

Abstract

The goal of this project was to improve upon prior iterations of SailGoat, an autonomous robotic sailboat. This was accomplished by improving the mechanical, electrical, and software systems already in place, as well as adding new systems. Our overall objective for this iteration was to increase the rigidity and reliability of the vessel.

Project Goals

SailGoat can...

- Plan and maintain a course
- Detect and maneuver around obstacles
- Sail autonomously for 7 hours
- Maintain RC control within 1 nautical mile

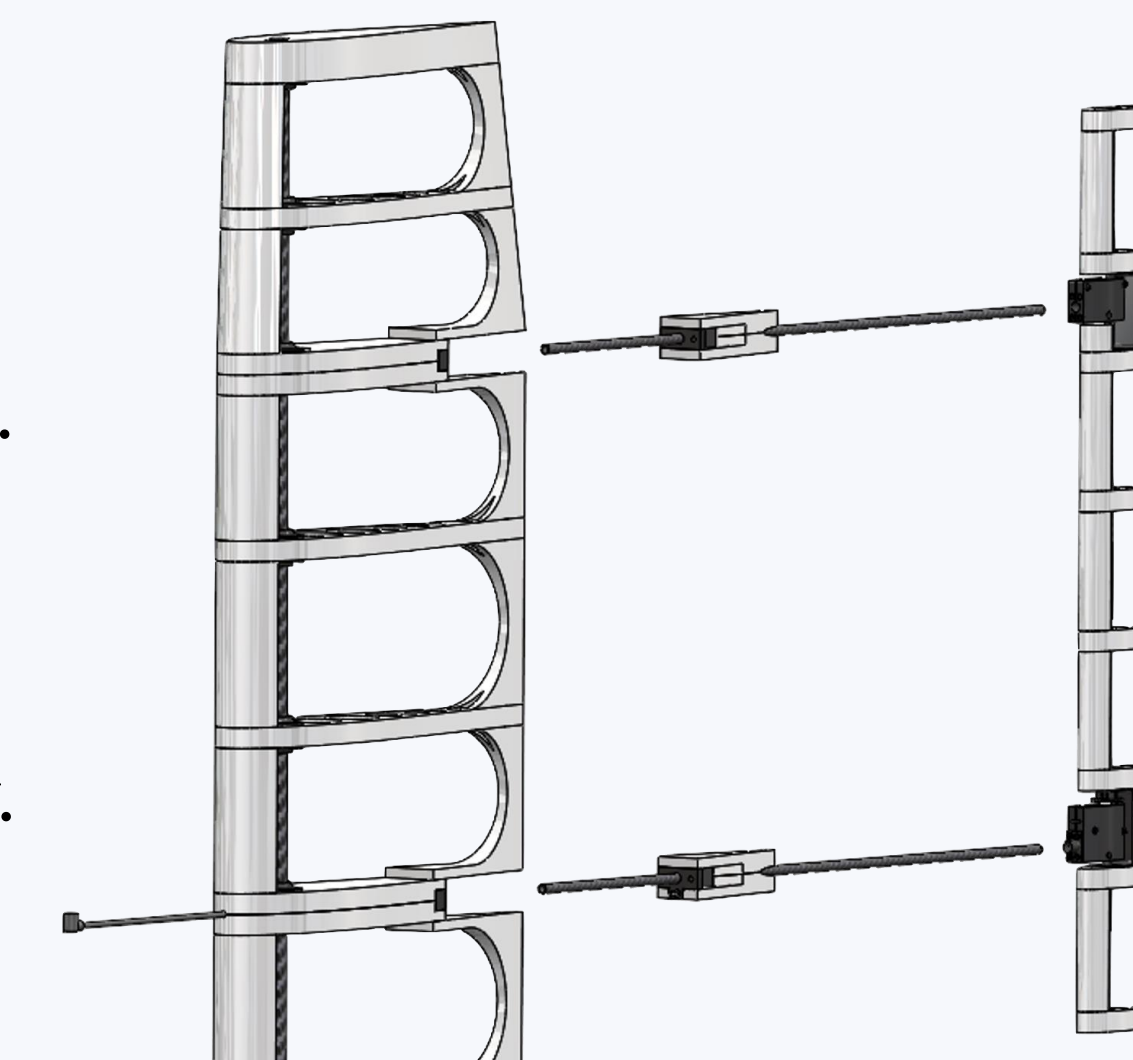
Computer Vision

- The computer vision system uses a custom object detection model trained to identify competition buoys.
- A ZED 2 camera mounted to the bow detects buoys and uses stereo vision to triangulate the approximate distance from the boat.
- Using the computer vision system, SailGoat can calculate the buoy's position relative to the camera.



