

Design and Fabrication of Solar Panels Cleaning System : A Review

Rahul K. Parihar, Rahul K. Kalnake, Rakesh H. Dongre, Roshan D. Raut, Vipin P. Ramteke,
Vivek S. Karanjekar, Vaibhav V. Patankar

Department of Mechanical Engineering, G. H. Raisoni Academic Collage of Engineering, Nagpur, Maharashtra,
India

ABSTRACT

The aim of this paper is to give an innovative concept to handle energy demand around the world is increasing rapidly for many applications. Solar energy is abundant in nature and is proving its existence for many applications like street lighting, house hold appliances, water heating, agricultural and industrial purpose. One of the ways to harness solar energy is done by using solar panels. Limitation of solar energy is its efficiency for any application due to the factors like dust, humidity, temperature etc. Electrical parameters of solar panel are sensitive to accumulated dust density and will affect the transmittance of the solar panel thereby reduce its efficiency. In order to overcome this problem, it is necessary to clean the solar panels regularly. One of the method is to increase the efficiency of solar panel is by removing the dust accumulated on solar panel. Cleaning of solar panels is difficult task. The normal way to clean the solar panels is washing them manually but it is not reliable and economical. In this regard a work is taken up to design and implement the automatic dust cleaning mechanism for solar panel. This mechanism is based on control circuit, DC motor; microfiber (bristles) to clean the panels. The paper provides you with the idea how the mechanism will work and its effect on the energy production by solar farms. It will also to help to understand the problem arise due to not cleaning of solar cells.

Keywords : Solar Panels, Energy loss, Mechanism, Automatic Dust Cleaning, Microcontroller.

I. INTRODUCTION

The sun emits energy at an extremely large rate hence there is abundant availability of solar energy in the nature. If all solar energy could be converted into usable forms, it would be more enough to supply the world's energy demand. However, this is not possible because of conditions in the atmosphere such as effect of clouds and temperature. Solar energy can be converted to more usable energy forms through solar panel. There is unprecedented interest in renewable energy, particularly solar energy, which provides electricity without giving rise to any carbon dioxide emission. Of the many alternatives, photovoltaic method of extracting power from solar energy have been considered has promising toward meeting the

continuously increasing demand of energy . The efficiency of solar panel is limited due natural conditions so it is very much essential to take care of parameters like dust, humidity and temperature. In this regard the work has been taken up to study the efficiency of solar panel with and without dust collected on it. The developed project includes design and to implementation of microcontroller based dust cleaning system. The main aim of the project is provide automatic dust cleaning mechanism for solar panel.

1.1. CLEANING METHODS FOR PV PANEL'S

1.1.1. Natural removal of dust

The natural powers are employed to remove the dusts, such as wind power, gravitation and the scour of the rainwater. The effect of this method is not very well. It is seen that the solar cell array can be turned to vertical or oblique position to remove the dusts easily when early morning, late evening, night and a rainy day. However, the rotation of the large solar cell array is very difficult.

1.1.2. Mechanical removal of dust

The mechanical methods remove the dusts by brushing, blowing, Vibrating and ultrasonic driving. The brushing methods clean the solar cell with something like the broom or brush that were driven by the machine was designed just like windscreen-wiper. However, firstly, because of the small size and the strong adhesively of the dusts, the cleaning method is inefficient. Secondly, the abominable working environment of the solar cell makes the maintenance of the machine difficult. Then, due to the large area of the solar cell array, the cleaning machine is powerful. Lastly, the surfaces of the solar cell maybe were damaged by the brush when wiping. The blowing method cleaning the solar cell with wind power is an effective cleaning one except the low efficiency, high energy-consumption and the unsatisfactory maintainability of the blower.

1.1.3. Electrostatic removal of dust

If there are a high potential on the surface of the solar panels, the charged and uncharged dusts will be attract to the panels because of the electrostatic forces. Then, the dust particles will be charged by the solar panels finally, so they have the same electric charge and the electrostatic forces between them are repulsion. At last, the dust particles will float away the solar panels. However, this strategy cannot be used in PV system, because of the effecting of the rain on earth

