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DUAL AXIS SOALR TRACKING SYSTEM

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Abstract: This paper presents a Dual-axis solar tracking system that boosts sun oriented energy assortment by utilizing LDR sensors to recognize the sun's area over the course of the day. The framework is painstakingly designed to ensure successful sun following in the two tomahawks. It comprises of a power supply, Arduino microcontroller, servo motors, LDR sensors, battery, charge controller, and solar panel. Most extreme solar energy is caught, working on yield proficiency, by constantly changing the direction of the sunlight powered charger in view of continuous data from the LDR sensors. The servo engines are told by the Arduino microcontroller to change the place of the sunlight powered charger in light of the examination of simple information from the LDR sensors. The framework's ability to work well even in cloudy climate, working on generally effectiveness and energy creation. Its adequacy and ease of use are additionally improved by the joining of a LCD display driven by the Arduino, which makes ongoing observing of framework working conceivable.

Index Terms: Solar Panel, Tracking System, Arduino, Servo Motor, LCD, Charge controller, Dual-axis solar tracking system

1.INTRODUCTION

Renewable energy sources have filled in notoriety overall because of the exhaustion of conventional energy sources and ecological worries. Sunlight based energy is potential for supportable power creation. Solar radiation's boundlessness and low natural effect make it a promising energy source [1].

Because of further developed effectiveness and lower costs, solar photovoltaic (PV) innovation is generally used to produce power. Fixed-slant PV frameworks, whose boards are fixed and calculated, have downsides. Since daylight hits boards at sideways points toward the beginning of the day and night,

cosine misfortunes diminish energy assortment productivity [2].

Scientists have created sun-tracking solar panels to evade these limitations and increment sun oriented energy assortment. These frameworks powerfully organize sunlight based chargers to screen the sun's situation over the course of the day for ideal daylight openness. Light-detecting innovations for sun following are accessible, but Light Dependent Resistors (LDRs) give more accuracy and trustworthiness [3].

LDR sensors and DC servo engines are utilized to make and execute a sun-tracking solar panel system. The principal objective is to make a more effective sun powered following component than fixed-slant frameworks. The proposed framework expands energy yield, particularly during slanted daylight in the first part of the day and night, by ceaselessly moving the sun powered charger direction to point toward the sun [4].

An Arduino microcontroller controls the solar panel's development by means of LDR sensor inputs. Arduino's configurable elements permit constant sun powered observing for ideal energy reaping. The solar panel's slant point might be changed without a hitch and precisely utilizing servo engines to keep up with oppositeness to the daylight [5].

This drive could further develop sun powered energy framework effectiveness and execution, assisting with moving to a feasible energy future. The recommended technique increments energy creation and sun based power producing benefit by brilliantly checking sun oriented radiation [6].

Sun powered energy enjoys obvious natural benefits. Sunlight based power creation lessens environmental change and air contamination by discharging no ozone harming substances or air poisons. Sunlight based chargers are intriguing as a perfect energy elective since they need little support and keep going quite a while [7].

All in all, this exploration fosters a sun-tracking solar panel system to expand sun based energy use. The framework utilizes LDR sensors, servo engines, and Arduino control to further develop energy assortment and advance sunlight based power [8].

2. LITERATURE SURVEY

Ongoing interest in solar tracking systems has developed in light of the fact that they improve sun powered charger arrangement with the sun's situation to support photovoltaic (PV) power plant effectiveness. This writing survey examines solar tracking system research, technique, innovations, and energy catch proficiency.

Verma et al. [1] audited photovoltaic power plant sun tracking systems widely. Single-pivot and double hub sunlight based trackers were analyzed in the article, alongside their upsides and downsides. Investigation of solar tracking system the board calculations and sensor advances uncovered their consequences for framework execution and energy creation.

Pavan et al. [2] examined a microcontroller-based sun-tracking solar system. Microcontroller-based control calculations were utilized to fabricate and develop a solar tracking device. The innovation naturally arranged sun powered chargers in light of

constant sun position information to increment energy assortment proficiency.

