Sun Tracking Solar Panel Efficiency Enhance by Using Microcontroller

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***Abstract*- The aim of our project is increase the energy generation and improve the efficiency of solar panel. Sun is an abundant source of energy can be stuff successfully using solar photovoltaic cells and effect to convert solar energy into electrical energy. But the power output of PV cell is dependent directly on the light intensity and the position of the sun in the sky change continuously from time to time. If the panel is perpendicular to the sun at this time PV cell is more efficient. Here we Designed dual-axis solar tracker to enhance the efficiency of solar panel. In this dual axis tracking is design by using LDR, DC Motors and Microcontroller.**

***Index terms*- Solar Panel, Microcontroller, LDR, DC Motors**

I.INTRODUCTION

During recent times due to the shortage of electricity, the search for an alternate source of power has been increasing. Solar power has proved to be one of the best alternative power sources since it is abundant in nature. It is also a renewable form of energy. A photovoltaic panel is a device used to capture the sun's radiation. These panels consist of an array of solar cells. The solar cells are made up of silicon (sand). They are then connected to complete a photovoltaic (solar) panel. When the sun rays are incident on the solar cell, due to the photovoltaic effect, light energy from the sun is used to convert it to electrical energy. The solar panels can be mounted as a fixed type or used as a tracker type. In the fixed type, the solar panel is mounted on the surface of the roof or ground irrespective of sun's direction at a particular angle. In single and dual axis solar tracking type the solar panel moves according to the movement of the sun.

II. METHODOLOGY

To develop this dual axis tracking system light dependent resistor (LDR) is used as sensor. The resistance of LDR decreases with increasing light intensity. Two 12 volt DC motors are used here for rotating the solar panel in two different axes. In this dual axis we are using four LDRs for detecting the light intensity. 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. The daily motion causes the sun to appear in east to west direction over the earth whereas the annual motion causes the sun to tilt at an angle of degrees while moving along east-west direction. So the maximum efficiency of the solar panel is not being used by single axis tracking system.

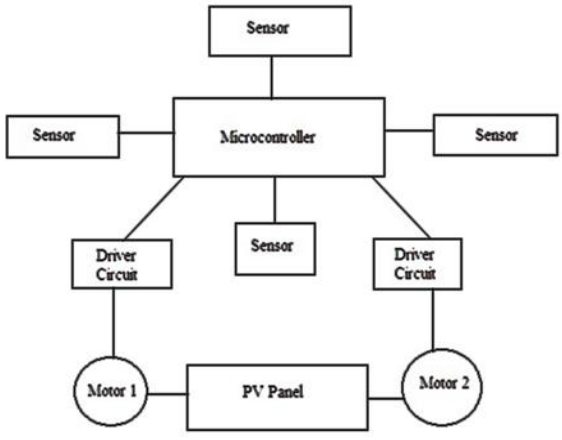

Fig.1

Two pair of light dependent resistors (LDR) is used as sensors to track the sun's exact position One pair

senses the position of the sun in vertical axis i.e. east and west side and other pair in the horizontal axis i.e. north and south side. This information is then passed to the light comparison unit. The rest LDR senses the night mode and the signal is sent to the light comparison unit. A light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity. Microcontroller 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 AVR microcontroller is use. The design of the light sensor is based on the use of the shadow. If the PV panel is not perpendicular to the sunlight, the shadow of the cylinder will cover one or two LDRs and this causes different light intensity to be received by the sensing device.

III. RESULT

Efficient energy from the sun is gained by the solar panels. And track the position of the sun by using the LDRs. Two DC motors are used to move the solar panel so that sun's beam is able to remain aligned with the solar panel.

Experimental Results

Table.1 shows the current and voltage values received from both the fixed and tracking panel for different times in a day. From the table it is seen that at 8:00 am there is much improvement in current by tracking panel compared to the fixed panel. But as time goes on this difference in current between this two technology decreases up to around 1:00 pm. After that when the sun rotates more towards west this difference increases again. The highest current of fixed panel and tracking panel is 0.29amp and 0.34amp respectively at 12:00 pm. But in case of voltage the variation is lesser compare with current as the voltage has no direct relation with the sun light intensity.

Table 1 Current and voltage values of fixed and tracking panel at different times in a day

Time	Fixed Panel		Tracking Panel	
	Current (A)	Voltage (V)	Current (A)	Voltage (V)
8.00 am	0.15	11.1	0.22	11.5
9.00 am	0.21	11	0.25	11.2
10.00 am	0.23	11.2	0.28	11.8
11.00 am	0.26	11.3	0.30	11.6
12.00 pm	0.29	11.5	0.34	11.9
1.00 pm	0.27	11.6	0.32	11.8
2.00 pm	0.25	11.6	0.29	11.6
3.00 pm	0.22	10.8	0.26	10.9
4.00 pm	0.19	9.4	0.22	9.9
5.00 pm	0.11	8.9	0.15	9.5

Table 2 shows the power values of both the fixed and tracking panel. The power gain of tracking panel over fixed panel for different times is also given in table. The maximum power output of the fixed panel and tracking solar panel is 3.33 watt and 4.40 watt respectively is found at 12:00 pm. Much more power gain is achieved in the morning and afternoon because the tracking system can accurately track the sun at these times while the fixed system not. For both technology power fall were very fast from 3:00 pm to 5:00 pm because of the low duration of day light.

Table 2 Power values of both the fixed and tracking panel

Time	Fixed Panel Power	Tracking Panel Power
8.00 am	1.66	2.53
9.00 am	2.31	2.8
10.00 am	2.57	3.30
11.00 am	2.93	3.48
12.00 pm	3.33	4.40
1.00 pm	3.13	3.77
2.00 pm	2.9	3.36
3.00 pm	2.37	2.83
4.00 pm	1.78	2.17
5.00 pm	0.97	1.42

IV. CONCLUSION

The empirical findings lead us to believe that the research work may provide some contributions to the development of solar energy applications. (1) a simple and cost-effective control implementation, (2) ability to move the two axes simultaneously within their respective ranges.(3) ability to adjust the tracking accuracy, and (4) applicable to moving platforms with the Sun tracker. In this paper a dual axis sun tracking system has been successfully designed, built and tested. It allows the sun's path from morning to evening and then gets back to the

initial position facing towards east side. So the system saves lot of energy by keeping the motors off during night period. This tracking technology is very simple in design, low in cost and accurate in tracking. Several solar technologies are available on the market. But this dual axis tracking technology has higher energy gain. comparing with both fixed solar panel and single axis solar tracking technologies.

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