https://doi.org/10.46335/IJIES.2025.10.4.2 **e-ISSN: 2456-3463**
Vol. 10, No. 4, 2025, PP. 7-10

International Journal of Innovations in Engineering and Science, www.ijies.net

Agriculture Automation Automatic Water Control System In Farm

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***Received on**: 13 March, 2025* ***Revised on**: 16 April,2025* ***Published on**: 18 April,2025*

Abstract- *In this article, we proposed an integrated application of automatic moisture and Irrigation control using Real-Time Clock (RTC) and Light-Dependent Resistor (LDR). The main idea of this Project is predicated on using as little energy as possible. In this work, we use the DS1307 realtime clock module to automatically switch on or off motor dependent on the time of day. Programming controls the timing of when the device is active. The most significant benefit of the proposed design is the reduction of risk associated with potential crashes and save water. Motors on the farm are often switched on at dry time and left OFF on wet conditions till necessity. Their operation is entirely automatic. Because of the protection of the farmers from the electrical shock during the rainy season, this proposed design intends to automate the operation of soil monitoring and irrigation in order to reduce water, power consumption and advance technological progress in agriculture farms and support in smart India. This system automates farm irrigation using microcontrollers to monitor and control water flow. It optimizes water usage, reduceslabor, and promotes healthy plant growth. Key features include real-time monitoring, automated irrigation, and remote access. Benefits include water conservation, improved crop yields, and increased efficiency*

Keywords *–Smart Agriculture, water control, farm*

1. INTRODUCTION

Agriculture is the backbone of many economies, and with the rising demand for food and the scarcity of natural resources like water, improving farming efficiency has become a necessity. One significant step in this direction is Agriculture Automation, particularly in irrigation systems. The Automatic Water Control System is a modern solution that optimizes water usage based on real-time data such as soil moisture, temperature, and weather conditions. In this project/report, we explore the design, components, functionality, and benefits of an automatic water control system in a smart farming environment. An automated water control system in agriculture uses automated irrigation controllers to precisely manage water application, optimizing water usage and reducing labor costs. This system employs, microcontrollers, and automated valves to monitor and manage water distribution acrossthe farm. It eliminates the need for manual watering, reducing labor costs, preventing water wastage, and ensuring crops receive the right amount of water at the right time. Such systems not only support sustainable agriculture but also improve crop yield and resourcemanagement. Automated Irrigation Systems: Automated irrigation systems play a crucial role in optimizing water usage and ensuring efficient crop growth. Literature on automated irrigation systems focuses on sensor-based technologies for measuring soil moisture, real-time data acquisition, and control mechanisms for water pumping. Its main purpose is to save water, keep plants and soil irrigated and without much of human support. A sensor will gather various readings from soil and based on moisture present, pump will turn on. It will be used to Irrigate land automatically.

2. LITERATURE SURVEY

Automatic water control systems have become a cornerstone of precision agriculture due to their potential to optimize irrigation schedules, conserve water, and improve crop yields. This review highlights key

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innovations and research trends in this field. Traditional irrigation methods often result in overuse or underuse of water, especially in regions with limited resources. Patil and Kale (2016) emphasized that manual irrigation systems are laborintensive and inefficient. Automated irrigation systems minimize human intervention and use realtime data to irrigate only when necessary. The integration of soil moisture, humidity, and temperature sensors allows systems to assess the soil and climatic conditions. Gutiérrez et al. (2014) demonstrated that a sensor-based system could save up to 40% of water while maintaining crop health. These sensors are typically connected to microcontrollers like Arduino or Raspberry Pi to automate water release based on sensor thresholds. Remote control capabilities using GSM modules or IoT platforms are increasingly common. Kumar and Patel (2017) implemented a GSM-based irrigation system allowing farmers to control pumps via SMS. Further

integration with IoT platforms such as Blynk and ThingSpeak provides live monitoring and analytics, significantly improving usability and reliability. Relay modules connected to microcontrollers are used to switch water pumps automatically. Shinde and Kadam (2018) designed a soil-moisture-responsive system using