Premkumar and Sowmya [4] recommended a successful MPPT for somewhat concealed solar PV frameworks. Fractional shadowing impacted sunlight based charger execution, in this manner the exploration conceived another MPPT calculation to lessen power misfortunes. The review showed upgraded energy extraction under various shade conditions, further developing framework effectiveness.

Obara et al. [5] made a metal hydride actuator-controlled solar tracking system. The exploration examined substitute incitation strategies for sun oriented following to diminish electric engine use. The review demonstrated the way that metal hydride actuators can follow the sun unequivocally and productively.

Carballo et al. [6] introduced an informative minimal expense sun oriented global positioning framework utilizing open-source equipment. A straightforward and conservative sun based tracker utilizing effectively open parts and open-source stages was planned and executed in the exploration. The review planned to improve active sun based energy innovation learning and trial and error in training.

Hoffmann et al. [7] played out a month to month profile investigation of a two-pivot sun tracker for photovoltaic boards. The examination tried a dual-axis solar tracking device in different environments and spots. The review inspected month to month energy yield examples to decide how well solar tracking boosts energy yield all year.

Abdullahpour et al. [8] made a dual-axis solar tracking system utilizing machine vision. The review utilized picture handling to screen the sun and change sun powered charger direction. The examination utilized machine vision to further develop following accuracy and ecological variation, improving energy assortment effectiveness.

Lim et al. [9] planned and constructed a large-scale dual-axis sun tracker with an upward pivot turning stage and different column rise structures. The examination analyzed the challenges of scaling solar tracking systems for business use, particularly in large PV power offices. The review further developed enormous scope following exactness and unwavering quality by refining mechanical plan and control calculations.

The writing concentrate on shows an assortment of solar tracking system strategies and innovations, each with its own advantages and uses. Specialists are further developing sun tracking technologies from microcontroller-based control calculations to machine vision and other incitation systems to upgrade energy assortment effectiveness and rush the change to a maintainable energy future.

3. METHODOLOGY

a) Proposed Work:

A Dual-axis Solar Tracking System using LDR sensors is introduced for productive sun tracking. The system needs a power source, Arduino microcontroller, servo motors, LDR sensors, battery, charge controller, and solar panel. The Arduino will dissect LDR sensor simple information and make

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servo engine control signals. The engines will pivot the sun powered charger in the two tomahawks to screen the sun over the course of the day. The innovation upgrades sunlight powered charger arrangement to improve sun oriented energy assortment and result productivity, even in mists. This work will further develop solar energy system execution, advancing supportable energy.

b) Block Diagram:

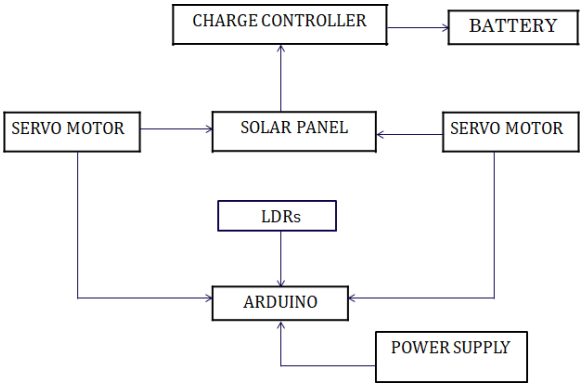

Fig 1 Proposed Block Diagram

In the proposed block diagram, the charge regulator deals with the charging of the battery, which drives the framework. The Arduino microcontroller guides the servo engines to change the heading of the sunlight powered charger. Light Dependent Resistors (LDRs) measure daylight force and give simple information to the Arduino. The Arduino deciphers this information and gives control signs to the servo engines. The sun powered charger, which is coupled to the servo engines, is situated in light of the sun's situation as detected by the LDRs. The power supply supplies electrical capacity to the Arduino and its parts. This coordinated innovation gives exact checking of the sun's development in the two tomahawks, expanding solar energy assortment for worked on yield productivity and execution even in changing weather patterns.

c) Components:

i) Charge Controller:

In a solar power system, a charge regulator controls how quick the battery charges. It makes guaranteeing the sunlight powered chargers give the right voltage and current levels to the battery, trying not to cheat and expanding battery duration.

ii) Battery:

