
University of Idaho
Senior Design Project Proposal
Fall Semester 2009
Embedded Linux Autonomous Mini-Submarine

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Overview:

The Center for Intelligent Systems Research (CISR) at the University of Idaho currently employs a small fleet of autonomous mini-submarines used in various research efforts conducted for the Office of Naval Research (ONR). Emerging research interests have provided an opportunity to upgrade the embedded computing systems in these vehicles in order to provide additional functionality, improvements in software compatibility and data processing capabilities.

The embedded computing system currently used to implement these vehicles consists of four processing modules based around Rabbit 3000 microprocessors and a data acquisition module employing a Texas Instruments DSP. The proposed upgrade would involve replacing one or more Rabbit microprocessor modules with embedded Linux modules capable of running an ONR software suite called MOOS, increasing the data bandwidth and capabilities of the DSP data acquisition module, and implementing additional feature requirements in the vehicle's software.

ECE Project Goals:

Primary project goals that must be satisfied are:

- Replace the Rabbit3000-based Guidance module in the sub with an embedded Linux board.
- Implement all existing sub behaviors using MOOS software.
- Increase data acquisition module recording bandwidth to 800 kB/s.
- Integrate data from the sub's Inertial Measurement Unit (IMU) into data acquisition recordings.
- Add software to provide upload/download of MOOS configuration files and data acquisition recordings via the vehicle's Wireless Ethernet connection.

Additional project goals that may be satisfied (but not at the expense of primary goals) include:

- Providing more flexible communication timing using the vehicles acoustic modem.
- An off-sub software suite to be run on a laptop or portable computer to provide one or more of the following:
 - Real-time display of vehicle operating parameters.
 - Real-time display of vehicle position in Google Earth or similar software.
 - Real-time manual control of vehicle operation.
 - Real-time display of acoustic modem traffic using a WHOI modem.

ME Project Goals:

Primary project goals that must be satisfied are:

- Develop a hydrodynamic model for investigating placement of fins, magnetometer and general layout of the mini-sub.
- Design a nose cone mount for the hydrophone for use in acoustic signature assessment missions.

Additional project goals that may be satisfied (but not at the expense of primary goals) include:

- Redesign of the tailcone, prop shaft, and propeller for quieter operation for acoustic signature missions.
- Fabricate the new components and test them on a mini-sub.
- Investigate different main propulsion configurations and their impact on the self magnetic and acoustic noise of the mini-sub.

Budget:

- A project budget of \$5000 will be provided by CISR. Additional funds may be available, depending on project requirements and progress.