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# Moisture Detection and Automatic Irrigation by Sensor Based Solar Tracker System

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**ABSTRACT:**
In this study, we propose a simple but efficient, lowcost powerefficient embedded system for solar based off grid irrigation by orienting the solar panel towards the sun to provide the necessary power source in remote areas or in the irrigation field ylppus tnerruc elbats a hguorht egnahc edivorp ot elbissop ton si ti erehw**.**The Solar Panel is used for ***5***V supply charging. We used Soil Moisture Sensor to sense the soil's moisture conditions. A water pump is connected to switch on and off automatically, based on the moisture sensor values.When humidity ***t***he soil level reaches to low,the soil moisture sensor sends a signal to the microcontroller to start the pump using solar energy stored. At the same time**,** microcontroller sends message about pump status to mobile farmers using GSM. The microcontroller gets pump status, humiditycondition of the soil and humidity and temperature in the air or surrounding area and provides this information revo a data acquisition instrument. The system can be used in various fields by regulatingthe necessary voltage including mobile phone charging, access drip irrigationand weather data monitoring and irrigation facilities as well.
***Keywords*:** Solar Panel, Soil Moisture Sensor, Arduino Uno, GSM.

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## I. INTRODUCTION

Solar panel installation and utilization has become a modern revolution with most of thescienti ficcommunity making use of the immensely potential Inexhaustible and nonpolluting solar energy sources are enough to meet our ever-increasing demands for agro Based applications and to build scientifically cleanand environmentally friendly applications. In India, for the most part in the light of it, agriculture assumes an imperative part in advancing nation as our economy. India places second place in cultivating yield worldwide. However, with population growth in urban and semi urban townships, the majority of groundwater resources have been depleted due to maladministration Water planning and conservation. Since most of the fresh water supply is to be provided to households, it is difficult to manage sufficient water supply that is the critical factor for the farming. Because rural households require water, carry enough water from rivers and water shortages, the government must use fast track agro based automation to supply water. Irrigation that will suffice to make legitimate use of rural water supply and coordination that will put a stop to the enormous waste of water resorption.

With the expansion of social Schemes for the preservation of rainwater focused on water conservation and drainage, it has proved vital to manage the use of electronic water. Equipment and equipment in places where water cannot be managed using electric power resources to address this issue, solar-based irrigation factors can be used to a large extent in irrigation to optimize water use through the adoption of the irrigation system based on sensors. Soil moisture sensor base irrigation system ensures proper level of soil moisture for growth Seasonal plants. In this system, sensor senses soil moisture content and switches the pump motor on or off accordingly. Sensor for soil moisture is used to detect soil condition whether soil is wet or dry.If the soil is dry, the pump motor pumps water until the field is wet which is monitored continuouslythat microcontroller.

The main advantage of the soil moisturesensor is to ensure precise measurements and farmers don't have to visit their farm to operate the pump. Identify obstaclework items to task the devices to automatically orient the solar panels in the direction of the position of the sun and the direction of the solar panel to get the maximum The Solar Cell output.The practical inefficiency of conversion of solar energy for solar panel components fixed at a certain angle is that we cannot track the direction of sunlight with the changes are diurnal and seasonal. Consequently, power output cannot be improved for the system as the Sensor base irrigation is also developed based on system based soil moisture. This work is a development of applications done in a college project. We had collected all the necessary components in the proposed work done first, and then used a solar panel to drive a charging battery. The light dependent resistors were not connected though we proved using electrical output in the proposed study. After you Analysis of moisture and moisture and soil moisture sensor interfaced with the GSM relay to calculate the output. Also attached to the Arduino was the Raspberi pi device to collect serial port data for soil and soil moisture and humidity mapping. To tackle the problem first, we include in our design the solar cell that looks as shown in Fig. 1.

