College of Engineering
LAMAR UNIVERSITY

OCI EIS

Solar Positioning System

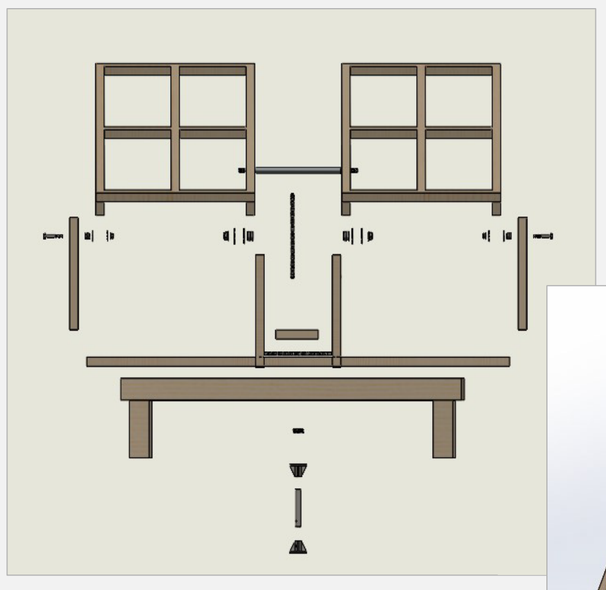
What is a Solar Positioning System?

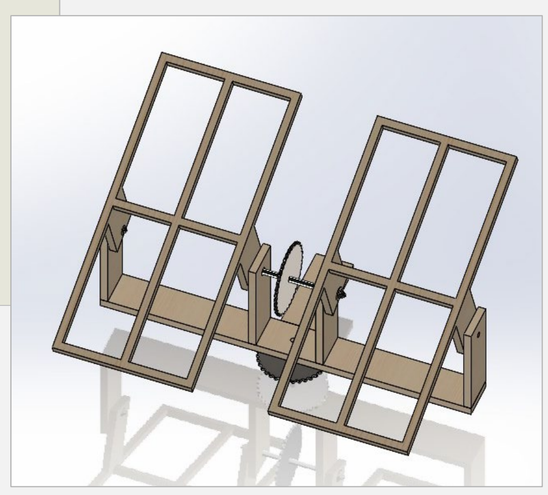
An innovative mechanism designed to address one of the primary drawbacks of traditional solar panels: limited efficiency. Unlike static panels that remain fixed in one position, the system enhances energy collection by tracking the sun's movement throughout the day. To accomplish this, a database containing the sun's calculated positions throughout the seasons was integrated into the system, allowing a dynamically adjustable panel's orientation and maximize solar energy absorption.

System Design

To allow Solar Positioning System structure to withstand hurricane winds and harsh environments, over 80% of parts are comprised of metal and aluminum materials. This is also due to components that require the ability to withstand the most concentrated load, such as the bearings, axels, and sprockets.

Governed by durability and reliability, a simple yet effective design was created to standard. With the decision to create the full-size prototype, purely structural components were created with commonly used wood types, such as 2x4" and 2x8".

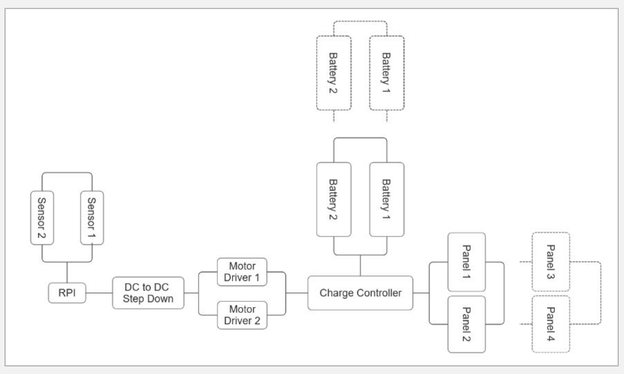




i. With the inclusion of two chain systems for both tilt and rotation, placement of control and electrical components were implemented at a later stage due to material procurement and manufacturing limitations.
ii. With four sprockets, two of which are placed on the motor's shaft, the system is allowed both tilt and rotation through a proper implementation to environments that can lead to animal habitat growth and environmental complications.

