RoboSub Team Killick 2017-2018

Next Semester Plan

Fall Semester 2017

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Power and Propulsion Subteam

A lot of headway was made by using direct controls to see how the AUV performed in the water. While this is a huge step in the right direction for testing and validating the mechanical design, the primary focus of the propulsion subteam will be working further towards autonomy. A few tasks that need to be completed to reach this goal will be to fully integrate the Raspberry Pi (master controller), the Arduino Mega (slave controller) and the Hall Effect sensors to achieve a means of motor control and actuation. The Arduino must be able to receive a continuous stream of values dictating AUV movement from the Raspberry Pi via serial communication, which will require information from vision and sensors to be interpreted by the controls subteam to achieve the desired actions. In addition, the Hall Effect sensors will be utilized such that the Arduino will be programmed to read in the current values of each individual motor. If any of the current values from each motor exceed a maximum threshold current, the the Arduino will send an *error* flag to the Raspberry Pi, thus sending the motor into a disarmed state.

Over all, the primary object for next semester will be to utilize this onboard method of motor control to either stabilize the AUV while it is in the water, or allow the AUV to follow a predefined path. Some secondary tasks will also consist of creating a printed circuit board (PCB) layout for all of the components of the propulsion systems. The PCB layout will improve the overall system organization for the AUV and allow for faster testing of other components. Finally, the propulsion subteam hopes to understand the power needs of each individual subsystem so as to finalize the batteries that will be used. As the other subsystems finalize their hardware components and carry out testing, the Propulsion team also hopes to have one integrated PCB layout started.

Vision and Sensors Subteam

There will be three main goals for sensors team next semester. The first is to build a hydrophone array as the competition will have several different tasks that need to be complete before the AUV can surface. These tasks signal their location with an underwater ping and the array will need to be able to hear these pings, differentiate between them, and determine their location relative to the AUV. The current plan is to have four hydrophones that are separated by a known distance, which will allow us to locate, in threespace, the pinger. The second main goal for the sensor team is to focus on vision as it still needs work before it can be used for autotomy. Currently it can only find exact shapes with large contrast between the shape and its background, which will not always be the case. We will have to push the system to its limits before it can be reliably used in the competition. The final main goal is to connect all of the sensors together physically via ethernet and work alongside controls to filter them together. An ethernet switch will be used as the hub and will be controlled by the Nvidia Jetson TX2. This is due to the fact that there is error in every sensor's measurement that can be reused with other sensors measurements. These are not trivial goals and will easily take all of next semester to complete.

Controls Subteam

This semester has been an amazing advancement by the controls team. With that being said, we still have a long ways to go. We need to continue delving into the integration side of implementation.

There will still need to be a huge amount of collaboration between the propulsion and sensors subteams, but the testing has been greatly rewarding to start to see systems come together. The primary goals of the controls subteam are to combine sensory input data so the AUV can autonomously follow a straight line as well as achieve and maintain a desired depth. Bumping into buoys based on shape and color as well as moving through gates are also goals for the controls.

Mechanical Subteam

Next semester the mechanical team plans to create the next revision of the electronics housing/chassis. The current design still has some microcracks allowing small amounts of water into the housing, and it also has a few unnecessarily large protrusions. The next design of the chassis will be cut from as few blocks of aluminum as possible, utilizing CNC machining to increase precision and reduce the number of weld beads. This revision will also be designed to facilitate the welds that are needed, utilizing wider flat pieces of thicker aluminum where weld beads will be placed to prevent cracking.

Following that the mechanical subteam will be focusing on designing and prototyping a manipulator arm to meet the demands of the 2018 RoboSub challenge, finishing the design of and casting fairings for the AUV body to further reduce the drag of the vehicle, designing and building a ballast system to better control buoyancy, updating and finishing the torpedo launcher design, and ensuring internal electronics mounting is optimized.

Recommendation for Project Continuation

Given the progress that the team as a whole has made this semester, the project should continue to be offered. At this point in time the project is set to continually advance and become more capable. If the team continues to progress, there is a high hope that the vehicle will compete during the third year of this project. The team should continue to test frequently in the pool at Colorado State University and work towards implementing computer vision. Another general guideline the team should follow is to work on one obstacle, like what will be in the course, and build up to testing with multiple obstacles of increasing difficulty. The construction of a library for base behaviors such as “track line” or “move toward buoy” would be a valuable tool that will set future teams up for success.