iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** IV **Month of publication:** April 2022

DOI: https://doi.org/10.22214/ijraset.2022.41498

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue IV Apr 2022- Available at www.ijraset.com

Dual Axis Solar Tracker with Cleaner

Ketan Patil[1], Rohan Dhulap[2], Sanket Kinjalaskar[3], Neeraj Kumar Yadav[4], Prof. Abdul Bari[5]
[1,2,3,4]*B.E. Student,* [5]*Professor, Dept. of Mechanical Engineering, Theem College of Engineering, Boisar, India*

Abstract: ***The goal of this project was to develop a laboratory prototype of a solar tracking system, which is able to enhance the performance of the photovoltaic modules in a solar energy system. The operating principle of the device is to keep the photovoltaic modules (solar panels) constantly aligned with the sunbeams, which maximizes the exposure of solar panel to the Sun's radiation. As a result, more output power can be produced by the solar panel. The work of the project included hardware design and implementation, together with software programming for the microcontroller unit of the solar tracker. The system utilized an Arduino sensor microcontroller to control motion of two D/C motors, which rotate solar panel in two axes. The amount of rotation was determined by the microcontroller, based on inputs retrieved from four photo sensors located next to solar panel. At the end of the project, and one cleaning unit also installed to clean the solar panels automatically with switch, a functional solar tracking system was designed and implemented. It was able to keep the solar panel aligned with the sun, or any light source repetitively. Design of the solar tracker from this project is also a reference and a starting point for the development of more advanced systems in the future.***

I. INTRODUCTION

With the unavoidable shortage of fossil fuel sources in the future, renewable types of energy have become a topic of interest for researchers, technicians, investors and decision makers all around the world. New types of energy that are getting attention include hydroelectricity, bioenergy, solar, wind and geothermal energy, tidal power and wave power. Because of their renewability, they are considered as favourable replacements for fossil fuel sources. Among those types of energy, solar photovoltaic (PV) energy is one of the most available resources. This technology has been adopted more widely for residential use nowadays, thanks to research and development activities to improve solar cells' performance and lower the cost. According to International Energy Agency (IEA), worldwide PV capacity has grown at 49% per year on average since early 2000s. Solar PV energy is highly expected to become a major source of power in the future.

However, despite the advantages, solar PV energy is still far from replacing traditional sources on the market. It is still a challenge to maximize power output of PV systems in areas that don't receive a large amount of solar radiation. We still need more advanced technologies from manufacturers to improve the capability of PV materials, but improvement of system design and module construction is a feasible approach to make solar PV power more efficient, thus being a reliable choice for customers. Aiming for that purpose, this project had been carried out to support the development of such promising technology. One of the main methods of increasing efficiency is to maximize the duration of exposure to the Sun. Tracking systems help achieve this by keeping PV solar panels aligned at the appropriate angle with the sun rays at any time. And with automatic cleaner it can clean all dust particles from solar panels with one switch. The goal of this project is to build a prototype of light tracking system at smaller scale, but the design can be applied for any solar energy system in practice. It is also expected from this project a quantitative measurement of how well tracking system performs compared to system with fixed mounting method.

II. LITERATURE REVIEW

In [1], The aim of this paper is to present a solar energy collection technology by a photovoltaic cell. To present this efficient solar distributed generation system, a dual-axis solar tracker is designed, built and tested. The tracker actively tracks the sun and changes its position accordingly to maximize the power output. The designed tracking system consists of sensors, comparators and microcontroller operated control circuits to drive motors and gear-bearing arrangements with supports and mountings. [2], The solar tracking system is the most common method of increasing the efficiency of solar photo module. This study presents the efficiencies of energy conversion of photo module with solar tracking system and fixed photo module. The proposed sun tracking system uses 4 photo resistors, which are mounted on the sides of the photo module. By these photo resistors the solar tracking system becomes more sensitive and it allows to determining a more accurate location of the sun. A comparative analysis was performed between fixed and dual-axis tracking systems. The results showed that the dual-axis solar tracking system produced 31.3% more power compared with stationary photo module.