When there is daylight, the sun powered chargers' electrical energy is put away in the battery. In the midst of practically no daylight, it offers a reliable power supply for the framework, ensuring energy accessibility and worked.

iii) Solar Panel:

Utilizing the photovoltaic impact, solar panels change daylight into electrical energy. They act as the principal energy hotspot for the framework and are comprised of connected sun oriented cells that, when presented to daylight, produce direct current (DC) power.

iv) Servo Motor:

A servo engine is a sort of rotating actuator that can precisely control the result shaft's rakish position. To boost sun based openness and energy assortment, servo engines in a solar tracking system move the solar panel to follow the sun's movement.

v) LDRs:

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These sensors change their opposition because of changes in how much light that strikes them. LDRs in a sun oriented global positioning framework follow the sun's area continuously by distinguishing varieties in daylight power and conveying simple messages to the Arduino.

vi) Arduino:

This open-source microcontroller stage is utilized to make intelligent articles and electronic contraptions. The Arduino in a solar tracking system breaks down sensor information, decides the sun's area, and controls servo engine development to expand solar panel arrangement.

vii) Power Supply:

The solar tracking system's parts are fueled by electricity from the power supply. To keep up with consistent activity and framework reliability, it could incorporate a battery reinforcement framework, a lattice connect, or other electrical sources.

d) Working process:

The charge regulator manages battery charging to begin the solar tracking system. Daylight controls the sunlight based chargers, which charge the battery. LDRs screen day to day sun oriented power changes and give simple signs to the Arduino.

The Arduino gauges the sun's situation continuously utilizing LDR information. The Arduino educates the servo engines to adjust the sun powered charger to the sun's development. Greatest daylight openness and energy assortment are accomplished by consistently further developing sunlight based charger direction.

The power supply supplies all parts with power for consistent activity. A synchronized method permits the solar tracking system to reap solar energy, conveying steady and feasible power for some purposes really.

4. EXPERIMENTAL RESULTS

Fig 2 Prototype Fabrication

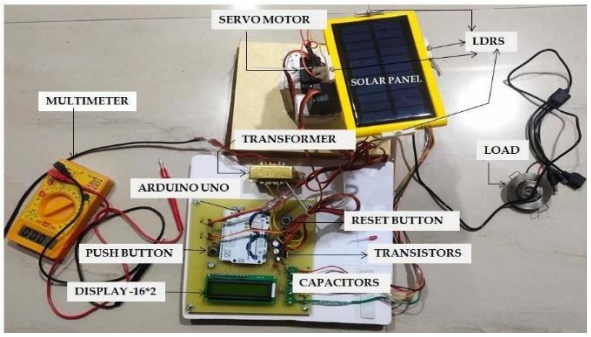

Fig 3 Hardware prototype

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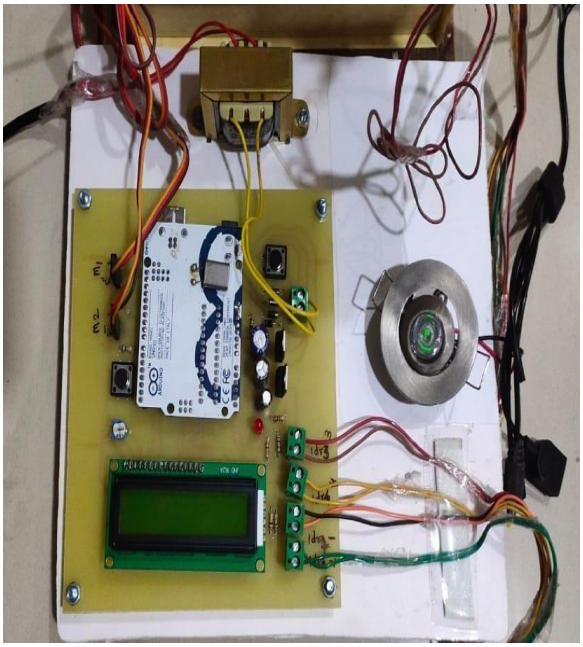

