2023 IEEE/ASME International Conference on
Advanced Intelligent Mechatronics (AIM)

Design and Control of a Solar Panel Cleaning Robot

Beom Jin Lee, Dong Wook Kwon, and Seul Jung

***Abstract*—This paper presents the design and control of a solar panel cleaning mobile robot carried by a drone. The robot has tracked wheels to stick to the slanted solar panels and move. Control between suction pad and wheel velocities has to be done with care in order not to slip down while moving. Experimental studies of moving on the solar panel were demonstrated to confirm the feasibility.**

***Index Terms*—Solar panel cleaning robot, suction control, cleaning tasks**

I. Introduction

RENEWABLE energy has been a hot issue in these days to provide solutions to energy depletion. One of renewable energies among various types is solar energy, which is easily obtained by solar panels and clean. To collect the solar energy, solar panels are installed in many places such as the farm field, mountains, roofs of buildings, the floating on the sea, the dessert, and so on. The area of solar panels has been remarkably increased.

Accordingly, the maintenance of solar panels becomes important. The cleaner solar panel is the more energies are produced. A problem is the remote distance of solar panels where humans cannot reach with ease. The cleaning task of solar panels is quite impossible.

Here we are proposing to use drones to clean the solar panels as shown in Fig. 1 [1]. A drone carries a solar panel cleaning robot to the panel and releases it on the surface. Then the drone picks it up after the cleaning task.

In this paper, a solar panel cleaning robot is designed and controlled. Experimental studies of performing the cleaning task on a solar panel are conducted.

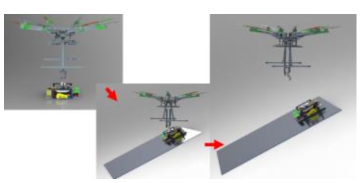
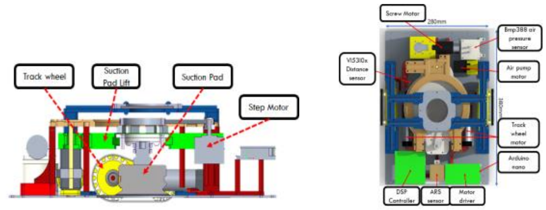


Fig.1 Drone for a solar panel cleaning robot(Dr. SPC).

II. Solar Panel Cleaning Robot

The overall structure of the robot is shown in Fig. 2. It has tracked wheels, a suction system, sensors, and necessary control hardware. One important design is how to make the robot stay on the slippery surface of a panel while moving.

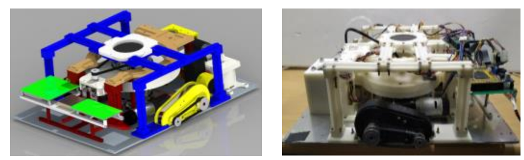
Here we are using a suction pad controlled by an air pump. The robot is controlled to move while suction pressure is applied. DSP is a main controller and Arduino nano is an auxiliary controller.



(a) Side view (b) Top view

Fig. 2 Solar panel cleaning robot structure.

The overall design and the actual robot are shown in Fig. 3.

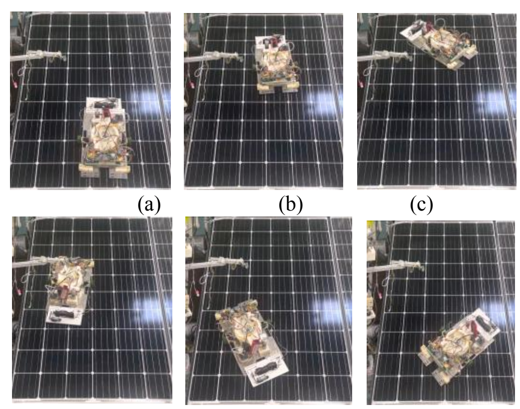


(a) Conceptual design (b) Real robot

Fig.3 Solar panel cleaning robot.

III. Experiment

A cleaning task has been performed on the solar panel as shown in Fig. 4. The robot moves up in Fig. 4 (a) (b), turns left in (c), moves down in (d), and turn left in (e) and (f).



(a) (b) (c)

(d) (e) (f)

Fig.4 Solar panel cleaning task.

IV. Conclusion

In this paper, a solar panel cleaning robot is designed and controlled. Control of driving a robot while staying on the slanted surface of a solar panel was quite challenging. Experimental results have shown the successful demonstration of a solar panel cleaning task.

References

[1] D. W. Kwon and S. Jung, "Design, Development, and Experiment of a Solar Panel Cleaning Robot" *KIEE*, vol. 70, no. 2, pp. 395-401, 2021.