IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

ISO 3297:2007 Certified ⁜ Impact Factor 8.066 ⁜ Peer-reviewed / Refereed journal ⁜ Vol. 10, Issue 4, April 2023

DOI: 10.17148/IARJSET.2023.10433

Smart Irrigation System Using Solar Energy

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Abstract: The topic of this essay is how to irrigate agricultural systems using solar power. This system uses moisture sensors to determine the soil's moisture content, and a controller will control the water pump's ON/OFF status using solenoid valves in accordance with that information. This project uses renewable energy, specifically solar energy, rather than non-renewable sources. A smart phone is used by an Arduino-based irrigation system to determine the state of the field. Moisture sensors provide data to Arduino as the soil's moisture content. The Arduino will activate the water pump by comparing this input value to a threshold value. the user's use of the GSM module to receive the motor's action. To supply water to the field in accordance with, the solenoid valve is used.

Keywords: Water pump, solenoid valve, solar panel, GSM modem, moisture sensor, and motor driver.

I. INTRODUCTION

The foundation of the Indian economy is agriculture. Because agriculture is our primary source of food, life would be impossible without it. The farmer must work hard to produce the crop that provides him little money, so he must explore other choices for survival. Additionally, because there is a shortage of workers for agricultural activities nowadays, automation in the agricultural process is required. An automated irrigation system powered by Arduino may be remotely controlled using an Android smartphone. It will be affordable and simple to use this system. The soil moisture sensors, which monitor the amount of moisture in the soil, provide the Arduino Uno microcontroller in this system with an input voltage signal. The Android smartphone and Arduino were connected. The user interface (UI) of the Android smart phone displays the data that has been received. The user interface makes it simple for the user to turn irrigation on and off remotely.

We use solenoid valves in our project, which is one of its most crucial components. An electric current flowing through a solenoid measures the electromechanical operation of a solenoid valve. It can be utilised to control water flow and gauge water level. Fast and risk-free switching, increased dependability, a long service life, best media compatibility of the materials employed, low control power requirements, and compressed design are all advantages of solenoid valves. In addition, the GSM module plays a crucial role in providing the user with field information. This initiative aims to address a variety of issues, including minimising water and labour waste and providing farmers with up-to-date field information via their mobile devices.

A. Techniques Used in Project

Solar energy is used in this project along with a tracking device for the sun. Two LDRs, a solar panel, a servo motor, and an ATmega328 controller make up the Sun tracking solar panel. On the solar panel's edges, there are two light-dependent resistors placed in a row. When exposed to light, resistors that are light dependent create low resistance. The panel spins in the direction of the Sun thanks to the servo motor attached to it. The panel is set up so that the light on two LDRs can be compared, and the panel is rotated towards the LDR with the higher intensity and lower resistance. The panel is rotated at a specific angle using a servo motor. When the light falling on the right LDR is more intense, the panel gently travels to the right, and when the light falling on the left LDR is more intense, the panel gradually goes to the left. At midday, when the Sun is ahead of the horizon, the brightness of both panels is equal. In such circumstances, the panel remains stationary and is not rotated. According to the direction of the sun, solar plates can be tilted to capture the most solar energy, which results in the highest efficiency. As a result of the sun's movement, intensity decreases. Motor driver receives signal from controller to follow it from east to west. We installed a limit switch at the west for the west side up to the limit inclination. If you return to the east station as the plate measures the west limit switch. to define east, or the datum location. We add a new limit switch to their system and watch for the following morning.

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Drip irrigation is a technology we are adopting in our project for irrigation. because drip irrigation is the most effective type of irrigation. Clay soils benefit greatly from this method of watering since the water is supplied gradually, allowing the soil to absorb it and preventing runoff.

Drip devices consume a much smaller amount of water than overhead sprayers do. The term "point source" drip systems refers to drip tubing that is distributed evenly over a planting bed and supplied with water at a rate the soil can absorb without losing water to misting, overspray, or runoff.

Controlling a valve automatically Solenoid valves are used to control irrigation as needed. Two solenoid valves and two moisture sensors are being used. This irrigation system uses a valve to regulate the watering system provided to agriculture, just like a regular irrigation system does.

