Station 173

Autonomous Underwater Vehicle

Leadership: Peter Webster, Jason Daniel Pieck, Anjani Gadkari, Nidhi Vadulas, Dilraj Gill, Luna Park, Jacob Marinas, Nico Holasek, Allen Cooke, Mohammad Ayub Hanif Saleh, Zenyn Ethridge, Luci Masselink, David Kou, Aditi Anand, Aubri Lee

Advisors: Shima Nazari PhD, Abhigyan Majumdar

About Us

Cyclone RoboSub, founded in 2023, is an engineering student design team at UC Davis developing an autonomous underwater vehicle (AUV). Our interdisciplinary team of 30+ students is organized into three divisions and six sub-teams, each tackling different aspects of this project.

Figure 1: Team photo from 2024-2025 team

RoboSub Competition

Teams from around the world compete with custom AUVs which complete tasks such as manipulating objects, maneuvering around obstacles, and firing torpedoes. Our team has prioritized navigation-based tasks, eliminating the need for precise manipulation. Cyclone RoboSub will be competing for the first time this year where we will debut our vehicle!

Vehicle Design

Our chosen thruster configuration allows for six degrees of freedom while its symmetry simplifies vehicle control and maneuverability. Designed to be neutrally buoyant and have a low center of mass, the vehicle naturally corrects errors in positioning. All electronics are housed in an acrylic tube with Blue Robotics WetLink penetrators to connect cables to the external environment.

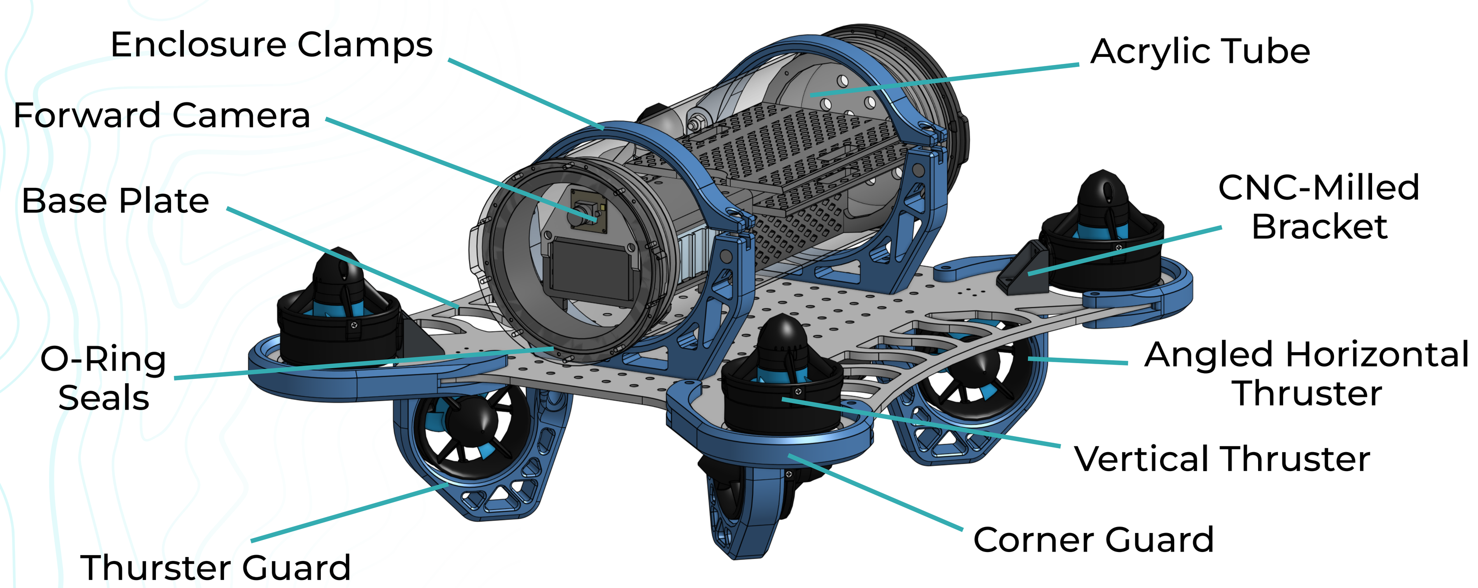

Figure 3: Structural CAD of Robot (Made in Onhape)

Manipulation

We designed servo-actuated mechanisms to release two small droppers into a bin during competition runs. The AUV centers itself over the bin using a downward facing camera and computer vision.