Fig 4 Circuit Connections

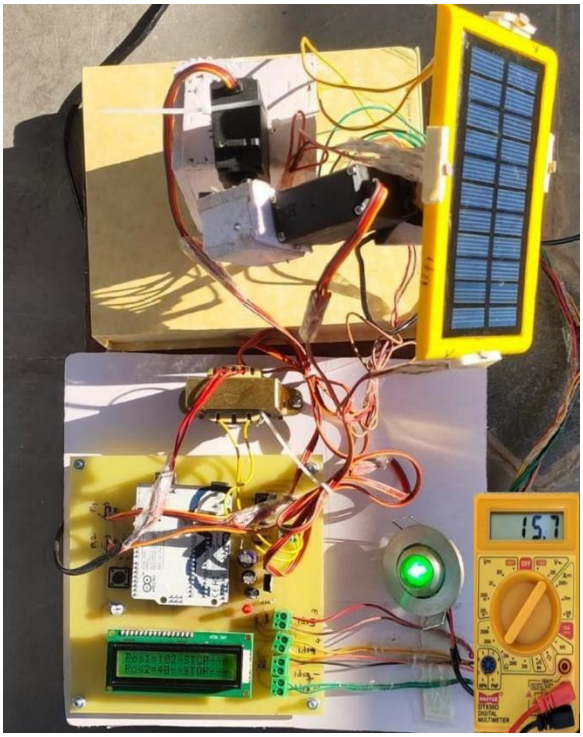

Fig 5 when LDR1 has more light intensity

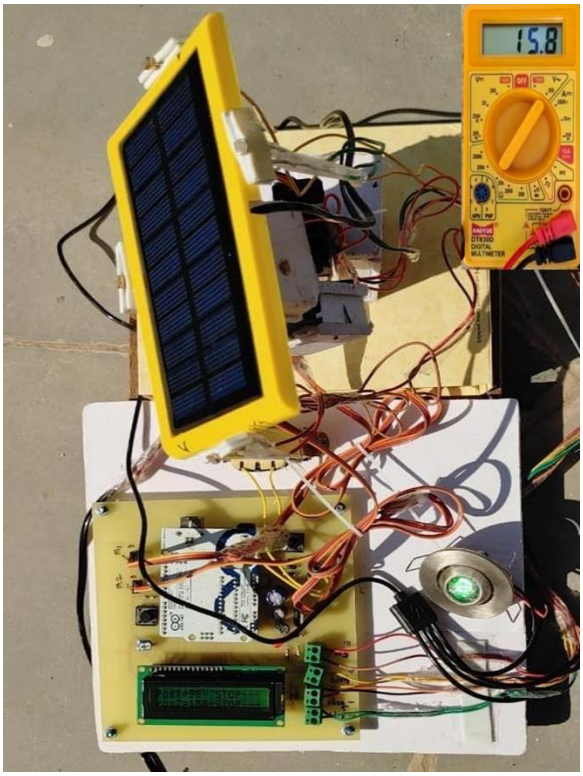

Fig 6 when LDR2 has more light intensity

Fig 7 when LDR3 has more light intensity

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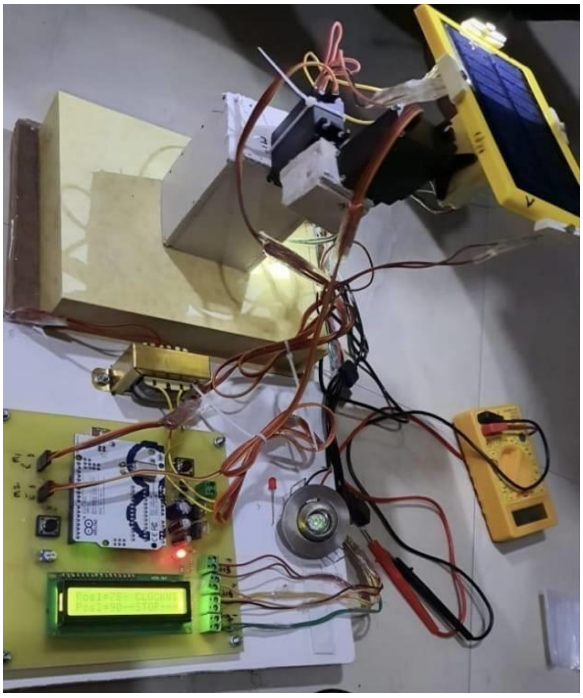