Wingsail

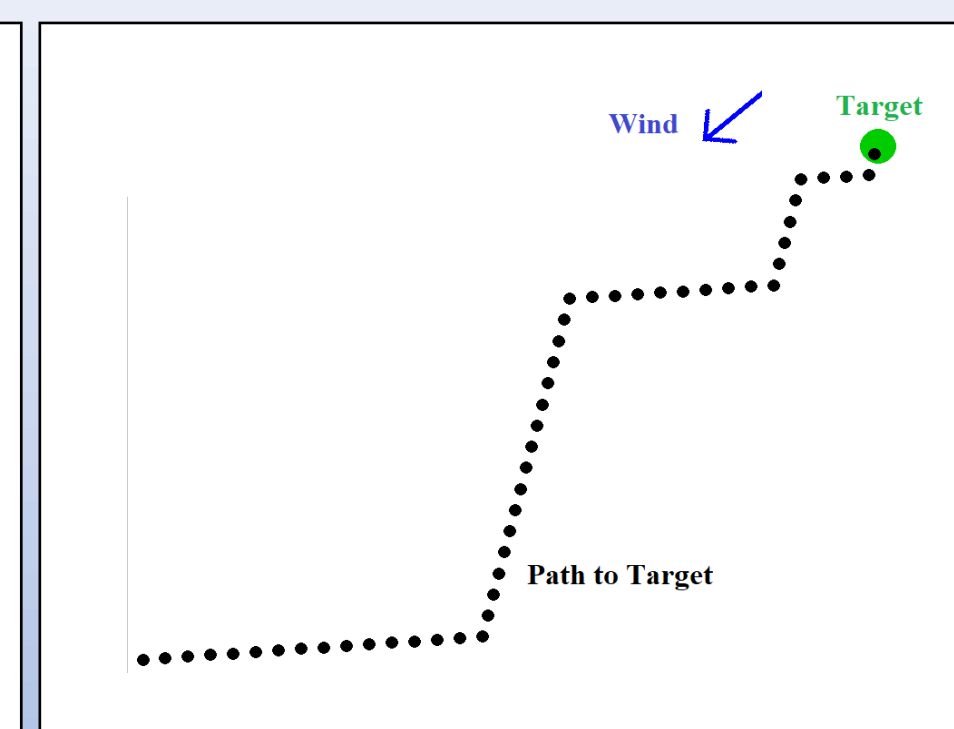
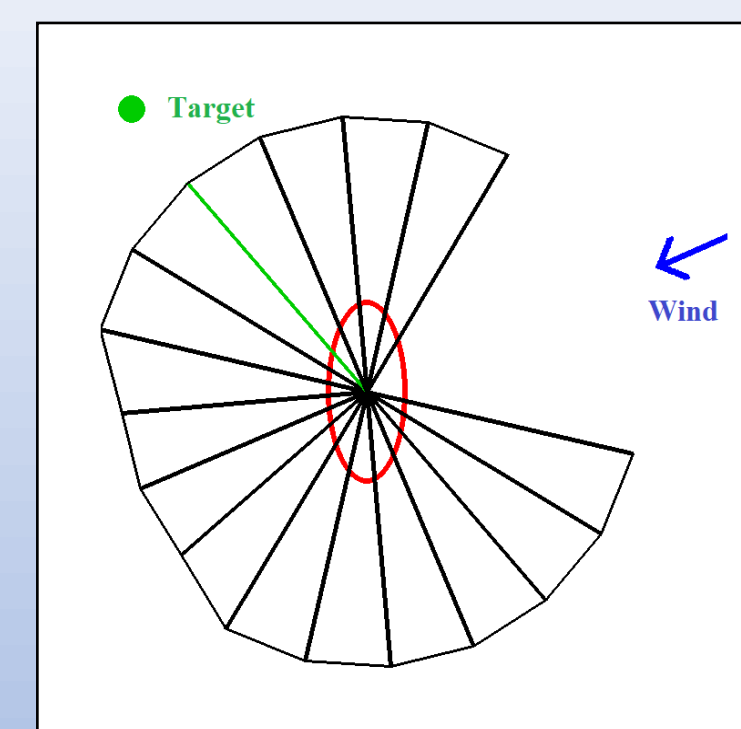
- The new wingsail includes a stronger carbon fiber tapered mast, significant weight reductions, and a redesigned trim tab assembly.
- The trim tab is more stable and has better modularity, using a two-boom mounting system and direct drive control.
- The trim tab electronics housing is now more accessible, and the wireless connection is more reliable using Bluetooth Low Energy.



