Analysis of Heliotropic Solar Panels

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Project Goal

The goal is to find an optimal design of a heliotropic solar panel by testing design choices such as single axis vs. double axis tracking, predictive vs. adaptive sun-tracking,and photoresistor vs. photodiode usage for the adaptive implementation.

Background

The efficiency of stationary solar panels is lessened when throughout the day the sunlight hits the panel at an angle other than perpendicular. Similar to the concept of heliotropism in plants, our solar panels will reorient to face the sun to maximize current. To exhibit this heliotropic nature we plan to use and compare a predictive and adaptive sun-tracking algorithm

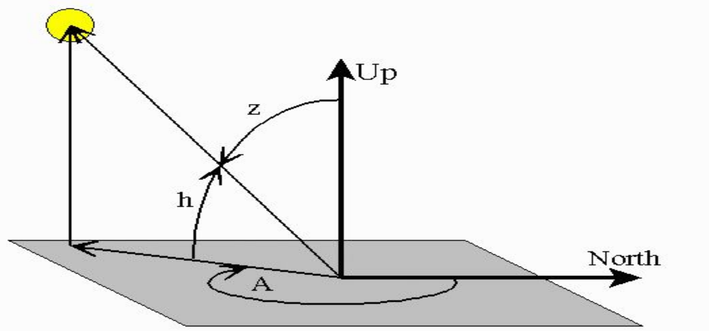

Fig. 1 Sun-tracking algorithm output angles

Progress Made

- Implemented the predictive sun-tracking algorithm that provides horizontal and vertical angles for orientation given the latitude, longitude, and the current time and date.
- Estimated geometric parameters required to obtain maximum degree of rotation
- Designed the circuitry for both sun tracking
- Prototyped single-axis solar panel implementing predictive sun-tracking

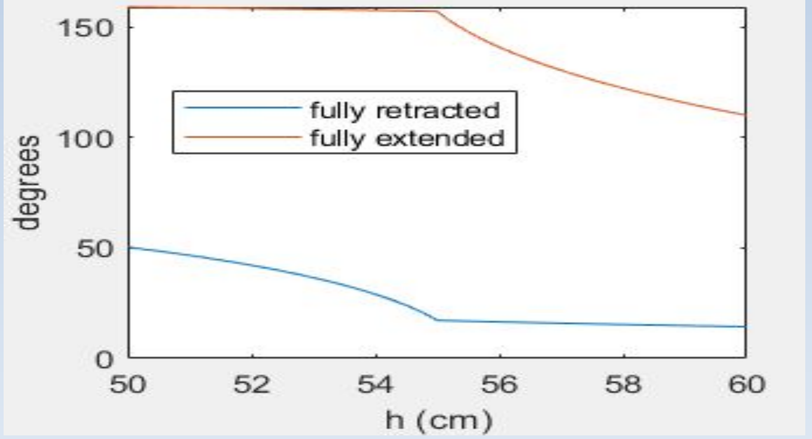

Fig 2. Range of motion graph of solar panel rotation

Challenges

- Acquiring funding and buying parts
- Obtaining sufficient rotation range from available component (12 inch actuator) and design
- Modeling the power draw of various components

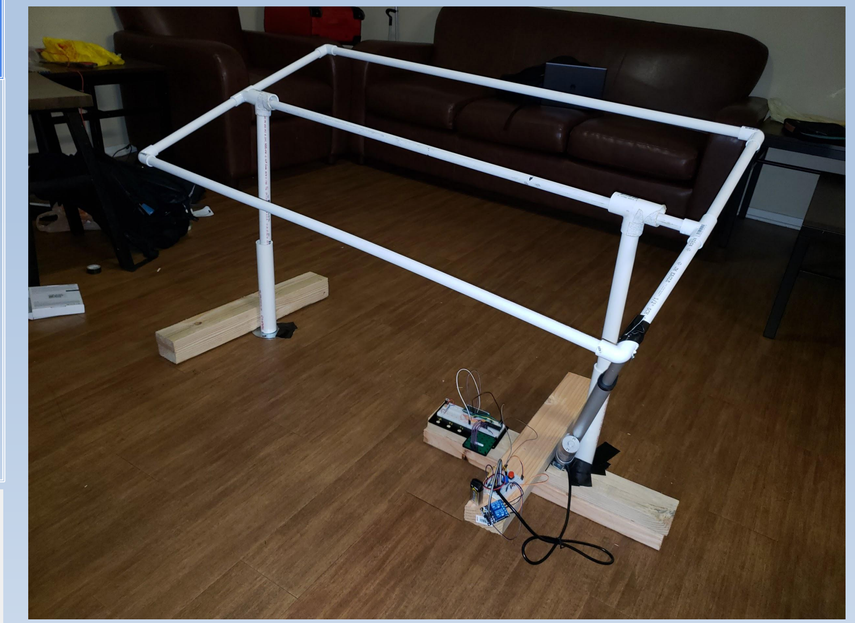

Fig. 3 Prototype for single axis predictive solar panel

Future Work

- Software to attain readings, store in a database, and graph current over time
- Refine sun-tracking algorithm
- Prototyping adaptive sun-tracking using photoresistors and photodiodes
- Using gyroscope reading to refine angle measurement (compared to approximation using stroke rate)
- Implementing the actual design using ordered parts delivered next quarter

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