In [3], Solar energy is projected as one of the important energy in the future as a great renewable energy source. Solar cells vary its performance under temperature changes. Change in temperature affects the power. So it is very necessary to improve the efficiency of the solar PV cells. Efficiency can be increased either by changing PV material, concentrating solar rays or using solar tracking system. In this study we use for two axis solar tracking systems using electromechanical devices, in which a controller detects the Sun apparent position, and controls the position of the structure supporting the panels toward the sun. This work studies the solution of two axis solar tracking system based on use of photo sensor outputs. To accomplish this, it is used a low-power microcontroller, suitably programmed, to control two electric motors to ensure that the panels supporting structure is always oriented towards the sun.

In [4], Theoretically, the solar tracking system describe as the device to get the optimize amount of sunlight according to sun movement. So, the shading effect issues can be minimized. This paper is presents the finding of photovoltaic (PV) harvesting energy via dual axis tracking system. The operation of two direct current (DC) motors motion was programme using PIC kit SK40C by using the Lab View Programming software. The first motor system delay timer is set at 15° rotation per hour and second motor system delay timers is set to rotate 180° after 12 pm. The field testing was initially set up at Perlis, Malaysia climate. An actual testing was used to collect the daily data. In [5], The aim of this paper is to solve the problem of energy crisis which is considerably a serious issue in this era. The necessity of using renewable energy sources namely solar energy has increased as compared to conventional methods of energy generation. Maximum energy from solar energy is hardly achieved due to effect of various environmental factors acting on the solar PV modules. To overcome this problem of efficiency in the solar PV modules, we have designed a system which not only track sun but also clean the solar PV module automatically. Dual axis sun tracking helps in receiving maximum solar radiations from the sun and using an automated cleaning system, we can improve the reduced efficiency of the solar PV modules due to accumulation of dust particles over the solar PV modules. In [6], Sun is a low cost source of electricity and instead of using the generators; solar panel can convert direct sun rays to electricity. Conventional solar panel, fixed with a certain angle, limits there area of exposure from sun due to rotation of Earth. In pursuing to get the maximum energy converted from the sun, an automatic system is required which should be capable to constantly rotate the solar panel.

III. PROBLEM STATEMENT

The problem here is the solar panel that is use only in fixed installation. Because of this problem, the power that can be generated is low. The fixed solar panels do not aim directly to the sun due to the constant motion of earth.

IV. DESIGN METHODOLOGY

To develop this dual axis sun tracking system, light dependent resistor (LDR) is used to track the sun's movement. The resistance of LDR increases with decrease in the light intensity or vice-versa. In this dual axis sun tracking system, we are using four LDRs for detecting the light intensity. To track the movement of the sun accurately, a dual axis tracking system is necessary. With the sun always facing the panel such that radiations received are normal to the panel surface, 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 of solar panel by accurate tracking of the sun.

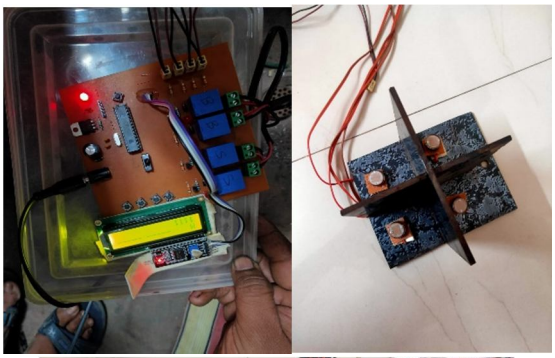
So the maximum efficiency of the solar panel is not achieved if single axis tracking system is used. Two pairs of light dependent resistors (LDR) are used to track the exact position of the sun. Out of the two pairs of LDR used, one pair senses the position of the sun in vertical axis and other pair in the horizontal axis.

