Solar Tracker

Project Description

This project is intended to design and manufacture a low-cost, yet effective sun tracking system for a pyrheliometer.

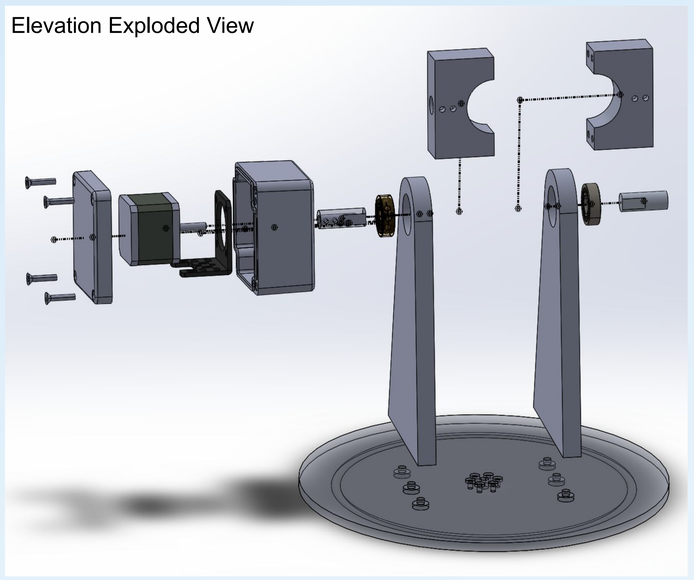
Requirements

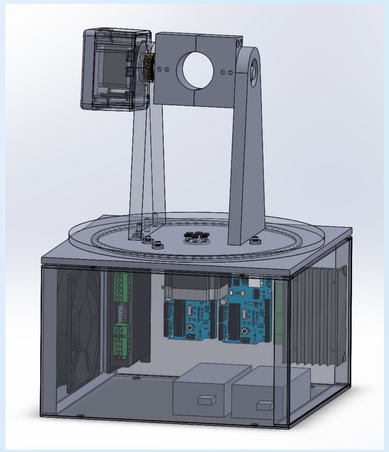
- It must track the sun in two axes
- Able to calculate solar position to a high accuracy
- Able to withstand the outdoors for extended periods of time (weatherproof)
- Low-cost, under $1,000

Fabrication & Assembly

Waterjet, mill, and CNC machines were used to produce parts.

Elevation Exploded View





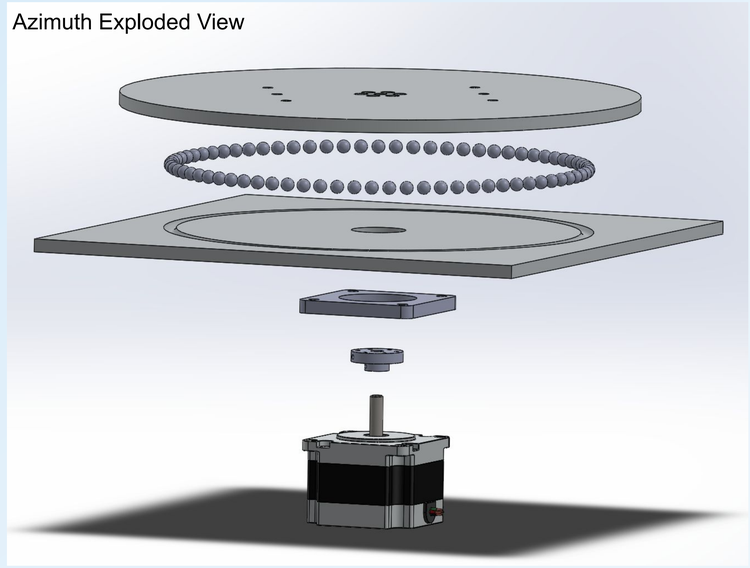
Solidworks Assembly of Tracker

Manufactured Assembly

Design

The solar tracker is designed to follow the sun's path by calculating the azimuth and elevation angles within a 0.2° accuracy. The system runs off an Arduino Mega, controlling two stepper motors microstepped to 1/16 providing movements in 0.1125° increments.

Azimuth Exploded View



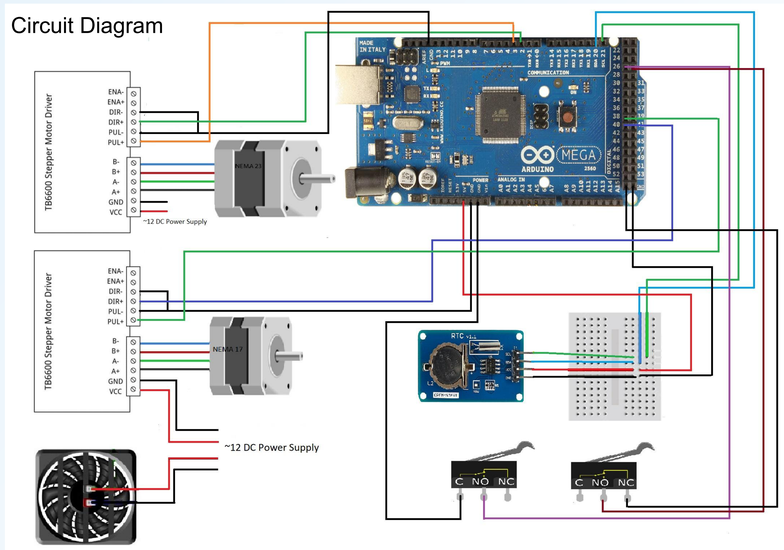
Testing & Analysis

The code's accuracy for both axes were tested against an high accuracy online calculator, and were found to have a maximum error of 0.112° in the azimuth and 0.136° in the elevation.

Hour	Ele (Calc)	Azi(Calc)	Ele(Ard)	Azi(Ard)	Ele(Error)	Azi(Error)
8:00:00	17.42	127.37	17.389	127.287	0.031	0.083
8:30:00	22.24	132.91	22.215	132.808	0.025	0.102
9:00:00	26.62	139.03	26.606	138.925	0.014	0.105
9:30:00	30.46	145.82	30.451	145.703	0.009	0.117
10:00:00	33.65	153.29	33.668	153.169	0.018	0.121
10:30:00	36.08	161.42	36.107	161.284	0.027	0.136
11:00:00	37.63	170.07	37.673	169.936	0.043	0.134
11:30:00	38.22	179.03	38.283	178.9	0.063	0.13
12:00:00	37.83	188.02	37.9	187.923	0.07	0.097
12:30:00	36.47	196.75	36.555	196.646	0.085	0.104
13:00:00	34.22	205	34.309	204.902	0.089	0.098
13:30:00	31.17	212.61	31.272	212.52	0.102	0.09
14:00:00	27.45	219.53	27.557	219.455	0.107	0.075
14:30:00	23.17	225.79	23.282	225.718	0.112	0.072

Online Calculator vs. Arduino Code calculations

Circuit Diagram



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