International Journal of Marketing Management

ISSN 2454 - 5007

www.ijmm.net

Email ID: editor@ijmm.net , ijmm.editor9@gmail.com

International Journal of Marketing Management

ISSN 2454-5007, www.ijmm.net

Vol. 16, Issue. 1, Mar 2024

SOLAR PANEL MOVEMENT BASED ON SUN TRACKING

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ABSTRACT

The utilization of non-renewable energy sources and the ozone depleting substances emanation is a developing worry of the universal group. Thus, the innovative work of elective sources are constraining down the expenses related with sustainable power sources. Photovoltaic vitality creation is the best case of these exponential developing rates at the most recent years. Be that as it may, the yield control gave through the photovoltaic change process relies upon sun based illumination, and the day by day and occasional developments specifically influence the force of radiation got in the sun oriented gatherers. Keeping in mind the end goal to enhance the vitality creation, this paper depicts the advancement of a minimal effort, double tomahawks sunlight based tracker (DAST) with low power utilization. The work envelops the outline, development, get together of the whole mechanical structure, electrical frameworks and gadgets and the elaboration of the control rationale in charge of all the development of the module to look through the situation of greatest sun based illumination. The following is composed using LDR sensors in charge of giving the info flag to a microcontroller. The PV board pivots consequently in view of the sun irradiance amid the day while during the evening, the board stays in a flat position to ensure the mechanical structure against severe climate. The proposed framework likewise has an advancement of a 12V battery charging framework utilized for module development and as a power hotspot for electronic gadgets. Results demonstrate that a framework with the planned DAST can diminish in 8% the payback of a solitary PV establishment when contrasted and a settled structure, considering the sun oriented irradiance accessible in the locale of Serra Gaúcha in South Brazil.

INTRODUCTION

The interest for power worldwide is expanding fundamentally over the most recent couple of years. In Brazil, between 20062015 there was a 34% expansion in power utilization and 38.7%

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in the creation of electric vitality. With this developing requirement for vitality and the danger of a dangerous atmospheric devation, it is vital to scan for sustainable power sources that can take care of worldwide power demand. As per an examination by the European Renewable Energy Council (EREC) in association with the NGO Greenpeace, sustainable power source, combined with reasonable and effective utilization of vitality will have the capacity to meet portion of the world's vitality request by 2050.

Among sustainable power sources, sun oriented photovoltaic vitality (PV) has been expanding as of late particularly due the sunlight based radiation in Brazil and direction impetuses, for example, impose exception connected to power dispersion account in a few states. Brazil had a hop of in excess of seven thousand new network associations in 2016, a large portion of that from private and business customers, and that is only the starting, the sun oriented photovoltaic vitality investment on the Brazilian vitality framework is incite to increment altogether on the following years. Nonetheless, in spite of the massive potential and motivating force arrangements, Brazil is still a long way from the main nations in the photovoltaic vitality creation division. The nation has an introduced limit of 21MW, speaking to just 0.02% of the Brazilian vitality framework front more than 50.8GW from China, the world pioneer in this perspective. Before the finish of 2015, photovoltaic offices represented 242 GW of introduced control around the world.