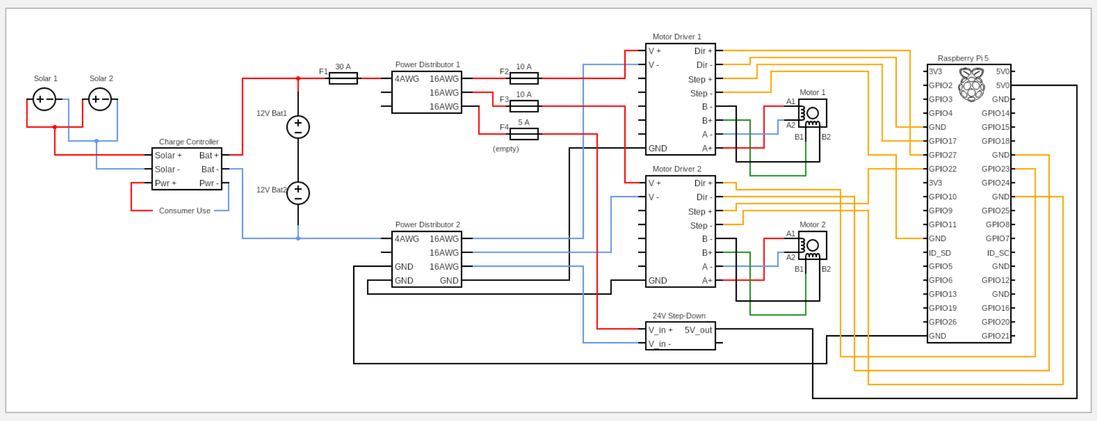
Electrical & Control System

As the brain and controller of the system, the electrical and control systems effectively runs on solar energy to be self-sufficient in any environment, along with accurate motor movement to allow maximized energy through proper panel positions in reference to the sun. Due to time constraints, rotary encoders/sensors were not implemented and tested for recalibration purposes.



With electrical focus on power, energy is stored in batteries and properly utilized to power and charge all components in the system, such as drivers and step downs.

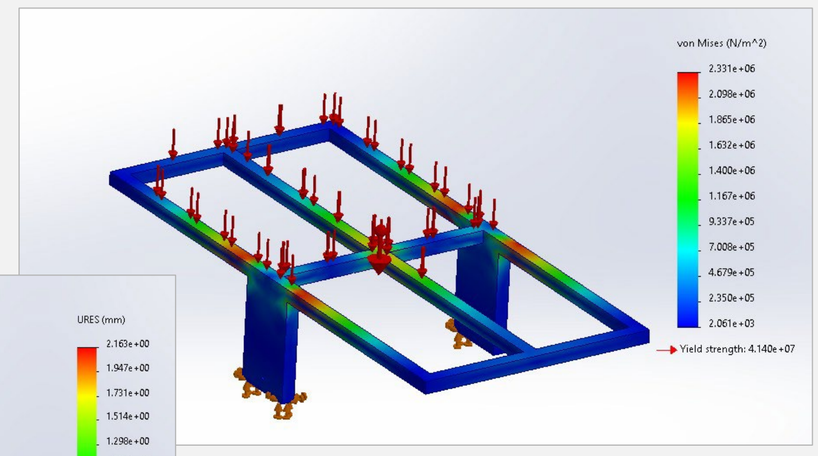
As the brains, the raspberry pi withholds a database in which is sent through the driver, thus moving the motors to the accurate angles for rotation and tilt of the system. Obtaining the latitude and longitude of a location, the azimuth and elevation is calculated and properly sent to respective motors.

