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# Dual Axis Solar Tracking System using LDR Sensor

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## Abstract

The recent decades have seen the increase in demand for reliable and clean form of electricity derived from renewable energy resource. One such example is solar energy. The challenge is to capture the maximum rays from the sun to convert solar energy into electricity. This paper deals with the efficiency of solar cell with tracking system. It also includes a proposed plan of simple dual axis tracking device which is based on servo motor which are in turns interfaced using Arduino microcontroller kit. The instruction to the servomotor comes from highly efficient light dependent resistors which are responsible for movement of photo voltaic (pv) panels towards maximum light intensity. To track the sun in two directions that is elevation and azimuth, a dual axis tracking prototype is developed to capture the maximum sunrays by tracking movement of the sun in four different directions. One axis is azimuth which allows the solar panel move left and right. The other axis is elevation and allows panel to turn up and down. The implemented system can save more energy and probably offers less in cost.

## I.INTRODUCTION

Demand for electricity and its price has steadily increased over time. Solar energy has become a preferred choice to meet the demand for energy as its ambiquitious, abundance and stability, whether in the midst of sunlight, solar energy is widely available and fully free photovoltaic solid-state device that only makes light from sunlight, silently and without any maintenance, pollution and any of the material resources not asignificant reduction. However, it is expensive to install, but in a longer it can save money energy and provide more reduction in cost. A solar tracker is a device for focusing one-day light reflection, solar photovoltaic panel or centering solar reflector o lens on the sun. Solar powered equipment works best when near sun or near, so solar tracker can increase the effectiveness of such device on the cost of additional system complexity at any fixed position. The tracker enables the panel to follow the path of the sun and produce more power because it is absorbed concentrated centered in more sunlight, especially solar cell application, require high accuracy to ensure the concentrated sunlight is properly directed to the powered device.

To get maximum intensity of light and zero voltage difference the position of panel must always perpendicular to the light source. The position of sun will change from the position of installed solar tracker and make the panel no more perpendicular to the sun which affects the output power. Therefore, dual-axis solar tracking makes the movement of solar panel to be always perpendicular to the sun. Thetracker will track the sun throughout the year and maintaining the output power generate by the solar panel.

## II. PURPOSE OF STUDY

The purpose of this paper is to design a system that track the solar UV light for solar panels. To prove that the tracking indeed increases the efficiency considerably. Increase the efficiency up to 30-40 percent.This can be achieved with this paper by using ATMEGA16 microcontroller that automatically generate the single and provide the generated signal to motor to track the sun in the rotated direction.

## III. THEORITICAL BASIS

A solar tracker is a device used for orienting a photovoltaic array panel or for concentrating solar reflector or lens towards the sun. The position of the sun in the sky is varied both with seasons and time of day as the sun moves across the sky. Solar powered equipment work as best when they are position at the cost of additional complexity to the system. There are different types of trackers. Extraction of usable electricity from the sun became possible with the discovery of the photovoltaic mechanism and subsequent development of the solar cell. The solar cell is a semiconductor material which converts visible light into direct current. Through the use of solar arrays, a series of solar cells electricity connected there is generation of a servo voltage that can be used on a load. There is an increased use of solar arrays as their efficiencies become higher. They are especially popular in remote areas where there is no connection to the grid. Photovoltaic energy is that which is obtained from the sun. A photovoltaic cell, commonly known as a solar cell, is the technology used for conversion of solar directly into electrical power. The photovoltaic cell is a non-mechanical device made of silicon alloy.

## IV. METHODOLOGY

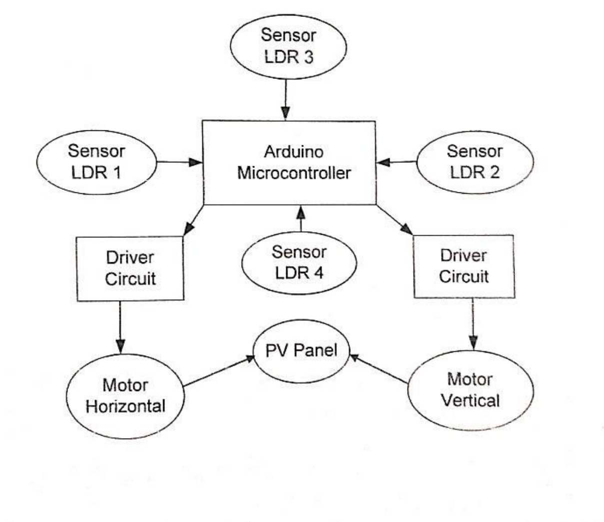


**Fig 1: Block diagram of Dual axis solar tracking system.**

There are several methods for the implementation of the dual axis solar tracking system such as dual axis tracking mechanism by fuzzy logic control, dual axis tracking mechanism by microcontroller different mechanism by using Arduino Uno etc. From above mentioned different mechanism of tracking system dual axis tracking system by using Arduino Uno is best method. This method of dual axis solar tracking mechanism is simple in construction, easy to operate also low maintenance is required for this method.