Figure 4: Bin Task

Figure 5: Path Marker

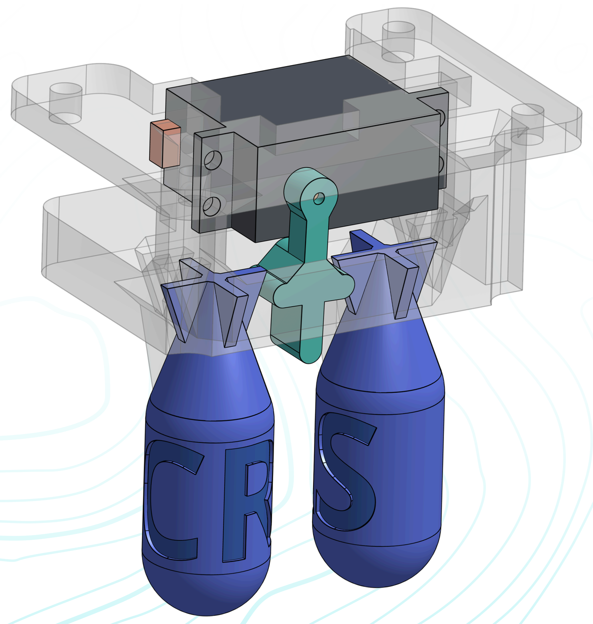

Figure 6: Dropper Assembly

Software Controls

The vehicle relies on a combination of sensors to determine its depth, heading, and position within the pool. All data and commands are sent over a ROS network and mission planning is handled by the Executive Main Loop which is written in C++.

