

Automatic Solar Panel Cleaner using Arduino

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Abstract – The purpose of this solar panel cleaning project is to research, develop, and implement an effective cleaning strategy to maintain the optimal performance of solar panels. The accumulation of dust, dirt, and debris on solar panels can reduce their efficiency and overall output, making regular cleaning essential for maximizing their energy production. To achieve this goal, we will conduct research into best practices for solar panel cleaning, including different cleaning methods and equipment. We will also perform testing to determine the most effective cleaning methods and equipment for different types of solar panels and environments. Based on our research and testing, we will develop a maintenance plan that outlines the frequency and method of cleaning for each solar panel installation. The plan will include recommendations for the use of eco-friendly cleaning products and will ensure that cleaning is carried out safely and effectively. Ultimately, the goal of this project is to improve the efficiency and effectiveness of solar panels, promoting the use of renewable energy sources and reducing our reliance on non-renewable energy sources. By implementing a regular cleaning strategy, we can ensure that solar panels are operating at peak efficiency and generating the maximum amount of electricity possible, saving money for individuals and businesses and contributing to a sustainable future.

Key Words - Solar Cleaner, Arduino Solar Cleaner, Automatic Solar Cleaner, Arduino based, dust cleaner, panel efficiency

I. INTRODUCTION

Solar panels are a popular and environmentally-friendly way of generating electricity. They are low-maintenance and can provide power for decades with minimal upkeep. However, one issue that can impact their performance is the accumulation of dust, dirt, and debris on their surfaces. This buildup can reduce the amount of sunlight that reaches the solar cells, lowering their efficiency and overall output. Therefore, regular cleaning of solar panels is important to maintain their optimal performance. A solar panel cleaning project can help to ensure that solar panels are operating at peak efficiency and generating the maximum amount of electricity possible. This can not only save money for individuals or businesses that rely on solar power but also help to reduce our reliance on non-renewable energy sources. The purpose of this project is to develop and implement an effective solar panel cleaning strategy. This will involve researching best practices for solar panel cleaning, testing different cleaning methods and equipment, and developing a maintenance plan to ensure that the solar panels are cleaned on a regular basis. By undertaking this project, we can

improve the efficiency and effectiveness of solar panels, and promote the use of renewable energy sources.

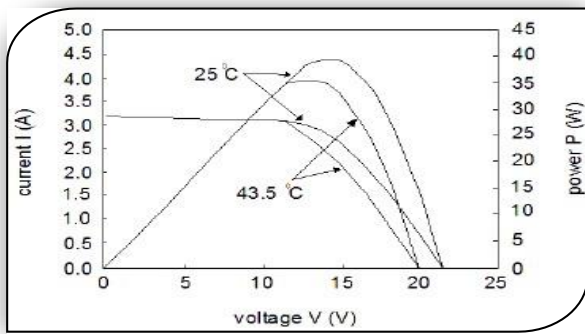
II. OVERVIEW

In March 2011, Tata Power Solar completed a 3 MW solar power facility for the company, using cells and modules developed in-house. The project was developed on 13 acres of land, with the site's natural landscape intact. This solar PV project in Mulshi, India, was completed in a record-breaking nine months and put into service in two phases – 1 MW and 2 MW, respectively, in January and March 2011. Carbon Project Power: 3 Mwproject Type: Power Producer Footprint Reduced: 12 Tones Per Yeartime to Complete Project: 16 Months Land Approximately 13 Acres module Count: 16,000 Modules Crystalline Technology 230 Wp Si

III. CELL TEMPRETURE

Temperature is one of the biggest factors that can increase and decrease solar cells efficiency. Increasing in temperature more than the set limit can affect in negative. If the temperature of solar cells rises above 25 degrees Celsius, the net output decreases with the rises of temperature. Good

installers would make sure while installing that solar cells are getting a sufficient amount of air. Above 25 degrees Celsius or 77 degrees Fahrenheit temperature can affect net production of current.



IV. SOLUTION

You should make sure that the solar panels are installed in such a way that they receive adequate airflow even as the temperature rises. When the temperature changes, the I-V and P-V properties at constant light are shown in the diagram [4]. Temperature effects are a byproduct of crystalline silicon cell-based modules' inherent characteristics. When the temperature drops, they produce more voltage, and when the temperature rises, they lose voltage. This temperature effect must be factored into any solar panel or system de-rating calculations.

V. SOLAR PITCH AND ORIENTATION

In the Northern Hemisphere, a non-tracking PV system should face true south. If you live in Flagstaff, Arizona, which is 35.2 degrees north of the equator, your panel should face directly south at a 35.2-degree angle. If the solar panels are to be mounted on a roof, remember to account for the roof's pitch. Adjust your solar panels twice a year for optimal performance. When the sun is high overhead in the summer, tilt the solar panel at a lower angle to catch more sunlight. Because the sun moves across the sky at a lower angle in the winter, solar panels should be angled higher during this time. Solar tracking systems in large commercial systems follow the sun automatically.



Fig.1 Solar Panel with Assembly of Cleaner.



