CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
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Project Number
J0201

Project Title
Follow the Light: Maximizing Solar Cell Efficiency

Abstract

Objectives/Goals

One of solar energy's setbacks is its efficiency. A solar cell only obtains its full energy potential when the sun is directly above it. Based on the speed of earth's rotation, this only occurs for less than 15 to 20 minutes a day. Once the sun is no longer directly above the solar cell, its efficiency drops.

The overall objective was to design, prototype, and build a device that allowed a solar panel to track the sun on one axis. This would permit maximum efficiency the entire day, versus the short period that the sun is directly above it (in the case of a stationary solar cell).

Methods/Materials

The circuit design was tested on a solderless breadboard, perfected, and replicated onto a regular circuitboard. The sensor component consists of two photoresistors, each in a small black tube to block interfering light. Each photoresistor reads a voltage drop (the more direct the sunlight is with the photoresistor, the lower the voltage drop). These voltages are what drive the motor system in the hardware one direction or another. This motor system is geared down to allow the platform with the solar cell to turn towards the light until the voltage difference zeroes out. This means both the sensor and the platform are aligned with the sun.

To compare the device's efficiency with that of a stationary solar cell, a testing device was built to eliminate variables that might make the results inaccurate. This testing device, using a cardboard box and a pinhole camera, simulates the angles during the day that the sun would be, in relation to a stationary solar cell. The solar cell was mounted to the front of the box and the voltage of it was measured at each of the 10 degree increments. (tests repeated 5 times)

Results

The data given from the simulation of a stationary solar cell showed an arc in efficiency, dropping as the sun became less direct. The data from my tracking mechanism showed how effectively it was able to overcome that efficiency drop by tracking the sun.

Conclusions/Discussion

The conclusion reached was that my device allowed the solar cell to harness its full energy potential for the entire day, versus facing the drop in efficiency as the earth rotates away from the sun, like the case of a stationary solar cell. Using my design, solar companies could increase solar energy's popularity as well as efficiency.

Summary Statement

The project's goal was to build a device that tracks the sun on one axis, allowing a solar cell to harness its full potential of energy throughout the entire day, as opposed to facing the drop in efficiency as the sun becomes less direct.

Help Received

Father taught student how to solder a breadboard, but actual project was performed entirely by the student.