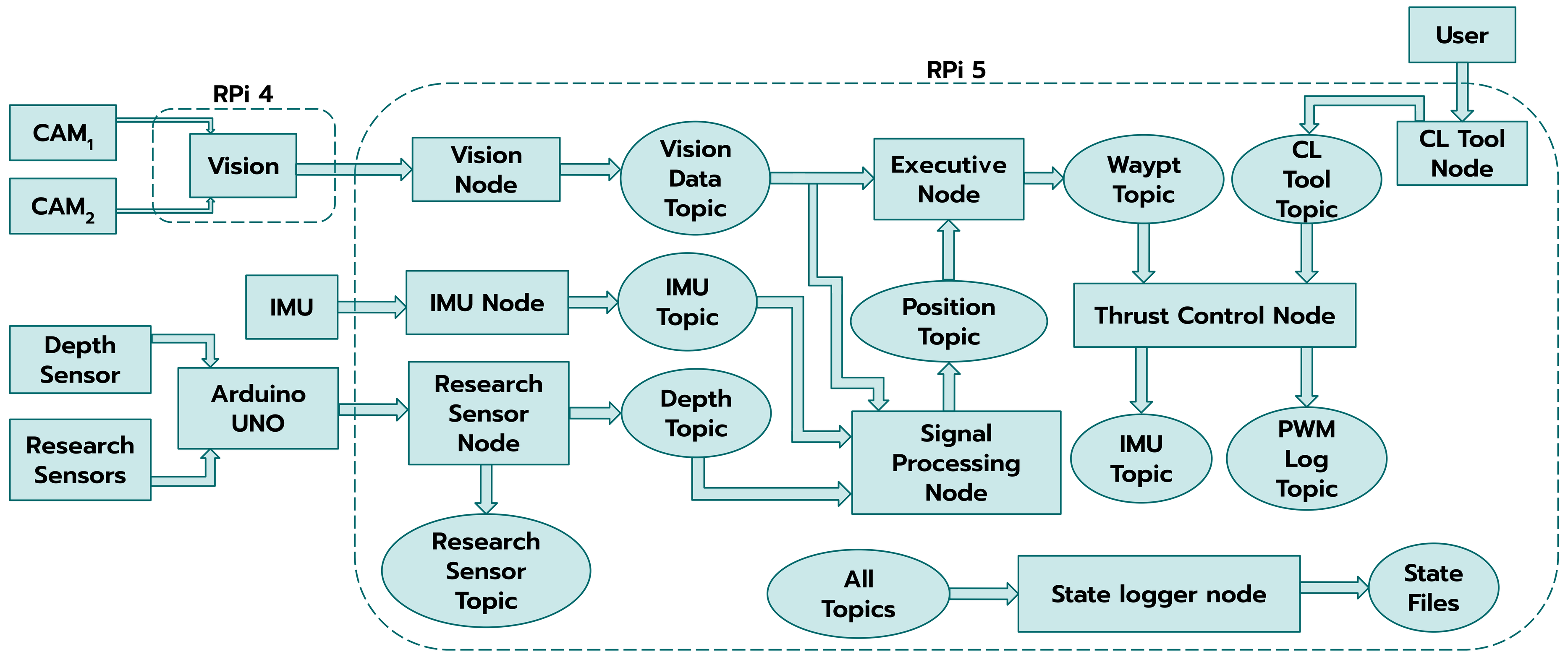

Figure 7: Overview of software structure spanning all hardware

Dynamics Modeling

The control scheme is built in MATLAB Simulink which generates trajectories and regulates PID feedback based on a built dynamic model and waypoints. The model accounts for the AUV's 6-axes of freedom, buoyancy, drag, and vectored thruster configuration. The parameters are measured and validated based on IMU data collected during underwater testing.

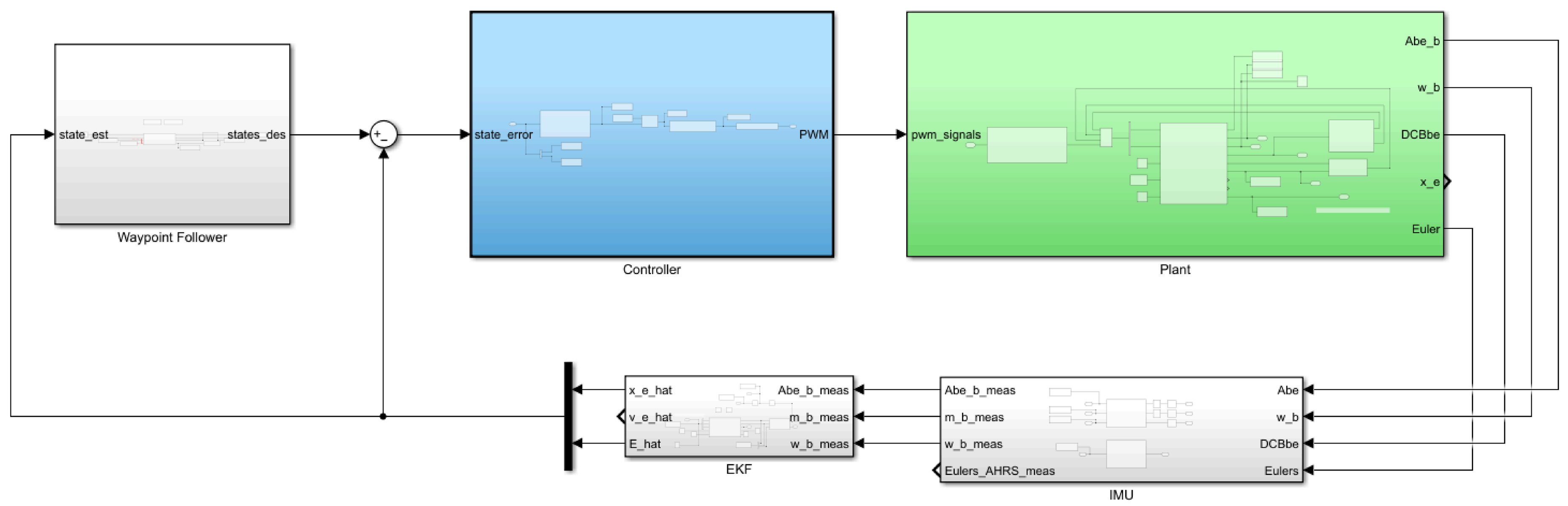

Figure 8: Simulink Block Model

Vision

Two cameras provide the vehicle with feeds that run through a YOLO vision model, to identify objects of significance. The downward facing camera allows for positioning the dropper, while the forward facing camera determines which side of the start gate the vehicle passes through. Identifying objects along the course help the robot track its position within the pool.

