DESIGN OF LOW COST CLEANING MECHANISM TO CLEAN SOLAR PLATE FOR ROOF TOP PV SOLAR

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Abstract: **Solar power has become a source of renewable energy and solar energy application should be enhanced. 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 this paper, we have design a system which can do such task without wasting the precious manpower. The system consists of dotted pipework which will rest over the aluminum part of the panel. The system is cost effective.**

***Keywords*—Aluminum section, pipes, pumps, sprinklers**

1. INTRODUCTION

The sun emits energy at a very large rate, so there is plentiful availability of solar energy in the nature. If all solar energy could be transformed into usable forms, it would be more enough to supply the world's energy demand. However, this is not possible because of circumstances in the atmosphere such as effect of clouds, dust and temperature. Solar energy can be converted to more usable energy forms through solar panel. There is incomparable interest in renewable energy, particularly solar energy, which provides electricity without giving rise to any carbon dioxide emission. Of the many substitutes, photovoltaic method of extracting power from solar energy have been considered has promising toward meeting the continuously increasing demand for energy. The competence 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 main aim of the project is providing automatic dust cleaning mechanism for solar panel. Conventionally cleaning system was done manually. The manual cleaning has disadvantages like risk of staff accidents and damage of the panels, movement difficulties, poor maintenance etc. The automatic dust cleaning system of solar panels has taken to overcome the problems arise in the outdated cleaning and also produces an effective, non- abrasive cleaning and avoids the irregularities in the efficiency due to the deposition of dust. Thus the developed model enhances the solar panel performance. Various source of energy like coal, gas, hydro,

nuclear, renewable, diesel and their some of them are going to be crushed within few years. Solar panels are a great tool to extract plentiful solar energy as an electrical output without any repercussion towards the environment i.e. clean energy. But in order to use solar energy solar panels needs to be in the open environment. Open environment includes dirt particles in the environment too. So these dirt particles can cause barrier to some fraction of in-coming solar rays. Due to that overall efficiency of system decreases [1,2]. In order to prevent that we need to remove that extreme of dirt particles via some user manual work but that can cost time and money. So to save that time and money we have designed a cleaning system for domestic purposes. Because unlike industrial, in domestic versatility too, panel arrangement is wide. Also there is a possibility of layered system. So we need to design a system that can fulfill all these requirements without putting much weight on panels and is affordable.

1.1 IMPORTANT TERMINOLOGIES

SOLAR HOTSPOT- Solar hotspots are the regions categorized by an exceptional solar power potential suitable for decentralized commercial misuse of energy with the favorable techno-economic prospects and organizational arrangement support to supplement solar based power generation in a country.

ENERGY SOURCES – Various source of energy like coal, gas, hydro, nuclear, renewable, diesel and their some of them are going to be exhausted within few years.

INSOLATION - Solar energy incident on earth surface.

PHOTOVOLTAIC CELL-Photovoltaic cell is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect.

1.2 PRINCIPLE OF PHOTOVOLTAIC CELL

Sunlight arresting the photovoltaic cell is absorbed by the cell. The energy of the absorbed light generates particles with positive or negative charge (holes and electrons), which move about or shift freely in all directions within the cell. The electrons (-) tend to collect in N-type semiconductor, and the holes (+) in the P-type semiconductor. Therefore, when an outdoor load, such as an electric bulb or an electric motor, is connected between the front and back electrodes, electricity flows in the cell.

1.3EFFECT OF DUST ON PV PANEL

Gathering of dust from the outdoor environment on the panels of solar photovoltaic (PV) system is natural. There were studies that showed that the accumulated dust can reduce the performance of solar panel, accumulated dust on the surface of photovoltaic solar panel can Reduce the system's efficiency by up to 50%.

2.CLEANING VIA PRESSURIZED WATER

There are two types of cleaning:
1. Dry Cleaning
2. Wet Cleaning
The method we choose for domestic cleaning purpose is" Wet cleaning". In our method we tried to overcome following faults that were in the single row robot system:
• Weight
• Cost of material
• Safety (Both equipment and personnel)
• Maintenance
• Lifespan

Also abide in mind that whole system is regarding the domestic purpose. More or less principles may change while applying the same over the bigger system i.e. industrial approach may require some updates in the existing system. [3]

3. APPROACH

System consists of dotted pipework which will rest over the aluminum part of the panel. In those holes (i.e dotted pipe) we used 180◦ sprinkler. We connected one end of the main tube to pressurized water supply and the other end we kept sealed off. As pressurized water is passed through the pipe, connected sprinklers which are facing the surface of the panel will clean the surface. [5,6]

3.1 WORK FLOW

Device mounted on the surface which can be used manually or automatically for cleaning purpose. There is a built of solid structure to withstand troublesome situations. We were able to reduce its weight by removing useless top part Solid hinge and angled clamp.

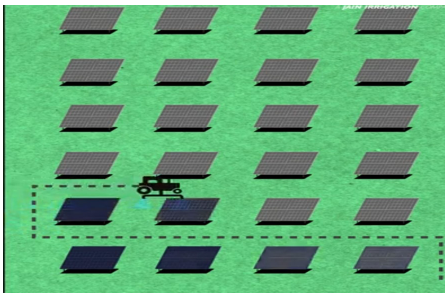

Fig 1 Without Pipes arrangement

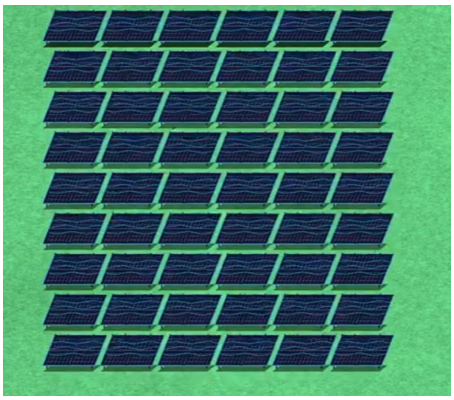

Fig 2 With Pipes arrangement

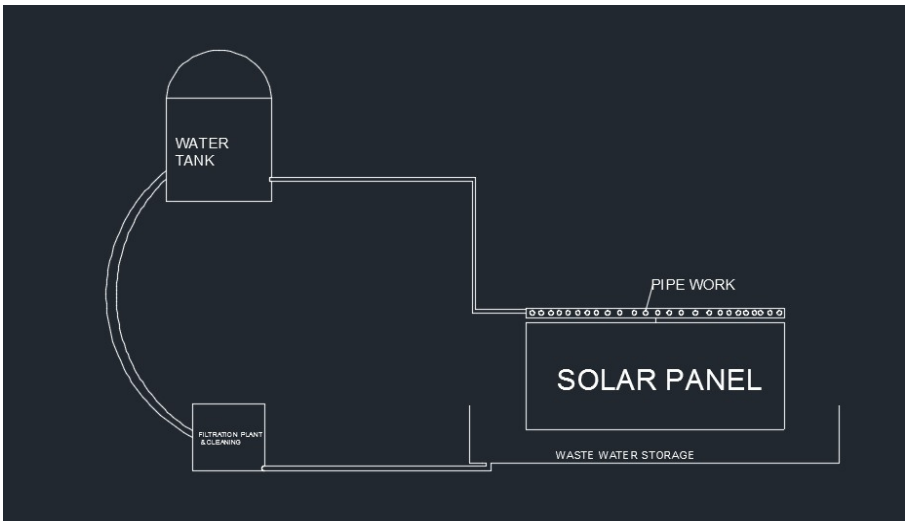

Fig 3 Block Diagram

3.2 COMPONENTS USED

- CINAGRO – Drip Irrigation Garden Watering kit
- Pepper agro drip irrigation plant watering sprinklers (180 Degree)
- Submersible motor
- Waste water collecting basket

3.3 MERITS

• All accessories of system stay out of the effective area of the solar panel so no shading loss.

• No moving parts as no wear and tear so maintenance is negligible.

•There is waste water collector at the end of the panel, so that water can be reused after filtration or maybe used for some other applications. e.g gardening. Also due to sprinklers wastage of water is less.

• All equipment in the system are made of light material so no burden to the panel.

• In moving system, control failure or some other reasons may cause system to fall off the panel structure. In that particular case safety of domestic person is compromised. Our system is stationary so no such scenario can occur.

• Cost of such system with good quality material is 10 times less than the dynamic system as it contains drive control system and machineries. Dynamic system is not suitable for wide versa-tility of panel arrangements.

•Saving of man hours and efforts that can be used elsewhere.

3.4 DEMERITS

• Excessive pressure can damage the pipe network.

• Using alkaline water may cause mineral spots upon the surface which have to be manually re-moved.

• Damaged pipe can't build up enough pressure which can cause more wastage with less work done.

• Some manual labor is still involved e.g opening the valve.

4. CONCLUSION

Existing automated cleaner mainly focus on large arrays and are unsuitable for small arrays namely residential groups. Our system can be stalled for rooftop panels. Cost of the system is low. It is easy to construct and maintenance is also low. We can also implement this system on a larger scale. The system can be retrofitted directly on to the panels in solar power plant, commercial, residential sectors. In this system, the water can be reused, vibration free, multiple row cleaning. The project intends to increase the efficiency of solar panel by removing all kinds of dust particles. In future it can be modified by sensors. time of installation along with panel frame, dust detection sensor, temperature sensor and camera surveillance, which is centrally connected.

5.REFERENCES

[1]*Ashish Saini and Abhishek Nahar "Solar Panel Cleaning System" ijir.2017; 3(5):1222-1226.*

[2]Satish patil, mallaradhya h m,"Design and implementation of microcontroller based automatic dust cleaning system for solar panel"ijerat.2016; 2(1):187-190.3.V.

[3]A. Ballal, Prof. R. M. Autee "Dual axis solar panel and panel cleaning system". ijates.2016; 4(6):85-93.

[4] Fawa dAzeem, G.B.Narejo"Design, development and performance evaluation of solar panel cleaning kit for street lights and ground mounted systems" 2016; 4357-4360.

[5] Rahul B. Ingle, Ravindra S. Chavan 'Automatic dust detection mechanism for solar panel cleaning system" IJARIIE. 2017; 3(3): 2546-2549.

[6]Dr.G.Prasanthi ME, Ph.D., T.Jayamadhuri" Effects Of Dust On The Performance Of Solar Panel And Improving The Performance By Using Arm Controller And Gear Motor Based Cleaning Metho,.IJISET.2015;2(9):329-334.

[7]Kiran M R, Rekha G Padaki. "Self-Cleaning Technology for solar PV Panel".IJSDR.2016; 1(9):148-173.

[8.Akhil Mishra, Ajay Sarathe" Study of solar panel cleaning system to enhance the performance of solar system"jetir.2017; 4:84-89.

[9].Z.H.Bohari."Solar Tracker Module with Automated Module Cleaning System"IJES.2015; 4(11):66-69