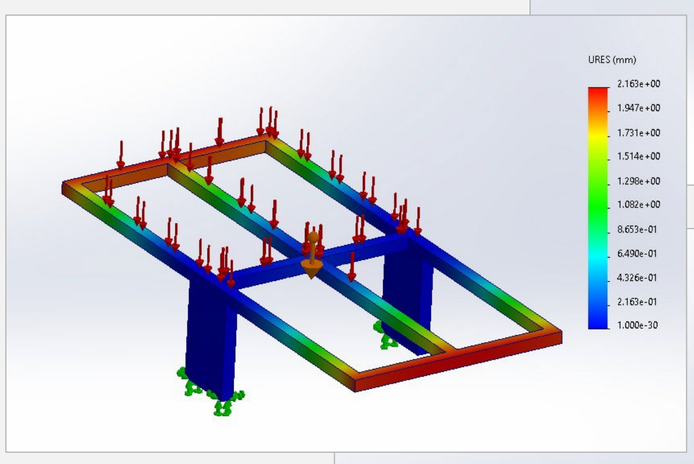


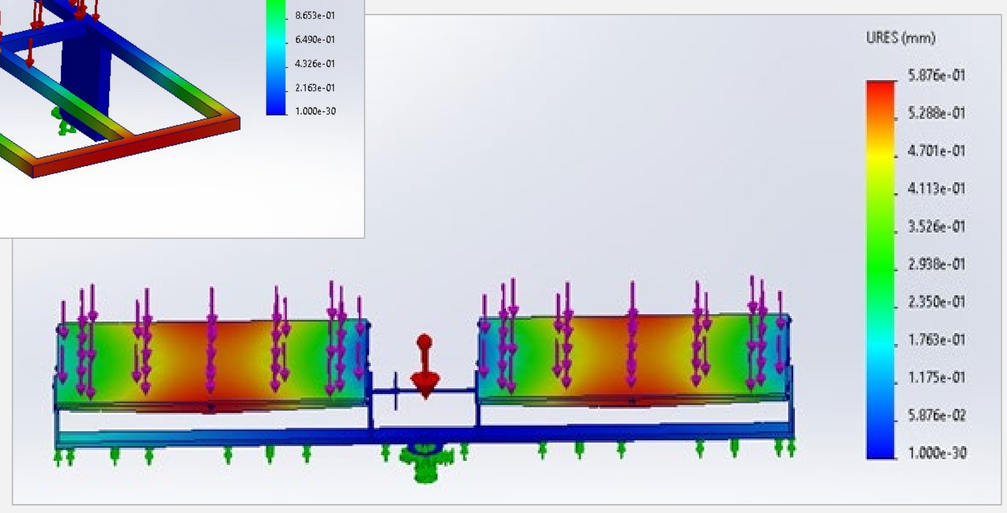
Mechanical Analysis

The analysis helps to determine the area's limitations in terms of the build's strength and weakness. It serves as preparation for the 'System Design' before the assembly, identifying critical areas each parts of the build. The parts are being analyzed include the platform (table) as foundation, beam, bracket, shaft, and solar panel frames. A few examples of the analysis are shown below, based on the following:

i. The model for "solar panel frames" with bracket is analyzed using a FEA analysis obtained experimentally to determine static wind resistance in 110 mph. The results shown below that Solar Panel Frames are adequate to maintain high wind resistance with minimal deformation in high winds.
ii. The bottom picture is shown as model for beam and solar panels are analyzed using a FEA obtained experimentally to determine type of forces for stress, strain, shear, tension, or compression limitations based on material.







Final Thoughts

In this project, the overall goal was to develop the fundamental design to create in mechanical approach with compatibility for electronic components to demonstrate our system positioning the solar panels.

With the full fabrication, the Solar Positioning System has reached its final assembly phase for future improvements and total end creation. Major goals set and achieved by team members in this project are as followed:

i. A physical and full-size build is fabricated based on the fundamental design.
ii. A working control system is implemented and successfully run.

With testing done on accurate panel positions and proper mechanical movement, the Solar Positioning System has completed its one semester run with no major issues.

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Sponsorships

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