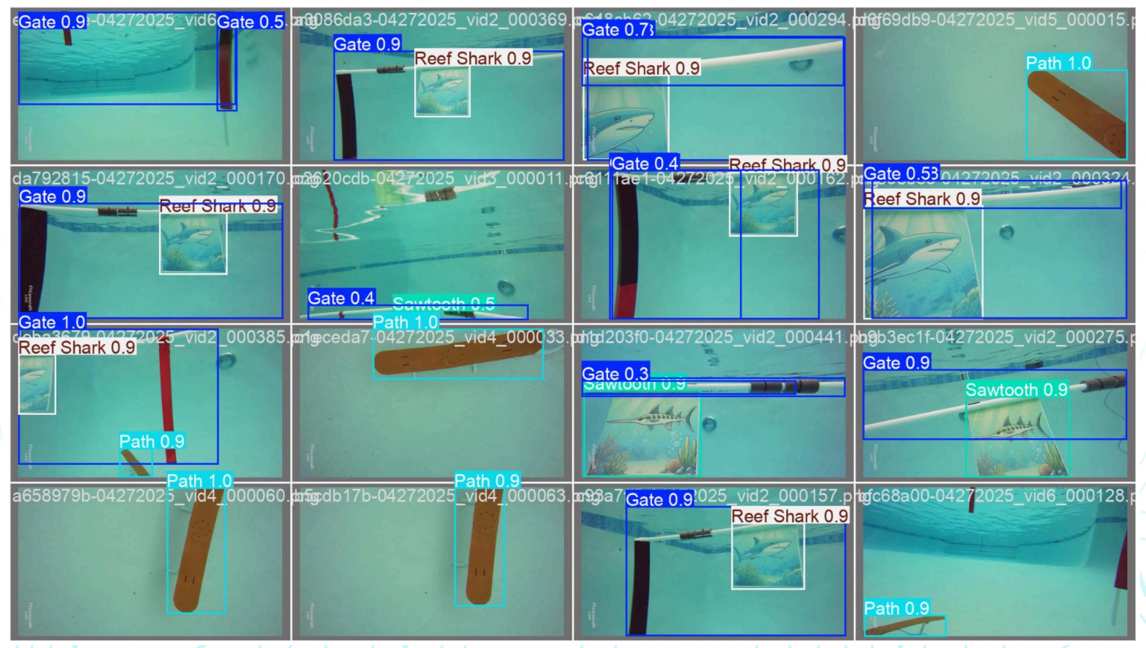

Figure 9: Object Recognition

Electrical Systems

The vehicle is powered by a single 16V Lithium Polymer (LiPo) battery which supplies power to the AUV's computers, sensors, and thrusters. Electrical components are precisely mounted to a 3D-printed internal structure to maximize volume within the tube and efficiently route wires between components. A custom PCB distributes 5V of power from the buck converter to low-voltage components.