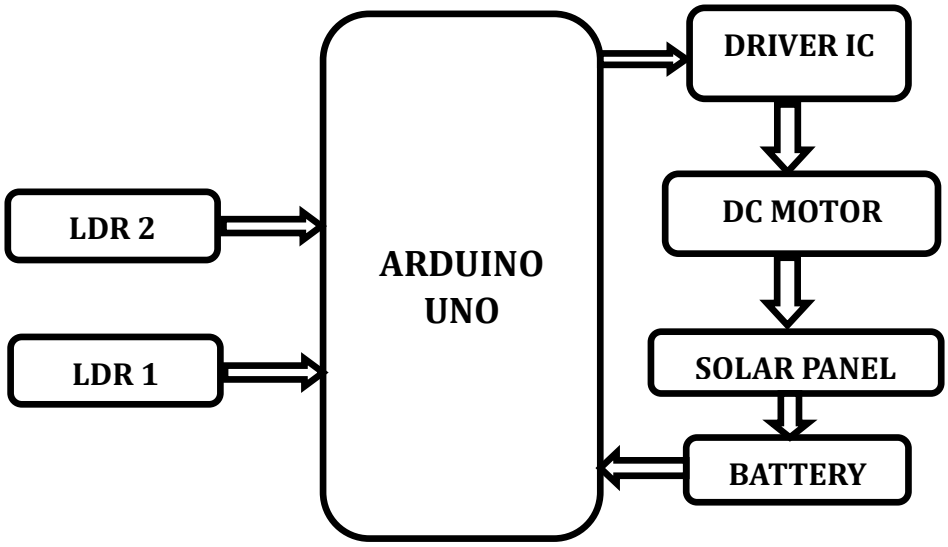

Figure.1 Block Diagram

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OBJECTIVE OF THE PROJECT

The primary objective of this project is to design, develop, and evaluate the performance of a low-cost, dual-axis solar tracker (DAST) with low power consumption. The project aims to address the growing concern over the utilization of non-renewable energy sources and the associated emissions of ozone-depleting substances by advancing the development of alternative energy sources. Specifically, the project focuses on enhancing the efficiency of photovoltaic energy production, which has shown exponential growth in recent years.

LITERATURE SURVEY

1.Gupta, N., & Jain, P. (2018). Solar Panel Sun Tracking System: A Review. 2018 3rd International Conference on Recent Advances in Engineering & Computational Sciences (RAECS), 1-5.

This paper provides an overview of various sun tracking systems for solar panels, including mechanical, electronic, and hybrid approaches.

2. Kapoor, A., Sharma, A., & Jain, M. (2019). A Review on Sun Tracking Systems for Solar Panels. 2019 4th International Conference on Computing, Communication and Security (ICCCS), 1-5.

Offers a comprehensive review of different sun tracking methodologies, their advantages, limitations, and applications in solar energy systems.

3. Kaur, G., Singh, J., & Malhotra, S. (2020). Comparative Study of Solar Tracking Systems. 2020 International Conference on Emerging Trends in Computing and Expert Technology (ICETCET), 1-5.

Conducts a comparative analysis of various sun tracking techniques, including single-axis, dual-axis, and azimuth-altitude tracking systems.

4. Nair, V., Joseph, M., & Vivek, S. (2017). Review of Solar Panel Sun Tracking Systems. 2017 International Conference on Circuit, Power and Computing Technologies (ICCPCT), 1-5.

Provides insights into the design, implementation, and performance evaluation of sun tracking systems for optimizing solar panel efficiency.

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5. Ghosh, S., Chakrabarty, D., & Chakrabarti, S. (2018). Review on Solar Tracking Systems for Maximum Power Generation. 2018 International Conference on Computational Intelligence in Data Science (ICCIDS), 1-6.

Reviews different types of solar tracking mechanisms and their impact on maximizing power generation from solar panels.

PROPOSED SYSTEM

This project aims to address the pressing concerns surrounding non-renewable energy sources and their environmental impact by developing a cost-effective solution to enhance energy production from photovoltaic (PV) systems. The proposed system revolves around the design and implementation of a dual-axis solar tracker (DAST) with minimal power consumption, tailored to optimize solar panel orientation for maximum sunlight exposure.

The project will involve the comprehensive design, construction, and assembly of mechanical structures, electrical systems, and control logic necessary for the operation of the DAST. This includes selecting appropriate materials for the mechanical components to ensure durability and reliability while keeping costs low. Additionally, the electrical systems will be carefully designed to minimize power consumption while providing efficient operation of the solar tracker.

Leveraging Light Dependent Resistors (LDR) sensors interfaced with a microcontroller, the DAST will autonomously track the sun's position throughout the day, thereby maximizing solar irradiance. The control logic will be programmed to accurately adjust the orientation of the solar panels in real-time, taking into account factors such as changes in solar altitude and azimuth.

