Solar Tracking and Cleaning System

Sakshi Kalshetty
E&EE, PDACE
Kalaburgi, India

Trupti Bandagar
E&EE, PDACE
Kalaburgi, India

Sanjeevkumar R A
E&EE, PDACE
Kalaburgi, India

Abstract— Solar energy is the renewable energy resource and it has numerous advantages over the other forms of energy. Solar energy is the best form of renewable energy resource and it is easily available form of energy. Solar energy is the third energy source which can be easily obtained without any expenses. The device ensures the position of the sun and controls the movement of the panel so that the maximum radiation of the sun can be extracted. The solar panels with tracking and cleaning system are generally suitable for the dusty environments, in countries like India. The dust gets accumulated above the solar panel and it reduces power efficiency by 50%, if in case the solar panel is not cleaned at regular intervals of time. This issued can be fixed by implementing a solar panel cleaning system. In this System as the panels rotate 180⁰ throughout the day, where cleaning brushes slides over the panel twice a day. Incase of daily generation of solar energy the tracking and cleaning system is 30% more efficient than the static solar panel.

Keywords— *Arduino UNO, servo motor, solar panel.*

I. INTRODUCTION

During the early 2000s, there was lot of discussion about whether tracking and cleaning technology or static solar panel option to be used for hassle-free working of the utilities. Developers decided to shift towards the new technology where there was less maintenance of the system. However, tracker technology was considered as alternative to static solar panel for utility-scale solar plants.

A solar tracker is a device which is used to track the position of the sun and controls the movement of the panel so that maximum radiation can be obtained. Solar Energy is extracted to the maximum level only when the sun rays are directly made to fall on the solar panel. Hence we can the increase of the solar panel in this way when compared with other static equipment. For the maximum power generation the solar panels must be placed perpendicularly to the sun rays. Incase of deviation of the sun rays from the optimum angle, this results in decreasing the power output of the panel. In case of few degrees of dis-alignment of rays it decreases 1-5% reduction in output energy. On the other hand, the dis-alignment of 10⁰-20⁰ of sun rays it results in decrease of energy generation up to 35%. The tracker uses motor to rotate the panel towards the maximum sun rays using Light Dependent Resistors(LDR).

Basically there are two possible ways to track the maximum sunlight namely, single axis and dual axis. The single axis solar tracker rotates along only one axis i.e east to west or vice versa. The dual axis solar tracker rotates along two axis i.e east to west and north to south. The single axis solar tracker is approximately 30% more efficient when compared with a static solar panel and the dual axis solar tracker is approximately 36% more efficient when compared with a static solar panel. The performance of the solar panel is mainly reduced due to many external factors such as dust, dirt, shadows and bird's dropping pollen above the solar panel. In the dusty environment the output efficiency of the solar panel gets reduced. Hence it becomes very necessary to track and clean the solar panel at regular time periods. Hence cleaning of the solar panel also plays a major role.[1]
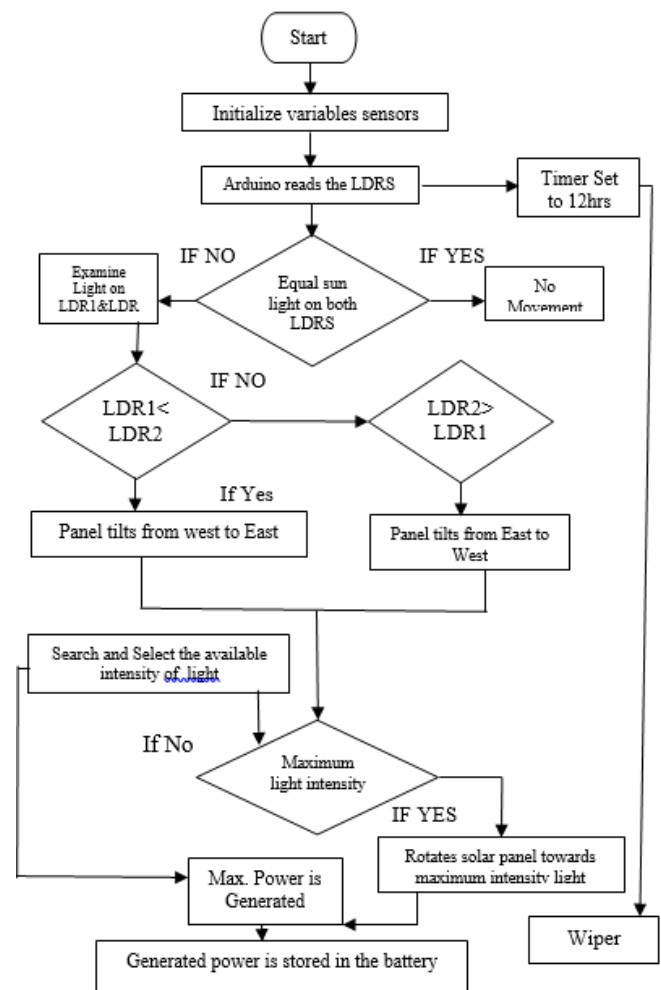
II. FLOWCHART

