International Journal of Trendy Research in Engineering and Technology
Volume 9 Proceedings of NCIES-25
ISSN No. 2582-0958

SOLAR POWER IRRIGATION SYSTEM

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Abstract

The Solar-Powered Irrigation System aims to maximize the use of water in agriculture by automating the irrigation process depending on the moisture content of the soil, employing solar power as a sustainable source of energy. Conventional irrigation systems tend to result in overwatering or underwatering, leading to inefficiency and wastage of water. To solve this problem, this project employs a soil moisture sensor to detect the water content in the soil and automatically turn on the irrigation system only when needed. The system runs completely on solar power, which makes it cost-effective and eco-friendly. In the system, a solar panel charges a battery that supplies power to the soil moisture sensor, relay, and water pump. The sensor measures the moisture level in the ground. If the moisture level goes below a certain level, showing that the soil is dry, the sensor will trigger a relay module, which, in its turn, drives the irrigation pump to irrigate the soil. When the moisture level is enough, the relay is deactivated so that unnecessary water flow is prevented. Interestingly, the system does not use a microcontroller, streamlining the design by connecting the digital output This direct connection makes the system more straightforward and economical while guaranteeing efficient water consumption. The use of solar power by the system makes it a perfect solution for areas with limited electricity supply, offering an independent, sustainable irrigation solution .The project shows that solar energy and basic sensing technology can be combined to develop an efficient, automatic irrigation system that saves water and minimizes the use of traditional manual irrigation methods. The union of renewable energy and soil moisture sensing is an effective solution for intelligent, water-conserving agricultural practices.

Key words — Soil Moisture; Solar Power; Relay Module; Sustainable Source.

I. INTRODUCTION

Figure 1: Solar Power Irrigation System

Solar energy is the most ubiquitous source of energy on the globe. Solar power is not only a solution to the current energy crisis but also an ecofriendly source of energy. Photovoltaic generation is an effective method for harnessing the solar energy. Solar panels (a group of photovoltaic cells) are now widely utilized for operating street lights, for energizing water heaters and to satisfy household loads. The price of solar panels has been reducing steadily which promotes its use in different industries. One such use of this technology is applied in irrigation systems for agriculture.

Solar powered irrigation system can prove to be an appropriate solution for farmers in the current state of energy crisis in India.One of the biggest problems that the agricultural industry is confronted with today is water scarcity. Conventional irrigation practices tend to lead to wastage of water through over-irrigation, water distribution inefficiencies, and manual monitoring. With growing demand for food globally, there is a need to implement more efficient water management practices. Automatic irrigation systems, based on sensors detecting the moisture levels of the soil and initiating irrigation accordingly, present a sustainable option to this issue. But they have the limitation that they are mostly dependent on an external power source, which is not readily available in rural pockets or in areas with sparse electricity supply. In response to these problems, the Solar-Powered Irrigation System was created. This project will integrate renewable solar energy with automatic irrigation technology to provide an efficient, environmentally friendly, and affordable water conservation solution in agriculture. The system utilizes a solar panel to charge a battery, which powers the entire irrigation system, the soil moisture sensor, relay module, and water pump. Since it depends on solar power, the system is autonomous and can run on its own, even in remote areas.

II. LITERATURE REVIEW

Water pumping is highly applied in irrigation systems by numerous farmers globally. Irrigation technologies evolve very fast from conventional irrigation activities that are largely reliant on farmers to new farm equipment which makes use of different machines and systems for pumping water and plantation. In research paper it mentions that, it conserves electricity by minimizing the use of grid power and saves water by minimizing water losses. They suggest an automatic irrigation system based on solar power which operates water pumps to pump water from bore well to a tank and the outlet valve of tank is controlled automatically using controller and moisture sensor to regulate the flow rate of water from the tank to the irrigation field which maximizes the utilization of water[1].

Crop fields are always dependent on and required the soil water level. Another study mentions as "A Research paper on solar powered irrigation system" Automatic irrigation system for the plants is built for this cause with humidity sensor and solar power. The device suggested takes its power from sun light through photovoltaic cells. Hence, the machine is not dependent upon the electricity. In this model, drive the irrigation pump with sunlight energy. The circuit includes a soil moisture sensor, which is planted in the soil to check if the soil is dry or wet. The whole device is controlled using a PIC microcontroller. When the moisture of the soil is low, the sensor detects the soil condition and the relay device attached to the motor switch is provided with condition. In dry condition it will ON and shut off the motor when the soil is wet [2].

