

Capstone Project Proposal

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

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Problem:

How can an existing AUV be improved to allow for object detection 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 is a collaboration between the ECE and ME teams and will consist of improving the navigation on an AUV by adding a forward collision avoidance sensor fitted in a nose cone developed by the ME team, and integrating it with MOOS IVP autonomous control software.

Product Design Specification:**Requirements & Specifications:****❖ *Must:***

- Research and select an appropriate echosounder
- Create a test plan per projected requirements
- Have a proof of concept/preliminary test of the selected echosounder

❖ *Should:*

- Be compatible with ME's design choices
- Integrate with MOOS IVP

❖ *May:*

- Develop a collision avoidance program
- Test collision avoidance in AUV

Stakeholders:

- ❖ Metron Inc. and PSU NEAR Lab

ECE Deliverables:

- ❖ Detailed design documentation (initial research, decision matrix, API, etc.)
- ❖ Weekly progress reports in the form of related work being uploaded Google Drive
- ❖ A final report that displays our research, findings, and recommendations
- ❖ A Capstone Poster Session poster for the capstone project required presentation
- ❖ A BOM (Bill of Materials)
- ❖ Must:
 - Test plan for isolated echosounder
 - Proof of concept demonstration of echosounder's ability for object detection
- ❖ Should:
 - Documentation of compatibility
- ❖ May:
 - Collision avoidance test plan for AUV in pool

Initial Product Design:

