



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

Name(s) Tyler E. Robertson	Project Number <p align="right">36549</p>
Project Title Improving Residential Solar Panel Efficiency in a Drought: A New Method to Clean Solar Panels without Water or Manpower	
<p align="center">Abstract</p> <p>Objectives/Goals Thanks to falling prices and legal mandates, residential solar panel installations increased 70% in 2015, with California leading the way. In the Central Valley, there is plenty of sunshine to support solar energy projects. However, the prolonged drought has produced dry, dusty conditions in the surrounding agricultural areas and poor air quality with high particulate and ozone levels. These conditions result in the buildup of material on solar panels, reducing their efficiency. Currently, residential solar panel cleaning options are limited to hand cleaning with water or very expensive machines. 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.</p> <p>Methods/Materials Lego NXT, Arduino microcontroller, paintbrush roller, IR remote, Bluetooth receiver, ultrasonic sensor, CO2 inflator. Three different robot prototypes were designed and built. 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 infrared or Bluetooth technology.</p> <p>Results Prototype #3 was the most effective using four wheel drive and Bluetooth control. It was able to move in all directions on solar panels at 20 degree angles and travel straight across panels sloped up to a maximum of 40 degrees. The ultrasonic sensor provided consistent edge detection during autonomous running of the robot. Wheel traction was the limiting factor in the robot's effectiveness as roof slope increased.</p> <p>Conclusions/Discussion The prototype robots demonstrate the ability to clean residential solar panels on sloped roofs without the use of water to allow improved solar panel efficiency in high particulate regions. The robot was designed to be portable, cost-effective, and easily controlled with a remote, reducing the need for physically washing solar panels on a roof. I believe that my project has a lot of 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 The RobotShop at Fresno IDEAWorks provided mentoring with robot programming. My parents supervised operation of power tools required during build.	