International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 15
May 2018

Solar Panel Cleaning System

Sanchit Sharma
Praful Pandey
Somesh Dhanker
Prof. Abhinav kumar
SSIPMT Raipur India

A B S T R A C T

Solar Energy is the most abundant form of energy available on earth. Fortunately it is also renewable source of Energy produced by the Fusion of Helium on Sun's surface. This Energy is becoming popular because of natural advantages. Photo Voltaic (PV) Modules are the devices used to convert solar energy in to electrical energy. The light rays consisting of Photons strike the Activated Silicon Junction Panels to produce Electrons which in turn constitutes to Potential difference across the junction there by generating current flow. Lot of high level research is going on in the areas of Materials Engineering, Silicon Junction etc. to tap the complete potential of solar energy, sadly the highest efficiency commercially achieved lies between 16-22%. It is very clear from the above explanation that increase in Photons increase the efficiency, but the settlement of dust particles on Solar Panels reduce the number of photons reaching the Silicon junction hence, drastically decreasing their Efficiency. Presently the panels are cleaned manually, which requires lot of Labor, Water and time, It is not cost effective also. Large Solar Energy Parks requires lots of resources for maintaining which proves to be very costly. Hence there is a requirement of a system which would eliminate all these problems.
In the present Work, we conduct a detailed survey on how the dust settlement affects the performance of the PV module and then design an effective automatic in-house and cost effective cleaning system to keep the top surface of the panels clean thereby maintaining its highest possible efficiency.

INTRODUCTION

1.1 SOLAR ENERGY

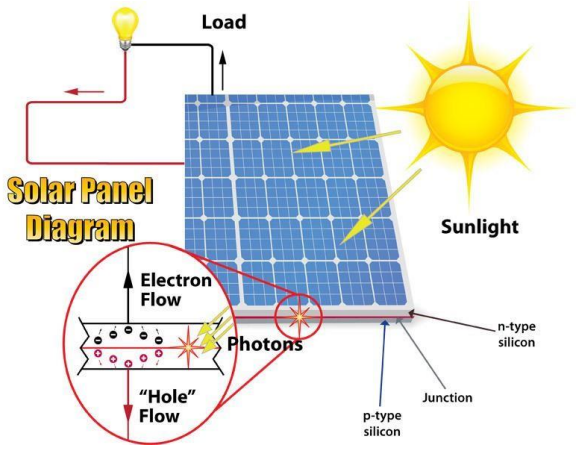
Solar energy, radiant light and heat from the sun, is harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaic, solar thermal electricity, solar architecture and artificial photosynthesis.
Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and collectors to harness the energy. Passive solar techniques include orienting a

building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

1.2 SOLAR PHOTOVOLTAIC ELECTRICAL ENERGY

Photovoltaics (**PV**) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic power generation employs solar panels composed of a number of solar cells containing a photovoltaic material. Materials presently used for photovoltaics include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium gallium selenide/sulfide. Due to the increased demand for renewable energy sources, the manufacturing of solar cells and photovoltaic arrays has advanced considerably in recent years.

Solar photovoltaics is a sustainable energy source. Solar photovoltaics is now, after hydro and wind power, the third most important renewable energy source in terms of globally installed capacity. More than 100 countries use solar PV. Installations may be ground-mounted (and sometimes integrated with farming and grazing) or built into the roof or walls of a building (either building-integrated photovoltaics or simply rooftop).



Driven by advances in technology and increases in manufacturing scale and sophistication, the cost of photovoltaic has declined steadily since the first solar cells were manufactured, and the leveled cost of electricity (LCOE) from PV is competitive with conventional electricity sources in an expanding list of geographic regions. Net metering and financial incentives, such as preferential feed-in tariffs for solar-generated electricity, have supported solar PV installations in many countries. With current technology, photovoltaics recoup the energy needed to manufacture them in 3 to 4 years. Anticipated technology would reduce time needed to recoup the energy to 1 to 2 years.