Autonomous Navigation

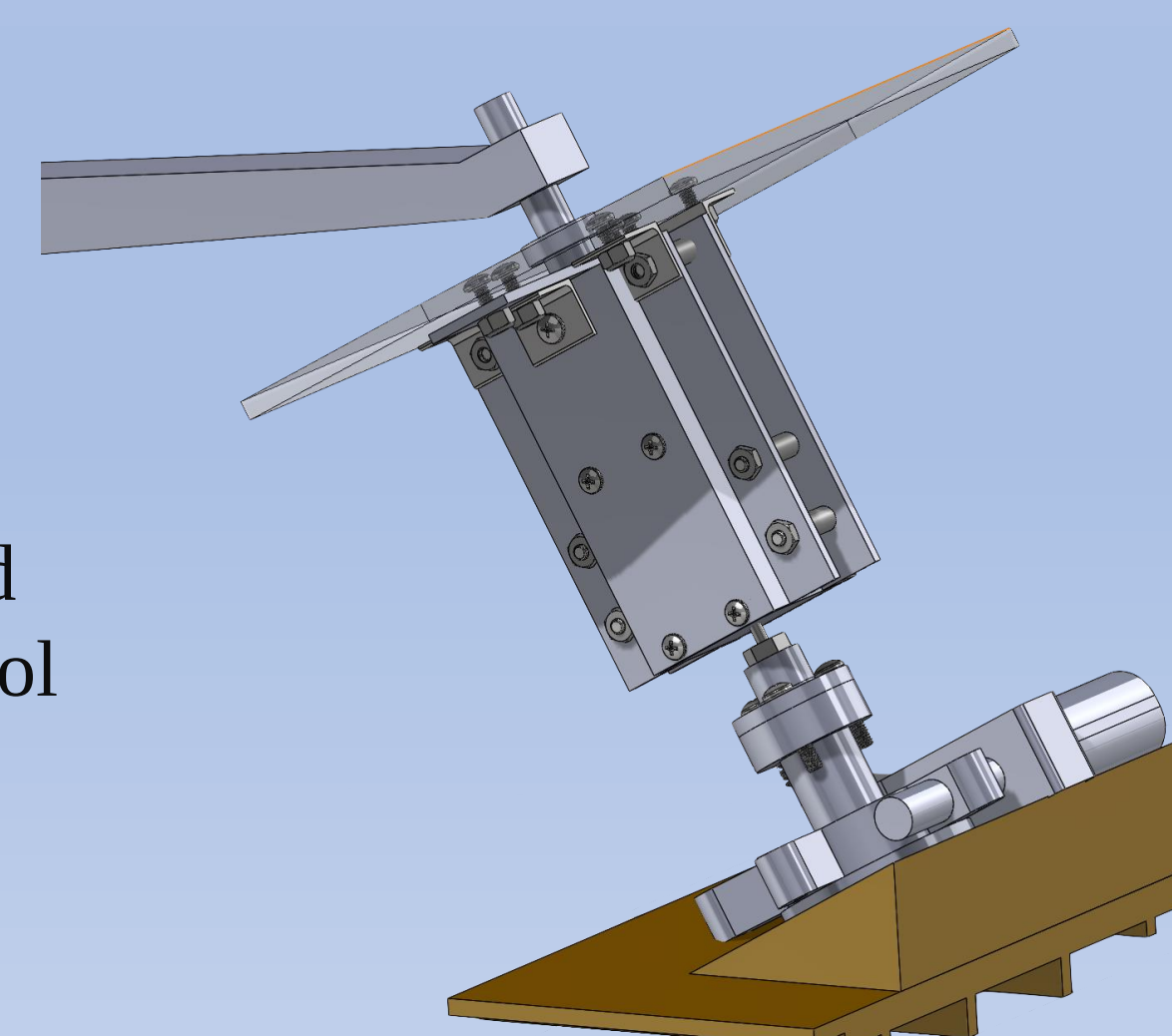
Autonomous Navigation has been completely revamped, and is now broken into three discrete processes:

1. A target position is generated using a map of the lake.
2. The optimal heading to the target position is calculated using a velocity-made-good polar diagram.
3. The rudder control and trim tab control algorithms work together to move the boat along the desired heading.



Ballast

- The new ballast implements a planetary gear transmission, maximizing motor performance and prioritizing torque to increase control of the system.
- The improved mounting system increases rigidity and reliability.



Results

- Buoys are detected with 98% certainty within 2 meters of the boat.
- SailGoat autonomously generates and maintains a navigable path between points on the lake.
- The wingsail operates without flexing in winds under 13mph.
- SailGoat maintains basic control of all sailing functions while under RC control.

