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Dual Axis Solar Tracker with Weather Sensors

V.Suma Deepthi
Assistant Professor, Electrical & Electronics Engineering Department
G.Narayanamma Institute of Technology and ScienceHyderabad, India
Email id: sumadeepthi.veeraganti @gmail.com

Sushma Pola, M.Harshitha, M Swetha, K.Alekhya
UG Students, Electrical & Electronics Engineering Department,
G.Narayanamma Institute of Technologyand Science Hyderabad, India

Abstract

Solar energy is one such non-conventional and sustainable form of energy that also has a high potential for conversion into electrical power. With the present solar energy harvesting technologies, we only have high production at specific periods, typically noon.

This paper presents a dual axis solar tracker system that significantly boosts productivity. This project is made up of several LDR sensors and a motorised mechanism that rotates the panel in the direction of the sun. Dual-axis solar tracker can improve energy by tracking sun rays from several solar panels. The microcontroller-based control system detects sunlight and controls the motorised mechanism. This project may also be used to simulate raindrops, temperature, and humidity using sensors, and the results can be shown on a mobile phone. This technology operates continuously and without interruption, increasing the efficiency of the solar panels by up to 80%.

Keywords: Motorized mechanism, solar panels, LDR sensors, microcontroller

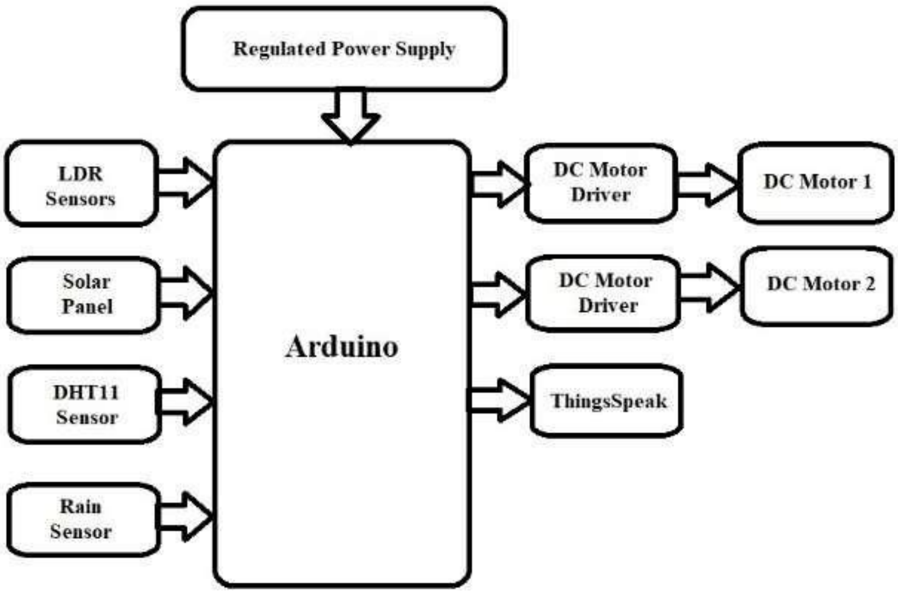
Introduction

The main purpose of this project is to design a solar tracker system that tracks the sun for producing maximum output for solar powered applications. This system also has DHT11 and Rain sensor to depict the weather parametric values.

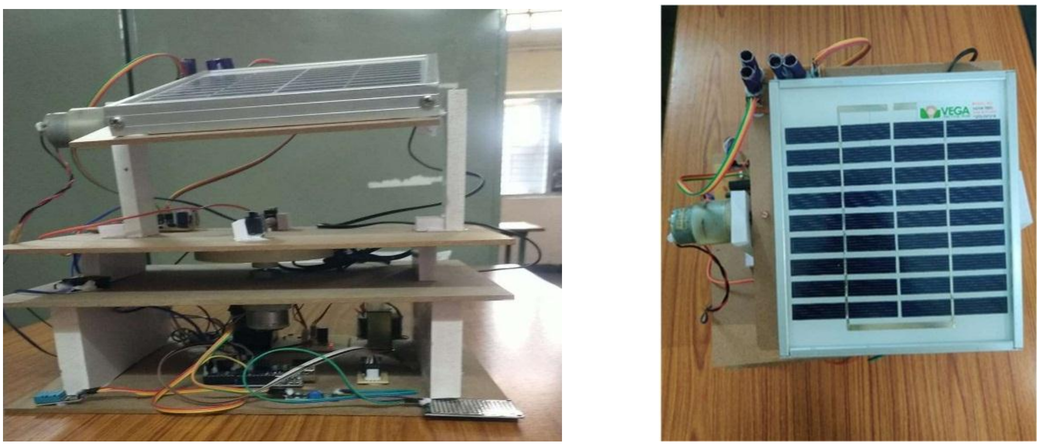
Nowadays, it is more difficult to strike a balance between energy production and consumption. Using solar energy as effectively as possible is the best method to rectify this equation's imbalance. The issue with solar energy utilisation is that solar cell panels need to beexposed to the sun's light to their full potential. The strength of the sun's light

varies from dawn to evening if the solar panel is positioned in a specific direction. The amount of solar energy produced by the solar cell can be increased by reorienting the solar cell panel towards the sun.
A motorised mechanism that rotates the panel in thedirection of the sun and a few sun light sensors make up this project. Sunlight detection and motorised mechanism control are handled by a microcontroller-based control system. Arduino is also interfaced with DHT11 and Rain sensors. The operation of this system is uninterrupted and continuous