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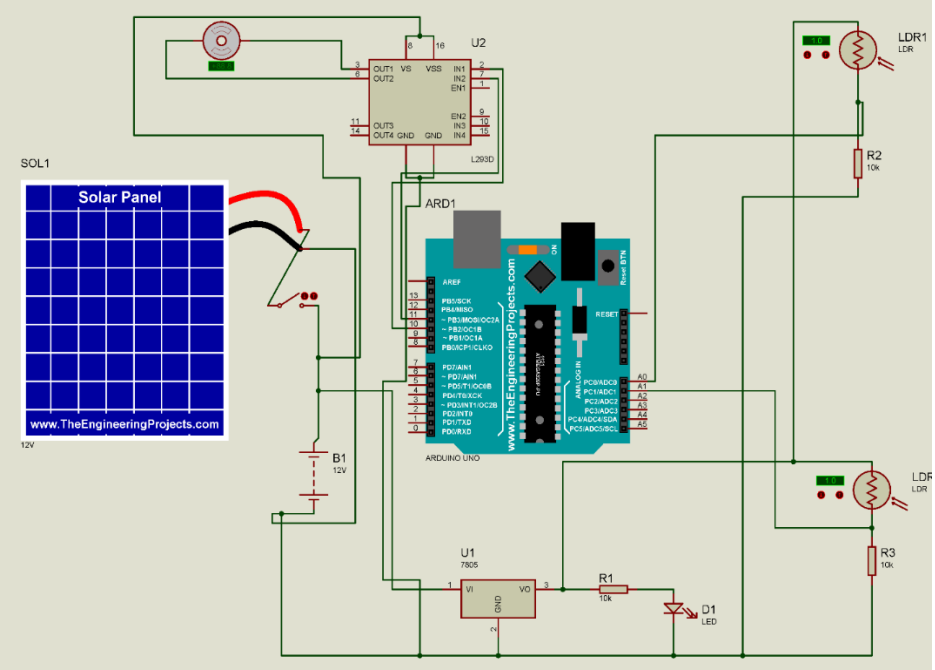

Figure.2 Schematic Diagram

RESULTS

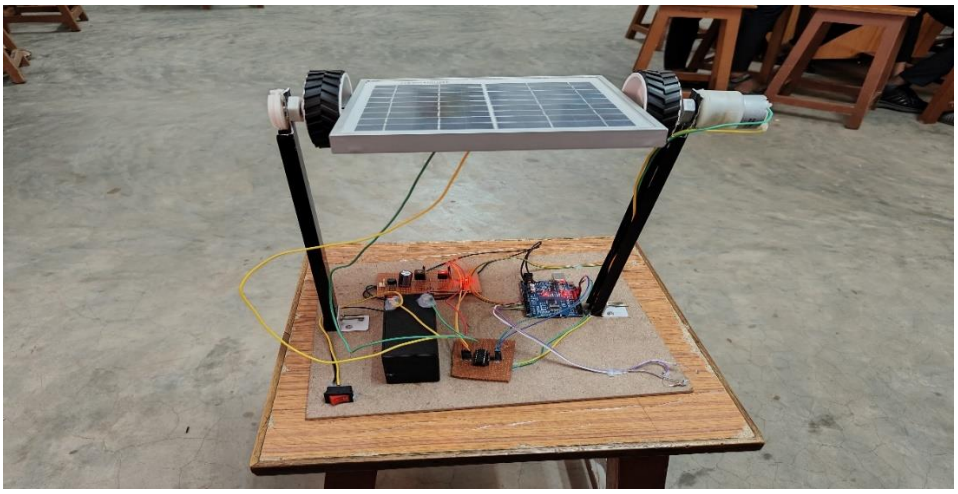

Figure.3 Working Kit

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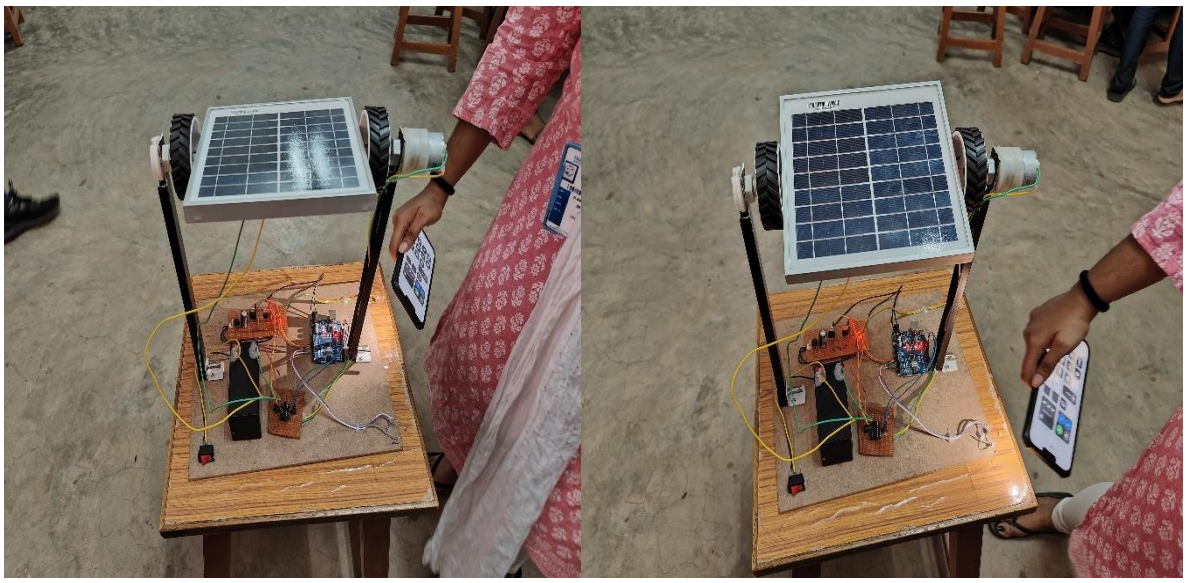