| | Position | Movement |
|---|---|---|
| LDR 1 | Left and Bottom | Servo motor A (Bottom)-Anticlockwise<br>Servo Motor B (Top)-Anticlockwise |
| LDR 2 | Right and Bottom | Servo Motor A (Bottom)-Clockwise<br>Servo Motor B (Top)-Clockwise |
| LDR 3 | Left and Top | Servo Motor A (Bottom)-Anticlockwise<br>Servo Motor B (Top)-Anticlockwise |
| LDR 4 | Right and Top | Servo Motor A (Bottom)-Clockwise<br>Servo Motor B (Top)-Clockwise |

**Table 1: LDR Position.**

The overall outputs that had been produced by the hardware dual axis solar tracker with 4 different position of LDR are shown above. Table explain the results that had been produced by 4 LDRs. LDR-1 that places in the top left and bottom gives the output to the Servo Motor A (bottom) will turn antilock wise while the Servo Motor B (top) will turn clock wise direction. The same rotation will happen for the Servo Motor of LDR-3 (left and top). Next LDR-2 that placed in the right and bottom gives the output to the Servo Motor A (bottom) will turn clockwise while the Servo Motor B (top) will turn clockwise and the same rotation will happen forth Servo Motor of LDR-4 (right and top). Basically, the same output will produce by LDR-1 and LDr-3 so for LDR-2 and LDR-4.

## V. EXPERIMENTAL SETUP

The proposed tracking does tracking of sunlight more effectively by providing PV panel rotation in two different axes. In dual axis tracking system optimum power is achieved by tracking the sun in four directions. In this way we can capture more sun rays. Movement in two axis ids explained with the help of figure which is explaining basic idea behind dual axis tracking.

The dual axis solar tracker follows the angular height position of the sun in addition to following the sun's east-west movement. The dual axis working is similar to single axis but it captures the solar energy more effectively by rotating in the horizontal as well as the vertical axis. The tracker model is composed of four LDR sensor, two stepper motor and microcontroller. One set of sensor and one motor is used to tilt the tracker in sun's east-west direction and the other set of sensors and other motor which is fixed ate the bottom of the tracker is use d to tilt the tracker in the sun's north-south directions.

## VI. HARDWARE IMPLEMENTATION

3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved using additive process. In an additive process an object is created by laying down successive layers of materials until the object is created. Each of these layers can be seen as a thinly sliced horizontal cross-section of the eventual objects. 3D printing is the opposite of subtractive manufacturing which is cutting out / hollowed out a piece of metal or plastic with for instance a milling machine. 3D printing enables you to produce complex shapes using less material than traditional manufacturing methods