1. Arduino and relays, automating irrigation and reducing manual effort, especially in large-scale farms. Sustainability in remote regions is supported by solar-powered systems. Meena et al. (2020) explored the feasibility of solar-powered automation, showing that they reduce dependency on grid electricity and are eco-friendly solutions for off-grid farming. Common challenges include sensor calibration drift, unstable GSM network connectivity, and the high initial cost of deployment. Addressing these barriers through cost-effective components and robust wireless communication is crucial for widespread adoption (Singh & Sharma, 2021). The literature suggests that automatic water control systems incorporating sensor data, GSM communication, and renewable energy sources significantly enhance water use efficiency. While the technologies are promising, further research is needed to make them cost-effective, userfriendly, and scalable for small and marginal farmers

2. CHALLENGES IN AGRICULTURE INDUSTRY

- Deficient production information.
- Less knowledge about the weather forcast.
- Not enough sales distribution information.
- Poor ICT(Information and Communication Technology) infrastructure and ICT illiteracy.
- Lack of awareness among farmers about the benefits of ICT in agriculture.
- Marketing research skills and research centre.
- Drastic changes in the climatic conditions
- Lack of interest in agriculture profession among young and educated professionals.
- High cost machineries for work.
- More manual work.
- Keeping a track of record manually.

3. METHODOLOGY:

Require component

Hardware	**Description**
Arduino UNO	Main microcontroller
GSM Module SIM800I	For remote SMS-based communication
Relay Module (Single Module)	To switch the solenoid valve
Solenoid Valve	Controls water flow
Power Supply (5v Adopter)	For supply Arduino uno
Connecting Wires, Breadboard	For connections
Voltage buck converter	Step-down voltage regulator

Methodology:

1. Sensor Network:

A network of sensors monitors soil moisture, weather (temperature, humidity, rainfall), and potentially other parameters like plant health.

2. Data Collection and Processing:

Sensors transmit data to a central control unit (e.g., a microcontroller, Raspberry Pi, or cloud-based platform).

3. Irrigation Control:

The central unit analyzes the data and, based on pre-programmed algorithms or AI-powered models, controls irrigation by activating or deactivating water pumps, solenoid valves, or other actuators.

4. Real-time Monitoring and Adjustment:

The system allows farmers to monitor irrigation in real-time and make adjustments as needed, either manually or through the automated system.

5. Types of Systems:

Smart Drip Irrigation: Delivers water directly to the root zone, controlled automatically by sensors.

Sprinkler Automation: Operates sprinklers based on crop needs and weather conditions.

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Precision Center Pivot Systems: Used in large fields, with automated pivots irrigating in a circular pattern.

Benefits:

Water Conservation: By irrigating only when and where needed, the system reduces water waste.

Reduced Labor Costs: Automation minimizes manual labor required for irrigation.

Improved Crop Yields: Precise irrigation ensures optimal moisture levels for healthy crop growth.

Cost Savings: Reduced water usage and labor costs can lead to significant savings for farmers.

Sustainability: By optimizing water use, the system contributes to more sustainable agricultural practices.

Example Technologies:

Soil Moisture Sensors: Measure the moisture content of the soil.

Weather Sensors: Collect data on temperature, humidity, rainfall, and sunlight.

Solenoid Valves: Control the flow of water to different irrigation zones.

Water Pumps: Deliver water to the irrigation system.

Microcontrollers (e.g., Arduino, Raspberry Pi): Process sensor data and control actuators.

IoT (Internet of Things): Enables remote monitoring and control of the system.

AI (Artificial Intelligence): Can be used to develop sophisticated irrigation models that optimize water usage.

Key Considerations:

System Cost: The cost of automated irrigation systems can vary depending on the size and complexity of the system.

Maintenance: Regular maintenance of sensors and other components is essential for reliable operation.

Integration with existing infrastructure: The system may need to be integrated with existing irrigation systems.

Data Accuracy: Accurate sensor data is crucial for effective irrigation control.