LITERATURE REVIEW

In this paper, the performance of solar PV panel subjected to environmental dust was experimentally studied. The effect of dust on the power reduction and efficient reduction of PV module was quantified. The maximum efficiency 6.38%, minimum 2.29% without dust & maximum efficiency 0.64%, minimum 0.33% with dust. The result shows that dust considerably reduces the power production by 92.11% and efficiency as 89%.[1]

This paper provides an appraisal on the current status of research in studying the impact of dust on PV system performance and identifies challenges to further pertinent research. A framework to understand the various factors that govern the settling/assimilation of dust and likely mitigation measures have been discussed in this paper.[2]

This paper contains the information about the panel which detect the presence of an obstruction shading a cell and actuate a cleaning mechanism that clean off the obstruction and therefore, restore the panel to normal capacity. To power the cleaning mechanism, we built our own power supplies which are supplied by a 12v battery.[3]

PROBLEM IDENTIFICATION

Things that makes solar panels dirty

- Solar panels are usually placed on high atop of the building, which makes it prone to the elements of nature such as dirt.
- It can get dirt in many forms that have biggest impact over the performance of solar panel system.
- Dust, grime or sand or loose soil from the ground can have big impact on the performance.
- They are airborne that get mixed with other substances in the air and get into the solar panels.
- Moisture is another problem that leads to water spots and immediate accumulation of dirt.
- Bird droppings, insects and bugs are other nuisances creating problems to the performance of solar panels.
- If the panel doesn't get regular cleaning, there will be a thick layer of dust accumulated on the surface of the panel.

Why do you need to clean your solar panels?

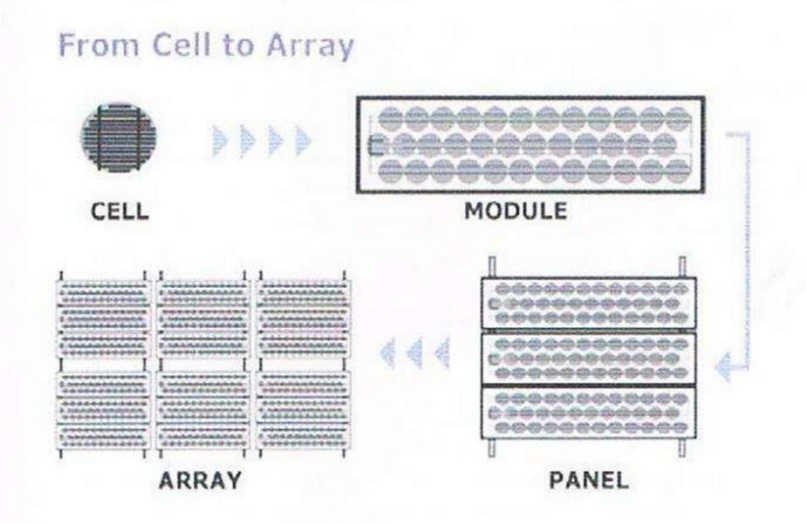
- Solar panels need to be as clean as possible to work at optimum efficiency and so that the solar cells can absorb energy and produce maximum electricity.
- Reduced solar panel output means that you may not produce enough energy to run your home and then still have to draw power from the grid. This means that you won't experience the drop in energy bills you were expecting.
- Dirt, grime and dust on solar panels can reduce their operating efficiency by as much as 40%.

Cleaning Solutions

- One proven way is to use a good cleaning kit and clean the panels easily and effectively.
- You can think of using an automated cleaning system that will clean the system at certain intervals.
- Last but not least, think about hiring a skilled solar cleaning professional team to get the job done for you.

PROPOSED METHODOLOGY

ABOUT SOLAR PANEL



- **Solar Cell**: Semiconductor device that converts sunlight into direct current (DC) electricity.
- **Module**: PV modules consist of PV cell circuits sealed in an environmentally protective laminate and are the fundamental building block of PV systems.
- **Solar Panel**: Includes one or more PV modules assembled as a pre-wired, field-installable unit.
- **Array**: A PV array is the complete power-generating unit, consisting of any number of PV modules and panels.

CONCEPTUAL PROJECT MODEL

The figures shown above are of the conceptual project model. This model shows the working of the mechanism that is going to be used in this project. All the components that are used here in this working model is a smaller version of those components which are actually going to be used in the main project.

