

An Arduino controlled Linear Fresnel Reflector

Submission is for research¹

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We have designed and constructed a simple, low-cost method of maximizing the amount of solar energy captured by a single solar vacuum tube using a linear Fresnel reflector. This is accomplished through several features. The first of these is giving the concentrator the ability to “follow” the sun, that is, the mirrors and the frame of the reflector automatically rotate as the sun moves throughout the day. The movement of these is controlled by modification of an Arduino solar tracking program created by the institute of Earth science research and education². Instead of using light-sensing hardware, the Arduino microcontroller continuously calculates the sun’s position with the aid of a battery controlled Real Time Clock (RTC). This program was modified to control the motion of a small stepper motor that rotates a timing belt to which each mirror is linked. The second feature is that the frame of the collector is made entirely of prefabricated T-slotted aluminum, making the reflector both lightweight and durable. Each mirror along with the vacuum tube itself are held by 3-d printed plastic components which were designed and printed in our lab. Assembly of this model is simple and relatively short, making it appealing to the average solar hobbyist or experimentalist. We hope to use this device to power a Duplex Stirling-engine-heat pump that would reduce heating costs for a typical home. Further work on the device can also be done to create a much more consumer friendly and marketable product. The device could also be modified for solar power generation and/or solar desalination. In summary, using modern microcontrollers, pre-made aluminum framing, and simple 3-d printed parts we have developed a new device that provides consumer friendly access to solar energy.

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2. Brooks, D. Arduino Uno and Solar Position Calculations. Institute for Earth Science Research and Education. Pennsylvania. February 2015.