Fig.2 Voltage Sensor



Fig.3 Arduino Uno R3

VI. BLOCK DIAGRAM OF SOLAR PANEL CLEANER

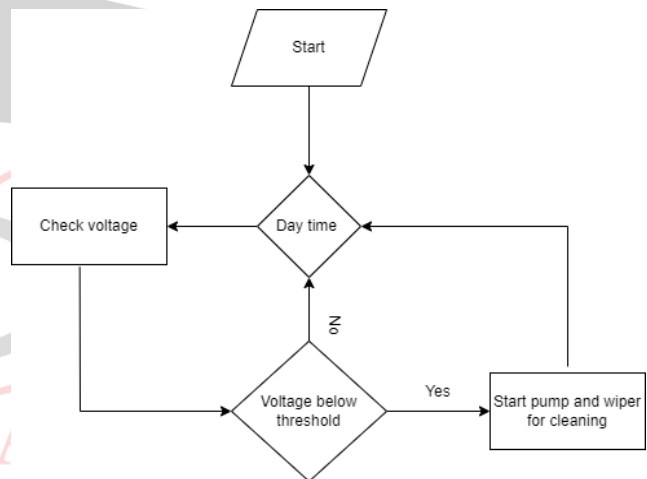


Fig.4. Block Diagram of Solar Panel Cleaner

VII. ANALYSIS OF DUST ON PANEL

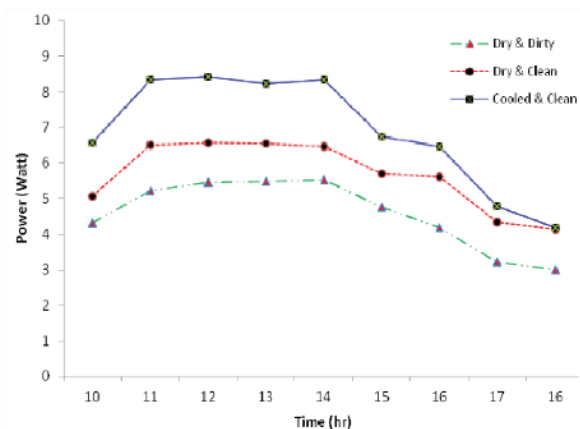


Table:

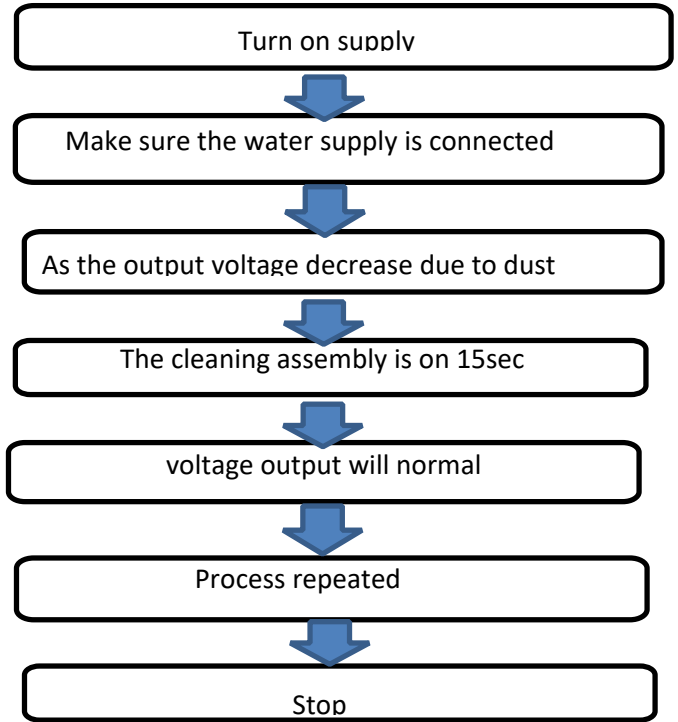
LOAD RESISTANCE in Ohms	VOLTAGE in Volts	CURRENT in Amps	POWER in Watts
1	1.69	1.43	2.4167
5	7.17	1.44	10.3248
10	14.79	1.35	19.9665
20	17.68	1.1	18.766
30	18.54	0.6	11.124
Open circuit	19.4	0	0
Short Circuit	0	1.45	0

Table1. Angle, Temperature, Without Dust

LOAD RESISTANCE in Ohms	VOLTAGE in Volts	CURRENT in Amps	POWER in Watts
1	0.96	0.76	0.7296
5	3.94	0.75	2.955
10	8.11	0.73	5.9203
15	11.21	0.72	8.0712
20	14.30	0.7	10.01
Open circuit	19.19	0	0
Short circuit	0	0.74	0

Table 2 Angle, Temperature, With Dust

VIII. ALGORITHM AND FLOWCHART



IX. WORKING SEQUENCE OF THE SYSTEM

Our project is related to cleaning of the solar panel the efficiency of the solar plant get reduced due to accumulation of the dust on the panel, Due to the dusty atmosphere the dust Gathered on the panel resist and create the barrier to the sunlight falling the surface of the panel. So as a remedy the automatic cleaning system is used for the panel . by using the cleaning system, we can increase the efficiency as well as increase the life of the panel. So, if the dust accumulates on it the output voltage of the panel can be reduced.

so, we connect the voltage sensor to the system to sense the voltage level if the voltage level is reduced the Arduino take signal from voltage sensor and activate the motor and start, he sprays motor to make panel somewhat wet and then activate another motor if the wiper to clen the all the dust on the panel this process will activate till the panel get clear and till recovery of the reduced voltage level.

X. CONCLUSION

In conclusion, the solar panel cleaning project is a valuable initiative that can improve the efficiency and effectiveness of solar panel installations. Regular cleaning can remove dust, dirt, and debris that can reduce the amount of sunlight reaching solar cells, resulting in improved energy output and cost savings. The project also promotes the use of renewable energy sources and contributes to environmental sustainability by reducing the need for non-renewable energy sources. While there are potential disadvantages to consider, such as cost and safety risks, these can be mitigated through careful planning and implementation. Overall, the solar panel cleaning project has numerous advantages that make it a worthwhile

investment for individuals and businesses that rely on solar power, ultimately contributing to a more sustainable future.

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