International Journal for Modern Trends in Science and Technology, 9(05): 805-808, 2023

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0905136
Available online at: http://www.ijmtst.com/vol9issue05.html

Solar Tracker Using Arduino UNO to Improve Performance and Efficiency

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To Cite this Article
T.Uma Mahesh, P.Chaitanya, K. Gopi Chand, N. Sai Manjunadha, P. Bhanu Kiran, Sd. Abdul Umar Faruque. Solar Tracker Using Arduino UNO to Improve Performance and Efficiency. International Journal for Modern Trends in Science and Technology 2023, 9(05), pp. 805-808. https://doi.org/10.46501/IJMTST0905136

Article Info
Received: 21 April 2023; Accepted: 20 May 2023; Published: 24 May 2023.

ABSTRACT

Usage of Energy fossil fuels is creating havoc to our environment. This is the primary cause of greenhouse effect which is felt all over the world. It is required to avert this crisis by using renewable sources of energy. One such alternative is solar energy. Apart from this there is a huge gap between energy demand and generation.

The main objective here is to make a modern solar tracking system with the help of Arduino, the solar panels are fixed on the structure that moves according to the position of the sun. We are fabricating single axis solar tracker run using Arduino uno. Generally solar panels are stationary. Due to revolution of the earth the position of sun changes and as a result solar panel does not align with the sun continuously and hence less electricity is produced. The proposed model of solar tracking device is developed which automatically changes the position of the solar panel and tracks the sun accordingly to maximize the power output. By using this Solar energy device, the efficiency of solar panel may increase from 15 to 36% more efficient than fixed one.

Keywords: ***Solar Panels, Tracking, Efficiency***

1. INTRODUCTION

Energy is scarce. Most of the energy so produced is from the fossil fuels. It is highly disturbing the environment and is creating greenhouse effect. Recently Delhi government tried to stop usage petrol and diesel vehicles. World over the situation is becoming grave. All governments are looking at alternative sources of energy. Presently most power generation sources are looking to use solar energy. This is produced by using solar panels. A system that tracks the sun will be able to know the position of the sun in a manner that is not linear. The operation of this system should be controlled independently. Therefore, the main objective of this project is to develop an Arduino based solar Tracking for energy improvement of solar PV panel.

2.OBJECTIVE

The solar panel gives the best output when the solar plate is perpendicular to incident rays (Sun rays). So, the system which will be having continuously 90 degrees with sun will be more efficient than the conventional fixed solar panel system. Objective of our project is to design and construct a system that continuously track Sun and align the Solar panel perpendicular to sun rays. This project gives the maximum amount of solar energy through Sun. This solar energy can be converted into electrical energy and can increase its efficiency.

3.COMPONENTS USED

- Solar Panel
- Arduino UNO
- Sensor
- Servomotor
- Wood
- DC Stabilizer

SOLAR PANEL

A solar panel is a set of solar photovoltaic modules which are electrically connected and mounted on a supporting structure. A photovoltaic module is a package, connected assembly of solar cells. The solar panel is also used as a component of a larger photovoltaic system in order to generate and to apply electricity and commercial and residential applications.

ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010.The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

SENSOR

A light-dependent resistor, alternatively called an LDR, photoresistor, photoconductor, or photocell, is a variable resistor whose value decreases with increasing incident light intensity.An LDR is made of a high-resistance semiconductor.

SERVOMOTOR

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analog or digital) representing the position commanded for the output shaft.

WOOD

Wood is a structural tissue found in the stems and roots of trees and other woody plants. It is an organic material – a natural composite of cellulose fibres that are strong in tension and embedded in a matrix of lignin that resists compression.