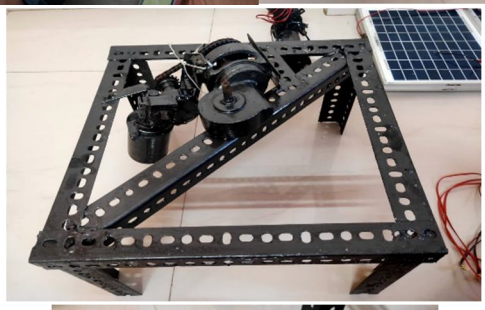
This information is then passed to the Arduino is the main control unit of this whole system. The output from the light comparison unit comes to the input of the microcontroller which determines the direction of the movement of the motors both in the horizontal and vertical axes. For this project Arduino microcontroller is used. The design of the light sensor is done on the basis of the use of the shadow. If the PV panel is not perpendicular to the sunlight radiations, this causes different light intensity to be received by the sensing device.

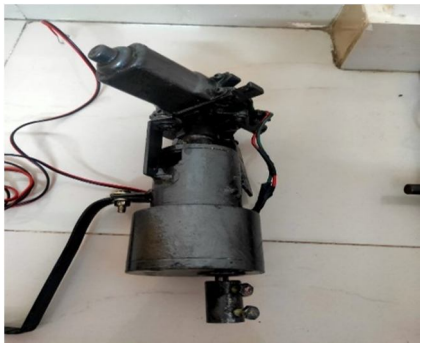
A. Cleaning System

In case, if the dust accumulated over the panels tends to pose hindrance for the sun radiations falling over the solar panel, the wipers over the panel will clean the dusty panels. when the value of output voltage drops below the set threshold value, the micro-controller will pass the signals to the cleaning system to start the cleaning operation. The whole cleaning operation is controlled using Arduino.

Geard Motor is provided for circular movement for the cleaner to clean the solar panels.







V. RESULTS

The project was successful and met every expectation.

