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# "Dual Axis Sun Tracking with an Automated Cleaning System for Pv Modules"

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***Abstract*** *– The aim of this paper is to solve the problem of energy crisis which is considerably a serious issue in this era. It is becoming essential to increase the use of renewable energy sources namely solar energy as compared to conventional sources of energy generation. Extraction of maximum energy from solar energy is hardly achieved due to effect of various factors acting on the solar PV modules. To overcome this issue, we have designed a system which not only track sun but also clean module automatically. Dual axis sun tracking helps in extracting maximum solar radiations from the sun. Whereas, using automated cleaning improves the reduced efficiency of solar PV modules due to accumulation of dust over the solar PV modules.*
***Keywords:*** *Dual axis solar tracker, Solar cleaning system, Solar energy, Solar PV modules.*

## I. Introduction

In this modern world, electricity is also added to the most basic needs in everyone's life. With the increasing demand of electricity, downfall in the supply of conventional sources used for energy generation has been observed. To balance out this scarcity in power generation, non-conventional energy sources for power generation are mainly adopted. Among all the nonconventional energy sources, power generation from solar energy is widely used. Since there is quite abundancy of solar energy all around the earth.

Nowadays in India, frequent power cuts are very common. Hence consumer tend to adopt alternative measures to generate power. They usually rely on solar energy for power generation. Power generation from solar energy comes with lots of pros and cons. One of the disadvantage of using solar energy as a method of power generation is that solar energy radiations coming from the sun to the earth varies according to the latitudes, longitudes, axis of rotation of the earth. Hence, construction of solar power plants are majorly done in those areas where solar radiation are expected to be more (i.e. regions near the equator).

Output of the solar panels is always depending upon maximum intensity of sunlight. The proposed system mainly concentrates on extracting maximum output from the solar panel. A Dual Axis Solar Tracker equipped with Automatic Cleaning System has been proposed to ensure maximum efficiency from Solar PV modules.

## II. Methodology

In this paper, use of different types of components to perform Sun tracking and Cleaning of PV modules are being used. The main components that will be used are Micro-controller, LDR, DC Servo motor, Solar panel (Flat plate collector). The control of both the systems are performed separately by using Micro-controller.

### A.Tracking Mechanism

This tracking movement is achieved by coupling a DC servomotor to the solar panel such that panel maintains its face always perpendicular to the sun to generate maximum output.This is achieved by using a programmed micro-controller to deliver pulses in periodical time intervals for the servomotor to rotate the mounted panel as desired. The micro-controller will be used in the proposed project is of 8051 family. Tracker are used to keep panels oriented directly towards the sun as it moves through sky every day. Using solar trackers increases the amount of solar energy which is received by solar energy collector and improves output of electricity which is generated.Solar trackers can increase the output of solar panels by 20-30%.Dual axis solar tracker are going to be used in this proposed project to achieve maximum output from the solar panels.

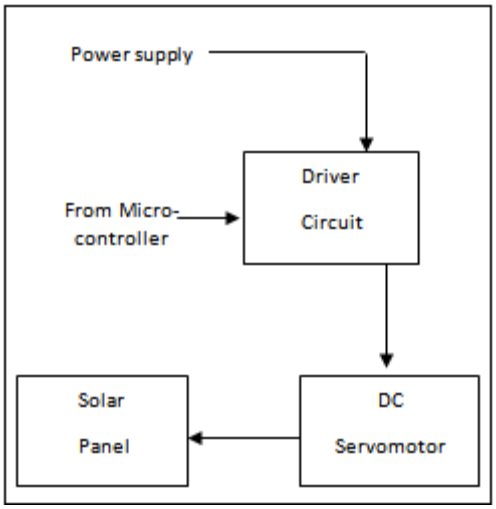


**Figure.1:** Block Diagram Representation of Sun Tracking System.

**B. Cleaning System**

Cleaning of solar panel can be achieved either by natural means or by manual operation. The main aim is to maximize the capture of rays of sun upon the solar panel. Hence, an automated cleaning system will be used to maximize the output of solar panels.In this system, sliding wipers / brushes will be used to remove the accumulated dust on the solar panels. This accumulated dust decreases the efficiency of the solar panel.If the solar panel is not cleaned for a month, the efficiency of solar panels may reduce to 15-30%. Hence, this combination mentioned above is mounted on the surface of panel and for movement of this mechanism DC servomotor assembly which is controlled by micro-controller is used.Water is required for cleaning the panel, so for this purpose valves are connected for water supply and DC water pump is used for pumping the water.

