International Journal for Modern Trends in Science and Technology, 8(08): 153-156, 2022

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0808021
Available online at: http://www.ijmtst.com/vol8issue08.html

Dual Axis Solar Tracker

Sai Srikanth V, V S Subrahmanyam, S.Praveen Kumar, K. Sai Bharath, R. Tarun Danteswar, S. Abhishek Y.Teja Naveen

Department of Mechanical Engineering, Raghu Engineering College(A)- Affiliated to JNTUK-Kakinada, Andhra Pradesh, India,

To Cite this Article
Sai Srikanth V, V S Subrahmanyam, S.Praveen Kumar, K. Sai Bharath, R. Tarun Danteswar and S. Abhishek Y.Teja Naveen . Dual Axis Solar Tracker. International Journal for Modern Trends in Science and Technology 2022, 8(08), pp. 153-156. https://doi.org/10.46501/IJMTST0808021

Article Info
Received: 11 July 2022; Accepted: 06 August 2022; Published: 12 August 2022.

ABSTRACT

Energy crisis is one of the prime issues in the third world developing country like Bangladesh. There is an enormous gap between generation and demand of electrical energy. Nearly 50% population of the country is extremely isolated from this blessing. Renewable energy is the only answer to solve this issue. Solar energy is one of the most effective resources of the renewable energy which could play a significant role to solve this crisis. This research presents a performance analysis of the dual axis solar tracking system using Arduino. The main objective of this research is whether a static solar panel is better than solar tracker or not. This work is divided into two parts hardware and software system. In hardware part, four light dependent resistors (LDR) is used to detect the utmost light source from the sun. Two servo motors conjointly used to move the solar panel to maximum light source location perceived by the LDRs. In software part, the code is written by using C programming language and has targeted to the Arduino UNO controller. The outcome of the solar tracker system has analyzed and compared with the fixed or static solar panel found better performance in terms of voltage, current and power. Therefore, the solar tracker is proved more practical for capturing the maximum sunlight supply for star harvesting applications. The result showed dualaxis solar tracking system produced extra 10.53-watt power compared with fixed and single axis solar tracking system.

Keywords—solar tracking; single axis; dual axis; light depending resistor (LDR), servo motor, arduino, altitude, azimuth, charge controller.

1. INTRODUCTION

The present condition of worldwide crisis for major energy resource causes a huge raise in the prices of combustible sources of energy. So there is a growing demand to find greener ways to power the world and minimize green house gas emission. In this worst challenging condition there is no other way than to find for renewable energy resource [1]. The sun is the natural power source that will keep on sharing its energy and most unlikely to vanish. It is a renewable resource that is clean and economical. This energy is available everywhere but due to geographical location Bangladesh receives the maximum amount of energy from sun [2]. Therefore, solar energy is rapidly getting popularity as an important means of expanding renewable energy resources. But most of the solar panels in Bangladesh are positioned on a fixed surface such as roof. As sun is a moving object, this approach is

not the best method. One of the solutions is to use a solar tracker that will actively follow the Sun. A solar tracker is a sensory device built with the solar panel which tracks the motion of the sun across the sky and moves the solar panel according to that motion o the sun, ensuring that the maximum amount of sunlight strikes the panels throughout the day. After finding the sunlight, the tracker tries to navigate through the path ensuring the best sunlight is detected. Commercially, single-axis and two axis tracking mechanisms are available. Previous researchers [3] used single axis tracking system which follows only the Sun's east-west movement. But the earth has two types o motion, the daily motion and the annual motion The daily motion causes the sun to appear in east to west direction over the earth where as the annual motion causes the sun to tilt at an angle o 3 while moving alone east-west direction [4] So the maximum efficiency of the solar panel is not being used by www.aasrc.org/aasrj American Academic & Scholarly Research Journal Vol. 5, No. 1, Jan. 2013 48 single axis tracking system. To track the sun movement accurately dual axis tracking system is necessary. With the sun always facing the panel, the maximum energy can be absorbed as the panel operates at its greatest efficiency. The main objective of this paper is to improve the power gain by accurate tracking of the sun. To develop this dual axis tracking system light dependent resistor (LDR) is used as sensor. The resistance of LDR decreases with increasing light intensity [5]. Two dual Op-amps are used as comparator for comparing the light intensity in two different axes. Again diodes are used for neglecting the negative voltages coming from the comparators. Microcontroller generates the suitable control signals to move the motors in the proper direction. But the microcontroller output ranges from 0 to 5 volt [6]. So to increase the voltage and current level motor driver is used. Two 12 volt full geared stepper motors are used here for rotating the solar panel in two different axes.

