IRON RANGE ENGINEERING

Scoping Document

OpenROV Team Spring 2021

(Open Source Remotely Operated Vehicle)

Client:

Director of Technology & Laboratories
Iron Range Engineering

Facilitator:

(Spring 2021)

(Project Manager)

(Documentation)

(Communicator)

(CAD/Programming Lead)

(Factotum)

Team Members:
Reese Rohweder

I. Problem Statement

The OpenROV team has been tasked with fixing problems and modifying the

Open Source Remotely Operated Vehicle (OpenROV) from last semester (Fall 2020). This ROV is to be used in local bodies of water. The client asked to have an ROV fix the problems as well as add modifiers to the ROV by the end of the semester. This project is very open-ended so there aren't any specific modifiers that our client is looking for.

II. Design Objective

OpenROV is a community project that brings different coders and builders together working towards having an ROV that can explore bodies of water everywhere. The objective of this project is to have a working ROV that is well documented for future improvements.

As a team, we have to come up with a conclusion for this project to be easily innovated by a new team that could pick this project up and start where we left off and make a new product and/or make ours better. We want to give something to the Iron Range Engineering (IRE) community that is very user friendly and able to be taken out into the real world and use this to explore.

III. Requirements

The OpenROV team is improving upon last semester's underwater drone. Since our problem is open-ended this semester, here are the things the team has decided to improve:

1. Water-proofing the underwater drone
2. Testing the water-proofing
3. Adding sensors to the underwater drone
4. Adding an arm to manipulate the underwater drone
5. Coming up with ideas to improve the underwater drone that could add value to the system.

IV. Constraints

The constraints of this project are the bodies of water, the waterproofing, the pressure for how deep the team's submarine can go, and the amount of money allocated. Bodies of water can differ in size, visability, and currents. Minnesota is also a cold state so the lakes freeze over which might cause problems due to the accessibility point of the submarine's submission into the water.

The waterproofing is important to make sure the team's vessel will be able to operate underwater. This also includes making sure everyone is safe if it short circuits. This is also important because if we do not have a waterproofed submarine then we might have to purchase new parts which money is another constraint. The depth of the water also affects the pressure against the submarine where it will need to be sturdy enough not to crack or break underwater. Money is a big constraint because of the amount of pieces and parts. Overall, the team has challenges with these constraints, but will work on them and create a great submarine.

V. Action Plan

For this project, our action plan for completion consists of fixing our propeller problem, finding sensors, and developing a grappling system. The propellers for our current design both have the same pitch and

spin in the same direction. So the way we plan on fixing that is by reprinting one of the props with an inverted pitch and reverse the motor. This will allow the ROV to be pushed straight instead of turning in one direction. Next, we plan on finding sensors that will relay the temperature and PH of the water. We can find simple sensors on hundreds of different websites so the real challenge will be finding the most cost-effective resource to acquire the sensors from. Next would be designing and incorporating a grappling system for the ROV. We will run through and design a few different concepts on SolidWorks before coming to a final decision on the design. After we've completed these initial objectives, if time allows, we plan on designing a way to determine the depth of the unit whether that be attaching a sonar device to a tether on the unit. Whatever decisions end up taking place, this action plan will not change.

Final Deliverables

The final deliverables for our project consist of our required documents and presentation and the ROV implementations and upgrades if you will. We also have to decide on a power source, in other words, which type or size battery we would like to implement. We also must conduct an initial test of the ROV even if it is in a tub of water to see what we are starting with for handling, visibility, and overall operation. Organizing and finishing up enclosure organization that didn't get to get accomplished last semester, organizing wires, mounting electronics, and mounting the battery tray. We will also be conducting field tests and taking note of what occurs whether it be good or bad and video of the tests. For these tests, we will be putting our results and takeaways into a document for future reference and evaluation.

VI. Timeline

The timeline for our project consists of the full duration of the 2021 spring semester. We have our scoping presentation due 2/10/21, scoping document is due 2/15/21, we also have our facilitator meetings each Thursday during class. In these meetings, we talk with our facilitator to make sure we are keeping on track and making progress. By participating in these meeting it can help keep our team a team, participating and feeling involved. We can use these meetings to share thoughts and ideas what is the best way to achieve our goals in an efficient, effective, and timely manner to meet our deadlines.