Figure 1. Flowchart of Solar Tracking and Cleaning.
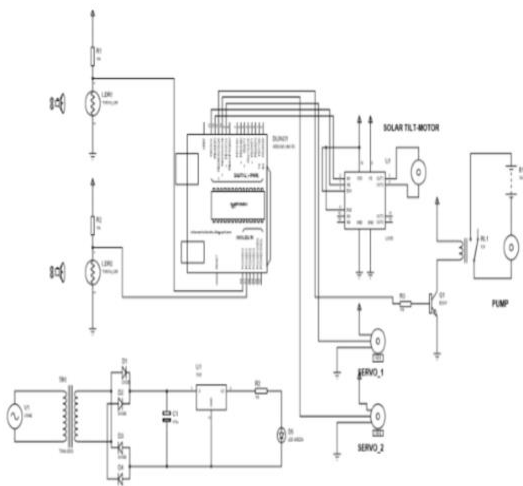
III. METHODOLOGY

Figure 2 Circuit Diagram

Two LDR's are placed on the side of the solar panel which are adjacent to each other, which senses the intensity of the light. Depending on these LDR's the movement of the tracker is decided. If in case, the first LDR senses the more light then the solar panel is rotated towards it with the help of Arduino UNO and vice versa with the second LDR. The stepper motor is being controlled by Arduino, only after the information passed through the LDR's. The Arduino is programmed using C language.

In addition to it, the Arduino controls the water pump which sprays the water on the surface of the solar Panel with sufficient pressure in order to clean the entire panel properly.

The major purpose of developing this paper is to achieve the maximum sunlight from the sun throughout the day which is possible only by using solar tracker. Hence maximum sunlight is extracted. The generated output energy is stored in a 12V DC battery. The LDR's detect the maximum sunlight across the solar panel. As long as sunlight falls on the first LDR, the data is sent to the Arduino and the solar panel is in the perimeter of the first LDR. Whenever the sunlight is out of the perimeter of first LDR it will stop sending the data. Similarly it works with the second LDR. After getting the information from the second LDR the panel is rotated towards the perimeter of the second LDR. In this way, solar tracker tracks the maximum intensity of available sunlight.

The other side of the working is cleaning of panel. The pump is operating on the on/off switch. As the pump get start it supply water towards the nozzle with the help of the piping system. The nozzle sprinkle water on the solar panel so that with the help of water dust and dirt on the panel get cleaned.[2]

IV. RESULT

Table 1: Solar power output and efficiency corresponding to the voltage and current for different interval of time during day time.[3]

S.N	Time	Voltage in Volts	Current in Amps	Power in Watts	Efficiency in %
1.	6:30am to 8:30am	6.2	0.28	1.73	57.6
2.	8:30am to 10:30am	6.9	0.3	2.07	69
3.	10:30am to 12:30pm	8	0.375	3	100
4.	12:30pm to 2:30pm	8	0.375	3	100
5.	2:30pm to 4:30pm	7.2	0.35	2.52	84
6	4:30pm to 6:30pm	6.1	0.25	1.52	50.6

V. FUTURE SCOPE

In the sector of solar energy, There are many large projects that has been proposed in India. The solar power target is revised from 20GW to 100GW by the Government by 2022. The worldwide installed PV capacity has increased to more than 300GW by the end of 2016. Large and Medium scale grid connected solar power projects includes a target of 60GW in the year 2022.

VI. CONCLUSION

As this proposed system acts as a single system which includes both, tracking as well as cleaning system. Usually dust gets accumulated on the surface of the panel which results in damage of the aluminum strip of the solar panel. So this damage of the solar panel can be prevented by implementing the cleaning system which thereby increases the efficiency of the solar panel.

By this, the life span of the solar panel can be increased, decreases the cost of cleaning process manually also tracking efficiency is increased.

Individually by using tracking system the efficiency is increased approximately by 30% and by cleaning mechanism the efficiency is increased by an amount of 50% per month.

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