COMPONENTS OF THE MODEL

There are several components which are used to make this model work successfully. These are

- Lead-acid rechargeable battery
- A potentiometer device
- Arduino circuit board
- L293D (Motor driver IC)
- Relay
- Pump
- Limit switches
- Solar panel
- D.C. Motors
- 9V Hi-watt battery

Potentiometer device

- Here, we have used this device to show the potential drop in the solar panel charging due to dust accumulation. In actual model, we don't require a potentiometer device. It is a resistor having three terminals having rotating contacts which works as a voltage divider. Potentiometers are generally used to govern electric gadgets which include extent controls on audio device. Potentiometers are hardly ever used to immediately manipulate huge power (more than a watt), because the energy dissipated in the potentiometer might be akin to the strength inside the controlled load.

Arduino Circuit Board

- It is a circuit board which is used to store the programming required to run a certain machine or a model. The programming which is used for our model is mainly 'C++'. We have used programming here to reduce the manual operations required to run the model. It includes a programmable circuit board and a software or IDE (Integrated Development Environment) which is used to upload the code from the computer to perform the necessary operations.

L293D (Motor Driver IC)

L293D is a motor driver IC which is used to drive the DC motors in both the directions i.e. forward direction and backward direction simultaneously. It is a 16 pin IC which can drive

two DC motors at a time. The H-bridge present is an electronic circuit which is used in robotics and which allows voltage to be supplied in opposite route across the load present.

Relay

- It is a switch which is operated by electricity. Many relays use an electromagnet to automatically function a transfer, however different operating concepts are also used, consisting of solid-state relays. Relays are used in which it's miles important to govern a circuit with the aid of a separate low-strength signal, or in which several circuits have to be managed via one sign.A sort of relay that may cope with the excessive power required to immediately control an electric powered motor or different masses is known as a contactor. strong-kingdom relays manage power circuits and not using a shifting element, alternatively using a semiconductor tool to carry out switching.

Pump

A pump is a device that actions fluids (beverages or gases), or every now and then slurries, by means of mechanical motion. Pumps function through many electricity sources, inclusive of guide operation, power, engines, or wind electricity, are available many sizes, from microscopic to be used in scientific packages to large business pumps. It is used in our model to supply the water on the solar panel for the proper cleaning purpose.

Limit Switches

In our model, we have used the limit switches to restrict the movement of the wiper we have used for the cleaning purpose. Limit switches are used in a ramification of packages and environments because of their ruggedness, ease of installation, and reliability of operation. they are able to decide the presence or absence, passing, positioning, and quit of journey of an object. They have been first used to outline the restriction of travel of an object; hence the name "restrict switch". they are used for controlling equipment as a part of a control system, as a safety interlocks, or to rely gadgets passing a point. A limit switch with a roller-lever operator; this is mounted on a gate on a canal lock, and shows the placement of a gate to a control gadget. Standardized limit switches are industrial manage additives manufactured with a spread of operator kinds, such as lever, roller plunger, and whisker kind. restriction switches may be at once automatically operated by using the movement of the operating lever.

DC Motors

DC motors have been used in the model to move the wiper on the solar panel for the cleaning purpose. A DC motor's pace can be managed over a extensive variety, using both a variable supply voltage or by means of converting the electricity of cutting-edge in its area windings. Small DC cars are utilized in gear, toys, and home equipment. The prevalent motor can function on direct modern-day however is a light-weight motor used for portable energy equipment and home equipment. The DC motors used in the model have 30 rpm. They can rotate in either direction with the help of L293D.

Conclusion

This proposed system has more advantageous because of a combination of tracking and cleaning system as a single system. Sometimes dust or other particles long time placed on solar cells so it damages the Aluminum strip of the solar plate. So we avoid this damage by this system. Increasing efficiency of the solar plate. By this system, we make the life of this plate longer than another plate. To reduces the cost of the manual

cleaning process and also increases the tracking efficiency. This system helps to generate more energy in Indian climatic condition.

References

[1] Geo Bruce, (2015). Arduino Solar Tracker. Retrieved from: http://www.instructables.com/id/ArduinoSolarTracker/?ALLSTEPS

[2] "Non-conventional Energy Sources" – G.D RAI "SMART SUN TRACKING WITH AUTOMATED CLEANIN SYSTEM FOR PV MODULES" AMIRAH AFIQAH BINTI AHMED

[3] The International Conference on Technologies and Materials for Renewable Energy, Environment and Sustainability, TMREES14 "Influence of Dirt Accumulation on Performance of PV Panels

[4] http://www.solar-tracking.com/

[5] www.wikpedia.com