

ABSTRAK

The maintenance of solar panels is crucial to ensure optimal performance in generating energy. The accumulation of dust, dirt, and other elements on the surface of solar panels can reduce the current output delivered to the load. One of the main challenges is the cleaning process, which requires considerable cost and labor, especially for solar panels installed on rooftops. Therefore, an automated solution is needed to clean solar panels without intensive manual intervention.

This study aims to design a prototype of a solar panel cleaning robot using the Time-Based Cleaning method, where the robot automatically performs cleaning based on a predetermined schedule. With this approach, the cleaning robot can operate independently without direct supervision and optimize cleaning according to the set time. The robot is designed to work on personal solar panels with dimensions of 1030x670 mm, without considering panel type or size variations.

The results of this study indicate that the solar panel cleaning robot is capable of increasing the panel's average output current by approximately $\pm 5\%$, exceeding the targeted increase of $\pm 2\%$. The time-based cleaning system has been proven to operate automatically according to schedule without manual intervention, thereby reducing dependence on human labor. The implementation of this robot also has the potential to extend the operational lifespan of solar panels by keeping their surfaces clean from dust and dirt that could otherwise degrade performance.