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Photovoltaic Panel Inspection and Maintenance

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Introduction

Photovoltaic Panels, other wise known as solar panels develop 'hotspots', areas of high temperature which develop on the panels if not properly supervised and maintained.

Nevada's goal is to produce 50% of its energy from solar energy along with other renewable resources by the year 2030. More solar panels in use will increase the demand.

Hotspots cause lower efficiency among the affected cells thus consuming more energy that it produces. High temperatures cause the materials to degrade and break, the panels will no longer work and have to be replaced.

Research Objectives

Manual Inspection of solar panels is time consuming and expensive. Reducing manual labor reduces cost and improves efficiency. With the increase of solar energy this issue will only become bigger.

Having a RC car or any other motorized vehicle going around solar fields operated by one person to inspect and do minimal maintenance on solar panels will help reduce the cost of labor, along with making the process faster.

Methodology

Thermal camera was used for the detection of hot spots. With the use of a color detection algorithm through the OpenCV library.

An Electric heating pad was used to simulate a hotspot which can be found in solar panels.

6 DOF robotic arm with a windshield wiper attached to the end effector was used to remove debris and other unwanted material from the surface of the solar panels.

Findings and Conclusion

Since a color detection programming function was used changes in light and backgrounds affects the detection does making it somewhat unreliable in certain environments.

The robotic arm used to clean the surface of the solar panels, in this case a white board was used to simulate the surface of the panels, had predetermined way points along the surface of the board.

Predetermined way points work for a control environment but in a real solar field where the orientation of the panels can vary this would not always work.

Future Research

Use of temperature detection for hotspots as supposed to using color detection for better accuracy. Add system on a drone.

Control of the robotic arm using a leader/follower approach to have more control of the forces to avoid damaging the panels.

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