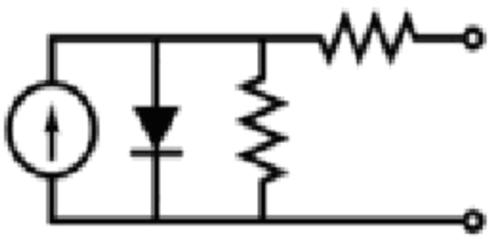

**Fig. 1 Equivalent Circuit of Solar Cell**

In order to model and analyze a solar cell's electronic behavior, it is useful to create a model bas ed on discrete electrical components that is electrically equivalent. An ideal solar cell may bemodeled in parallel with a diode using a current source. In practice no solar cell is ideal, so a shunt resistance and a component of series resistance are added to the Model. The result is the "equivalent solar cell circuit" Dynamic trackers measure the light force from the sun to determine where the sun-based modules should point. Sensors located on the tracker in different areas and if the sun is not incidental to the tracker specifically, the light force on one light sensor will be changed in contrast to another. Differentiation may be used to determine in which bearing the tracker needs to tilt to face in the direction of the solar rays.

## II. *TYPES OFSOLAR*TRACKERS

First, there are many different solartrackertypesthat can be grouped intosingle axisand double axis models.

### A. SINGLE SOLAR AXIS TRACKERS

Single pivoting sun powered trackers can h ave either an even application or a vertical application. The flat part of the system is used as part of a tropical day during which the sun rises high evlewt ta, trohs era syad eht tey. si tros lacitrev ehT seod nus eht erehw sepocs hgih fo trap a sa dezilitu hgih teg ton, gnol eb nac suad remmus rehtar tub. fo tniop tlit elbazimotsuc yllacisyhp a evah eseht0 – 450and programmed following of the sun from East to West .They utilize the PV modules themselvesas ligh morf ecnatsid cigetarts a niatniam ot rosnes t rof dna tnempoleved gniwollof suoulfrepus ytilibadneped.

### B. SREKCART SIXA RALOS LAUD

Double axis solar trackers have both ahoriz ontal and a vertical axis so the apparentmotion of the Sun can be tracked anywhere in the world exactly. This type of system is used to control astronomical telescopes, and also in hydro plants to send water at fixed points in predicting and tracking the sun's motion across the sky using solar power. Trackers with double axis track the Sun both east to west and north to south for additional power output (approx.40 percent gain) and comfort. A servo motor for the two degrees of solar panel freedom has been added to our structure ansdwd prototype design.

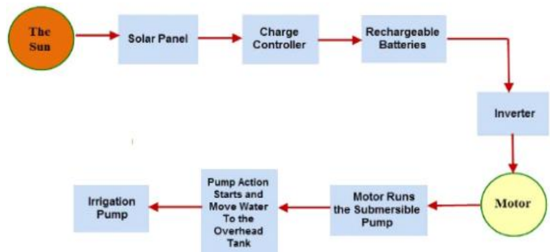


**Fig .2 Pumping and Irrigation Monitoring**

These stationary and expensive solarpanels areunabl e to extract the maximum solar energy, as the weather conditions are not stable[3]. The poweroutput of solar panels is maximum when adjusted perpendicularly to the direction of the sun's rays, since both the area of sunlight on solar panels and the intensity of the sun's rays are maximum in thisCase. It has been found that solar panel efficiency is improving by 30- 60percent for mobile solartracking systems rather than a stationary array ofsolar panels[4]. A power efficient solar trackeris challenging to design and implement due to theimmobility of the solar panels. The angle of sun-rays inclination to the solar panels Continuouslychanging due to the sun's movement from east to west due to earth's rotation, Independent of theweather[5].The essential thought behind this workis that the LDR's detect the power of light, thecomparators contrast the lightforce of the episode with the force of the opposite occurrence. Lower scale Using a stepper motor driver circuit,the controller turns the stepper engine by the coveted point on the yield of the comparators to increase theproductivity.The power of the instrument foradap tation inthearea where it is set and theclimate conditions Daylight changes,for which weinfluenced the arrangement to change the incentive limit by using variable resistance.

