Azim6 Heliostat Module

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Abstract

Azim6 Heliostat Module introduces revolutionary design concepts that will change the future of the concentrated solar energy market. The heliostat design is innovative through ease of manufacturing, optimal structural modularity, and the ability to withstand harsh outdoor conditions with ease of maintenance. The principle that sets this heliostat module apart from other comparable products is our ability to maximize efficiency by minimizing resources used. The basis of the small, innovative design involves four mirrors mounted to a bar with motors individually controlling the tilt of each surface and a revolving base attached to the ground allowing for a substantial range of motion. This allows the module to effectively track the sun throughout the day while reducing the number of motors and subsequently the cost. Cost also is significantly reduced through 3D printing technologies that allow most of the system to be made from ABS plastic opposed to a costly aluminum structure. The design is practical for hassle-free maintenance with the ability to detach each mirror and motor assembly from the module individually. Plastic covers are used to protect the system from the wear and tear of sand and other outdoor elements, allowing for a 20-year minimum lifetime. This design is cost effective, has a long lifetime, and meets the performance specifications laid out by the customer in an efficient and innovative way.

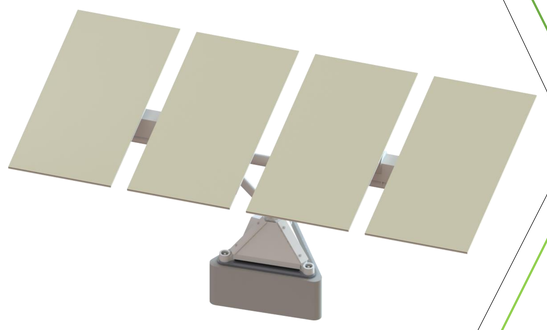
Product Functionality

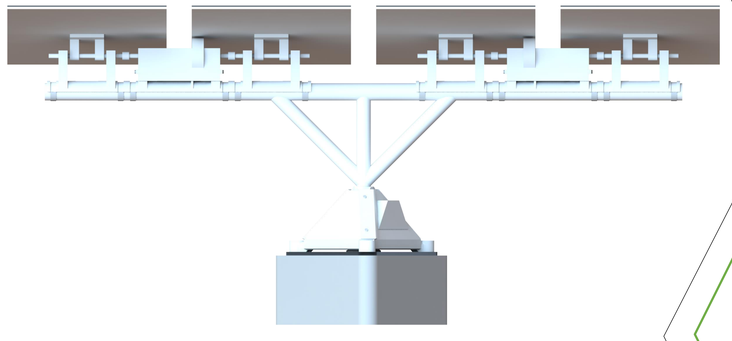
The Azim6 Heliostat consists of four reflective surfaces that are attached to an injection molded ABS support system. The support system is divided into two sections that contain a 12V DC motor that controls the rotation of two reflective surfaces around the horizontal x-direction. Each section can be removed from the module if needed to for repair or cleaning. The support for the reflective surfaces is held by an ABS truss structure that connects to a center rod. The rod is held in place by the base that is bolted to a concrete floor from three flanges. The base also contains a belt system that allows for the rotation of the entire heliostat module around the vertical z-direction. The motors in this heliostat module are controlled by a Raspberry Pi Zero W microcontroller that is attached to one of the flanges of the base of the system. Each motor and the controller are covered by baffling to prevent system malfunction from external conditions.

Cost Breakdown

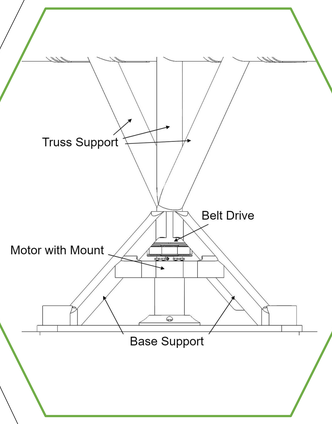
OTS Parts:	$103.57
Raw Materials:	$18.48
Manufacturing Labor:	$23.75
Assembly Labor:	$5.50
Energy Consumption:	$0.30
Total:	**$ 151.60**

Azim6 Full Assembly



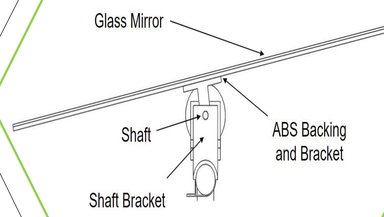


Support System



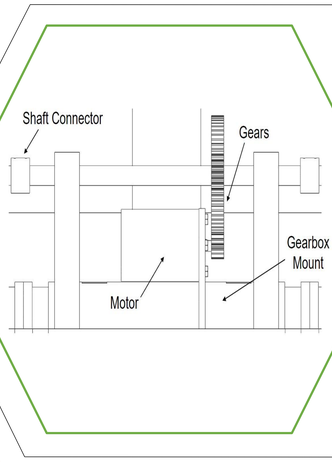
The support system utilizes a simple T-bar design alongside vertical support shafts to help reduce beam deflection and vibrational oscillation due to the weight of the reflective surfaces. This system is made from injection molded ABS to keep cost and weight low, capitalizing on small heliostat design.

Reflective Surface



The reflective surface is made from glass mirrors that are made to ASTM C1036 standards and high-quality silver. The reflective surface is connected to a support backing made of ABS to allow for sufficient strength and drive down module cost.

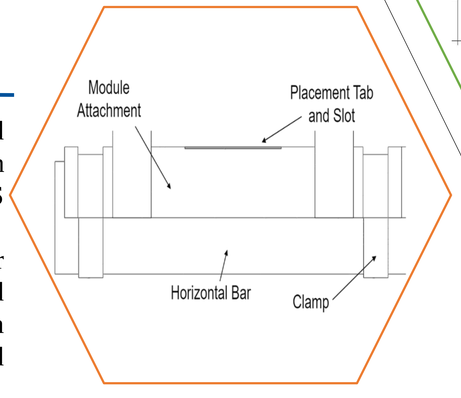
Control/Actuation



Actuation of the system is controlled using two axes of rotation: one that is the main shaft rotating about its primary axis, while the reflective surfaces rotate to keep the azimuth oriented properly. The Azim6 heliostat module is controlled using 12-Volt DC motors and a Raspberry Pi Zero W microcontroller.

Modularity

- Reflective surfaces and gearbox are attached to an injection molded ABS structure.
- ABS structure allows for the reflective surfaces and gearbox to disconnect from the system for cleaning and repair.



Acknowledgements

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Customer Needs Mapping