1.2. Comparison between different Solar PV cleaning Techniques

Cleaning System	Advantage	Disadvantage
Fuzzy Logic Control based Cleaning System	<ul style="list-style-type: none"> • Automatic cleaning system • Robust design 	<ul style="list-style-type: none"> • High Cost
Heliostats Cleaning Team Oriented Robot (HECTOR)	<ul style="list-style-type: none"> • Extreme and thorough cleaning • No external power supply required 	<ul style="list-style-type: none"> • Robots require charging separately
Solar Brush	<ul style="list-style-type: none"> • It is wirelessly controlled • Automated robot 	<ul style="list-style-type: none"> • Heavy load on the surface of panels • Human attention is required • Slow performance
Automatic Solar Panel Cleaning System	<ul style="list-style-type: none"> • Cleans dust efficiently 	<ul style="list-style-type: none"> • Human interference required
Electrostatic Charge System for Cleaning	<ul style="list-style-type: none"> • No water required • No heavy gears required 	<ul style="list-style-type: none"> • Requires to be charged

1.3 Manufacturing and Installation

We have to clean solar panel by dry cleaning process, for that we are using nylon brush of soft bristles so that it should not affect the transparency of solar panel in long term use. Now this brush will rotate at high speed for throwing of the dust from the panel. The rotating motion for brush is given to it by motor

mounted beside it, the motor is of high rpm and low torque, so for balancing that chain sprocket is provided between them. This whole assembly is mounted on the frame; the pedestal bearing is used for mounting rollers.

The frame with this assembly is mounted on four rollers; all four rollers are having individual motors of high torque and low rpm. Below frame four idle rollers are also given for travelling smoothly on solar panel frame. We have used timer circuit in our machine by which we can set how many times a day our machine will clean the solar panels. Our circuit is having only three press buttons one will start the machine and other two will increase and decrease the time in seconds, which will be shown in display. On both the ends of the machine limit switch is mounted which will stop the machine as it will go on the one end of the solar panel row.

II. LITRATIRE SURVEY

In this paper you will find the idea of how the system will help you to clean the solar panels without the help of human & water, thus saving the water usage. To do so various different kinds of research paper has been reviewed so that the concept should be clear and the manufacturing of system should be easy. The need to clean the solar panels on regular basis is necessary because accumulation of dust on panels is necessary either manual or by automatic. With reference to this paper we have developed a new and easy technique to clean the panels reduces the intensity of incident rays, thus reducing its production efficiency. So periodic cleaning of panels.

Various different methods are there for cleaning of panels like human using brush, spraying of water. But with the use of such techniques we are wasting water as well as we are investing huge amount in cleaning. Cleaning is done everywhere. They have design a robot which is human operated & thus it cannot work

all the time as the panels should be cleaned after specific interval of time. Hence there should be some automation done for better scope.

This paper has given a better idea of making the mechanism. They have composed of a cleaning head that moves on panels while the robot's auxiliary equipment for power & water supply is connected via umbilical, located on an adjacent support vehicle. The cleaning head is driven vertically by Cables & horizontally by a pair of motorized drive trolleys which rides along the bottom & top edges of array panels. The drive and cleaning system needs to ensure the longevity of device. So design of new system is necessary so that there will not be any complex in use and it will be fully automatic.

Cleaning the solar panels is normally by washing which is very tedious & cumbersome, at the same time its expensive too. The design of auto cleaning robot will have flexibility in order to fix on different sizes of flat solar panels. In accordance with dimensions of flat plate, the robot consists of rollers that will be driven by DC motors through belt system. The movements of rollers will be controlled by microcontroller. In this they have used the external power for driving motor. It helps to reduce the labor requirement.

III. CONCLUSION

Dust accumulation on PV panels can significantly reduce their power output. While the Geographic region is solar-energy rich, the desert conditions are quite dusty threatening the PV systems power generation potential. The robotic system proposed by me with the help of company is a simple way to tackle this challenge effectively. Although promising results will be obtained. Here we are going to set a new benchmark by using latest technology and replacing the conventional methods of cleaning the solar panels. We are saving water, time and money. In general the technique used by other method explain above total cost of solar panel maintenance goes around 5% of total plant cost annually but cleaning done by robot

reduced it by 2%. The mechanism of this kind can clean the solar farm as and when require very easily without man power thus saving the cost and waste age of water. Further we can add very interesting features in our system like de-ionized water cleaning; camera for inspection and climate based cleaning. The major advantage of this robot is that we can inspect the farm without going on actual site. Also in future we can reduce the weight and can made compact design of the system with the help of booming technology. Also now a day there is increase in use of solar system in industries as well as at homes, thus giving a bright future scope for this system.

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