

# Dual Axis Solar Tracking System-A Comprehensive Study

Mr. Nikhil U. Nagose, Mr. Vaibhav B. Dodke, Ms. Shreya A. Thawari, Mr. Rajat C. Patil,  
Mr. Adarsh R. Damle, Ms. Bhagyashree D. Rathod, Prof. Ekeshwari A. Rangari  
Jagadambha College of Engineering and Technology, Yavatmal, India

**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 dual axis 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

## I. INTRODUCTION

Now a day's our socio-pecuniary growth depends on a lot of electrical energy. However, in rising countries, this electrical energy is feebly managed. So we can solve this problem by using renewable energy. Solar, wind, gas, biomass, water etc. sources of renewable energy. Among this solar power is being rife attributable to its non-contaminated assets. This solar power is regenerated into electricity for supplementary use. This revolution is done by exploitation photo-voltaic switch. Solar panels are utilized in incarcerate the solar irradiance. However solar tracker is best than the panel because it senses the twist of the world rotates by its axes following the formatter will need to create these components, incorporating the applicable criteria that follow. Solar energy is the main furnish source of all energy produced by sunlight. The energy of the sun reaches on earth with entirely different rays. A huge amount of energy is transmitted from the sun every day; within the earth, we get a diminutive magnitude of it. It sparkling and absolve to the entire and that we can never face the insufficiency of solar energy like more than a few different energy. During this work dual axis, solar tracker is the main focus to talk about [20]. This paper also demonstrates the renewable energy state of dealings, entirely special light sensors, some expected value of solar tracker etc. We are going to end with the premeditated tricks which might be functional for upward the solar energy.

## II. SOLAR ENERGY

### 2.1 Solar Energy Circumstances of Bangladesh

Developing country like Bangladesh, we don't have an adequate electric energy. Presently the quantity has augmented to 53% [2]. The government has located up the purpose of on condition that electricity to all by 2020 and to make sure consistent and eminence supply of electricity at a level-headed and inexpensive cost [2]. Extension of Renewable Energy is one of the vital strategies adopted as a piece of petroleum diversification agenda [2]. Renewable Energy

policy 2009, the Government is policy to smooth the progress of both public and private sector investment in Renewable Energy projects to replacement indigenous non- renewable energy supplies and scale up contributions of existing Renewable Energy based electricity productions [2]. The Renewable Energy strategy envisions that 5% of total vigor fabrication will have to be achieved by 2015 and 10% by 2020 [2]. To achieve this intention, Government of Bangladesh is looking for an assortment of options sooner Renewable Energy assets. The Government of Bangladesh has already launched “500 MW Solar Power Mission” to promote the use of Renewable Energy to solve the scarcity of electricity [2].

### 2.2 Solar Energy Perception in Bangladesh

Bangladesh has a hopeful radical prospective in solar energy. To fulfill this demand Bangladesh government has premeditated to increase countrywide power production competence up to 16000 MW of that 800 MW is expected to be generate from renewable sources [5].

### III. SOLAR TRACKER

A solar tracker is a perfect tool for track the path of the sun from east and west during daytime [20]. Usually solar tracker is classify into two group i.e. i) Single axis solar and ii) dual axis tracker. For a conscientious line of longitude, every day sun moves from east to west on a fixed solar path [20]. However, the sun moves through 460 degrees north and south throughout the seasonal revision. In our proposed model we have partiality to use micro controller based dual axis solar tracking system [16]. The angles of occurrence of sun beam are going to be 0°. We use light dependent resistors (LDR) for trace intensity of the light of the sun [20]. LDR incessantly monitor the solar emission and this data is transferred to the servo motor via micro-controller [20]. Where the intensity of sunshine is highest the servo motor moves the panel that direction [20]. Our proposed model is to calm the ability expenditure and make the highest use of solar power generation [20]. The main plus point of our proposed model is that we use two servo motor. In order to control two motor, system desires a lot of power. Within the projected model we tend to don't use two servo motor at the same time. At the preliminary stipulation two servo motor begins running [20]. Since the sun change its location device detects the position of the sun and it takes four minute [16]. When the sun moves from east to west, second servo motor can stop working which situated in vertically in the solar tracker. The second servo motor will begin running if through the sun moves to the north or south position [16]. During summer the solar path relies close to same in Bangladesh. The second servo motor won't run if there's no seasonal change. The movement of the solar panel towards in vertical and horizontal on azimuth and altitude angle is taken as a reference [5]. The solar elevation approach is distinct for the reason that the angle located stuck between the horizontal and as a result the line linking to the sun [16]. At nightfall or break of day distance from the ground approach is 0° and formerly the sun is at the pinnacle the height above sea level angle relies 90° [14].“Fig. 1,” shows the position of the sun over the year.The dual-axis in service is as good as to single axis however it captures the solar energy more productively by rotating within the horizontal as well because the vertical axis the likely anticipated for dual axis tracker is shown in “Fig 3,” [12]. 4 LDR sensors, 2 servo motor and Arduino microcontroller consists our proposed system. One rest of sensors and one motor is used to incline the tracker in sun's east – west route and the other rest of sensors and also the other motor that is mounted at the base of the tracker is used to tilt the tracker within the sun's north-south route [12]