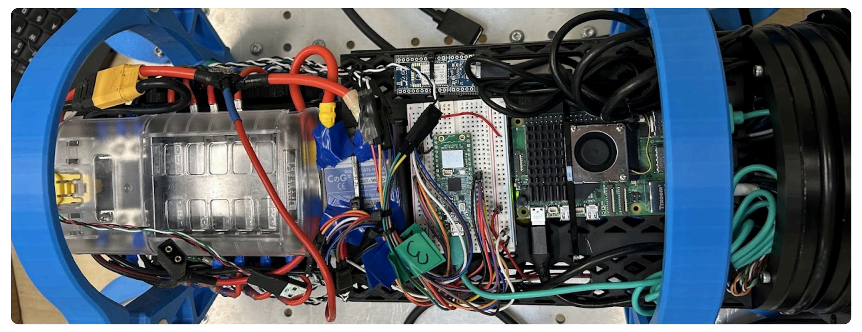

Figure 10: Primary robot wiring

Figure 11: Custom designed PBCs

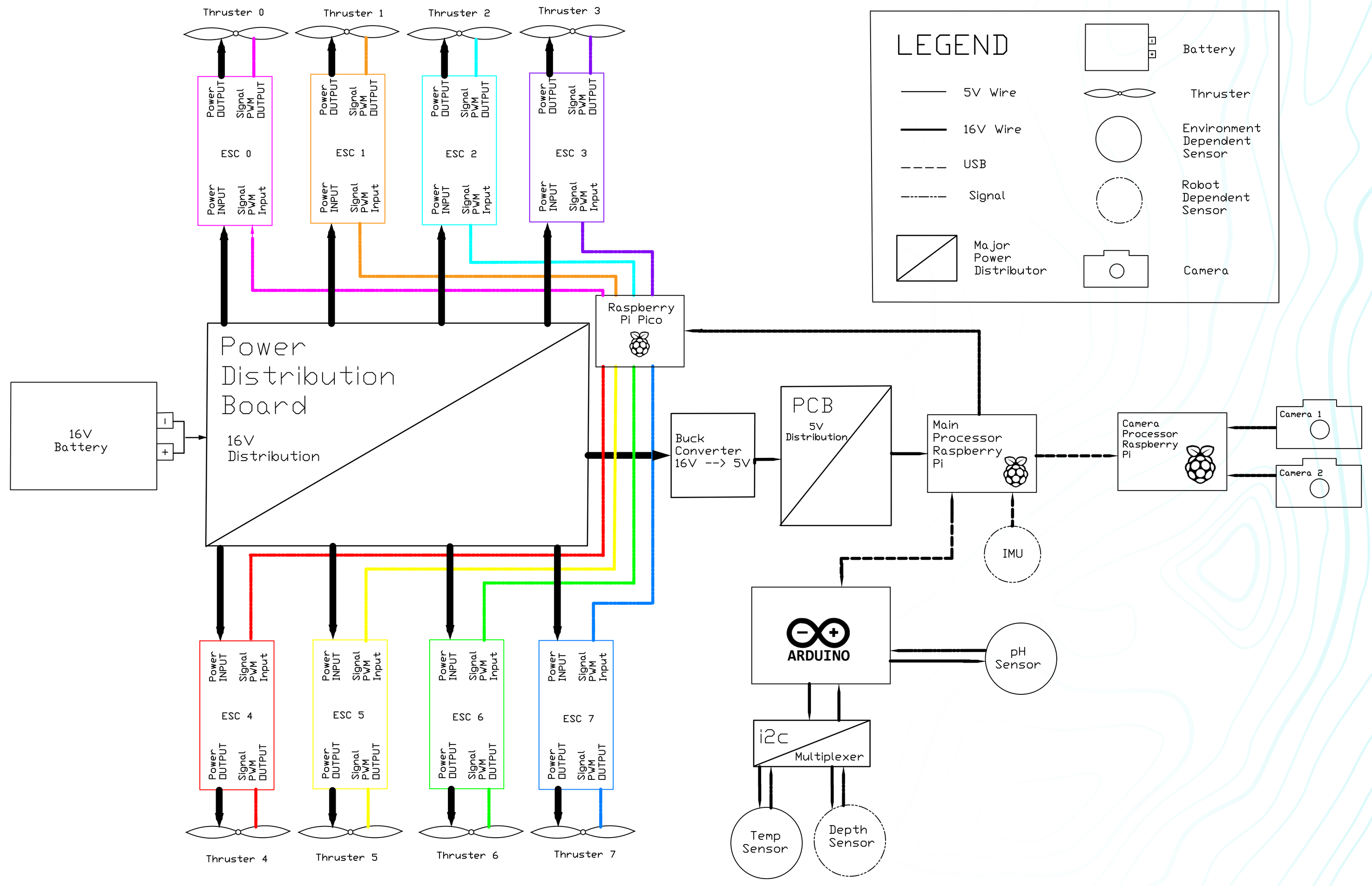

Figure 12: Electrical diagram of the robot

Research

Beyond the competition, Cyclone RoboSub is contributing to environmental research efforts through field deployments and interdepartmental collaborations. Equipped with sensors to measure temperature, depth, pH, and dissolved oxygen, the vehicle can collect environmental data and is schedule to take two transects along the UC Davis Arboretum. The team is also exploring opportunities to contribute to marine science research at the Bodega Marine Lab.

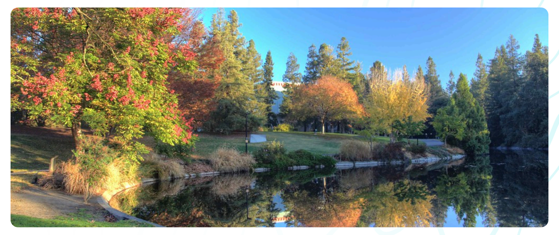

Figure 13: UC Davis Arboretum

Figure 14: Research instumentation

Acknowledgements

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