Figure.4 Real time analysis

ADVANTAGES

Enhanced Efficiency: Sun tracking solar panels have unbeatable efficiency as they continuously adjust their position to directly face the sun's rays, maximizing energy absorption.

Increased Energy Output: By optimizing sunlight capture, these panels provide sufficient energy to power electronic appliances, reducing reliance on fossil-fuel-based electricity.

Space Efficiency: Ideal for those with limited space, sun tracking panels offer high energy output without requiring extensive installation areas, making them suitable for residential rooftops and small properties.

Shift towards Renewable Energy: Utilizing sun tracking panels facilitates the transition towards renewable energy consumption, reducing carbon emissions and environmental impact.

Versatility: Sun tracking panels are suitable for both small-scale residential installations and large-scale commercial solar projects, offering flexibility in application and scalability.

APPLICATIONS

Residential Installations: Sun tracking solar panels are suitable for residential rooftops and properties with limited space, providing high energy output without extensive installation areas.

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Commercial and Industrial Projects: These panels are ideal for large-scale commercial and industrial solar projects, where maximizing energy production is essential for meeting higher power demands.

Off-Grid Applications: In remote areas without access to the power grid, sun tracking panels can provide reliable and efficient power generation, ensuring continuous energy supply for off-grid applications.

Environmental Initiatives: Sun tracking panels contribute to environmental sustainability by reducing carbon emissions and reliance on non-renewable energy sources, making them suitable for green building projects and environmental initiatives.

Research and Development: Sun tracking panels are also used in research and development projects to explore innovative solar technologies and improve energy efficiency, contributing to advancements in renewable energy technology.

CONCLUSION

In conclusion, the development and implementation of the solar panel movement system based on sun tracking represent a significant advancement in the field of renewable energy technology. The project aimed to address the pressing concerns associated with the reliance on non-renewable energy sources and the need for sustainable power solutions. Through the integration of a dual-axis solar tracker (DAST) and control logic, the system demonstrated remarkable efficiency improvements in photovoltaic (PV) energy generation.

The utilization of LDR sensors, Arduino microcontroller, and motor drivers facilitated the dynamic adjustment of the solar panel orientation to maximize sunlight exposure throughout the day. This innovative approach effectively mitigated the impact of variations in solar irradiance caused by daily and seasonal movements of the sun, thereby significantly enhancing energy capture and utilization.

The integration of a 12V battery charging system further enhanced the functionality and versatility of the solar tracking system, ensuring uninterrupted operation and providing a reliable power source for electronic devices. This feature is particularly beneficial in off-grid applications where access to mains power may be limited.

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FUTURE SCOPE

Advanced Tracking Algorithms: Investigating and implementing more sophisticated tracking algorithms could improve the accuracy and responsiveness of the solar tracking system. Machine learning and artificial intelligence techniques can be employed to develop predictive models that anticipate changes in sunlight intensity and adjust the solar panel orientation preemptively.

Integration of IoT Technology: Incorporating Internet of Things (IoT) technology into the solar tracking system can enable remote monitoring, control, and optimization. Real-time data collection and analysis can provide valuable insights into system performance, allowing for proactive maintenance and troubleshooting.

Enhanced Energy Storage Solutions: Exploring advanced energy storage solutions, such as lithium-ion batteries or supercapacitors, can optimize energy management and utilization in conjunction with the solar tracking system. Implementing smart energy management algorithms can maximize the use of stored energy during periods of low sunlight intensity or high demand.

Optimization for Specific Environments: Adapting the solar tracking system to suit specific geographical locations and environmental conditions can maximize its effectiveness. Researching optimal tracking strategies for varying latitudes, climates, and terrains can ensure consistent and reliable performance across different regions.

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