## III. LITERATURE REVIEW

A number of research and hardware-Basedanalyses show thatwe can applyauto-tracking techniques to the solar tracking methodology analysis. Auto tracking of a solar tracker based on an 8051microcontroller usinga combination of LDRs, opto-couplers,stepper motor,Relays, analog to digital converters, etc., andmanual "Sun Tracking Software" tracking is reported in [1]. Anuraj et al reported usingATMEGA 16 to implement a solar tracking system that improved the power efficiency by as much as 20percent [2]. Tudorache etalexplained thedesign and implementation of thePhotovoltaic (PV)power plant solar tracker system.The workings of the the tracker is based on a DC motor controlled by an intelligent driver circuit movinga mini PV panel which senses the difference signalfrom two efficient light sensors[6]. Tracking the implementation of a prototype solar tracker using a PIC 16F84A microcontroller with a two degree design Reported in [7] is freedom- azimuth andvertical. Many recent studies involve the use of adual axis solar photovoltaic tracking system using a feedback control theory, a four-quadrant lightdependent resistor (LDR) sensor and simpleelectronic circuits. Tracking is done using a uniquedual axis AC motor and a stand-alone PVinverter [8].

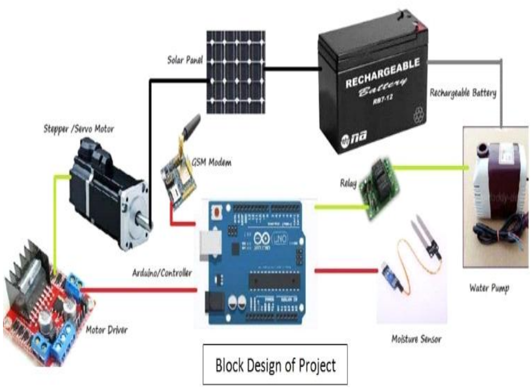


**Fig. 3 Module Diagram for the Stepper Motor**

## IV. APPLICATION OF THEALGORITHM

The panel receives analog input from the A rduino microcontroller. In micro Controller the maxi mum voltage that can be obtained from the solar cell is set as the reference voltage.Thevoltage andcurrent of the output panel iscompared to the reference voltage and the current corresponding tothe controller gives the signalMotor stepper. If the ADC output is equal to the reference voltage the stepper motor will keep thesolar panel in the same direction. And if the output is less than the reference voltage then the stepper motor will continue to rotatethesolarpaneluntilwegetthevoltageequalto the voltage reference.

A stepper / servo motor controls the solar panel to rotate to adjust the light. On a fixed time basis LDR is not used to earn the benefit in time). A rechargeable battery will be charged out of Solar Panel. The pump will be operated via the battery. There will be a moisture sensor, and the pump will start when the value goes below a predefined value. The user also receives an SMS notification of the moisture status at his / her mobile phone when it goes under that predefined value. Using Arduino the entire project is controlled. Using the Arduino Moisture sensor, which controls the data with serial pin and transfers the output to Raspbery pi to the sensor data log.

### A. HARDWARE DEVELOPMENTANDI MPLEMENTATION

We will elaborate in this section theblock diagram, circuit diagram, working principle and various comp onents required to implement our solar tracking syst em. The block diagramofthedesigned solar tracker system is shown in Fig.3.For condition 1, $V_{out}$ will be close to 5V and under normallight condition $V_{out}$ will be close to 2.5V. So, to differentiatebetween normal light condition and perpendicular lightcondition, we set a threshold of approximately 4V. Steppermotor is a digital actuator whose input is in the form ofprogrammed energization of the stator windings and whoseoutput is in the form of discrete angular rotation. The steppermotor is used to rotate the solar panel accordingly where weobtain maximum voltage. The cylindrical covering is used toprevent the stray light from being detected by the LDRs [9].We had earlier calculated the resistance of the LDR underthree different situations using multimeter. The steps involvedin the selection of stepper motor are as follows,

1. Initialize a servo object for the connected servo
2. Initialize the relay pin and other variables for sensorinformation
3. Attach the signal pin of servo to pin9 of Arduino
4. Sets the GSM Module in Text Mode
5. Set Mobile Phone Values
6. Send SMS on pump status on pump on and off
7. Servo command to set value for rotation of the

servomotor
8. Rotate at the specified angle for specifying the acceleration
9. Call the functions
10. Set the value of the moisture sensor using loop to beput in Raspberi pi to calculate every minute.
11. Read data using the dht11 sensor to calculate the temperature and humidity using data pin.
12. Put the delay to calculate using serial pin port.
13. Raspberi pi measures the change of soil moisture using values for the soil moisture sensor
14. Calculate humidity and temperature using DHT11sensor gives the condition of the environment.
15. Apply machine learning algorithms to identify thenature of the soil conditions.

