IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Dual Axis Solar Tracker

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Abstract:

The solar tracking system is the most common method of increasing the efficiency of solar photo /smodule. This study compares the energy conversion efficiency of photomodules with solar tracking systems versus photomodules that are fixed. Four photo resistors, installed on the proposed sun tracking system's on both sides of the picture module. The solar tracking system is made more sensitive by these photo resistors, which enables it to pinpoint the sun's location with more accuracy. Fixed and dual-axis tracking systems were compared in the analysis. According to the findings, a dual-axis solar tracking system generates 31.3% more power than a stationary photo module.

Keywords: Solar energy, Automatic solar tracking system, Arduino microcontroller, LDRs, stepper motors, maximum illumination, reduction in cost, maximum efficiency.

I. INTRODUCTION

In order to use the solar tracking system to harvest the most power possible from the sunlight. The power generation process was not as efficient back then as it is today since there are so many different types of power generation systems, including nuclear power plants, hydroelectric power plants, geothermal power plants, alternative energy source power producing techniques, both renewable and non-renewable. In contrast to non-renewable energy sources, solar power generation is one of the zero-emission and pollution-free processes used in this study.

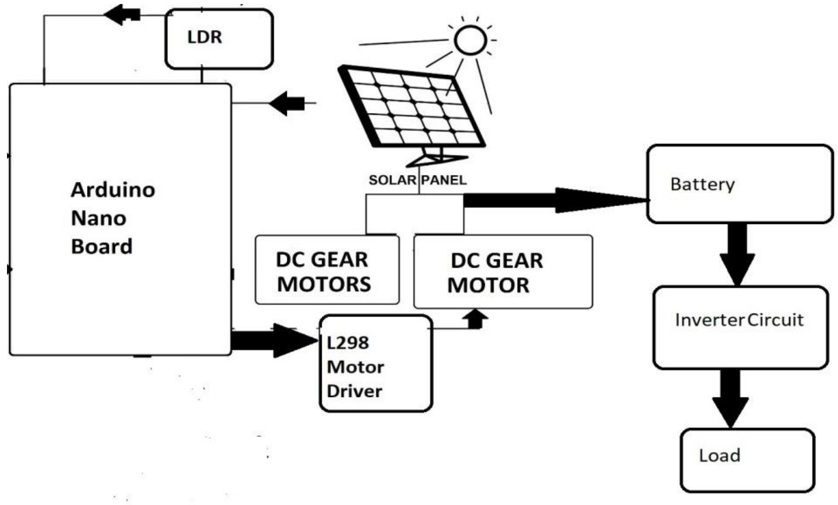

Fig 1 Block Diagram

II. LITERATURE SURVEY

The paper by Andres A. focuses on solar tracking, a technique that involves adjusting the position of solar panels to follow the sun's path throughout the day. The author highlights the importance of solar tracking in enhancing the efficiency of solar energy systems, as it can significantly increase the amount of energy harvested by the panels. The paper presents a literature survey on the various solar tracking techniques available, including single-axis, dual-axis, and azimuth-altitude tracking, among others. The author also discusses the factors that influence the choice of a tracking system, such as the location of the solar panels, the type of solar cells used, and the application of the solar energy system. The paper concludes by emphasizing the need for further research to develop more efficient and cost-effective solar tracking systems to enhance the adoption of solar energy technology.[1]

The paper by Chng et al. (2019) focuses on the design and installation of a solar tracing device, which is used to improve the efficiency of solar panels by aligning them with the sun's position. The authors begin by discussing the importance of solar energy as a clean and renewable source of power, and the need to improve the efficiency of solar panels to make them more economically viable.[2]

The paper by H. Lee et al. (2009) provides a comprehensive review of sun tracking systems. The authors begin by discussing the importance of solar energy as a clean and renewable source of power, and the need to improve the efficiency of solar panels to make them more economically visible.The paper then provides a brief literature survey of previous work on sun tracking systems, including the various types of trackers (single-axis, dual-axis, etc.) and the different control strategies used to operate them. The authors also discuss the advantages and disadvantages of each type of tracker, as well as the factors that affect their performance (such as weather conditions, shading, and wind).[3]

The paper then presents the results of the experiment, including the performance of the PV panels under different weather conditions. The authors discuss the effects of temperature and humidity on the performance of the panels, as well as the relationship between irradiance and panel performance. They also compare the performance of different types of PV panels under the same conditions.[4]

The paper by V. Manimegalai et al. (2017) focuses on the grid interfacing of renewable energy sources (RES) and their impact on power quality using a shunt active power filter (SAPF). The authors begin by discussing the growing demand for clean and renewable energy sources, and the need to integrate them into the grid to reduce greenhouse gas emissions and improve energy security.[5]

The paper then provides a brief literature survey of previous work on the grid integration of RES and the challenges associated with it. The authors highlight the various technical issues that arise from the variability and intermittency of RES, such as voltage and frequency fluctuations, harmonics, and power quality problems. They also discuss the different strategies used to address these issues, such as energy storage systems, power electronics converters, and control algorithms.[6]

Next, the paper presents the proposed system for grid interfacing of RES using a SAPF. The authors describe the different components of the system, including the PV panel, the SAPF, and the control system. They also discuss the different types of data collected during the experiment, such as voltage, current, power, and harmonic distortion.[5]