II. BLOCK DIAGRAM

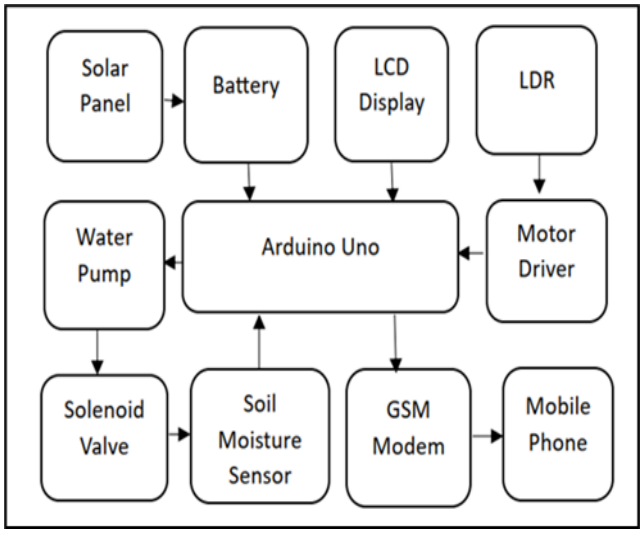

Fig. 1. Block Diagram

III. HARDWARE REQUIRED

A. Soil Moisture Sensor

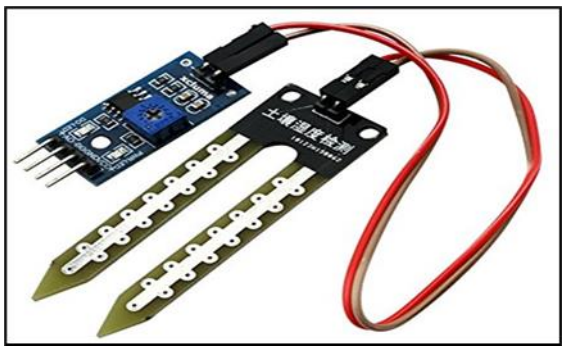

Fig. 2. Soil Moisture Sensor

The sensor in the figure is typically used to calculate the amount of moisture (water) in the soil. These sensors can detect a certain degree of wetness.

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B. Arduino

Fig. 3. Arduino

An open-source electronic platform with a microcontroller board based on ATMega328p is the Arduino, which is depicted in the figure. Controlling system operation is the role of Arduino.

C. **Solenoid Valve:**

Fig. 4. Solenoid Valve

The solenoid coil, which functions electronically with a 12-volt DC supply, powers the valve. There are two outlets, and when no voltage is provided to two terminals, the valve remains closed. However, when a 12-volt DC source is applied, the valve opens and water can flow through.

D. Solar Panel:

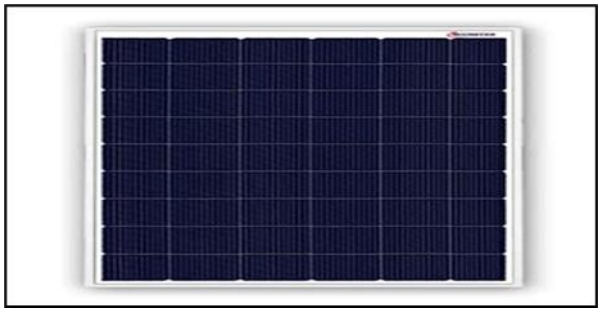

Fig. 5. Solar Panel

Sunlight from solar panels is collected as clean, renewable energy and converted into electricity that can be utilised to power electrical loads. The battery can be charged with a tiny amount of electricity for a considerable amount of time using the low wattage panel.

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E. Battery

Fig. 6. Battery

As its name suggests, a 12-volt lead acid battery is used to store energy from solar panels. Battery can be utilised as a backup to keep the system powered during the night.

F. GSM Module:

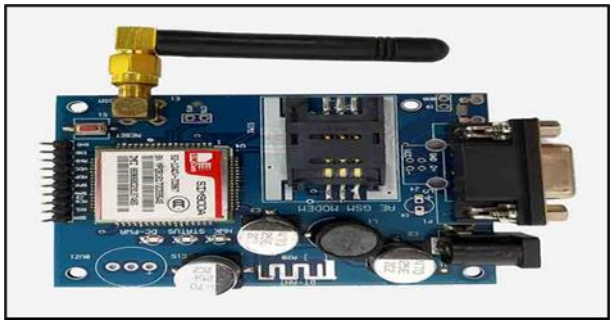

Fig. 7. GSM Module

A GSM module is a device that offers a wireless data link to a network using the GSM mobile telephone technology. Mobile phones and other equipment that communicates with mobile telephone networks use GSM modules. To identify their device to the network, they need SIMs. Using the GSM library, the Arduino GSM shield enables an Arduino board to make voice calls, send and receive SMS, and connect to the internet

G. Water Pump:

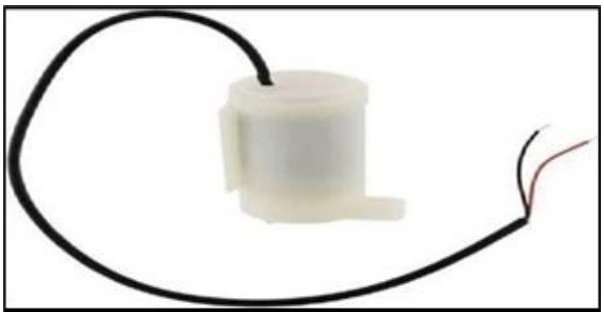

Fig. 8. Water Pump

The plants will receive water from the water pump. It will be connected to the relay switch that regulates the flow of water. This water pump uses a small, inexpensive submersible motor.

