# Power Your Home with a Makeup Mirror!

EML 4501
Group 12 Fall 2021


## Abstract:

The Makeup Mirror Heliostat was designed by the four engineers in Group 12. Each engineer has a similar educational background but brings their own ideas to the design. Our team has a passion for providing innovative, environmentally sound solutions to economically expensive problems. We applied this passion by using creative design, engineering analysis, and our expertise in CAD to minimize the cost of a small-scale heliostat. The focal point of our design is the 'makeup mirror' support system. This specific design allowed for the team to integrate a two-axis gimbal system without adding any additional parts, besides motors and gears. This mechanical system was used to ensure maximum solar reflection onto a central receiver as the day progresses. These heliostats will be implemented as a field of modules providing sufficient thermal energy to generate renewable energy. Each module contains four heliostats installed on concrete foundation and is built to withstand 20 years of weather and general wear. Group 12 produced a final design that meets all of the customer needs and will provide renewable energy for years to come.



## Meet the Engineers:

- Davis Whitfield
- Kent Snelson
- Gurgen Saakian
- Maxwell Schreiber


## Let's talk Numbers:

**Materials:** $373.82
**OTS Parts:** $307.39
**Manufacturing Labor:** $50
**Assembly Labor:** $200
**Energy Consumption:** $0
**Total:** $931.21

## Product Functionality:

A solar energy collection field consists of a large number of heliostats that adjust their position depending on the position of the sun to reflect the sunlight onto a solar receiver target. The receiver target is located on a central collection tower. The energy from the concentrated sunlight is used to generate electricity. It is important to place the receiver target at a large height in order to minimize shading effects from the surroundings.

Our design is a heliostat that utilizes a flat square mirror, concrete screw foundation, gimbal base, and 3 servo motors to provide 360 degrees in azimuth rotation and 180 degrees in elevation rotation. It is applicable in low-cost applications of heliostat fields that utilize a plethora of heliostats placed in modules of 4-16. This heliostat is unique due to its usage of a bevel gear rotation system to provide the required azimuth rotation while remaining cost efficient.

## Full Design Render

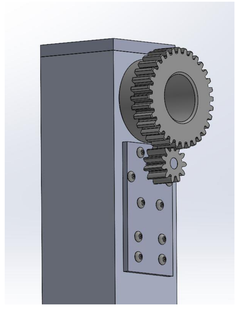
## Hedgehog Concept

**What are you best at?**
Our CAD and engineering analysis skills are very good and assist us in making educated decisions on design feasibility.

**What are you passionate about?**
We are passionate about providing innovative solutions to make environmentally friendly power solutions more fiscally sensible.

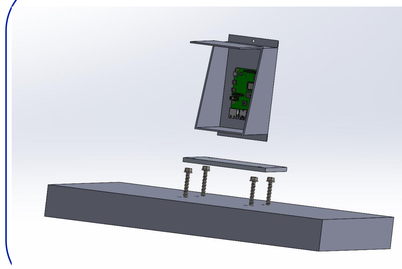
**What drives your economic engine?**
20% profit per module by minimizing cost/part through using OTS parts whenever possible to meet consumer needs.

## Subsystems



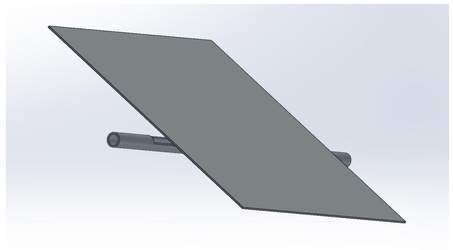
### Frame:

Using a system of 2 DC motors with 2 gears each, elevation rotation is provided. The frame is made from extruded aluminum bar.



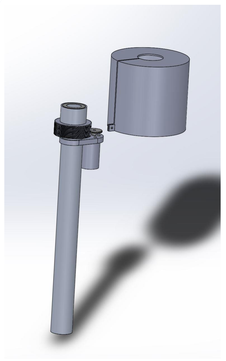
### Foundation:

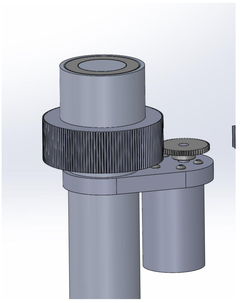
A raspberry pi computer within a metal housing is attached to the support pole. The pole is mounted to an aluminum plate and concrete foundation using concrete screws.



### Reflective Surface:

A 0.25 square meter panel of silver coated glass is mounted to an aluminum backing, which itself is mounted to a cylindrical aluminum extrusion to be placed into the frame to allow for rotation.





### Support:

Cylindrical aluminum extruded bar is connected to a DC motor and bevel gear system, using bearings to allow for 360 degrees of azimuth rotation of the frame.

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