2. LITERATURE REVIEW

The first solar tracker was a mechanical system by C. Finster, invented in 1962. Though the Finster solar tracker realized insignificant energy gains, years of testing and research have led to improvement of the conversion output of the PV system and consequently the emergency of different tracking technologies and applications (e.g. concentrator and non-concentrator). In short, improved solar cells have been developed and the use of solar tracking system over the use of conventional fixed PV system has grown. In fixed photovoltaic system the solar receiver (PV module) is in a stationary position facing the true north. However, with mechanical or electro-mechanical systems, the orientation of the collector change continually in reference to the azimuthal directions (east-west) and also in its elevation. This is dependent on the tracker's geometrical capacity.

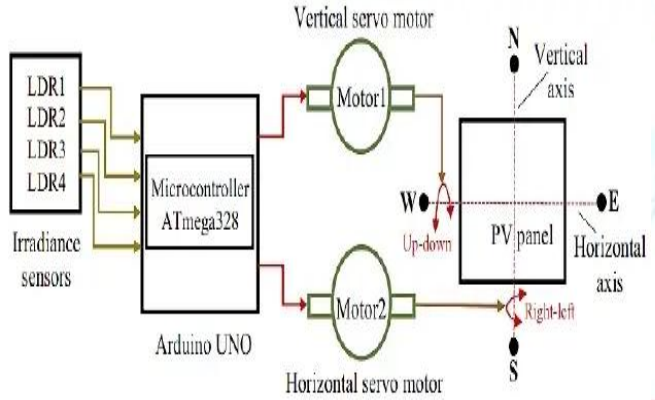
1. 3. EXPERIMENTAL SETUP & METHODOLOGY

Solar panel is mainly made from semiconductor materials. Si used as the major component of solar panels, which is maximum 24.5% efficient. Unless highly efficient solar panels are invented, the only way to enhance the performance of a solar panel is to increase the intensity of light falling on it. Three ways of increasing the efficiency of the solar panels are through increase of cell efficiency, maximizing the power output and the use of a tracking system. MPPT technology will only offer maximum power which can be received from stationary arrays of solar panels at any given time. The technology cannot however increase generation of power when the sun is not aligned with the system. Because the position of the sun changes during the course of the day and season over the year. So, the implementation of a solar tracker is the best solution to increase energy production. Solar tracking is a system that is mechanized to track the position of the sun and align perpendicular to increase power output by between 30% and 60% than systems that are stationary. It is a more cost-effective solution than the purchase of solar panels. Some researchers have conducted various studies to establish the optimal degree of tilt of a solar panel to increase the output power. Currently, there are two main types of solar trackers: the one axis and two axes.

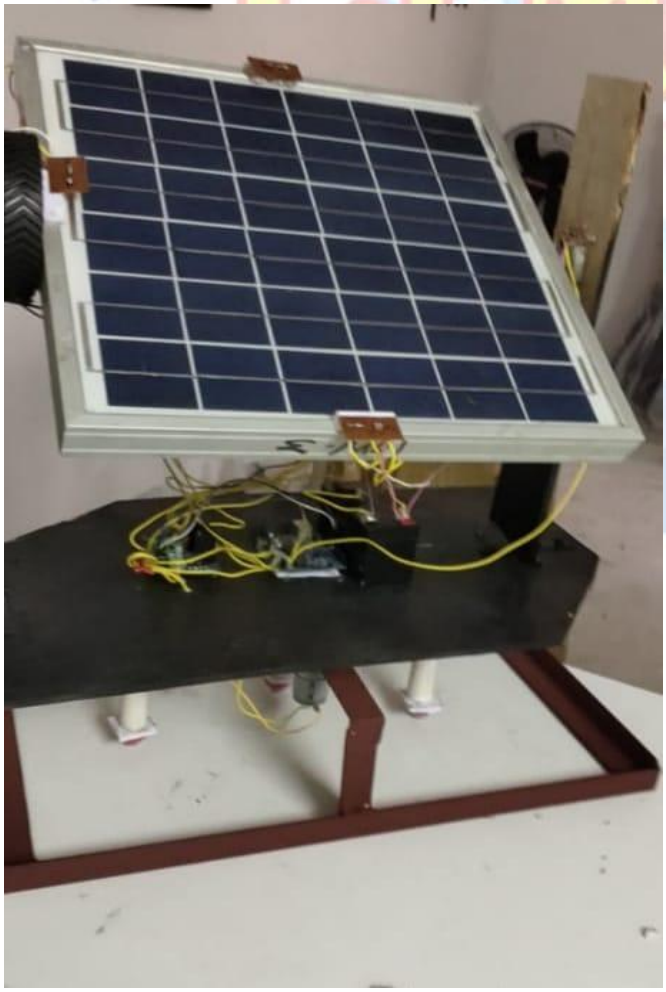
Single-axis trackers have only one axis of movement as shown in usually aligned with North and South. This allows the panels to arc from east to west, tracking the sun as it rises, travels across the sky, and sets. Dual-axis trackers have two degrees of freedom as shown in, that act as axes of rotation, aligned with North-South and with East-West, giving them a wide range of position