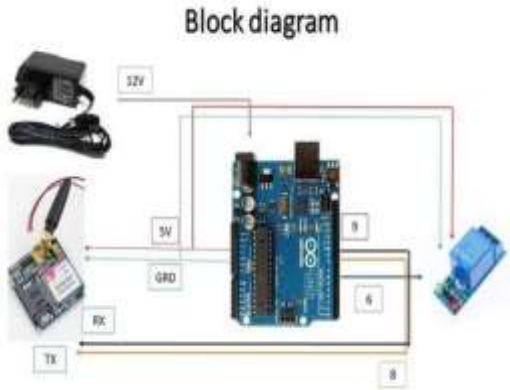

Figure 3.1

RESULTS AND DISCUSSION

At this stage the system is ready to be tested, first reconnect the power back to the sim900, then use the adapter to power the Arduino. Then power on the system and wait until the GSM pairs with the network. First send SMS ON to the system and notice the change in behavior on the relay module, then send SMS OFF to the system and check out the change in the relay module. In order to check the state of the system send SMS STATE and the system will relay by relay on or off. This system is easy to be configured and it is very useful to control remotely Any electric or electronic device. I hope you enjoy this topic and if you have any issue please do not hesitate to send. All thebest

comes, including optimized water usage, reduced labor costs, and improved crop health. These systems help farmers deliver the right amount of water to crops, minimizing waste and promoting uniform growth, as well as enabling remote monitoring and control.

Water Conservation:

Automated systems can be programmed to deliver water based on specific crop needs and environmental conditions, leading to significant water savings compared to manual irrigation methods, which can be up to 30%.

Reduced Labor Costs**:**

Automation eliminates the need for manual labor to operate irrigation systems, saving time and resources. Farmers can control the system

remotely through mobile devices, streamlining operations.

Improved Crop Health and Yield:

Uniform water distribution ensures that crops receive the right amount of water, preventing stress and promoting healthy growth. This can lead to increased yields and higher financial returns for farmers.

Enhanced Efficiency:

Automated systems provide real-time monitoring of soil moisture, weather conditions, and system performance, allowing farmers to make informed decisions and optimize irrigation practices.

Environmental Benefits:

By minimizing water wastage and runoff, automated irrigation systems help to protect water resources and reduce environmental impact.

Increased Crop Productivity:

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Optimized water delivery can enhance crop growth, leading to higher yields and improved quality.

Final testing diagram

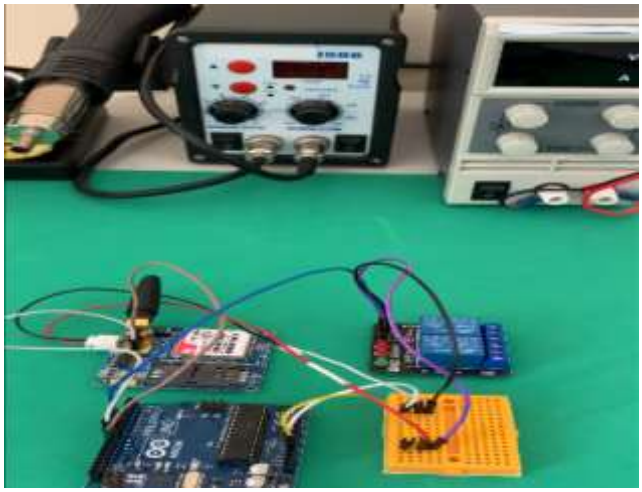

Figure 3.2 testing Diagram

4 CONCLUSION

The implementation of an automated water control system in agriculture significantly enhances irrigation efficiency, conserves water, and reduces manual labor. This project successfully demonstrated that microcontrollers (e.g., Arduino) can automatically regulate water flow based on real-time water condition. The integration of automation not only optimizes water usage but also promotes sustainable farming practices. With further development and scaling, this system can be adapted to various crop types and climatic conditions, contributing to precision agriculture and

improving crop yield. Integrating automatic water control systems with other farm automation systems, such as precision farming and crop monitoring, to create a comprehensive farm management system.

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