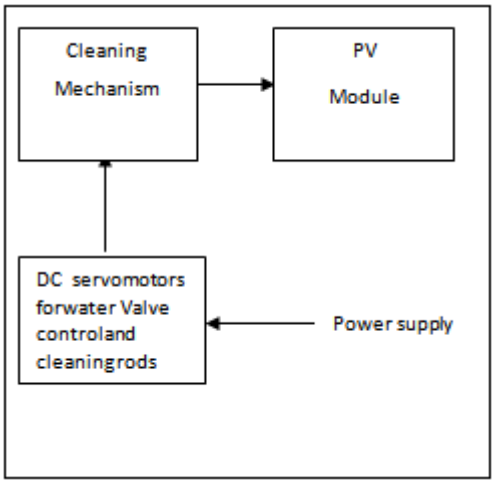


**Figure.2:** Block Diagram Representation of Cleaning System.

**C.Block Diagram**

As shown in fig.-3, the LDR sensors are used to trackthemaximum intensity of sunlight. Here we use the micro-controller for deciding the directionof rotation of motor-B. The logic is that the micro-controller detects the sunlight falling on LDR. If there is unequal distribution of radiation on the panel, the motor will run in such a manner to achieve radiations normal to the panel.

The whole cleaning mechanism is also controlled by the micro-controller. In this system we basically use sliding wiper to remove the dust saturated on the surface of the panel.

If the reading of the dust sensor is above the permissible value then the motor will rotate in clock-wise direction and according to that our cleaning assembly will move on the surface of the panel.

If the sensor reading is below the permissible value then the motor will move in reverse direction and so on.

The cleaning assembly will consist of the wipers/rollers, brush, water valve etc.

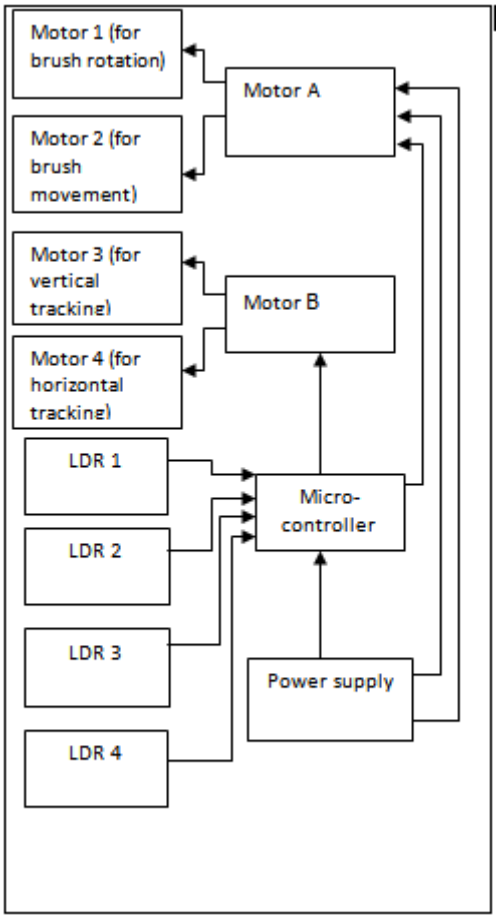


**Figure.3:** Block diagram representing the control mechanism using micro-controller.

**Advantages**

- Improved efficiency can be attained by using automated cleaning.
- Maximum power can be produced by using sun tracking system.
- It is very feasible for general facilities that require no large power.
- Labour costs can be reduced since automated cleaning system is employed.

**Application**

- Solar trackers are widely used by power companies, solar monitoring station, etc.
- It is mainly used in commercial, domestic areas etc.
- It can be used for domestic back up power system.
- It can be used for small and medium scale power generation.
- It can be used for power generations at remote places where power lines are not accessible.

## III. Conclusion

Solar tracker plays a vital role in increasing the efficiency of the solar panels in recent years, thus proving to be a better technological achievement. The vital 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 is designed such that it can trap the solar energy in all possible directions. Generally, in a single axis tracker that moves only along a single axis it is not possible to track the maximum solar energy. In case of dual axis trackers, if the solar rays are perpendicular to panel throughout the year. Hence, maximum possible energy is trapped throughout the year. Thus, the output increases indicating that the efficiency more than a fixed solar panel (about 30 -40% more) or a single axis tracker (about 6 -7% more).

## Acknowledgement

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