options. When seasons changes, the sun's path goes from low in the sky in winter too high in the sky in summer as shown in figure. So, in order to accurately follow the sun, the two-axis tracking is required as solar azimuth angle as well as solar altitude angle of sun varies (in two axis) all the time [23].

This optimizes maximum power from the PV system over a day than non-tracking system.



4. EXPERIMENTAL SET UP OF DUAL AXIS SOLAR TRACKER:



5. CONCLUSION:

Dual axis tracker utterly aligns with the sun route and tracks the sun movement in a very a lot of cost-effective loom and includes a marvelous performance upgrading. The investigational outcomes clearly show that dual axis tracking is good enough than single and fixed solar systems. The proposed system is value effective conjointly as a stroke adjustment in single axis tracker provided notable power increase within the system. Through our experiments, we've got found that dual axis tracking will increase energy by about 40% of the fixed arrays. With a lot of works and higher systems, we tend to believe that this figure can raise more.

3. FUTURE WORK:

Commercially, dual axis solar tracking is still rare even in countries wherever a major part of electricity is being produced by solar energy as they claim that single axis tracking is doing the work. However dual axis tracking will noticeably increase the potency. For our research work we've implemented this procedure on a sporadic power PV panel. Cost effectiveness and proposed system potency may be discovered on a business level. This research used mono crystalline PV panel. But a poly crystalline material based PV panel also can be used for this proposed model. We used LDR for this proposed model but LDR is not a good choice as a sensor as it affected by dust. So in future, we can also use the more efficient sensor. A reliable structure is very expensive compared to solar panel cost; therefore, adding an additional panel to the system instead of spending on tracking structure is much more cost effective.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Brahmeshwararao V.K., Kumar D.H. Arduino based two axis solar tracking by servo mechanism.

[2] itla L.S., Malode Y. Dual axis solar tracking system for maximum power using Arduino.

[3] Reddy S., Mouli C. Development of dual axis solar tracker with Arduino with lab view.

[4] Farhana A., Titirsha T., Sanjidah S., et al. Installing dual axis solar tracker on rooftop to meet the soaring demand of energy for

developing countries. In India Conference (INDICON), 2013Annual IEEE, 2013, 1-5p.

[5] Siddique A.R.M., Titirsha T., Sanjidah S., et al. An Analytical Approach to Design a Cost Effective Dual Axis Solar Tracker Based on CSP and PVT technology.

[6] Deepthi S., Ponni A., Ranjitha R., Dhanabal R. Comparison of efficiencies of single-axis tracking system and dual-axis tracking system with fixed mount. International Journal of Engineering Science and Innovative Technology. 2013, 2(2), 425-430p.

[7] Hussain A.S., Siddiq A.I., Aziz M.W. Microcontroller Based Dual Axis Sun Tracking System for Maximum Solar Energy Generation. American Journal of Energy.

[8] Shrivastava S.M. Dual axis solar tracker. Gautam Budh Technical University, Journal of Electrical and Communication. 2013.

[9] J Pradeep, "Development of Dual-Axis Solar Tracking using Arduino with Lab VIEW," International Journal of Engineering Trends and Technology (IJETT), vol. 17, p. 321, 2014.

[10] Md. Tanvir Arafat Khan, "Design and Construction of an Automatic Solar Tracking System," International Conference on Electrical and Computer Engineering, ICECE, pp. 326-27, December 2010.

[11] O. R. Otieno, "SOLAR TRACKER FOR SOLAR PANEL," University of Nairobi, 2009.

[12] "Utility Drive," 29 November 2016. [Online]. Available: https://www.utilitydive.com/news/following-the-sun-a-brief-history-of-solartrackers/431189/. [Accessed 29 September 2018].

[13] "Coursera," [Online]. Available: https://www.coursera.org/lecture/photovoltaic-solar-energy/1-the-global-contextenergetics-SQu3n. [Accessed 29 October 2018].

[14] Online]. Available: https://www.finder.com/uk/nation-most-solar-power. [Accessed 28 October 2018]