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Automatic Solar Panel Cleaning System

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Abstract-*The solar PV modules are generally employed in dusty environments which is the case in tropical countries like India. The dust gets accumulated on the front surface of the module and blocks the incident light from the sun. It reduces the power generation capacity of the module. The power output reduces as much as by 50% if the module is not cleaned for a month. In order to regularly clean the dust, an automatic cleaning system has been designed, which senses the dust on the solar panel and also cleans the module automatically. In terms of daily energy generation, the presented automatic-cleaning scheme provides about 30% more energy output when compared to the dust accumulated PV module.*

Key Words: Solar Energy, Cleaning System, Automatic system

1.INTRODUCTION

As the range of applications for solar energy increases, so does the need for improved materials and methods used to harness this power source. There are several factors that affect the efficiency of the collection process. Major influences on overall efficiency include solar cell efficiency, intensity of source radiation and storage techniques. The materials used in solar cell manufacturing limit the efficiency of a solar cell. This makes it particularly difficult to make considerable improvements in the performance of the cell, and hence restricts the efficiency of the overall collection process. Therefore, the most attainable method of improving the performance of solar power collection is to increase the mean intensity of radiation received from the source.

There are three major approaches for maximizing power extraction in medium and large scale systems. They are sun tracking, maximum power point tracking or both. The solar tracker, a device that keeps photo voltaic or photo thermal panel in an optimum position perpendicularly to the solar radiation during daylight hours, can increase the collected energy from the sun by up to 40%. Usually the fixed PV panels cannot follow the sun movement. The single-axis tracker follows the sun's East West movement, while the two-axis tracker follows the sun's changing altitude angle too. Sun tracking systems have been studied with different applications to improve the efficiency of solar systems by adding the tracking equipment to these systems through various methods. A tracking system must be able to follow the sun with a certain degree of accuracy, returns the panel to its original position at the end of the day, and also tracks during cloudy periods.

1.1 OBJECTIVES

- To clean the solar panel effectively.
- To avoid the manual work.
- To avoid dust associated problems on solar panels.
- To improve overall solar panel efficiency.

2. LITERATURE REVIEW

- **Masuda S. et. al,** In this patent paper, inventor has invented a transparent technique for solar PV panel's dust Cleaning on self. The shield is a panel of clear non-conducting (dielectric) material with embedded parallel electrodes. The SPV panel is coated with a semiconducting film. Electrodes are attached to a single phase AC signal or to a multi-phase AC signal that produces a travelling electromagnetic wave.
- **Williams R B. et. al,**In this paper author has worked on a particular downfall of Electrodynamics Screen (EDS) and tried to resolve it by providing an integrated approach. An EDS based systemrequires a high-voltage external power source for its operation, but the EDS can be madeself-sustainable with the power output from the PV cell itself. Author incorporates atransparent EDS with a PV array as its power source to make itself sustainable.

3. MAIN COMPONENTS REQUIRED

3.1 Frame:

This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

3.2 Battery:

Sealed lead acid battery with voltage 12v and nominal capacity of 7Amp is used for the energy storing purpose. The

battery usage and maintenance is of free type. The battery is charged during the day in the presence of sun i.e., solar energy and use when necessary. The batter after charging can be used up to 5-6 hrs Continuously.

Fig.3.2 Battery

3.3 Solar Panel:

solar panel of 20watts 12volts,1.4amps.Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity.

Fig.3.3 Solar Panel

3.4 DC Motor:

The motor is used to drive cleaning unit, 12V 1.2 Amps DC motor. This single phase motor work on the Fleming hand rule and generate electric current and this electric current converted to mechanical work like to rotate the blade and cut the brush.

Fig.3.4 DC Motor

3.5 Pump:

Pump is used to supply water required for cleaning. Capacity of pump is 12V and 5 Amps.

Fig.3.5 Pump

5. WORKING

The cleaning unit moves on the solar panel in a back and forth motion. The cylindrical Brush mounted on the cleaning unit rotates in the clockwise direction. The cleaning unit along with the rotating brush moves along the solar panel towards the bottom of the panel. Along the entire path, it forces the dust to move in the direction of the motion of the cleaning unit and finally blows it away at the edge of the panel. Once the cleaning unit reaches the lower end of it, it again returns back. Once it reaches the top of the panel, the cleaning unit stops there. Then the locomotion units come into action. Then the wheels move in the direction parallel to the edge of the solar panel until it reaches the part of the panel that is not cleaned.

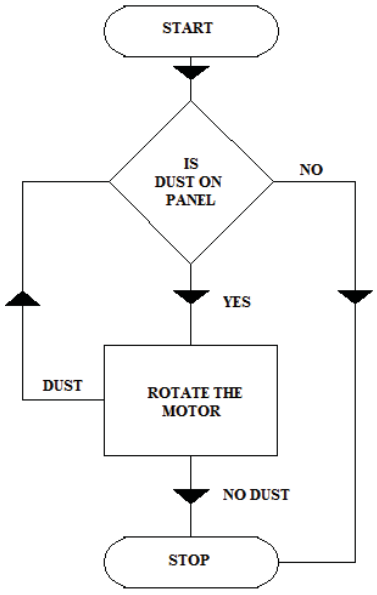

Fig.5 Working Flowchart

6. ADVANTAGES

1. Increases the efficiency.
2. Avoids the damage of solar plate strips.
3. Reduces threat to human life.

4. Manual assistance is not required.
5. Working principle is quite easy.
6. It is easy to construct and cost is low.

7. CONCLUSIONS

Existing automated cleaners mainly focus on large arrays and in general are unsuitable for installing on smaller arrays namely residential roofs. For those with limited space this means that a smaller array only needs to be installed, hence our idea serves as a huge advantage for those smaller sites. Our system can be installed for roof top solar panels. The solar panel cleaning system was first designed taking into consideration the design parameters. Our model was tested and the following observations were made. The rack and pinion mechanism work as it was designed to do.

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