pump will not start and indicate a necessity of water to the user which will help the user take necessary actions.. This will thus warn the user to arrange a separate water source for watering before the plant within 5 hours which is its stress sustainable limit beyond which it will start wilting.

The different conditions required are follows:

1. If the moisture level is below threshold value
2. Whether the water level is adequate.
3. If yes then the motor will start otherwise user will display the message of failure due to scarce water resources with a deadline of 4 hours

The water supply will be provided at night as the rate of evapotranspiration is the lowest at that time i.e. between 10 p.m-5a.m. Thus this sensing will be monitored after every 5 hours. This monitoring will be done through RTC which will store the given dates and time of the last sensed output and previous data also. It thus gives us a chance to monitor these values over a period of certain days depending on plant growth and thus provide the requisite amount of water to the plants to prevent stress. The watering will stop after the plant is adequately watered and thus ensure a maximum crop yield with meticulous use of water resource and preserving soil nutrients.

2.3 Implementation

Hardware Implementation

A. SOIL MOISTURE CONTENT

Moisture sensor measures the water level in the soil. It uses dielectric constant or contact, electrical resistance, with neutrons as a proxy for moisture. The relationship between measured properties may change depend on environmental factors such as temperature or electrical conductivity and soil type.

B. PUMP MOTOR

The pump may be a common mechanical device, so the main function of this device is to move a gas otherwise fluid forward during piping. It is used to draw water from low pressure level to high level. It converts the energy flow from the engine to the fluid. Pumps use mechanical energy to inject fluid and expel it by compressing it.

C. ARDUINO

Fig 2 Arduino Board

The Arduino Uno is a microcontroller board taking into account the ATmega328. It has 14 computerized info/yield pins (of which 6 can be international Journal of Advanced Technology and Innovative Research Volume.08, IssueNo.04, April-2016, Pages: 0635-0642 utilized as PWM yields), 6 simple inputs, a 16 MHz clay resonator, a USB association, a force jack, an ICSP header, and a reset catch. It contains everything expected to bolster the microcontroller; just join it to a PC with a USB link or power it with an AC-to-DC connector or battery to begin. The Uno contrasts from every former board in that it doesn't utilize the FTDI USB-to-serial driver chip. Rather, it includes the Atmega16U2 (Atmega8U2 up to versionR2) modified as a USB-to-serial converter

The water level sensor is a device that measures the liquid level in a fixed container that is too high or too low. According to the method of measuring the liquid level, it can be divided into two types: contact type and non-contact

DOI: 10.48175/IJARSCT-12734

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type. The input type water level transmitter we call is a contact measurement, which converts the height of the liquid level into an electrical signal for output. It is currently a widely used water level transmitter.

It acts a switch to the circuit. If the tank has no water, the tank sensor is in off position, then the circuit will not be turned on

Software Implementation

The software implementation is done through C++ programming language using any of the compiler platforms like VS code, Online gdb etc. The flowchart shown here givesus a rough idea about how the program works.

- The operation is started.
- The program signals the microcontroller to check ifwater is present in the tank through the water level sensor.
- If the water is present the program directs the micro-controller to check if soil is dry or not, else symbolizesthat no water is present.
- If the soil is found to be dry by the soil moisture sensorthen motor is switchedon by the power supply of battery.If not, it symbolizes that soil is moist.
- The system is stopped until the soil is dry again. Flowchart is detailed in Fig 3

D. WATER PUMP

Water pumps are a critical component of an automatic irrigation system as they are responsible for moving water from the source to the irrigation system. In an automatic irrigation system, a water pump is used to ensure that water is delivered to the plants at the right time and in the right amount.

E. RELAY

Relay is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit

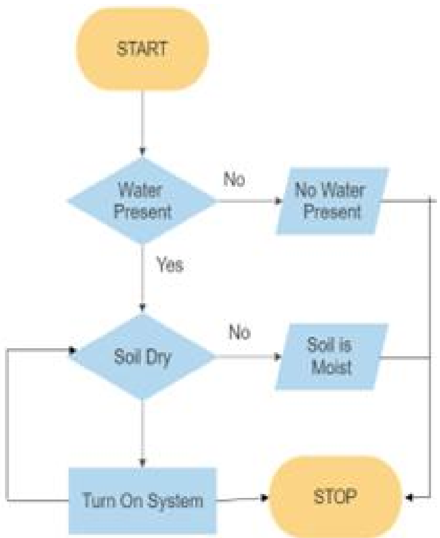

Fig 3 Flowchart of the software implementation

Table 1. COMPARISON OF DIFFERENT CROPS AND THE REQUIRED MOISTURE CONTENT

Crop Season	Crops	Moisture Content
Kharif	Rice	450-700mm
Kharif	Maize	500-800mm

Kharif	Sugarcane	1500-2500 mm
Kharif	Ground nut	500-700mm
Rabi	Wheat	456-650mm
Rabi	Oats	456-650mm
Rabi	Mustard	400mm
Rabi	Pea	350-500mm
Zaid	Pumpkin	25-30mm
Zaid	Strawberry	26-35mm

