

Abstract

Competition Strategy

The SD Mines RoBoat team's main goal was to create a functional boat to bring to competition that can be reliably built on top of in the upcoming years. We realized that this will give us a slight disadvantage at first as we will not be able to complete all the obstacles, but we see that this will allow us to have a firm foundation to build off in the upcoming years. Due to this reliability is the most important aspect to us in this design.

To build for reliability, the team focused on completing the first task in a way that can be expanded and built on. We chose the first task as it is a simple task, is mandatory for the competition, and uses the key elements that the competition is based on.

To achieve the necessary reliability the team used three systems for tracking and detection: Image processing, Lidar, and Sonar.

Design Creativity

Hull Design

Choosing a hull design was dependent on the challenges the boat would face during the competition. With stability being of clear importance, the hull was based off of that of a catamaran. The catamaran design also provided the ideal base for the electronics while leaving space for additions that could be added later on for the competition.

Battery Box Wedge

We wanted a way of diverting water away from the battery box so we picked a rounded design as a way to allow water to divert around the box along with underneath. The rounded design also allows for better stability.

Electronics Mounting Plate

In order to mount electronics on the boat, we needed to have a dedicated place for them to sit. It was important to keep the electronics as far away from water as possible, while keeping the electronics in a place where they could be cooled easily. Ultimately, we developed a plate that would sit in the middle of each haul. With this, we also developed a mounting system with bars that would mount seamlessly to the sides of the hauls. All-in-all, we had an incredibly stable system in place to mount all of the electronics to the boat.

Experimental Results

Acknowledgements

We would like to thank the entire South Dakota Mines campus and community for their support. The CSC faculty especially Dr. Jeff McGough, for support and providing facilities for us to use, Dr. Mohammadreza Mehrabian for his support and encouragement throughout the project, and Dr. Arron Lalley for his support in the use of the various shops on campus. We would also like to thank all those who helped us set up our club and secure funding namely Cory Headley, Cooper Emery, and Michael Keegan. We would also like to thank Perry Ketelsen for her help in designing our logo. Finally, we would like to thank our sponsors including Midland Scientific, Raven Industries, SD Mines, C.R. Fischer and sons, The Rapid City YMCA, Pita Pit/Therese Rowland and The Monument.

References

Appendix A: Component Specifications

Component	Vendor	Model/Type	Specs	Custom/Purchased	Cost	Year of Purchase
ASV Hull Form/Platform	Custom	Custom		Custom		2023
Waterproof Connectors	N/a	N/a	N/a	N/a	N/a	N/a
Propulsion	BlueRobotics	T200 Thruster		Purchased	358	2022
Power System	C.R Fischer	SCP12550 G22 Battery		Purchased	0	2022
Motor Controls	BlueRobotics	Basic ESC		Purchased	72	2022
CPU	ROCK Pi	ROCK Pi 4		Purchased	0	2022
Teleoperation	Spektrum	SPM1000		Purchased	0	
Compass	N/a	N/a	N/a	N/a	N/a	N/a
Inertial Measurement Unit (IMU)	N/a	N/a	N/a	N/a	N/a	N/a
Doppler Velocity Logger (DVL)	N/a	N/a	N/a	N/a	N/a	N/a
Camera(s)	Intel	RealSense				
Hydrophones	N/a	N/a	N/a	N/a	N/a	N/a
Algorithms	custom	-	-	Custom		
Vision	N/a	N/a	N/a	N/a	N/a	N/a

Localization and Mapping	RPLIDAR	S2M1-E30		Purchased	400	2023
Autonomy	custom	N/a	N/a	Custom	N/a	N/a
Open-Source Software	N/a	N/a	N/a	N/a	N/a	N/a