**Abstract**

The proposed project presents an autonomous solar panel cleaning robot designed to efficiently clean rectangular solar panels while intelligently navigating the surface using edge and obstacle detection. The system aims to maintain solar panel efficiency by removing dust and debris, which otherwise reduce energy output.

The robot utilizes an L293D motor driver to control two DC motors, enabling forward motion, directional turns, and precise maneuvering. Two water pump motors are controlled via L293D modules to spray cleaning fluid during movement. Edge detection is handled by an inverted IR sensor placed at the front of the robot, preventing it from falling off the panel. An additional inverted IR sensor is placed on the left side to detect obstacles such as wiring or structural obstructions. The robot stops only when both the front edge and left obstacle are detected, ensuring safe operation.

The cleaning path includes an alternating U-turn pattern to cover the panel width completely. When the front IR sensor detects an edge, the robot performs a controlled 180-degree turn by making two sequential 90-degree turns with a short forward movement in between. The direction of the U-turn alternates between left and right on each detection to cover the panel efficiently in rows.

Safety is further enhanced with an inverted rain sensor. If rain is detected, or if both edge and obstacle are detected simultaneously, the robot halts operation to avoid electrical hazards or mechanical issues.

This solution offers a low-cost, scalable, and effective approach to maintaining solar panel efficiency with minimal human intervention, particularly suited for large-scale installations in dusty environments.

**BLOCK DIAGRAM**



