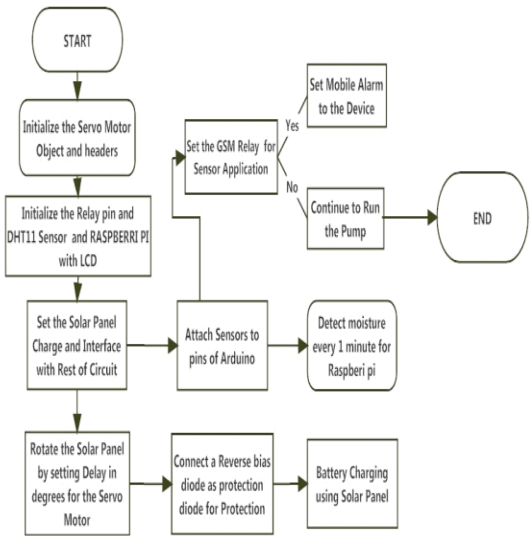


**Fig. 4 Flow Diagram showing Execution ofHardware andsoftware implementation**

This frame lends plants water. In addition,the useof this sustainable source of power is not required due to the use of a solar The main advantages of this proposed system are as follows.Powered device by using soil moisture sensors in the field. This sustainable source of power supplies almost zero waste materials, for example carbon dioxide or other substances So, poisons have the leasteffect on condition.The proposed frameworkcontrols the measurement of water use in theagrarian fields for water system. In this way, paying extra water levy on water reduces theexcessive weight on farmers.Despite this controlled water system,additional costs for water pumping also decrease the problems ofmovement and circulation in the water Level field. This framework diminishes keeping running offoverwatering soaked soils,abstaining from floodingat the wrong time,which will enhance enough water and supplement field adjustment at the timeof need.It also counteracts the saltiness of ruralareas causing poor profitability and soil fertilitydinnudation through the level of soil moistureIdentification-Identification. This framework also helps to effectively expel human error by modifyingthe level of accessible soil dampness and boostingtheir net benefit.By using the following frameworkbased on sunlight when contrasting with settledboards, the yield of vitality is expanded.Principleutilization of the proposed framework is for agribusiness field water systems. Indeed we, too,are This framework can be applied in agribusiness,in particular in nurseries or controlled farmingframeworks, enabling high accuracy control of soil dampness.Using sunlight-based vitality in the proposed framework allows us to use that framework in remote areas where power is not accessible

## V. CONCLUSION

Solar power delivers enough power to drive thesystem.The proposed model can be an appropriate alternative to overcome the need forelectricity and to ease the irrigation system for our farmers.The solar tracker system designed could track the sun's movement in bi-directional motion. The power that solar tracking obtains is almost constant over a ttime span when compared to panel output without tracking.Figure 5 shows the designed solar tracker system which in fact is the main system's working model.The tracker's components are Microcontroller(Arduino Uno), OPAMP as a comparator (LM358),Servo Motor (4SHG-050A 5IS 5V, 5fi), Solar Panel

)SS3P type module),and Stepper Motor Driver andMoisture Sensor as well as DWT11 Moisture and Temperature Sensor, which gives the arduino thenecessary output to track the soil conditions indifferent locations.Hardware will be further enhancedwith the use of various sensors. The model we havedeveloped is an integrated system, as we used anarduino as a programmable microcontroller and alsoused raspberri pi for control in the interface with arduinoThus, while the system lacks a bootloader and requires an integrated bootloader,The system will depend onthe agricultural scale in use.The solar accessenergy produced using solar panels can also begiven to the grid which small change in the system, which can be a source of income for farmers andlocal communities and encourage profitable farmingand techno-innovation in India while at the sametime providing a solution to energy crises.

**Fig. 5 Designed Solar Tracker System**

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