I. Working



The project has a rechargeable battery of 12V,1A which supplies power to the system. The battery is recharged either from transformer or from solar panel. When sunlight is not available, transformer is connected to 230V AC input, else the transformer is disconnected andsolar panel is connected to the battery. The power from battery is used to control two DC motors of 12V,3.5rpm which are used to control the solar panel, one to controlx axis position and the other to control in y axis position.The project has 3 limit switches which are interfaced to PIC 16f73 microcontroller at pins C5,C6,C7. The 2 DC motors are interfaced through L293D motor driver to pins C0,C1,C2,C3. The 4 light dependent resistors are interfaced to A0,A1,A2,A3 pins directly. Rain sensor is connected to A0 pin, DHT11 sensor is connected to pin 10 and ESP8266 is connected to pins 8,9 directly to Arduino UNO. Before the project is switched ON, internet is supplied to system to upload data to Thingspeak platform, under the Wi-fi name "project" and password "123456789". To download the data onto the platform, data imports exports is used. To erase the previous data from platform, clear channel is used. Data will be uploaded to Thingspeak platform within 15 seconds of ON. Microcontroller has limited pins which are used for other input and output pins. Hence, Arduino UNO from ESP8266 Wi-fi Module is used to upload the data. When the project is switched ON,12V input is given to microcontroller for the purpose of solar tracking using the four LDRs. Two LDRs are used to track in North-South direction while the other two LDR's are used to track in East-West direction. Initially when the project is switched ON, solar panel moves to zero position. When sunlight falls on LDRs, the LDRs track the direction of maximum intensity and absorbs the sun light to convert it into electrical energy and stores it for further purposes.



(a) (b)