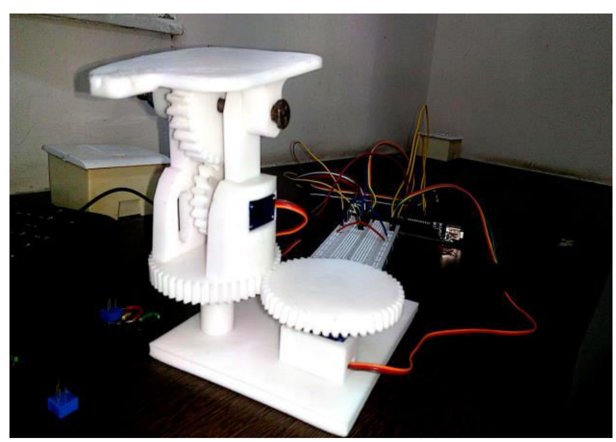

**Fig 2: Prototype of Dual-axis solar tracker.**

## VII. FLOWCHART

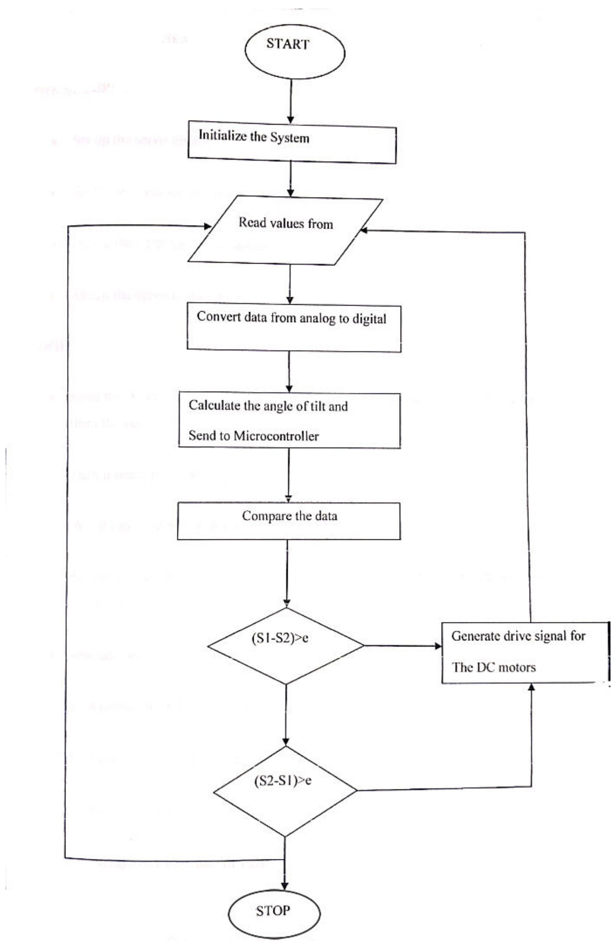


**Fig 3: Flow chart.**

Algorithm starts with taking data from sensor. Sensor output is analogue which is converted to digital signal. This task is performed using analogue to digital converter. Digitized signals are forwarded to microcontroller. After collecting digitized signal, it decides about the movement direction of DC motors. Controller algorithm is showing that microcontroller drives DC motor only if sensor light sensing is not equal to each other and if sensor signals are equal. It goes to start of algorithm. This process id repeated until light falling on sensor pairs is equal to PV panel is adjusted in a position for optimum power. In addition, to save the generated power the motor is going to be stopped at the time of night when there is no light intensity fall on the photovoltaic.

## VIII. RESULT

From the graph fig 4. it is seen that the output power of the dual axis solar tracker compared to flat plate solar mechanism system is very much higher. We know that the efficiency of any system is directly proportional to the output power. So, it is clear that the efficiency of dual axis solar tracker mechanism system is higher than the flat plate solar system. Hence the generating efficiency of PV module is improved by using axis solar tracker.

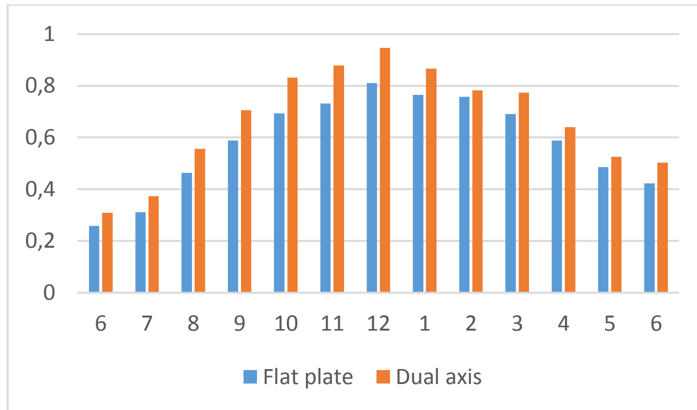


**Fig 4: Graph of Flat plate and Dual axis solar tracking system.**

### A. TESTING METHOD

After completion of hardware there is need to perform test on it to know about his efficiency. To check whether the system tracks the sun's position accurately, we had to keep the solar tracking system in open space where sunrays are available throughout the day. Accordingly observing the power generated after every hour. This test is carried out separately on two tracking system i.e. flat plate, dual axis per day respectively. After observing the readings, we have concluded that the proposed system is more efficient than other.

### B. TESTING RESULT

| TIME | FLAT PLATE (WATTS) | DUAL AXIS (WATTS) |
|---|---|---|
| 06:00 AM | 0.258 | 0.309 |
| 07:00 AM | 0.311 | 0.373 |
| 08:00 AM | 0.463 | 0.556 |
| 09:00 AM | 0.588 | 0.705 |
| 10:00 AM | 0.693 | 0.831 |
| 11:00 AM | 0.732 | 0.878 |
| 12:00 AM | 0.810 | 0.946 |
| 01:00 AM | 0.765 | 0.866 |
| 02:00 AM | 0.775 | 0.782 |
| 03:00 AM | 0.782 | 0.768 |
| 04:00 AM | 0.629 | 0.640 |
| 05:00 AM | 0.506 | 0.525 |
| 06:00 AM | 0.422 | 0.503 |
| TOTAL | 7.734 | 8.708 |

**Table 2: Output comparison of Flat plate and Dual axis solar tracking system.**

## IX. CONCLUSION

The paper gives a brief overview of solar tracking system based on microcontroller and also describe about the simple and attractive features of tracking system. This solar tracker operation costs and maintenance cost are comparatively low. Here the use of servo motor in solar trackers enables accurate tracking of the sun and light dependent resistor are used to determine the solar light intensity. The paper concludes that solar tracking system more effective method to track the solar insolation and provide economic consistency for generation of electric power. Solar power technology is constantly advancing and improvements will intensity in future.

## X. FUTURE SCOPE

With the available time and resources, the objective of the paper was met. This is able to be implemented on a much larger scale. For future, one may consider the use of more efficient sensor, but which are cost effective and consume little power. This would further enhance efficiency while reducing cost. If there is the possibility of further reducing the cost, it would be a great deal.

## XI. REFERENCE

[1] Anuraj, A., & Gandhi, R. 2014. Solar tracking system using stepper motor. International Journal of Electrical Engineering, Vol. 7, No. 6, pp. 561-566.

[2] Arsalam, S. 2013. Sun tracking system with microcontroller 8051. International Journal of scientific & Engineering Research, Vol. 4, No. 6, pp. 2298-3001.

[3] J. A. Beltran, J. L. S. Gonzalez Rubio, C. D. Garcia-Beltran: Design, Manufacturing and Performed Test of a solar Tracker Made by an embedded control 2007.

[4] Renewable energy resource- S.R.Rao.