International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 06 | June - 2022 Impact Factor: 7.185 ISSN: 2582-3930

DEVELPOMENT OF SOLAR PANEL CLEANING SYSTEM

Syed Aman Hussain[1], Shubham Kishor Dagade[2], Aniket Mohan Bhagwatkar[3] , Rahul Kumar[4] Dipteshwar Bisen[5]

[1]Department of Mechanical Engineering, Priyadarshini College of Engineering, Nagpur, India

---

Abstract -This project is developed for the betterment of the solar panel users. We providing transparency in cleaning system by using the most newly invented technology, which provide a better performance, integrity, consistency, cost-effective and scalable solution for the removal of dust and speck. The presented cleaning system provides about 32% more energy output compared to the dust accumulated solar panel. Also this system reduces manpower for cleaning of solar panel. This is automatic solar panel cleaning system.

Key Words::Solar Panel, Cleaning, Automated System, etc…

1.INTRODUCTION

Dust or other particle`s speck on solar panels that causes a decrease in optical efficiencies of systems. However, geographically widespread data is only available for solar photovoltaic (PV) systems. Accumulation of dirt or particles like dust, water, sand on the surface of solar panel obstruct or distract light energy from reaching the solar cells and result is reduction in energy produce.

Nowadays, different electrostatic cleaning methods and water-based methods are available and widely used as solar panel cleaner. A semiautomatic wiper control system-based cleaning method is presented in. A maximum efficiency of 86.7% is achievable by this cleaning mechanism. Multiple cleaning systems which include air and water, vibration is presented in for the harsh desert environment. The output power of the system is increased by 27% by using a water jet spray. A self-cleaning method is proposed in which is automatic. To design the system, a 50 Wp solar panel is used which can generate 26-50% more electricity with the proposed cleaning method than a normal solar panel. The whole system is controlled by a microcontroller. Another wiper control method-based two steps cleaning system is developed in where water is first applied on the panel surface and then the wiper is triggered. The system's efficiency becomes 17.55% after cleaning which is quite identical to the average efficiency of the system before dust accumulation. Electrostatic dust removal is another type of efficient method but it is not suitable for pole mounted PV installations.

An electrostatic cleaning equipment is proposed in which is economical and suitable for the mega solar power plants in deserts. The proposed system shows better performance when the dust is less than 5 g/m2. A self-cleaning method based on electrostatic travelling wave is designed in where the system consists of transparent dielectric film and parallel electrodes. With this system, 90% of total dust is cleaned within 2 mins without any water and moving parts. An automatic robotic cleaning system is presented in where a silicon rubber brush is used with an aluminum core to clean the surface of solar panel. On the other hand, Surface acoustic wave is utilized in to remove the spoiling particles from the surface of solar panel. Cleaning effects of surface acoustic wave are also analyzed in this study where spoiled solar panels are used

OBJECTIVE

Design a solar panel cleaning system which can increase the efficiency of solar panels.

.

2. LITERATURE REVIEW

The principal objective of this work is to study the effect of dust and dirt on solar panels and study all aspects of a possible cleaning system which increases the efficiency of solar panels. Ample research papers were reviewed from different sources some of the important points are given below. The accumulated of dust is responsible for soil loss on solar panels which decreases its efficiency of generation of solar energy. It has to be cleared on regular interval of time for better results. Dust settlement for the most part depends on numerous components like compound properties, size, weight, shape, site, tilt point surface completion, stickiness, wind speed, etc. Dust exposure affects many parameters of SPV; so several attempts have been made to address this issue. Dust particles are very common in the atmosphere.

In some places, it is found settled but at some it is not; for example in National Capital Region (NCR) the dust particles coming from Rajasthan drift towards NCR and causes a dip in the air quality of Delhi also considering the fact that Delhi and NCR region is highly polluted on its own making the are much more polluted. And when it gets settled it may be also settled on solar panels or PV panels and according to studies the layer accumulated dust on the surfaces of solar panels or PV panels can come from many different sources and can have a major impact on electricity production. The efficiency of the solar

panel can be reduced by up to 50% in a dusty environment, as this interferes with the amount of direct sunlight.

3. METHODS AND MATERIALS

In accordance with the dimensions of the flat plate panelNthe solar panel cleaning system consists of brush driven by DC motors and actions of brushes is controlled by remote. The frame carrying this cleaning brush is moved along the length of the solar panel in horizontal direction and vice versa, which results in mopping action on the solar panel cleaning the panels. This frame is also consists of DC motors which will produced the rotational motion which is converted into linear motion. This action is also controlled by remote. The shifting of frame from one solar panel row to another solar panel row is done manually. The frame is moved in horizontal direction until the solar panel row ends. All this cleaning actions will consume a time of 80sec for mopping action for cleaning the one solar panel of dimension 1956-990-40(mm). Once one row of the solar panel is cleaned, it moves to another row and hence the cleaning process gets repeats.

Figure.1.1: Working model of Automatic Solar Panel Cleaning System

Figure.1.2: SMPS circuit.