Fig 8 when LDR3 has more light intensity

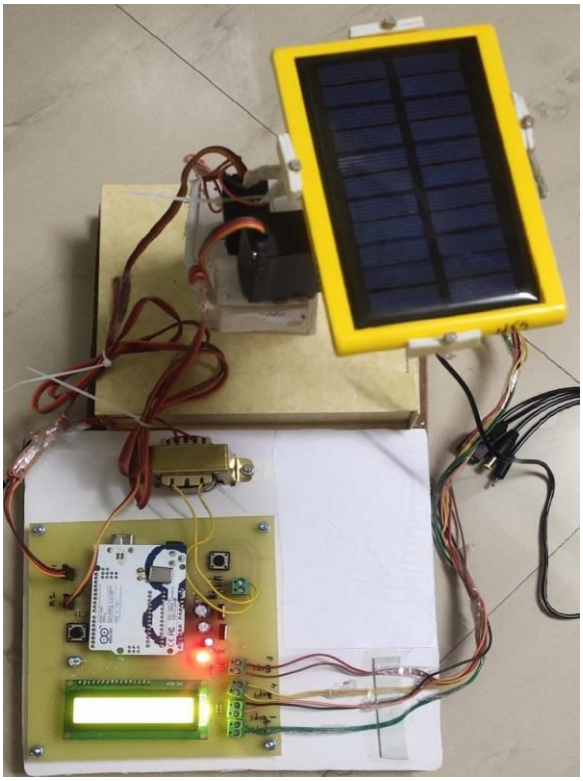

Fig 9 when LDR1=LDR2=LDR3=LDR4

5. CONCLUSION

To summarize, there are a great deal of advantages that the recommended dual-axis solar tracking system with LDR sensors has over fixed and single-hub global positioning frameworks. By joining two DC servo engines under the course of an Arduino microcontroller, the framework can follow the development of the sun in both even and vertical tomahawks, accordingly improving the assortment of sun based energy. At the point when single-pivot and double hub following are thought about, the last option creates over 40% more prominent energy creation, making it the best method for changing over sun oriented energy. Besides, the reproduction results affirm how well the framework attempts to build the energy creation of a PV framework that is connected to the network. The dual-axis solar tracker is a reasonable choice that might be useful to help energy proficiency and decrease reliance on regular energy sources because of its robotized working and minimal expense plan. In light of everything, this study accentuates how pivotal state of the art following advancement’s are to augmenting solar energy use and propelling manageability in power creation.

6. FUTURES SCOPE

The arranged dual-axis solar tracking system will ultimately be upgraded further utilizing modern sun tracking calculations, coordinated brilliant lattice highlights for better energy the executives, and ML approaches for execution and prescient upkeep. Further examination could focus on further developing the framework's part parts' strength and

constancy, exploring other sensor advancements for further developed accuracy, and growing the framework to oblige greater establishments. Dual-axis solar tracking systems might be embraced all the more rapidly by means of organizations with organizations and taxpayer supported initiatives, which will support the shift to feasible and successful solar energy use.

REFERENCES

1. Bhagwan Deen Verma, Prof. (Dr.) Mukesh Pandey, Asst. Prof. Anurag Gour. "A Review Paper on Solar Tracking System for Photovoltaic Power Plant". International Journal of Engineering Research & Technology Vol. 9 Issue 02, February(2020): 2278-0181

2. Pavan kalyan .G, Dharma .B, Anil kumar .B, Sagar nayak. "Sun Tracking Solar System Using Microcontrollers."International Journal of Innovative Research In Technology 147981: 2349-6002.

3. Cotfas, D. T., and Cotfas P. A. "Multiconcept methods to enhance photovoltaic system efficiency." International Journal of Photoenergy 2019 (2019).

4. Premkumar, M., and R. Sowmya. "An effective maximum power point tracker for partially shaded solar photovoltaic systems." Energy Reports 5 (2019): 1445-1462.

5. Obara, Shin'ya, Kazuhiro Matsumura, Shun Aizawa, Hiroyuki Kobayashi, Yasuhiro Hamada, and Takanori Suda. "Development of a solar tracking system of a nonelectric power source by using a metal hydride actuator." Solar Energy 158 (2017): 1016-1025.

