Solar Power Cleaning Robot

Suyash Barge[1], Omkar Pawar[2], Tushar Sathe[3], Ramchandra Sutar[4], Kajal Shinde[5],
[12345]Diploma In Electrical Engineering, Sanjay Bhokare Group Of Institute Miraj, Maharashtra, India
[6]Prof. R.S.Mulani, Dept. of Electrical Engineering, SBGI Miraj, Maharashtra, India

---

Abstract The "Solar Panel Cleaning Robot" is an automated and efficient system designed to clean solar panels regularly. Dust, dirt, bird droppings, and other particles accumulate on the surface of solar panels, which reduces their energy generation efficiency. This robot helps solve that problem by keeping the panels clean and maintaining their performance.

In this system, DC motors are used to move the robot across the surface of the solar panel. A rotating brush or wiper is attached to the robot, which effectively removes dust and dirt from the panel surface. In some designs, a water spray system is also included to improve cleaning efficiency, especially for sticky or stubborn dirt.

The robot operates using a rechargeable battery, which can be charged using solar energy. This makes the system energy-efficient and environmentally friendly. A microcontroller is used to control the movement of the robot as well as the cleaning mechanism, ensuring proper and smooth operation.

The design of this system is simple and cost-effective, making it easy to use and maintain. It is especially suitable for small and medium-scale solar installations.

INTRODUCTION

The increasing demand for renewable energy has led to the widespread use of solar panels for electricity generation. Solar energy is clean, sustainable, and environmentally friendly, making it an important solution for future energy needs. However, the efficiency of solar panels can be significantly affected by external factors such as dust, dirt, bird droppings, and other particles that accumulate on their surface over time.

Regular cleaning of solar panels is necessary to maintain their maximum efficiency and power output. Traditional manual cleaning methods are not only time-consuming and labor-intensive but can also be risky, especially for panels installed on rooftops or large solar farms. In addition, frequent manual cleaning increases maintenance costs and may not always be practical.

To address these issues, the "Solar Panel Cleaning Robot" is developed as an automated and efficient solution. This system uses motors, brushes, and a microcontroller to clean the panels without human intervention. It ensures safe operation, reduces maintenance efforts, and improves the overall performance and lifespan of solar energy systems.

1.1 Sub Heading 1

The "Solar Panel Cleaning Robot" is an automated system designed to keep solar panels clean and maintain their efficiency. Dust, dirt, and other particles reduce the performance of solar panels, and this robot helps solve that problem by regularly cleaning their surface.

It uses DC motors to move across the panel and a rotating brush or wiper to remove dust and dirt. Some designs also include a water spray system for better cleaning. The robot operates on a rechargeable battery, which can be charged using solar energy, making it energy-efficient and eco-friendly.

A microcontroller controls the movement and cleaning process, ensuring smooth operation. Overall, the system is simple, cost-effective, and reduces manual effort while improving the performance of solar panels.

1.2 Sub Heading 2

The system consists of a rechargeable battery, DC motors, a motor driver, a microcontroller, and a cleaning mechanism. The battery supplies power to the entire system and can be charged using a solar panel, while the DC motors help the robot move across the panel surface.

A brush or wiper is used to remove dust and dirt effectively from the solar panel. The microcontroller controls the movement and cleaning process through the motor driver, ensuring smooth operation.

This system provides a simple, efficient, and automatic solution for cleaning solar panels and maintaining their performance.

2. HEADING 2

This section describes the overall design of the system using a block diagram. It shows how power flows from the battery to the motor driver and then to the DC motors and cleaning mechanism. The battery can also be charged using a solar panel, making the system energy-efficient.

The microcontroller controls the entire system and ensures proper coordination between the motors and the cleaning mechanism. This allows the robot to move smoothly and operate effectively on the solar panel surface. Additionally, the system is designed to be simple and cost-effective, making it easy to use and maintain. It also reduces manual effort and saves time.

A brush or wiper is used to remove dust and dirt from the panel. Overall, the system provides a simple, efficient, and automatic solution for cleaning solar panels and maintaining their performance.

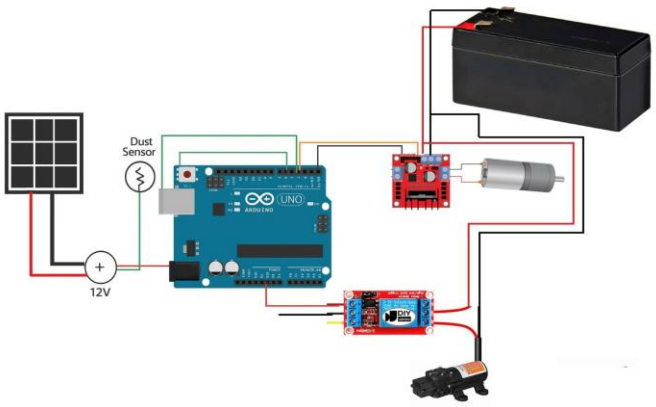

Fig –1: **Circuit Diagram of Solar Powered Cleaning Robot**

Fig -2: **Solar Powered Cleaning Robot**

This project is a solar panel cleaning robot integrated with basic automation. A rechargeable battery powers the system, and a solar panel can be used to charge the battery. A motor driver is used to control DC motors for the movement of the robot, and a cleaning brush or wiper is used to remove dust from the panel surface.

A microcontroller (Arduino UNO) is used to control the system. The movement of the robot is controlled manually or by a fixed program. A relay module is used to control the water pump for cleaning.

Thus, the system provides a simple, efficient, and eco-friendly solution for cleaning solar panels.

3. CONCLUSIONS

The solar panel cleaning robot is an eco-friendly and efficient system.
It helps to maintain the cleanliness of solar panels and improves their efficiency.
The system reduces manual effort and saves time.
It provides automatic cleaning, making it easy and safe to use.
It is suitable for homes, industries, and large solar farms.
Thus, this project supports renewable energy and modern automation technology.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to our project guide for their valuable guidance and support.
We also thank our institute and all those who helped us in completing this project successfully.

System Components & Their Functions

Sr. No.	Component	Function
1	Solar Panel (12V)	Converts sunlight into electrical energy
2	Battery (12V, 1.3Ah)	Stores electrical energy and powers the system
3	Arduino UNO	Controls the overall operation of the robot
4	Relay Module (5V)	Controls the water pump ON/OFF
5	Motor Driver (L298N)	Controls the speed and direction of motors
6	Geared Motor (12V, 30 RPM)	Moves the robot on the solar panel surface
7	Cleaning Brush	Removes dust and dirt from the panel surface

REFERENCES

[1] J. John, M. Smith, Design and Development of Solar Panel Cleaning Robot, International Journal of Engineering Research & Technology, 2020.
[2] R. Kumar, S. Gupta, Automatic Solar Panel Cleaning System, International Journal of Scientific Research in Engineering, 2019.
[3] A. Sharma, P. Verma, Solar Panel Maintenance Using Robotic System, International Conference on Renewable Energy, 2018.
[4] M. Patel, K. Shah, Design of Automated Cleaning System for Solar Panels, International Journal of Advanced Engineering Research, 2017.