DC STABILIZER

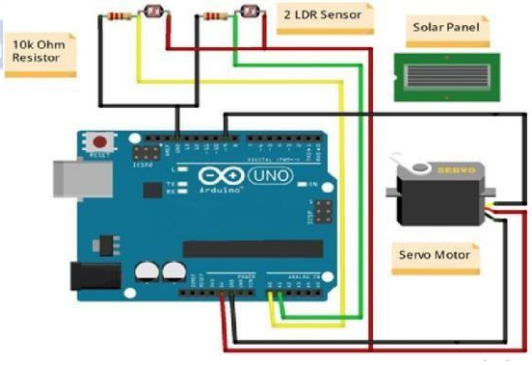
A voltage regulator is a system designed to automatically maintain a constant voltage. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

4. METHODOLOGY

A solar panel, an Arduino microprocessor, and sensors make up the solar tracking system. Light must be emitted by the sun for this system to function.

The LDRs act as sensors, detecting the intensity of light entering the solar panels and sending data to the Arduino microcontroller.

CIRCUIT DIAGRAM



The servo motor circuit is then built; it has three pins, the positive side of which is linked to the +5v of the Arduino microcontroller. The servo's negative is linked to ground. The servo's third pin i.e., data point is linked to the microcontroller's analogue point. A potentiometer is attached to control the servo motor's speed.

The idea behind maximum power point tracking is to gather the most power possible by adjusting the most effective voltage in the pv module.

The comparison is made between the output voltages and the battery voltage. They take the high voltage electricity from the PV modules and alter them so that they can charge lower voltage batteries. The

power is now converted to the best voltage possible in order to get the greatest current in the battery.

5.INSTALLATION

- Assemble the Frame with wood
- Design holding parts in solidworks and saved in STL format
- Slicing and generation of supporting structures of STL file using printrite software
- Printing the parts in 3D printer and fixing them
- Fix the servomotor and ball bearing in supports
- Fix the shaft through bearing and solar panel
- Assembling solar panel to shaft and servomotor
- Giving connections for servomotor and sensors by using Arduino board
- Load the code to Arduino UNO using cable.

6.CALCULATION

- Cost of 1 unit of current = Rs.10
- Cost of 1 joule = 10/(3600*1000) =Rs. $2.77 * 10^{-6}$
- Total number of joules =3600* 17.04 = 61344
- Total power saved and money saved = 10*3600*17.04/(3600*1000) = 0.174
- Assuming average day time is about 10 hours
- Therefore, Amount recovered per day = 10*0.174 = Rs.1.74
- For panel area of 150 cm^2 we can save Rs. 1.74 per day
- Assuming big panel area of 7800 cm^2 we can save Rs. 90.48 per day

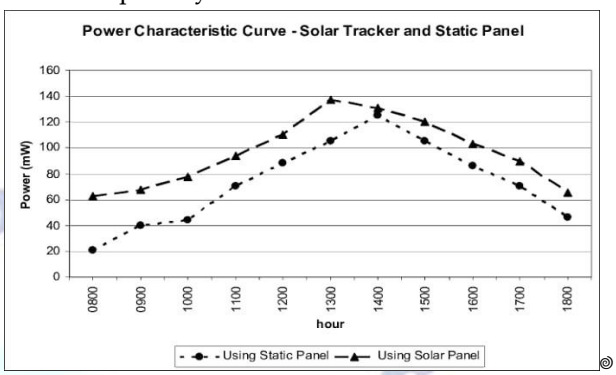


Fig: Comparing fixed and tracking solar panel

7.CONCLUSION

An application of solar tracker using Arduino approach has been presented in this study.

As a conclusion, firstly the development of tracking system to control and monitor the movement of solar panel based on the intensity of the light is achieved. The solar panel will face the sun perpendicularly to absorb more solar energy.

Secondly, solar tracking systems generate more output during the hours while fixed solar panel installation generates least power. However, shading effect give a slightly impact for solar panel to produce the output value. Thirdly, the percentage efficiency of the system in energy conversion increase when implemented the tracking system. The efficiency gain varies significantly with altitude and the orientation of a fixed solar panel installation in the same location.

Conflict of interest statement

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

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