In another research mentions "Solar Power Irrigation System by IOT" to design an automatic irrigation system which can sense the moisture level of the soil and a solar-powered automatic irrigation system that employs water pumps to pump water from a bore well to a tank. A controller and moisture sensor are employed to automatically control the outlet valve of the tank, regulating the flow of water rate between the tank and the irrigation field in order to optimize water use. All our energy requirements can be fulfilled by cost-effective solar electricity. Solar-powered smart irrigation systems are the key to success for Indian farmers. The system consists of an autonomous water flow controller system utilizing a moisture sensor along with a solar-powered water pump [3]. Though there are some systems that exist for automated irrigation, there is a great requirement for a system that is more accessible, cheaper, and more sustainable.The Solar-Powered Irrigation System, as proposed, seeks to offer an effective and sustainable means of automating the irrigation process while saving water. The system integrates clean solar energy with real-time monitoring of soil moisture for automating irrigation, maximising the use of water in accordance with the soil's requirements. The system is off-grid, and thus ideal for rural and remote locations where electricity is not readily available.

III. SYSTEM OVERVIEW

Proposed System are as follows:

The system uses solar panels to provide renewable power,which is used to charge a battery that supplies the whole irrigation system. The solar panel makes the system autonomous, minimizing the use of outside power sources and making it ideal for off-grid areas.There is a soil moisture sensor buried in the soil to monitor its moisture level continually content. This sensor is digital in output and gives a binary signal (high or low moisture) depending on the condition of the soil. The sensor senses when the soil moisture drop below a set threshold, which means irrigation is required.The output of the soil moisture sensor is directly connected to a relay module. When the soil level of moisture is low (i.e., dry soil), the relay will be activated to close the circuit, which powers on the water.

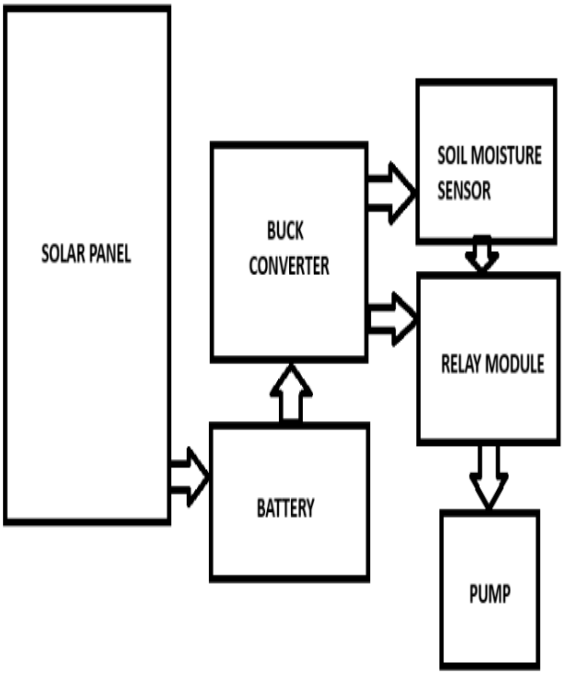

Figure 2: System design for Solar Power Irrigation System

During daytime, the solar panel charges the battery, powering the soil moisture sensor, relay, and water pump. The soil moisture sensor checks the moisture level in the soil continuously. When the moisture level falls below the set level, the sensor triggers the relay to turn on, and it makes the pump water the soil. When the soil moisture level is sufficient, the relay switches off the pump, and the irrigation stops. The system is self-sustaining, demanding less human input, ensuring effective water use and minimizing the possibility of over-irrigation.