VI. CONCLUSION

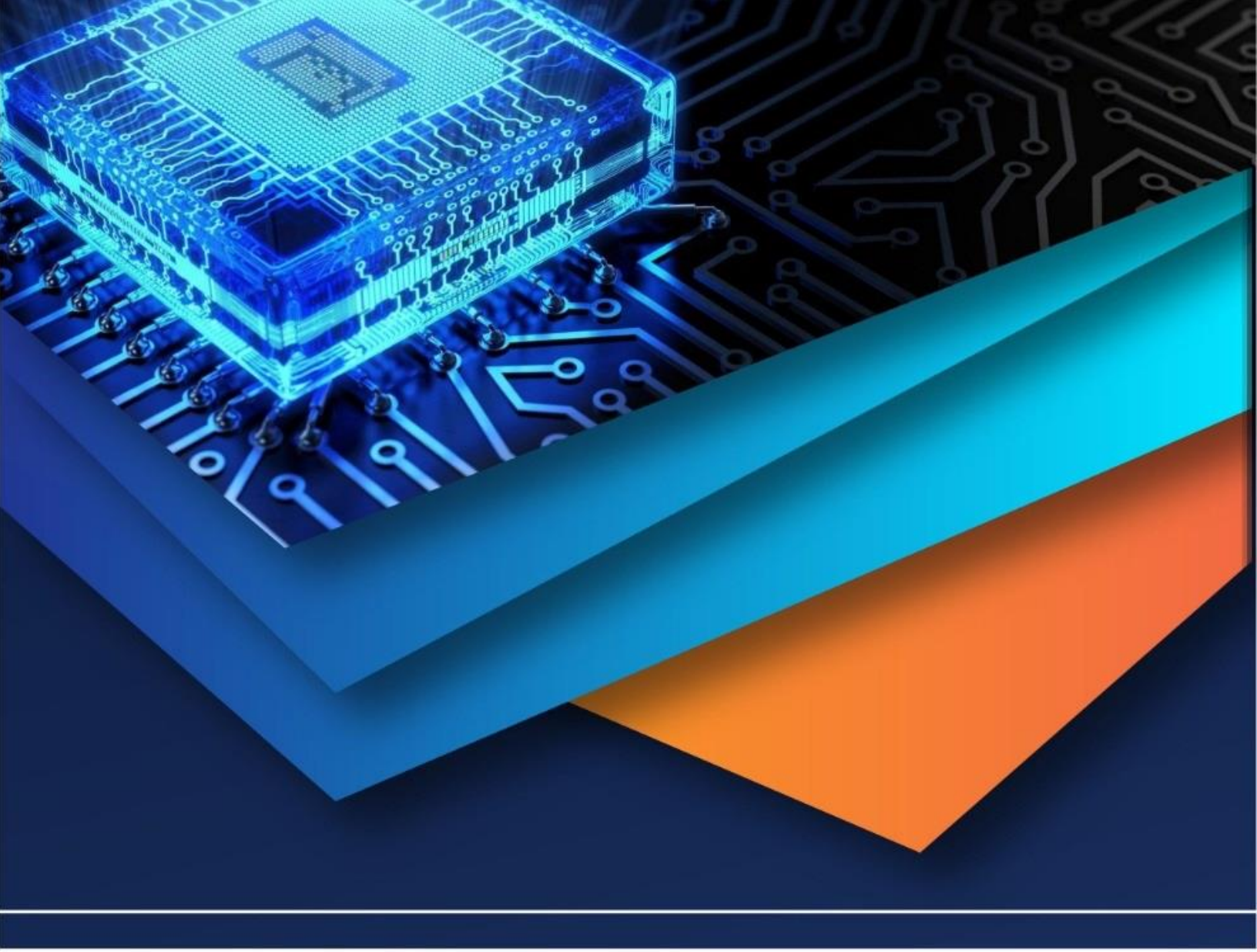
Solar tracker plays an important role in increasing the efficiency of the solar panels in these recent years, thus proving to be a better technological achievement. The major importance of dual axis solar tracker lies in its better efficiency and sustainability to give better output compared to fixed solar panel or a single axis solar tracker. The tracking system employed is designed such a way that it can trap the solar energy in all possible directions. In a single axis sun tracker that moves only along a single axis, tracking the maximum solar energy is somewhat not possible. In case of dual axis sun trackers, if the solar rays are perpendicular to panel throughout the year. Hence, maximum possible energy is trapped throughout the year. Thus, the increase in output indicates that the efficiency of dual axis sun tracker is more than a fixed solar panel (about 30 - 40% more) or a single axis tracker (about 6-7% more).

VII. ACKNOWLEDGEMENT

This project was proposed, designed and constructed by students of final year, Theem College of Engineering (Mechanical Department.). Under the guidance of Prof. Abdul Bari.

REFERENCES

[1] Marthoz Angulo-Calderón 1, Iván Salgado-Tránsito 2, Iván Trejo-Zúñiga 3, Carlos Paredes-Orta 2 Link- Appl. Sci. 2022, 12, 2625. https://doi.org/10.3390/app12052625
[2] Elsevier B.V. Peer-review under responsibility of the organizing committee of SMPM 2019. Link - 10.1016/j.promfg.2019.05.082
[3] 1Komal Choudhary, 2Harshada Kawale, 3Sagar Navghare, 4Swapnil Bendre, 5Prof. Prasanna Titarmare Link--www.jetir.org (ISSN-2349-5162)
[4] 1 M.E. Scholar, DIEMS Aurangabad, 2 Asst. Prof., DIEMS Aurangabad, Maharashtra, (India) Link-. Vol No.4, Issue No.6,June 2016 www.ijates.com
[5] Afiqah N.N a, Syafawati N.Ab, Idris S.S.H, Haziah A.H, Syahril M.D School of Electrical System Engineering, Universiti Malaysia Perlis, Pauh Putra Campus, Link--. doi:10.4028/www.scientific.net/AMM.793.328
[6] PrajaktaPawar, PriyankaPawale, TanujaNagthane, MohanThakre, NayanaJangale Link -https://doi.org/10.1016/j.gltp.2021.08.049
[7] Nasrudin Abd. Rahim,1,3 and Yusuf A. Al-Turki3 https://doi.org/10.1155/2013/820714



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY