

PERFORMANCE ENHANCEMENT OF SOLAR PV PANELS BY USING LOW COST WATER JET SYSTEM

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Abstract-The clean sources of energy, whose optimal use minimises the environmental impacts, producing low secondary wastes and are the most sustainable are undoubtedly “renewable technologies”. Renewable energy is way cleaner than the fossil fuels. It comprises of solar, wind, tidal, hydropower and geothermal energy. Basically sun is the source of all the energies. As in any panel or device, maintenance is required for solar panels too. Operation and maintenance of solar panels become vital for improving their efficiency. Thus the panels need to be cleaned and taken care of at regular intervals. The cost of maintenance would rely upon the number of panels and their accessibility. For cleaning purpose a water jet with low watt pump can be used throughout the year except the rainy days. Some important contents to be focused upon for the maintenance of solar pv panels include the annual cleaning for higher efficiency; mostly where the surface of the panel is degraded, thorough visual inspection of all the panels, string tests of the photovoltaic module, checking of the inverter system, maintenance report production, inspection of the cabling and the isolator distribution board, checking of the meter and the labeling, analysis of the energy production, checking of voltage and current, repair and replacement of faulty items, alert report of the roof condition. However, preventive maintenance measures can be adopted at primary level; like initial build, engineering and design of the pv panels should be focused upon, risks can be mitigated by using multiple smaller inverters than a large one, site visits should be conducted at least once or twice annually.

Key words- Renewable technology, fossil fuel, solar panel, water jet, isolation distribution board.

I. INTRODUCTION

Generally efficiency of solar panels depends upon intensity of sunlight falling on it but as solar panels get covered with dust particles, required amount of sunlight is unable to strike on solar panel. So it is very necessary to clean it in regular intervals of time. As it is quite costly to setup a solar panel so it is quite necessary to do its maintenance work for desired output. First of all, solar panel is installed in inclined plane. It depends on the area where it is installed that how much dust particles are covering the panel within certain duration. And these dust will be cleaned by our given model which enhances the solar radiation on the panel to increase its efficiency. We want to clean the solar panel to increase its efficiency so that maximum charging can take place and backup power will be higher. The power supplied to the DC motor pump is controlled by ARDUINO UNO microcontroller circuit.

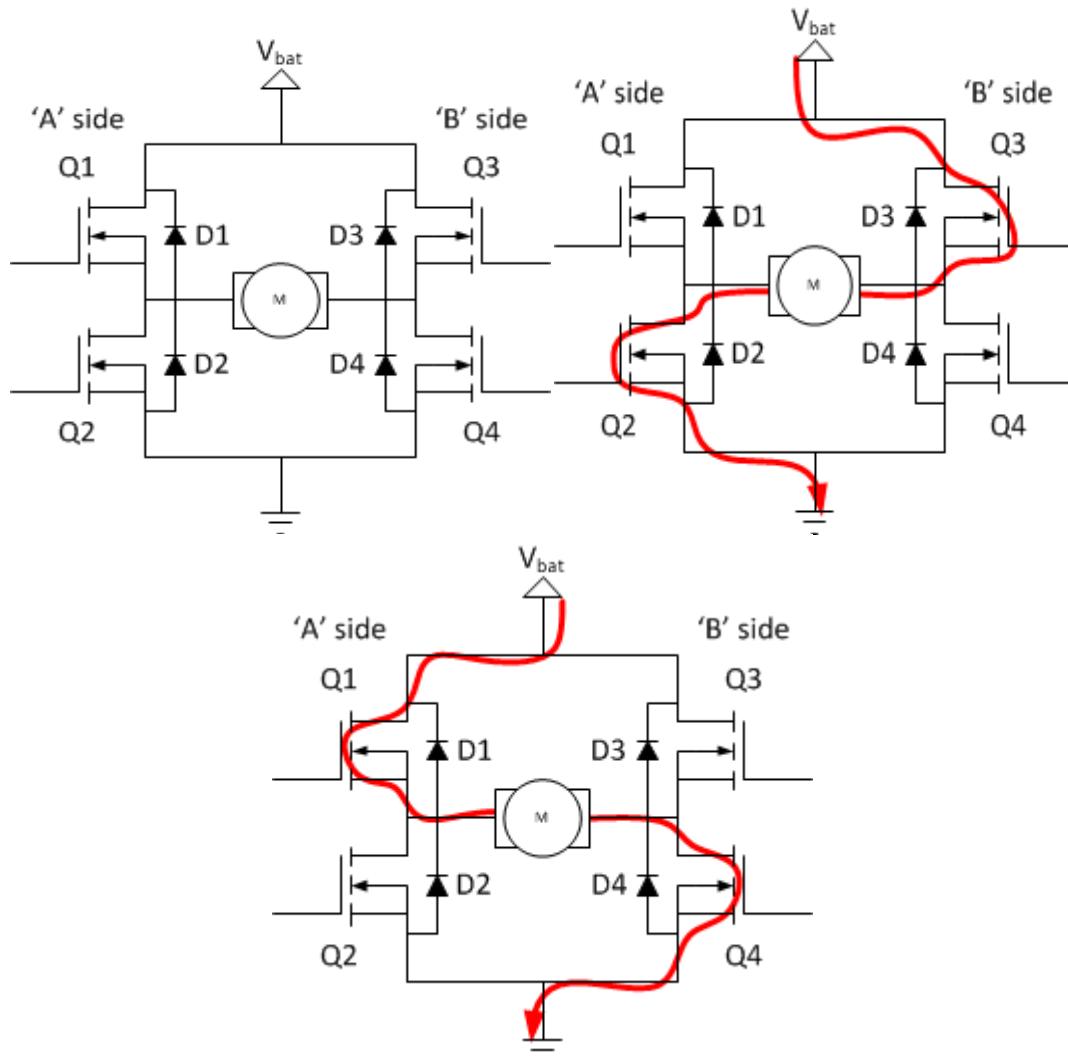
The main advantage of arduino uno circuit is to provide a time delay for both turn on and turn off time. Also it makes the system fully automatic, as it turns on the power supply (once in a day, once in an area is). So the user doesn't have to worry about switching on and off of the circuit or power wastage as arduino circuit will manage all these problems.

For cleaning purpose we have to set up a water tank of desirable size from where water is sunk and sprayed over the panel and after using the water we can reuse it and in this way water wastage will not be there. So from this project as we are getting full efficiency all the time so the battery life will also be enhanced due to interruption free charging. Also backup provided by battery will also be increased. The main objective of this working model is to clean solar panels periodically.

as per our wish. As solar panels generally requires very little maintenance depending on the area where it is installed.

II. DESIGN

2.1. CIRCUIT TO DRIVE MOTOR IN CLOCKWISE AND ANTICLOCKWISE DIRECTION



2.2. ARDUINO

An arduino shown is an open source microcontroller board, it is used to read sensor and control things like motor and bulbs. It allows us to upload program which can than react with the real world . Basically if there is something that is in any way control by electricity the arduino can interface with it in some manner. The main advantage of arduino uno circuit is to provide a time delay for both turn on and turn off time. Also it makes the system fully automatic, as it turn on the power supply (once in a day, once in a week or once in a month) depending upon how dusty the area is. So the user don't have to worry about to switching on and off of the circuit or power wastage as arduino circuit will manage all this problems

2.3. WORKING

First of all the 10W power supply is given to the Arduino microcontroller circuit and then two output ports are taken from the microcontroller. One of the ports is then connected to the water pump and the other is connected to the 12 V DC motors. Then rails are connected to motors upon which there are pre installed wipers shown in fig 2.3(a), depending on for what duration and time we want to operate it. Here appropriate delay is provided through microcontroller.

OUR APPROACH

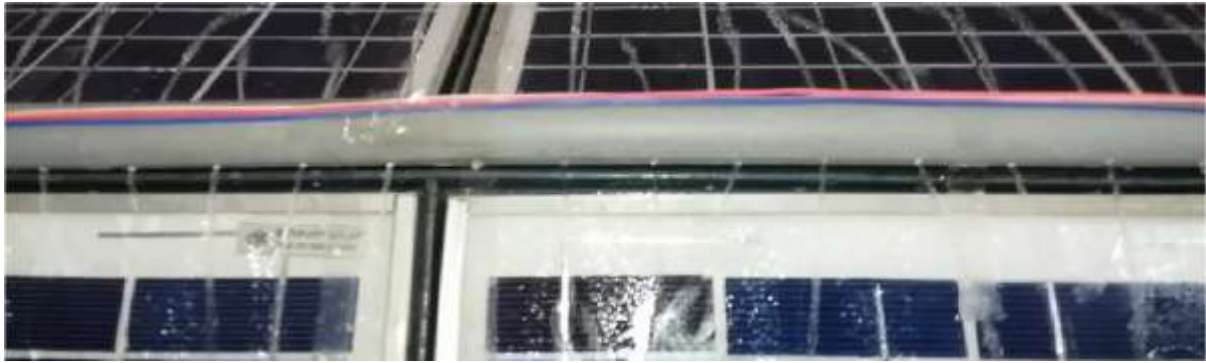


Fig 2.3(a) Wipers installed on rails connected with motor



Fig 2.3(b) Water jet on solar panel

III. ANALYSIS

In this chapter the output voltage of solar panel is taken in every 15 minutes of a particular day and the curve is drawn between open circuit voltages versus time in hours. The curves are analysed commercial packaged software MATLAB and given from fig 3.1 and fig 3.2. Here the panel is analysed for different output power during different time of day (from 10.30 am to 4.00 pm) with and without cleaning the panel.

Table 1: Panel Terminal Voltage during different time of a week (without Cleaning)

Date Time	21.03.16 (Mon)	22.03.16 (Tues)	23.03.16 (Wed)	24.03.16 (Thu)	25.03.16 (Fri)	26.03.16 (Sat)	27.03.16 (Sun)
11.30	19.70 V	19.68 V	19.80 V	19.58V	19.02 V 0	19.44 V	18.31 V
11.45	19.30 V	19.50 V	19.62 V	19.70 V	19.40 V	19.62 V	18.20 V
12.00	19.32 V	19.32 V	19.67 V	19.22 V	19.81 V	19.66 V	19.20 V
12.15	19.23 V	19.23 V	19.46 V	19.13 V	19.40 V	19.56 V	19.13 V
12.30	19.22 V	19.25 V	19.56 V	19.68 V	19.38 V	19.43 V	19.02 V
12.45	19.43 V	19.43 V	19.59 V	19.28 V	19.54 V	19.68 V	19.33 V

13.00	19.35 V	19.35 V	19.69 V	19.15 V	19.30 V	19.69 V	19.13 V
13.15	19.35 V	19.35 V	19.69 V	19.15 V	19.29 V	19.69 V	19.15 V
13.30	19.35 V	19.35 V	19.63 V	19.15 V	19.34 V	19.63 V	19.25 V
13.45	19.42 V	19.42 V	19.67 V	19.22 V	19.43 V	19.67 V	19.22 V
14.00	19.26 V	19.28 V	19.23 V	19.18 V	19.19 V	19.23 V	19.16 V
14.15	18.67 V	18.67 V	19.40 V	18.47 V	18.47 V	19.40 V	18.47 V
14.30	19.11 V	19.11 V	20.00 V	19.01 V	19.01 V	20.20 V	19.01 V
14.45	20.00 V	20.10 V	20.10 V	20.10 V	20.10 V	19.34 V	19.90 V
15.00	19.25 V	19.25 V	19.19 V	19.15 V	19.04 V	19.39 V	19.15 V
15.15	18.6 V	18.92 V	19.72 V	18.62 V	18.65 V	19.12 V	18.72 V
15.30	19.71 V	19.71 V	19.16 V	19.51 V	19.72 V	19.16 V	18.61 V
15.45	19.43 V	19.28 V	19.09 V	19.50 V	19.52 V	19.06 V	18.33 V
16.00	18.79 V	18.80 V	19.16 V	18.59 V	18.54 V	19.16 V	18.59 V

Table 2: Panel Terminal Voltage during different time of a week (with Cleaning)

Date Time	21.03.16 (Mon)	22.03.16 (Tues)	23.03.16 (Wed)	24.03.16 (Thu)	25.03.16 (Fri)	26.03.16 (Sat)	27.03.16 (Sun)
11.30	19.90 V	19.92 V	19.90 V	19.68 V	19.12 V	19.54 V	18.41 V
11.45	19.72 V	19.80 V	19.72 V	19.80 V	19.50 V	19.72 V	18.30 V
12.00	19.77 V	19.61 V	19.77 V	19.32 V	19.91 V	19.76 V	19.30 V
12.15	19.56 V	19.50 V	19.56 V	19.23 V	19.50 V	19.66 V	19.23 V
12.30	19.53 V	19.48 V	19.66 V	19.78 V	19.48 V	19.53 V	19.12 V
12.45	19.78 V	19.64 V	19.79 V	19.38 V	19.64 V	19.78 V	19.43 V
13.00	19.89 V	19.50 V	19.89 V	19.35 V	19.50 V	19.89 V	19.33 V
13.15	19.89 V	19.49 V	19.89 V	19.35 V	19.49 V	19.89 V	19.35 V
13.30	19.93 V	19.54 V	19.93 V	19.35 V	19.54 V	19.83 V	19.35 V
13.45	19.87 V	19.53 V	19.87 V	19.42 V	19.53 V	19.87 V	19.42 V
14.00	19.43 V	19.39 V	19.43 V	19.28 V	19.39 V	19.43 V	19.26 V

14.15	19.60 V	18.99 V	19.60 V	18.67 V	18.67 V	19.60 V	18.67 V
14.30	20.20 V	19.29 V	20.20 V	19.11 V	19.11 V	20.20 V	19.11 V
14.45	20.20 V	20.40 V	20.20 V	20.10 V	20.20 V	19.54 V	20.00 V
15.00	19.49 V	19.40 V	19.49 V	19.25 V	19.24 V	19.59 V	19.25 V
15.15	19.06 V	19.60 V	19.92 V	18.92 V	18.95 V	19.92 V	18.92 V
15.30	19.92 V	19.92 V	19.36 V	19.71 V	19.92 V	19.36 V	18.81 V
15.45	19.60 V	19.93 V	19.09 V	19.80 V	19.82 V	19.06 V	18.53 V
16.00	19.65 V	19.50 V	19.16 V	18.79 V	18.74 V	19.36 V	18.79 V

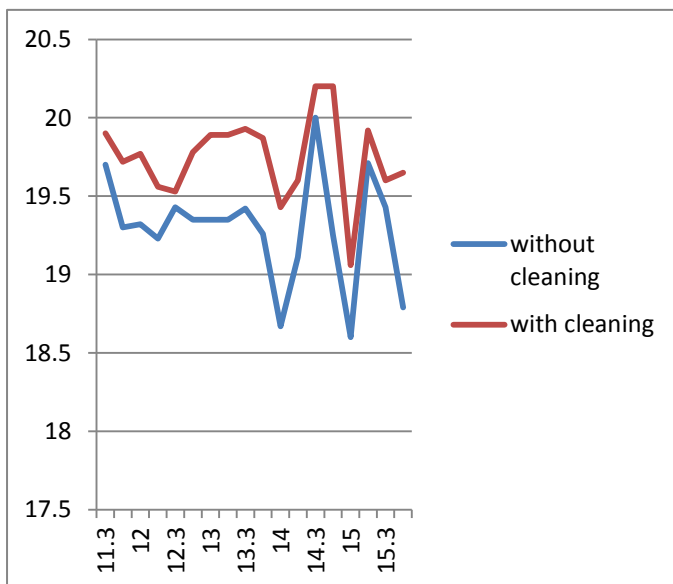


figure 3.1 (21.03.16)

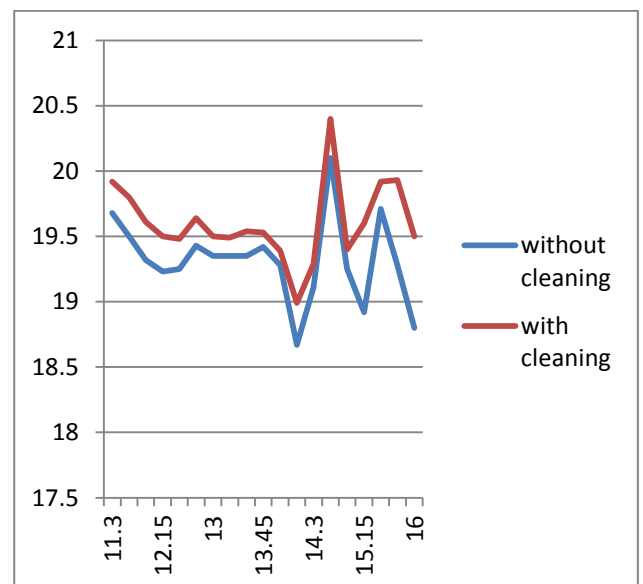


figure 3.2(22.03.16)

(Above shows the voltage variations while cleaning and without cleaning the panel in different days.)

IV.CONCLUSION

Hence we want to conclude that by using automation not only we can save energy and do the maintenance but also we can save the human power and avoid the risk of damaging the panels. This project makes the solar set up cost efficient by maintaining output constant. Hence it will reduce the pressure on grid for supply of energy. As people only worry about installation of solar panel not its maintenance which after some year cost them a lot and become a burden for them this project is taking power generated by solar panel only and It will economical to drive the cleaning circuit for few minutes in a month or twice in a month .So ratio of power used in cleaning purpose and power developed by the solar panels is very less. It is of low cost as well as if we use this project no any technical failure will happen in a single solar panel and we shouldn't bother about its maintenance as microcontroller will take care of it.

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