- ❖ Hardware Architecture
 - Under development

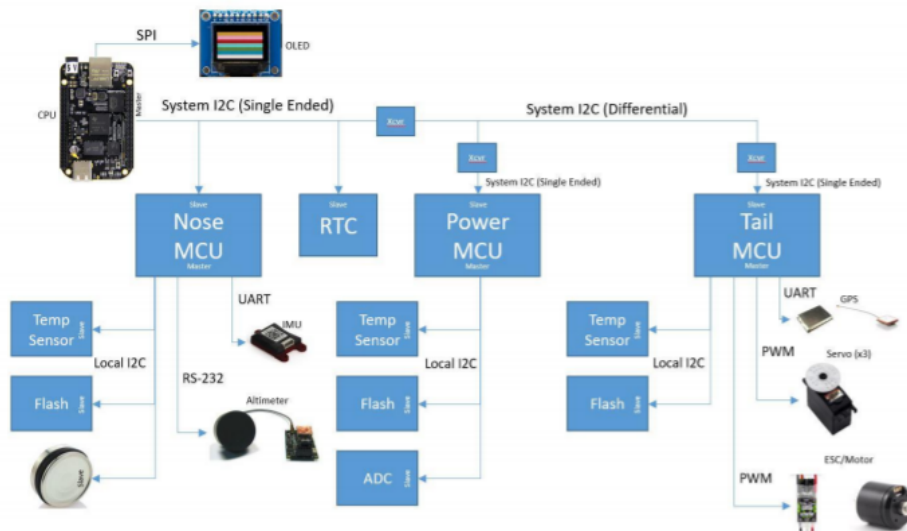
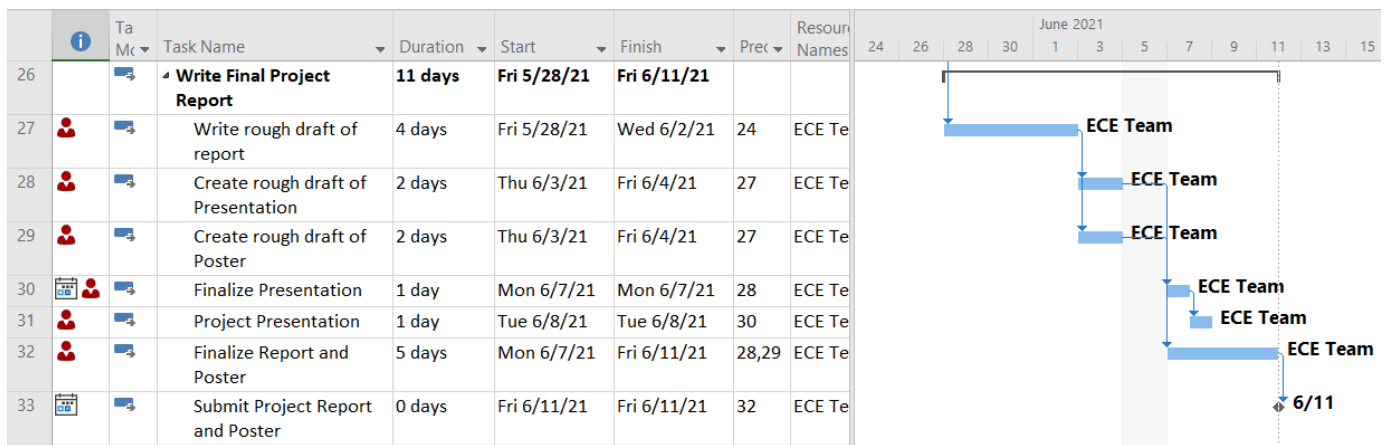
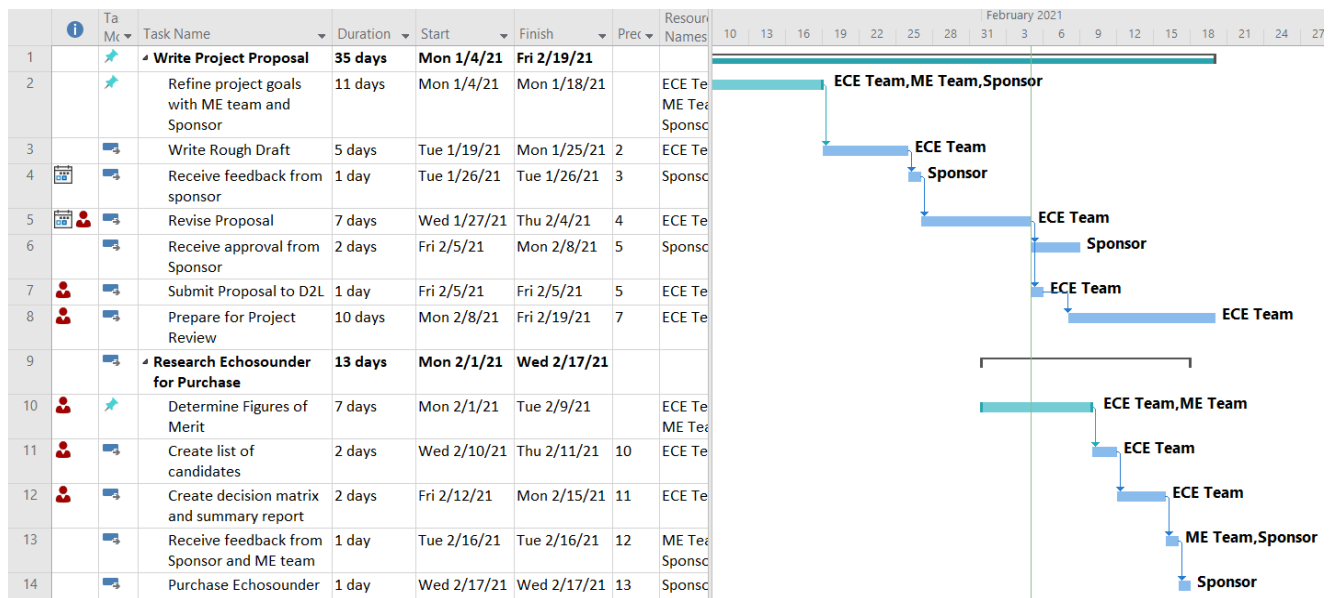
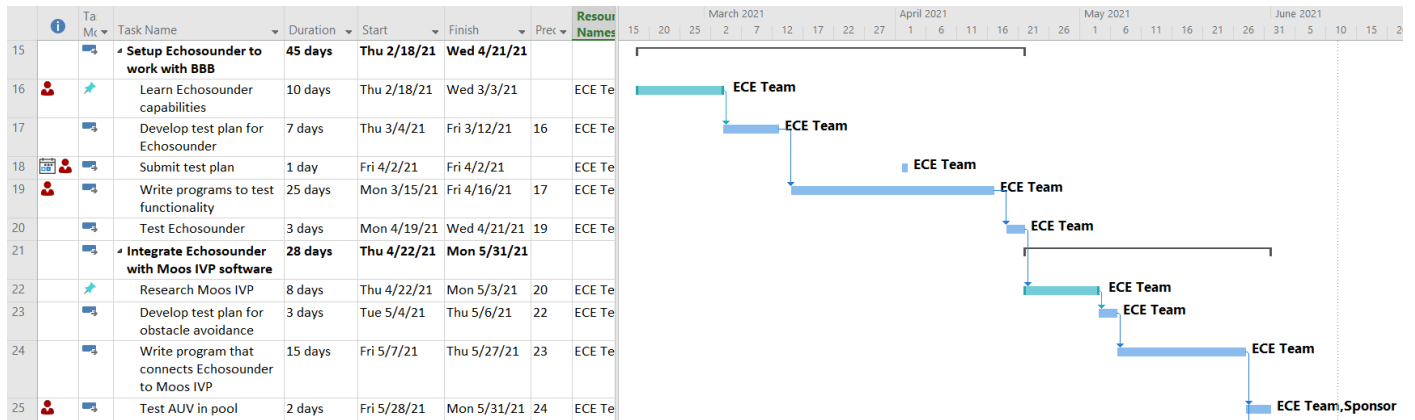


Figure 4: Vehicle architecture overview showing hardware and communications

- ❖ Software Architecture
 - MOOS IVP autonomous control software (C++)
 - Beaglebone Black Linux environment (Debian)
- ❖ Back up plans
 - Ultimate goal is autonomous collision avoidance program, however, we may limit scope to the “musts” of providing proof of concept test to prove the viability of our echosounder selection

Project Management Plan:**Timeline:**

Milestones:

- ❖ Define requirements for sensor based on AUV's capabilities and ME team's design decisions
- ❖ Conduct research on echosounder candidates
- ❖ Generate necessary documentation of results to receive approval of final decision
- ❖ Order Echosounder
- ❖ Test Echosounder's object detection in relevant environment
- ❖ Generate test cases for AUV such that it can receive environmental input and respond according within the range of the AUV's capabilities
- ❖ Integrate Echosounder with Moos IVP to create collision avoidance program
- ❖ Test AUV's collision avoidance in pool
- ❖ Create Final Project Report and Presentation

Budget:

- ❖ A BOM (Bill Of Materials) should be devised such that all components, manufacturing, and costs are enumerated and documented
- ❖ Echosounder budget approximately \$1000
- ❖ 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. We want to try to learn something from this project. We strive to make the project successful.