CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
Andrew J. Kim

Project Number
J1410

Project Title
Solar Trackers in Motion

Abstract

Objectives/Goals
To demonstrate a system that can constantly create a 90º angle of incidence on a solar panel attached to a moving object. We will demonstrate this system by building a robot using Lego NXT and program it using LabVIEW. Together, they will demonstrate a way to track the sun while moving.

Methods/Materials
Design a robot that can move in all three dimensions (Put that can spin vertically on top of a motor that spins horizontally). Test and see if your robot is stable and strong, if not, add beams or make the base wider to make it so. Open LabVIEW on your computer. Take your robot and plug it in to your computer with the USB cable. Get the Solar Elevation and Azimuth on LabVIEW using the GPS sensor. Use the solar elevation to move the vertical motor. Take the difference from the Azimuth and the compass reading to move the horizontal motor, this will move the solar panel so that it faces the sun even if it is not facing North. This program will allow your robot to track the sun from any position.

NXT brain NXT building kit 2 motors AA batteries (You may need a lot, one NXT brain needs 6 AAs and they drain pretty fast) Dexter Industries GPS sensor for NXT NXT compass sensor (2 if your plan on making it move) 1 60 volt solar panel A roll of tape (masking, scotch, or duct) A computer with LabVIEW (preferably laptop) An area with view to the sun A calculator Lots of paper Pencil and eraser

Conclusions/Discussion
I was unable to finish the last and key part of the experiment, which was to have the robot track the sun whilst moving. The robot did track the sun, but it was unable to do so while on the move. I had failed to consider how challenging it would be to find the correct equation to find the solar elevation. Most of the websites which I believed to have the formula were wrong. The first constantly gave a negative number that was nowhere close to where the sun was in the sky. One gave odd numbers that were tens of degrees off. Only on the third try did I find the real equation for solar elevation, which is given in the research section of this report. After finding the formula, I was able to make a robot that track the sun from any position. However, I encountered some problems when I tried to make this program run continuously. The program needs to run continuously for the robot to be able to track the sun while on the move.

Summary Statement
Developing a program that will maximize the power output of a solar panel by tracking the sun using a GPS and a digital compass.

Help Received
Father helped decipher formula from a website. Mother helped to glue/tape the board.