

UROP Summer 2021 Project

CoRoMoana - An Open-Access Marine Collaborative Robot Testbed at Kilo Nalu Observatory

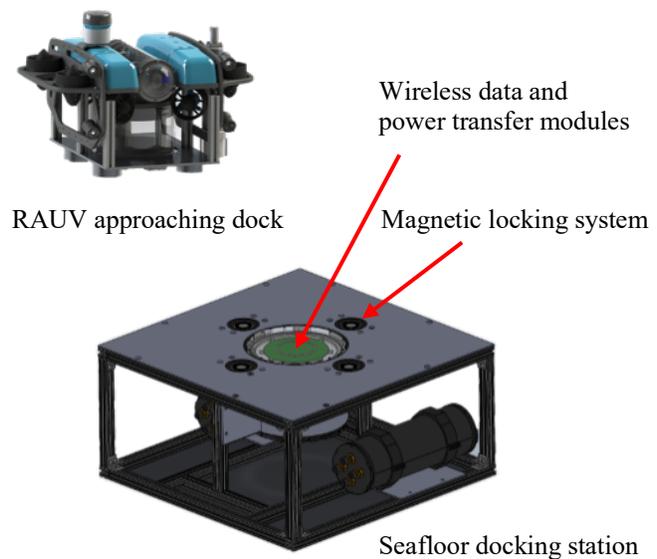
Hosting Lab: Robot Autonomy and Navigation Laboratory (<http://www2.hawaii.edu/~zsong>)

Faculty advisor: Zhuoyuan Song, Assistant Professor of Mechanical Engineering

Graduate student advisors: Maddyson Jeske and Jonathan Wallen

BACKGROUND

The objective of this summer project is to contribute to the development of a shared, open-access testbed, named CoRoMoana, for collaborative marine robots at the Kilo Nalu Observatory (KNO). The long-term vision is to make KNO the first open-water test site for resident autonomous underwater vehicles (RAUVs) to accelerate research and education of related disciplines including oceanography, marine biology, and ocean and coastal engineering at the University of Hawaii. In collaboration with the Ocean and Resources Engineering Department and Hawaii Natural Energy Institute, the Robot Autonomy and Navigation Laboratory is developing an intelligent RAUV (an underwater robot that lives in the ocean) and a first-of-its-kind underwater docking station (a connection point on the seafloor that provides power and network to the robot) to be deployed at KNO in Fall 2021 through a research grant from the Department of Energy.



PROJECT SCOPE

This Summer Undergraduate Research and Creative Work Opportunity is sponsored by the Undergraduate Research Opportunities Program (UROP). The scope of this summer project involves:

- the development of a simulation environment to test autonomy algorithms for vehicle docking and mission planning
- the integration of various scientific sensors with the RAUV and the docking station, and
- the design and fabrication of the mounting structures for securing the docking station and additional sensors onto the seafloor at KNO.

WHY JOIN?

A great opportunity to contribute to the development of the first open-water underwater robot testbed in the nation and accumulate hands-on experience with state-of-the-art AI and robotics hardware and software.

OPENINGS

Three openings for the position of undergraduate research assistant are available. 32 hours per week are expected from each position for 12 weeks (5/24 – 8/13). All positions will be paid at level A21 (\$11.65/hour). Renewals after summer are possible pending candidate performance. Successful candidates are required to attend the [SURE Symposiums](#) hosted by UROP. **To apply, please send an email to Prof. Song (zsong@hawaii.edu) and copy mjeske@hawaii.edu and jwallen@hawaii.edu with 1) your resume and 2) the position number.**

1. Software Engineer

Description: Implement an unmanned underwater vehicle simulator (UUVS) using visualization plugin Gazebo and the Robotic Operating System (ROS) framework; create simulation models for custom underwater robots and docking station in the UUVS; test underwater docking control algorithms developed by the lab; support bench and field tests of the robot and dock.

Ideal Qualifications:

- Proficiency in programming with Python and/or C/C++
- Experience with Robot Operating System (ROS)
- Familiarity with Linux development system (e.g., Ubuntu)
- Basic software development practices (e.g., version control, unit test)

2. Electrical/Electronics Engineer

Description: Integrate electronic hardware including processors, sensors, power systems, networking devices with the peripheral systems of the RAUV and the docking station; establish data connections between sensors to central processors by implementing appropriate communication and timing protocols; troubleshoot bugs with the power systems of the RAUV and the docking station; support bench and field tests of the robot and dock.

Ideal Qualifications:

- Knowledge and experience with PCB design
- Experience with common inter-device communication protocols (e.g., SPI, I²C, Ethernet)
- Proficiency in using circuit prototyping and testing tools
- Experience in embedded systems

3. Mechanical Engineer

Description: Design and fabricate a mounting structure for an acoustic communication and tracking device; design and fabricate a fairing for the docking station to improve its hydrodynamic stability and cosmetics; assist the assembly and seal tests of the RAUV and docking station; support bench and field tests of the robot and dock.

Ideal Qualifications:

- Proficiency in CAD design and analysis in SolidWorks
- Experience in machining and fabrication of mechanical components
- Basic understanding of hydrodynamics
- Knowledge and experience with corrosion prevision and marine-grade materials

