Capstone Project Proposal

Project #19: Improved AUV
Metron Inc. and PSU NEAR Lab

Adam Provost
Jinhao Hou
Yuhang Zhu
Noah Page

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(Author: Adam Provost with Jinhao Hou)

Problem:

How can an existing AUV be improved to allow for long distance communication and active collision avoidance?

Overview/ Executive Summary:

Metron Inc. is sponsoring a capstone with the PSU NEAR lab to further develop an autonomous underwater vehicle (AUV). The AUV will be used for acoustics research and in the search for historical shipwrecks in conjunction with the Maritime Archaeological Society. The project will consist of improving the navigation and communication systems on an AUV by adding a long-range radio modem and a forward collision avoidance sensor.

Product Design Specification:

Requirements & Specifications:

Our ECE team *must* identify a commercial off-the-shelf (COTS) radio modem for integration that can be used to communicate with the AUV over a 2 km range. This entails detailed research of all possible avenues and options, devising crucial decision matrices to compare and contrast the trade-offs, and conversing with all parties to ensure that the optimal component is selected while still abiding by the constraints of communication, size, and compatibility; Constraints such as 'the radio modem must be able to be operated without an FCC license' have been detailed (along with others that have not been enumerated) and shall have to be taken into account every step of the way.

Additionally the ECE team *must* research and *must* select an appropriate echosounder to be used for forward collision avoidance, and shall be handled similarly with detailed research of all possible avenues and options, devising crucial decision matrices to compare and contrast the trade-offs, and conversing with all parties to ensure that the optimal component is selected while still abiding by the constraints of size, performance, compatibility, reliability, and viability in relation to the abilities of the AUV. This project is largely a research project and therefore will require a timeline reserved for researching such that future implementations of this selected device are smooth and successful.. To have a proof of concept of the selected echosounder, and thus demonstrating the viability of the selected components, a test *should* be conducted to show that the selected echosounder has the ability to detect a potential obstacle.

Stakeholders:

❖ Metron Inc. and PSU NEAR Lab
❖ Oceanographer

ECE Deliverables:

❖ Detailed design documentation enumerating what our design does with the selected components, how it works using the selected components, and why we selected the components that we did
❖ Weekly progress reports in the form of related work being uploaded to a drive folder
❖ A final report that displays or research, findings, and recommendations
❖ A Capstone Poster Session poster for the capstone project required presentation
❖ A BOM (Bill of Materials)
❖ Electrical and communication integration of radio system with Beaglebone Black computer.
❖ Demonstration of SSH access to devised systems over radio data link.
❖ Proof of concept demonstration of echosounder's ability for obstacle detection

Initial Product Design:

❖ Hardware Architecture
  ➢ Block Diagrams (L0 & L1)
❖ Software Architecture
  ➢ Languages and development environment list
  ➢ Data flow diagram using specific components
❖ Back up plans
  ➢ What can we fall back on if things go wrong

Project Management Plan:

Timeline:

Gantt Chart will be generated under these constraints given by Dr. Faust and uploaded to Drive:

"Use a Gantt chart. It can be simple (Word table or Excel spreadsheet) or it can be fancy (MS Project, ProjectLibre, or some online Gannt program like Asanna and InstaGantt). However you do it, you'll need carefully think about how much time things are going to take, multiply it by a factor of 3 for the fact it's way more complicated and harder than you think, and then by a factor of 4 because you theoretically only have 10 hours a week to work on Capstone so you're 0.25 FTE (full time equivalent), and now you should be panicking about getting your project done and handed off before the end of May. Your timeline should be realistic: it's going to take time to get PCBs, components, and development boards. Things are going to go wrong, and you've underestimated how much time some parts of your capstone will take. Try to factor that in by providing wiggle room in your schedule for unexpected delays"

Milestones:

❖ Conduct research on radio modem & echosounder possibilities
❖ Generate necessary documentation of results to receive approval of final decision
❖ Order and test components individually to ensure they operate as expected
❖ Generate test cases for AUV such that it can receive environmental input and respond according within the range of the AUV's capabilities
❖ Conduct test on components for verification

Budget:

❖ A BOM (Bill Of Materials) should be devised such that all components, manufacturing, and costs are enumerated and documented
❖ All purchases shall be thoroughly researched and decided upon as a team
❖ All purchases shall be approved by the sponsor and sponsoring organization
❖ Budget constraints shall be discussed with sponsor as the project progresses on a need be basis

Team and Development Process:

❖ Team members: Adam Provost, Yuhang Zhu, Noah Page, Jinhao Hou
❖ Skills: Matlab, Circuit design, Basic electronics, Signals and systems controls
❖ The point person to be communicating with the industry sponsor and the faculty advisor is Adam Provost, who is our ECE team leader.

- ❖ We will use the GitHub collaboration website.
- ❖ We will follow the timeline and we will not be particularly anxious to finish this project. We want to try to learn something from this project. We strive to make the project successful.