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IV. WORKING

ATMEGA328P is used in the project. By employing a solenoid valve and a solar tracking system, we are able to accomplish our goal with the Smart Irrigation System. When a soil moisture sensor notices that the earth is dry, it signals the controller. Data is processed by the controller, which then signals the relay. Relay turns on the appropriate motor and valve. As soon as the sensor detects soil dryness, a signal is sent to the controller. The controller will shut off the valve and motor. Utilising solar output and LDR Light Intensity, we create solar tracking. Additionally, GSM module is used for machine and user communication. so that the user can learn the system's current condition.

V. FLOW CHART

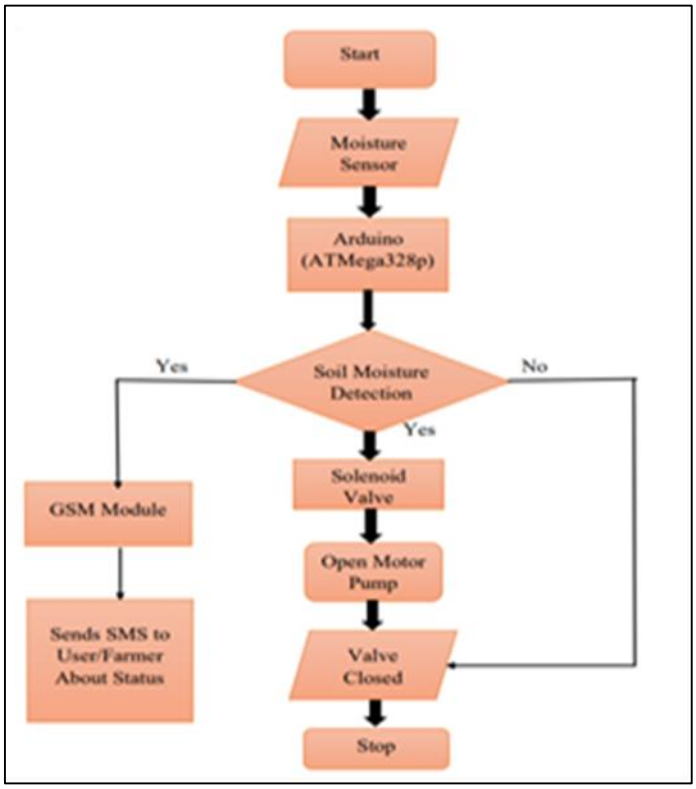

Fig. 9. Flow Chart

TABLE I MAIN COMPONENT

Components Required	Specifications	Quantity
Solar panel	12 Volt, 20 W	1
Arduino UNO	ATmega328p	1
GSM Module	T900	1
Battery	12 V, 9 Ah	1
Soil moisture sensor	LM358	2
Relay	12 V	3
Water pump	12 V	1
LCD display	16*2	1
Regulator	7805	1
Solenoid valve	12-volt, 0.3 Amp	2
Gear motor	12-volt, 0.3 Amp	2
Motor Driver	LM293	1
Potentiometer	50k	1
LDR	I=100	1

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VI. RESULT

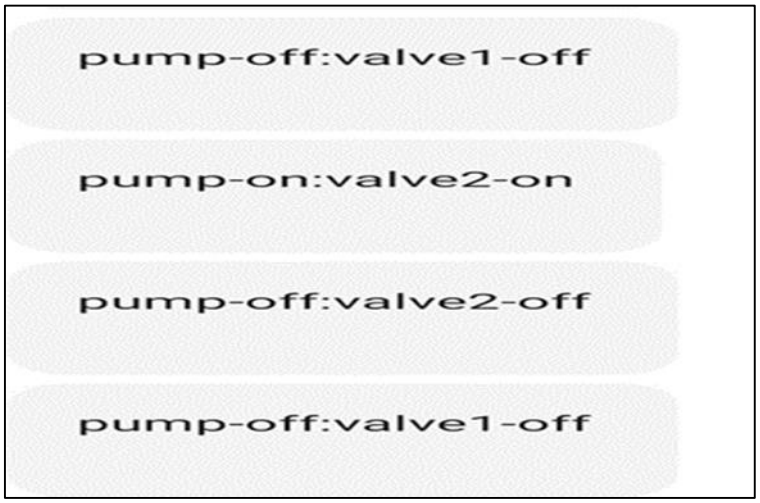

Fig. 10. Result

We use GSM Modem for real time interface with user. We get message on mobile regarding motor turn on/off.

FUTURE SCOPE

The suggested system allows for the flexible addition of new technologies and sophisticated apparatus, such as sophisticated sensors over wide areas and intelligent submersible motors.

VII. CONCLUSION

A very user-friendly irrigation controller that can be installed at a reasonable cost is provided by this project's mix of hardware and software. The created Arduino & Solar-based irrigation system can operate continuously for an unlimited amount of time, even under unusual conditions, from the perspective of functioning in a remote location.

ACKNOWLEDGMENT

We would like to convey our sincere appreciation to our mentor, **Prof. V. B. Magdum**, Assistant Professor in the Electrical Engineering Department, for his unwavering support, creative suggestions, and encouragement during the entire project-related process. We really appreciate the assistance provided by the entire professors and support staff of the department of electrical engineering, whether directly or indirectly.

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