III. PROPOSED METHODOLOGY

1. The size and weight of the solar panel(s) to be tracked are the initial steps in designing a dual-axis solar tracker with Arduino. This information is critical in determining the best motors and bearings to sustain the weight of the panels. In addition, the type of tracking system - active or passive - must be determined.
2. Once the tracking system has been selected, the relevant sensors must be identified and incorporated into the design. We used LDRs to measure the intensity of the sunlight and two servo motors to regulate the position of the solar panels in our system. We also utilised an RTC (real-time clock) module to keep time and an LCD screen to display the time and sun position.
3. The Arduino code was created to determine the sun's location based on data from the LDRs and the RTC module. The code then sends signals to the servo motors, causing the solar panels' position to be adjusted correspondingly. To ensure correctness and efficiency, the code was tested and debugged multiple times.
4. After building the tracker and writing the code, we ran many tests to evaluate its performance. We tested the tracker in a variety of lighting settings to guarantee that it accurately monitored the sun's location. We also tested the tracker for many days to check that the RTC module was keeping accurate time.
5. Our testing revealed that the dual-axis solar tracker powered by Arduino was capable of tracking the position of the sun and altering the position of the solar panels accordingly. Even in shifting lighting conditions, the tracker maintained a high level of accuracy.

VI. HARDWARE IMPLEMENTATION

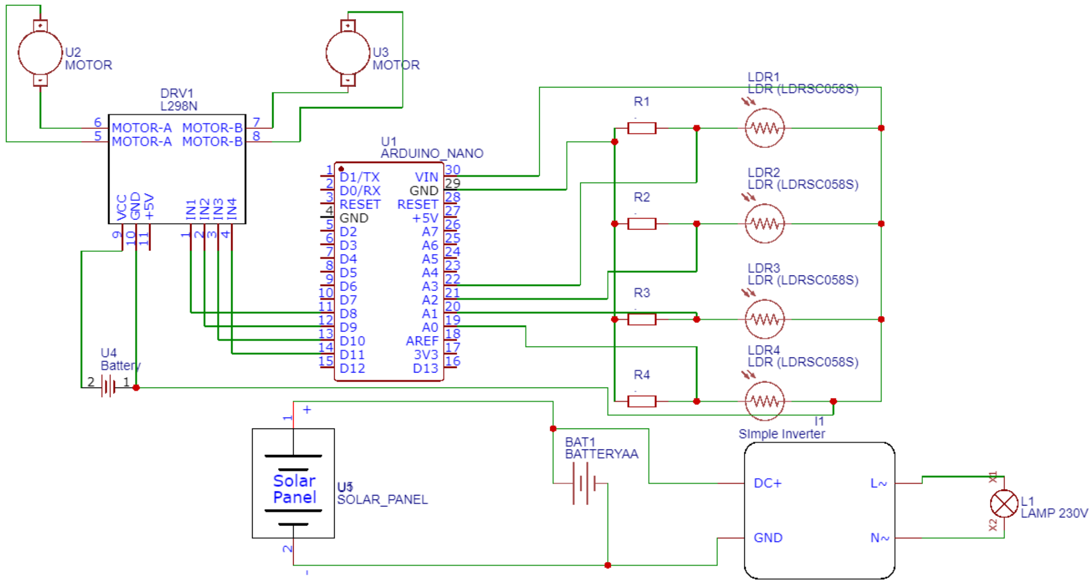

Fig 2 Block Diagram

V. HARDWARE MODEL

Fig 3 Working Model

A dual-axis solar tracker is a device that helps to maximize the amount of sunlight that a solar panel receives by automatically adjusting the position of the panel in two dimensions - azimuth (horizontal) and elevation (vertical). Here are the basic steps involved in the working of a dual-axis solar tracker:

1. Light Sensors: The tracker is equipped with light sensors that detect the intensity and direction of sunlight. These sensors are typically placed on top of the tracker or on the solar panel itself.
2. Ardiuno Nano: A Ardiuno Nano is used to process the data from the light sensors and calculate the optimal position for the solar panel. The microcontroller then sends signals to the motors to adjust the position of the panel.
3. Motors: The tracker has two motors that move the panel in two dimensions. The azimuth motor rotates the panel horizontally to track the movement of the sun throughout the day, while the elevation motor tilts the panel vertically to account for the changing angle of the sun throughout the year.
4. Power Supply: The tracker is typically powered by a small solar panel or a battery. This ensures that the tracker can operate independently of the electrical grid.

Overall, a dual-axis solar tracker can significantly increase the efficiency of a solar panel by ensuring that it is always aligned with the sun. This can result in a higher output of electricity, which can be especially useful in remote areas or off-grid applications.

VI. CONCLUSION

Automatic dual axis solar tracking has been attempted so as to track motion of the sun for collecting maximum energy. Logic for Automatic Dual-axis solar tracking system is checked. Efficiency of power generating with the help of Dual-axis solar tracking system is much more as compared to the single-axis solar tracking system. dual axis solar tracking system provides higher efficiency on solar energy absorption. It can reach efficiency up to 40% more efficient than fixed panel construction Following are the concluding remarks:

• It has been found that ON-OFF control provides sufficient motion of motor for getting motion of Solar Panel

• Microcontroller has been used that generates the control commands. It has been found that control algorithm works satisfactorily.

• Accuracy of the system depends upon the accuracy of sensor. Accuracy and resolution of sensor are important for successful execution of algorithm.

ACKNOWLEDGMENT

"We would want to thank everyone who helped make this study paper successful and to show our appreciation. First of all, we would like to express our gratitude to our Guide Dr.Pramod Bhavarthe for their crucial advice and support during the research process. Additionally, we would like to express our gratitude to the participants for their time and insightful comments on our study. We also appreciate the International Journal of Creative Research Thoughts (IJCRT), Communication, and Technology for giving us the opportunity to share our work on their platform."

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