6. Carballo, Jose A., Javier Bonilla, Lidia Roca, and Manuel Berenguel. "New low-cost solar tracking system based on open source hardware for educational purposes." Solar Energy 174 (2018): 826-836.

7. Hoffmann, Fábio Moacir, Rolf Fredi Molz, João Victor Kothe, Elpidio Oscar Benitez Nara, and Leonel Pablo Carvalho Tedesco. "Monthly profile analysis based on a two-axis solar tracker proposal for photovoltaic panels." Renewable energy 115 (2018): 750-759.

8. Abdollahpour, Masoumeh, Mahmood Reza Golzarian, Abbas Rohani, and Hossein AbootorabiZarchi. "Development of a machine vision dual-axis solar tracking system." solar energy 169 (2018): 136-143.

9. Lim, Boon-Han, Chern-Sing Lim, Hu Li, Xing-Lan Hu, Kok-Keong Chong, Jin- Long Zong, Ke Kang, and Woei-Chong Tan. "Industrial design and implementation of a large-scale dual-axis sun tracker with a vertical-axis- rotating-platform and multiple-row-elevation structures." Solar Energy 199 (2020): 596-616.

10. Fernández-Ahumada, L. M, Ramírez-Faz. J, López-Luque. R, M. Varo- Martínez, Moreno-García. I. M., and Casares de la Torre. F. "A novel backtracking approach for two-axis solar PV tracking plants." Renewable Energy 145 (2020): 1214-1221.

11. Chowdhury, Muhammad EH, Amith Khandakar, Belayat Hossain, and Rayaan Abouhasera. "A low-cost closed-loop solar tracking

system based on the sun position algorithm." Journal of Sensors 2019 (2019).

12. Khan, Rafid Adnan, Rezwanul Mahmood. M, and Anisul Haque. "Enhanced energy extraction in an open loop single-axis solar tracking PV system with optimized tracker rotation about tilted axis." Journal of Renewable and Sustainable Energy 10, no. 4 (2018): 045301.

13. Hafez. A.Z, Yousef. A.M, and Harag. N.M. "Solar tracking systems: Technologies and trackers drive types–A review." Renewable and Sustainable Energy Reviews 91 (2018): 754-782.

14. Carballo, Jose A., Javier Bonilla, Manuel Berenguel, Jesús Fernández-Reche, and Ginés García. "New approach for solar tracking systems based on computer vision, low cost hardware and deep learning." Renewable energy 133 (2019): 1158-1166.

15. Umar, Najibhamisu, Birinchi Bora, Chandan Banerjee, and Panwar. B. S. "Comparison of different PV power simulation softwares: case study on performance analysis of 1 MW grid-connected PV solar power plant." International Journal of Engineering Science Invention (IJESI) 7, no. 7 (2018): 11-24.

16. Baby Shalini. V, Gattu Vinay Goud, Chandragiri Radha Charan. " Grid Connected Rooftop Solar Pv System: A Pre-Feasibility Estimation Using Pvsol Premium And System Advisor Model(Sam) " International Journal Of Scientific & Technology (2019)

17. Khalil, Linta, Kamran Liaquat Bhatti, Arslan Iqbal Awan. M, Mughees Riaz, Kiran Khalil, and Nashitah Alwaz. "Optimization and designing of hybrid power system using HOMER pro." Materials Today: Proceedings (2020).

18. Ozcan, Huseyin Gunhan, Huseyin Gunerhan, Nurdan Yildirim, and Arif Hepbasli. "A comprehensive evaluation of PV electricity production methods and life cycle energy-cost assessment of a particular system." Journal of Cleaner Production 238 (2019): 117883.

19. Sharma, Rakhi, Shivanshu Sharma, and Sumit Tiwari. "Design optimization of solar PV water pumping system." Materials Today: Proceedings 21 (2020): 1673-1679.

20. Mochi, Pratik K. "Simulation and Performance Analysis of 100kWp Grid Connected Solar Photovoltaic Plant Using PVSyst Software." In National Workshop on Research challenges in Power Electronics & Power System. NIT Calicut, 2016.