III. RESULTS

There have been several similar projects but this project has an edge over other projects as it is possible to adjust the threshold of the system and grow other crops in different seasons and increase the outcome and yield from the land.

Fig 4. Setup of the Proposed system

Fig 5. Setup when the tank is empty

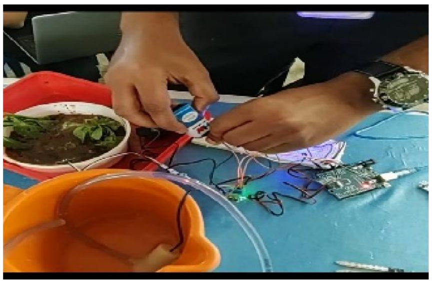

Fig 6. Water flows into the soil in case of low moisture content

Fig 7. Two glowing lights indicatesoil is moist enough and no water flows.

IV. CONCLUSION

The implementation of an irrigated automation system has proven to be a feasible and cost-effective solution for optimising water resources in agricultural production. The system offers significant benefits, particularly in regions facing water scarcity, by enabling cultivation and improving overall sustainability. One of the key advantages of this automated irrigation system is its adaptability to specific crop requirements. By adjusting the irrigation parameters, farmers can ensure that the crops receive appropriate amount of water, leading to improved yields and reduced water wastage. Additionally, the system requires minimum maintenance, making it a practical and an efficient choice for farmers. In conclusion, the automated irrigation presented in the study offers a practical solution for optimising water usage, maximum crop yields, and promoting sustainable agricultural practices. This paper demonstrates the basic idea of automated irrigation system which could be improved to a great extent by integrating it with a mobile application. The mobile application could be tailored in such a way that it could cater to the farmers' needs. Mobile application could include an option of wireless connectivity to facilitate remote irrigation, temperature monitoring, information about hydrological properties of different types of soil and then evapotranspiration which could turn out to be a boon in the field of modern irrigation methods in agriculture

REFERENCES

[1]. Taneja, K. and Bhatia, S., 2017, June. Automatic irrigation system using Arduino UNO. In 2017 International Conference on Intelligent Computing and Control Systems (ICICCS) (pp. 132-135). IEEE.

[2]. Devika, C.M., Bose, K. and Vijayalekshmy, S., 2017, December. Automatic plant irrigation system using Arduino. In 2017 IEEE international conference on circuits and systems (ICCS) (pp. 384-387). IEEE.

[3]. Doraswamy, B., 2016. Automatic irrigation system using Arduino controller. Int. J. Adv. Technol. Innovative Res, 8(4), pp.635-642.

[4]. Yasin, H.M., Zeebaree, S.R. and Zebari, I.M., 2019, April. Arduino based automatic irrigation system: Monitoring and SMS controlling. In 2019 4th Scientific International Conference Najaf (SICN) (pp. 109-114). IEEE.

[5]. Prasojo, I., Maseleno, A. and Shahu, N., 2020. Design of automatic watering system based on Arduino. Journal of Robotics and Control (JRC), 1(2), pp.59-63.

[6]. Shiraz Pasha, B.R. and Yogesha, D.B., 2014. Microcontroller based automated irrigation system. The International Journal Of Engineering And Science (IJES), Volume3, (7), pp.06-09.

[7]. Kansara, K., Zaveri, V., Shah, S., Delwadkar, S. and Jani, K., 2015. Sensor based automated irrigation system with IOT: A technical review. International Journal of Computer Science and Information Technologies, 6(6), pp.5331-5333.

[8]. Divani, D., Patil, P. and Punjabi, S.K., 2016, April. Automated plant Watering system. In 2016 International Conference on Computation of Power, Energy Information and Communication (ICCPEIC) (pp. 180-182). IEEE.

[9]. Kamelia, L., Ramdhani, M.A., Faroqi, A. and Rifadiapriyana, V., 2018. Implementation of automation system for humidity monitoring and irrigation system. In IOP Conference Series: Materials Science and Engineering (Vol. 288, No. 1, p. 012092). IOP Publishing.