Image 1: Prototype of the proposed project

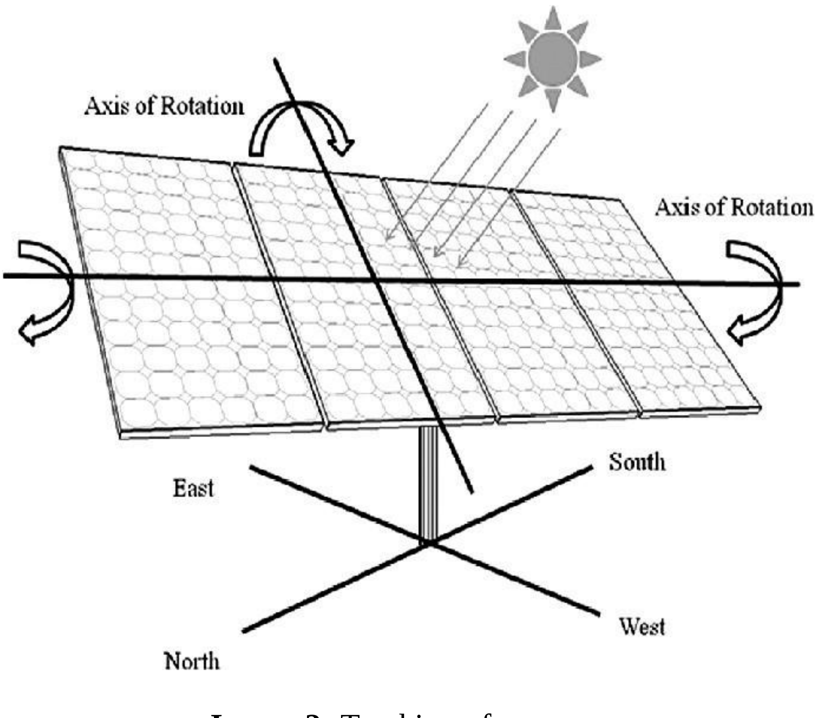


Image 2: Tracking of sun rays

II. Observation:

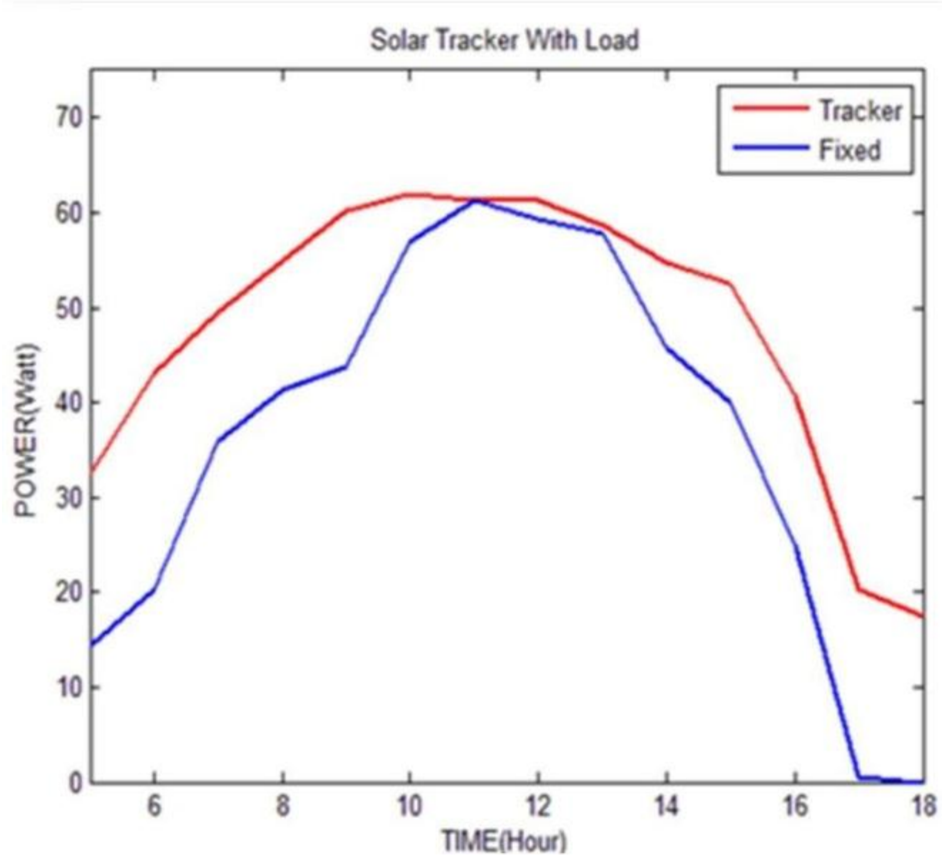


Image 3: Graph comparing time and power derived from fixed solar panel and solar tracker

Table 1: Table representing comparision between fixed and tracker solar panel

SNO	Time taken (in hours)	Power generated(in watts)	
		Fixed solarpanel	Tracker solar panel
1	0	15	32
2	6	20	40
3	8	35	50
4	10	40	55
5	12	60	60
6	14	45	53
7	16	20	25
8	18	0	18

III. Advantages

- Low cost and reliable circuit.
- Increases efficiency to a great extent.
- User friendly.
- Efficient design.
- Low power consumption.
- Weather monitoring using Thingspeakplatform.
- Can sense sun in both the axis.
- Stored energy can be used for various purposes.

IV. Disadvantages:

- Interfacing of microcontroller with LDR Sensors is sensitive.
- Monitoring of the solar panel is required

V. Applications:

- It can be employed in locations such as greenhouses, plant nurseries, woodland areas, agricultural fields close to majorthoroughfares, radio stations, and weather reporting stations.
- It is applicable to solar power facilities,substations, factories etc.

Conclusions:

The implementation of a dual axis solar tracker utilising LDR and an Arduino UNO is presented in thispaper as an intriguing and simple experiment. The performance of the tracker is enhanced by the use of PMDC motors. The architecture helps by keeping trackof solar radiation using a multiple sensors to extract all of its energy. The solar panel is precisely aligned with the sun's incident rays, making the application possible. The concept of a solar tracking device, which can capture more energy than the stationary solar panel, is perfectly matched to the situation. The goal is to create a simple, affordable tracking system. Solar tracker has been increasingly important in recent years as solar panel performance has increased, demonstrating its superior technical achievement. Comparing a dual axis solar tracker to a five-axis solar panel or a solar tracker with a single axis reveals how much more effective and durable the dual axis solar tracker is at producing superior performance. The tracking system is designed to allow for the capture of solar energy in any direction.

In general, a single axis tracker that simply moves along one axis is unable to track the maximum solar energy. In the case of dual axis trackers, if the solar rays are perpendicular to the panel for the entire year. As a result, it produces as much energy as it can to offset the energy it loses during the day and year. As a result, the performance improves, indicating a higher efficiency than a fixed solar panel or a single solar tracker axis.

Future Scope:

Real Time Clock (RTC) interfaces can replace the sensors utilised for this seasonal tracking in the design and development process to further improve thepaperwork. The tracking capability and longevity can further extended using more precise motors, and the only disadvantage is that the cost will be slightly higher. Replacing Arduino in place of microcontroller makes it less expensive, albeit being more challenging. Irrespective of the axis of rotation solar trackers helps in maximising generation of solar energy. Current situation of depletion of fossil fuels gave us the opportunity to utilize renewable sources to a great extent in which solar energy contributes a major part

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