### IV. 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.

#### V. 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.

#### REFERENCES

- [1] Jahan, Nusrat, Md Abir Hasan, Mohammad Tanvir Hossain, and NwomeySubayer. "Present status of installed solar energy for generation of electricity in Bangladesh." *Int J Sci Eng Res* 4 (2013): 604-8.
- [2] Daily Generation Data sheet, Bangladesh Power Development Board (BPDB), available at < > Last accessed on 06 June, 2017 at 12:30 pm.
- [3] Bank, Grameen. "Grameen hakti: pioneering and expanding green energy revolution to rural Bangladesh." (2007).
- [4] R. Nicole, "Title of paper with only first word capitalized," *J. Name Stand. Abbrev.*, in press. [5] Afrin, Farhana, Twisha Titirsha, Syeda Sanjidah, A. R. M. Siddique, and Asif Rabbani. "Installing dual axis solar tracker on rooftop to meet the soaring demand of energy for developing countries." In *India Conference (INDICON), 2013 Annual IEEE*, pp. 1-5. IEEE, 2013.
- [6] Cheema, Sukhraj Singh. "Simulation studies on dual axis solar photovoltaic panel tracking system." PhD diss., Thapar University Patiala, 2012
- [7] Barsoum, Nader. "Fabrication of dual-axis solar tracking controller project." *Intelligent Control and Automation* 2, no. 02 (2011): 57.
- [8] Charge controller concepts: available at, >, Last accessed on 29 June, 2016 at 11.30 pm.
- [9] Boylestad, Robert L. *Electronic Devices and Circuit Theory: For VTU*, 10/e. Pearson Education India.
- [10] Dhanabal, R., V. Bharathi, R. Ranjitha, A. Ponni, S. Deepthi, and P. Mageshkannan. "Comparison of efficiencies of solar tracker systems with static panel single-axis tracking system and dual-axis tracking system with fixed mount." *International journal of engineering and technology* 5, no. 2 (2013): 1925-1933.
- [11] Akbar, Hussain S., Abulrahman I. Siddiq, and Marwa W. Aziz. "Microcontroller Based Dual Axis Sun Tracking System for Maximum Solar Energy Generation." *American Journal of Energy*. [12] Deepthi, S., A. Ponni, R. Ranjitha, and R. Dhanabal. "Comparison of efficiencies of single-axis tracking system and dual-axis tracking system with fixed mount." *International Journal of Engineering Science and Innovative Technology* 2, no. 2 (2013): 425-430.
- [13] Bangladesh rural electrification and renewable energy development – SHS project available at, < > Last accessed on 10 April 2017.
- [14] Shrivastava, Swetansh Mani. "Dual axis solar tracker." *Gautam Budh Technical University Journal of Electrical and Communication* (2013).
- [15] Aashir Walled, DR. K M Hassan, Umar Siddique Virk "Designing a Dual Axis Solar Tracker For Optimum Power." *University of Engineering and Technology, Lahore Journal of Electrical Engineering*.
- [16] Siddique, A. R. M., Twisha Titirsha, Syeda Sanjidah, Farhana Afrin, and Asif Rabbani. "An Analytical Approach to Design a Cost Effective Dual Axis Solar Tracker Based on CSP and PV Technology."
- [17] Titirsha, Twisha, A. R. M. Siddique, Farhana Afrin, Syeda Sanjidah, and Asif Rabbani. "Introducing dual axis solar tracker with reflector to increase optimal electricity generation in Bangladesh." In *Developments in Renewable Energy Technology (ICDRET), 2014 3rd International Conference on the*, pp. 1-6. IEEE, 2014.
- [18] Hossain, Shah Mohazzem, Md Rokonzaman, and Mohammed Hossam-E-Haider. "Sustainability, Prospect and Challenges of Renewable Energy in Bangladesh."
- [19] Islam, Mohammed Rafiqul, Md Nur Alam, and Rezaul Karim. "Solar PV System Design and Installation at Roof Top to Partial Fulfillment of Elevator and Common Load."

[20] Afrin, Farhana, Twisha Titirsha, Syeda Sanjidah, A. R. M. Siddique, and Asif Rabbani. "Installing dual axis solar tracker on rooftop to meet the soaring demand of energy for developing countries." In India Conference (INDICON), 2013 Annual IEEE, pp. 1-5. IEEE, 2013.