



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Tyler E. Robertson	Project Number S0318
Project Title Improving Residential Solar Panel Efficiency in a Drought: Cleaning Solar Panels without Water or Manpower	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Despite a non-drought year in 2016-2017, during the summer months in the Central Valley dry dusty conditions in the surrounding agricultural areas and poor air quality with high particulate and ozone levels will lead to a buildup of material on solar panels, reducing their efficiency. Even if water restrictions are lifted, water is still a valuable resource and valley residents need a cost effective way to remove dust and dirt from their solar panels without using water. The goal of this project was to design and build a cost-effective robot that would clean residential solar panels without the use of water or manpower. Year Two of the project focused on continued redesign and testing of prototypes to achieve the goal.</p> <p>Methods/Materials Robot prototypes were designed and built using Arduino microcontroller and Actobotics robot components. Each prototype was tested for effectiveness at driving straight and turning on a solar panel placed at an increasing angles (0-40 degrees). The ultrasonic sensor provided distance feedback to keep the robot from running off the edge of the solar panel. Prototypes were programmed to be autonomous or remotely controlled with either Bluetooth or radio frequency technology. Initial testing was completed to test improvement in solar panel power output.</p> <p>Results The tracked robot design was effective for driving straight on slopes up to 40 degrees, but demonstrated difficulty negotiating turns due to the increased traction. Improved robot control and consistency were noted using Spektrum DXe radio system compared to the Bluetooth phone control. The ultrasonic sensor provided consistent edge detection during autonomous running of the robot. Traction continues to be the limiting factor in the robot's effectiveness as roof slope increases.</p> <p>Conclusions/Discussion Year Two prototypes demonstrated improved ability to clean residential solar panels on sloped roofs without the use of water to allow improved solar panel efficiency in high particulate regions. Without water as a cleaning substrate, there is a limit to the extent a solar panel can be cleaned. The robot is designed to be portable, cost-effective, and easily controlled with a remote, reducing the need for physically washing solar panels on a roof. I still believe that my project has potential on the market, especially for homeowners in areas of high dust or pollution.</p>	
Summary Statement I designed and built a cost-effective robot that cleans residential solar panels without the use of water or manpower.	
Help Received Fresno IDEAWorks provided feedback with robot design. My parents supervised operation of power tools required during build.	