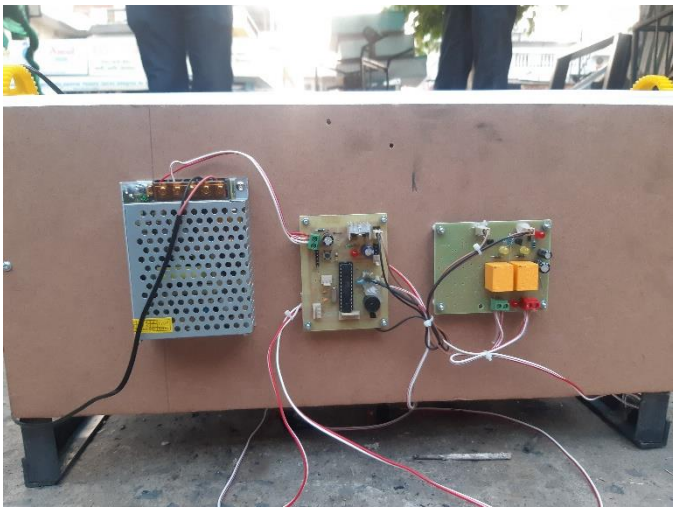
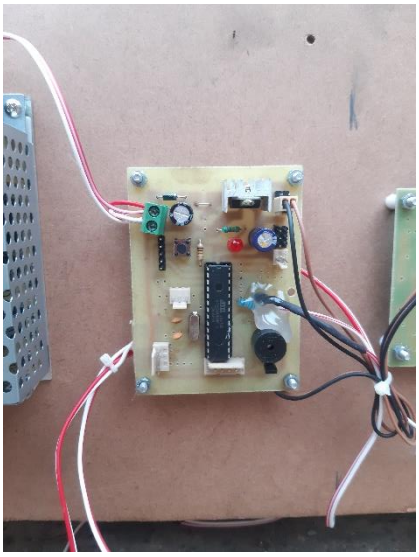


Figure.1.3: 12V DC motor with rack and pinion.

Figure.1.4: Microcontroller with IC.



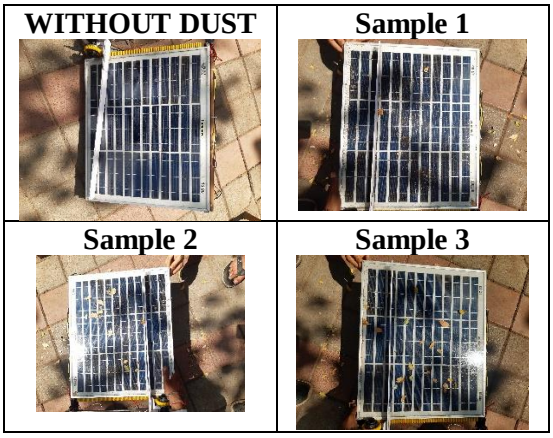


Figure.1.5: Cleaning shaft of the proposed solar panel cleaner

4. OBSERVATIONS

CONDITION	OUTPUT VOLTAGE (V)
Without dust (normal)	36.4
Sample 1	33.2
Sample 2	32.6
Sample 3	32.1
Sample 4	31.4
After cleaning	36.2

5. RESULTS AND DISCUSSION

The reduction of output power is reducing after cleaning of solar panel by water spray with using rubber wiper. The dirt, speck of particles or bird drop are the reasons of losses power. Another technique is dry cleaning cannot completely remove all dirt and other particles from solar panel, it`s only remove upper layer. In this system no external power is required, system uses rechargeable battery and also battery is recharge directly from solar panel. This system is made up of light weight- long lasting material, so the cost and power consumption is less compare to other system. Water is down the temperature of solar plate during th

6. CONCLUSIONS

In conclusion we see the system working properly we can get the proper solar panel cleaning is done. In future by replacing the rack and pinion mechanism system can be designed for different type of solar panel installation like residential rooftop, commercial rooftop, solar farm, carport using advanced technology applying in it. And it is also based on need of cleaning dependent on continent`s weather and type of land. This model can be implemented is small scale like solar pump, single panel cleaning etc.

7. REFERENCES

1) s F. Mejia, J. Kleissl& J. L. Bosch, 2013. The Effect Of Dust On Solar Photovoltaic Systems, Energy Procedia 49 (2014), pp. 2370 – 2376.
2) Shaharin Anwar Sulaimana, Atul Kumar Singhb and et al, 2014. Influence Of Dirt Accumulation On Performance Of PV Panels, Energy Procedia 50 (2014), pp. 50-56.
3) N. Ketjoy& M. Konyu, 2014. Study Of Dust Effect On Photovoltaic Module For Photovoltaic Power Plant, Energy Procedia 52 (2014), pp. 431-437
4) S. B. Halbhavi, S. G. Kikani and et al, 2014. Microcontroller Based Automatic Cleaning Of Solar Panel, Ijltet 5 (4), pp. 99-103.

5) Selvaganesh, P.S. Manoharan &V.Seetharaman, 2017. Cleaning Solar Panels Using Portable Robot System, Ijcta 10 (02), pp. 195-203.
6) Yiannis P. Markopoulos, June 2014. Robotic Device For Cleaning Photovoltaic Panel Arrays, Sustainable Technology And Energy Solutions, Researcher Gate, pp. 38-42.
7) Athira Sivan, Lakshmi Priya and et al, May 2017. Automatic Self Cleaning Solar Panel, Irjet4, pp. 2035-2037.
8) Dipankar Deba, Nisarg L. Brahmbhatt, 2017. Review Of Yield Increase Of Solar Panels Through Soiling Prevention, And A proposed Water-Free Automated Cleaning Solution, Elsevier 2017.
9) Brian Parrott, Pablo Carrasco Zanini, 2018. Automated Robotic Dry-Cleaning Of Solar Panels In Thuwal, Saudi Arabia Using A Silicone Rubber Brush, Elsevier 2018.
10) Hussein A. Mohammed1, Baha'a A. M. Al- Hilli and et al, 2018. Smart System For Dust Detecting And Removing From Solar Cells," Conference Series 1032.