IV. METHODOLOGY

The design of the solar-powered irrigation system is centred around simplicity, sustainability, and automation. The system comprises four main components: a solar panel, a soil moisture sensor, a relay module, and a water pump. The solar panel serves as the primary energy source, converting sunlight into electricity to charge a battery. This battery stores the energy for use during non-sunny hours, ensuring the system remains functional at all times, even when solar power is not available. The soil moisture sensor is placed in the soil to measure the moisture content continuously. When the moisture level drops below a predefined threshold, indicating that the soil is dry, the sensor sends a digital signal to the relay module. The relay is connected to a water pump, and when the signal from the sensor triggers the relay, it activates the pump to water the crops. Once the soil reaches an adequate moisture level, the sensor detects the change and sends a signal to turn off the relay, halting the irrigation process. This automation ensures that water is supplied only when needed, preventing over-watering and optimizing water usage. The relay module acts as the control interface, providing a simple mechanism to switch the pump on or off based on the soil moisture readings. The system operates completely off-grid, using solar power, which makes it ideal for rural and remote areas where access to traditional electricity sources is limited. This design methodology ensures a sustainable, cost-effective, and easy to-implement solution for small-scale farmers, promoting water conservation and reducing the need for manual intervention. A **solar-powered irrigation system** with soil moisture sensing, as proposed in this project, offers an ideal solution by utilizing renewable energy and a simple, direct control mechanism without the need for complex microcontrollers. This system will be energy-efficient, easy to implement, and cost-effective, addressing the challenges faced by farmers in water-scarce and off-grid regions.

V. RESULT ANALYSIS

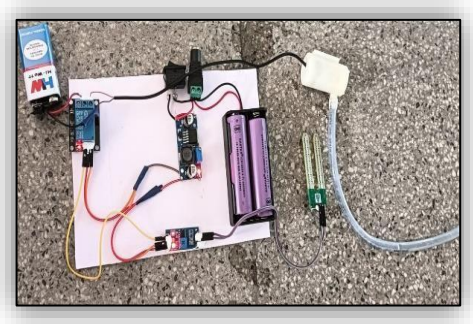

Figure:2 Model of solar power irrigation system.

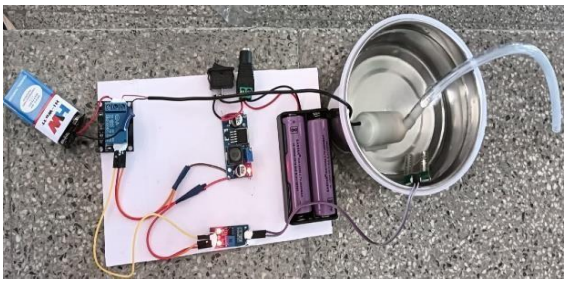

Figure:3 Water pump is off when moisture sensor is in wet.

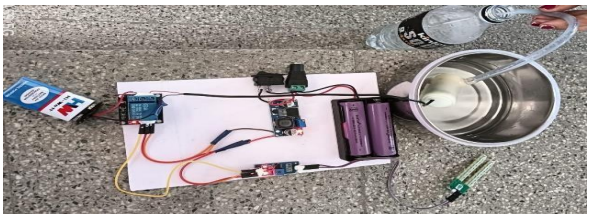

Figure:4 Water pump is on when moisture sensor is in dry

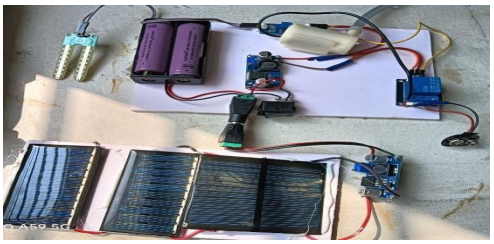

Figure:4 Charging of battery using solar panel

VI. CONCLUSION

The solar-powered irrigation system is an efficient, cost-effective, and sustainable solution for automating irrigation in agricultural practices. By utilizing renewable solar energy, the system provides an off-grid solution for remote areas, reducing dependency on conventional power sources. The integration of a soil moisture sensor ensures that water is supplied only when necessary, conserving water and preventing over-irrigation, which is critical in water-scarce regions. This project demonstrates the potential for using simple, yet effective technology to address water management challenges in agriculture. The system operates autonomously, requiring minimal human intervention and offering low maintenance costs.

REFERENCE

[1] H. Suresh, V. Umasankar, V. Thulasi, S. Harishankar, R. Sathish Kumar, and U. Vignesh, “Solar Powered Smart Irrigation System,” Res. India Publ., 2014.

[2] http://www.jetir.org.

[3] Santosh Kumar Sethi, Sakti Prasad Das, Umakanta Pradhan, Pragyan Paramita Pani, Assistant professor, Department of Civil Engineering, Aryan Institute of engineering and technology, Bhubaneswar, “Solar power irrigation system by IOT,” Industrial Engineering Journal April 2024.

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