Project Proposal and Statement of Work

FAMU-FSU College of Engineering
Department of Electrical & Computer Engineering

Team: #4 RoboSub

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Project Executive Summary

The Association for Unmanned Vehicle Systems International (AUVSI) in conjunction with the U.S. Office of Naval Research host an annual competition in which teams from across the world develop autonomous underwater vehicles (AUVs), also called RoboSubs, that have certain abilities which are used to accomplish tasks within an obstacle course. AUVSI's primary goal of the competition is to "advance the development of Autonomous Underwater Vehicles (AUVs) by challenging a new generation of engineers to perform realistic missions in an underwater environment." It is the hope that the event not only helps to connect young engineers and the organizations developing AUV technologies, but also encourage excitement about STEM careers.

The competition is located in San Diego, CA at the TRANSDEC pool (pictured in Fig. 1) and typically takes place at the end of July or beginning of August. It lasts roughly one week, including several days of practice and two competition rounds. Performance during each round determines the progress of a team through the competition.

Figure 1: TRANSDEC Pool

In order to proceed with the competition, the sub must pass through a validation gate made of PVC pipe. After that, the following tasks are available for completion (based on the 2014 competition rules):

- Follow a path of orange line segments that guide the sub between tasks
- Bump a moored LED buoy that is alternating between Red and Green. Bump until buoy is stuck on green. Then bump a regular red buoy, followed by the regular green buoy.
- Maneuver around/over PVC by passing over the horizontal section, to the left or right of the center Red riser and inside the outer Green risers.
- Drop one marker in a bin with the primary alien target, and one marker in a bin with the secondary alien target.
- Fire a torpedo though a small hole in a target.
- Remove a red power pin that is a steel washer attached to a blue circle by a magnet, and then place the washer back in it's original position.
- Capture one or more Mars rocks (red) or cheese blocks (green) and deliver them to the Sample box.
- Surface inside the proper PVC octagon based on which set of acoustic pingers are making sound.

This project would allow the team to develop a sub for the competition based on the work of teams in previous years and ideally compete this coming summer.

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1. Introduction

1.1 Acknowledgements

The RoboSub team members would like to thank Dr. Mike Frank for his general advisement throughout the project, as well as Dr. Victor DeBrunner for technical advisement. The team would also like to thank the FAMU-FSU College of Engineering for their financial contribution to this project.

1.2 Problem Statement

General Problem Statement

This summer AUVSI will host their 18th Annual RoboSub Competition in San Diego, CA. The competition is an obstacle course that requires an autonomous underwater vehicle to maneuver it. There are numerous tasks involved in the competition, and they all require the sub to have certain abilities in order to complete them. To complete some of the basic tasks, the sub must be able to:

- Run autonomously without any attachments
- Change depth, direction, and speed
- Pass through and around PVC structures
- Recognize colors

While these are not all the capabilities a sub would need to have in order to complete all tasks in the competition, they are the main capabilities that would result in a successful project for this team.

General Solution Approach

The sub is using the same hardware that was implemented in the last two year's design. For each task and subtask, the Logger function will output what the sub is currently doing by clever use of strings. This will allow for debugging based on whether the sub is doing the proper task at the proper time. The sub is completely battery powered. The code is written in C and C++.

1.3 Operating Environment

The primary operating environment of practice and testing of the sub throughout the year will take place in the FSU Morcom Aquatic Center, located in Tallahassee, FL. Since this pool is chlorinated, the buoyancy of the sub will be slightly higher than it would be at the competition pool. Additionally, the sub will have better visibility in the Morcom pool than in the competition pool.

The final operating environment will the the TRANSDEC pool in San Diego, CA. This pool is 300 ft by 200 ft by 38 ft and contains about 6 million gallons of saltwater, aiming to replicate ocean conditions. Because of the size of the pool, this facility is open-air and is exposed to all possible weather conditions. Within the facility, the sub will be transported by a crane and will be placed in a sling to be inserted into the water for testing and competition.

1.4 Intended Use and Intended User

The intended use of this sub is to compete in the AUVSI RoboSub competition in San Diego, CA in summer 2015. It will complete the validation tasks, such as passing though the validation gate, and also perform a number of other tasks throughout the course.

The team members of this project are the only intended users, as they will be the only operators of the sub. Future project team members are also considered to be intended users, yet they are not going to be using the sub this year.

1.5 Assumptions and Limitations

Assumptions

- The rules for the 2015 competition will be very similar to the 2014 competition. Since the rules and requirements have not yet been posted, the team is to work on the project as though it is being prepared for last year's competition.
- The visibility conditions will not largely differ between the practice pool and the TRANSDEC pool.
- The sub will not behave differently at 17 ft (depth of Morcom pool) versus 38 ft (depth of TRANSDEC pool).

Limitations

- The body of the sub must be reused from last year as there is not enough money to redesign it, nor are they any mechanical engineering students on the team to assist in a redesign.
- The sub can weigh no more than 125 lbs and must fit in a space that is 6 ft by 3 ft by 3 ft, according to the requirements from last year's competition.
- The financial budget is not large as most of the work expected to be performed is programming.
- Testing facilities on campus are not capable of replicating ocean conditions.

1.6 Expected End Product and Other Deliverables

The completion of this project shall result in the creation of a fully functional autonomous underwater vehicle (AUV), also referred to as a "sub". It is expected that this sub will qualify for the AUVSI RoboSub competition in California and compete in the summer of 2015.

In addition to the completed sub, the team is to produce a website, journal paper, and introductory video for the competition. It is expected that the website will contain all team information and work, and the journal paper will be a technical paper which contains the operations and functionality of the sub, essentially a user manual. The purpose of the video is to introduce team members and their sub to the AUVSI committee and all others involved.

2. Concept Generation & Selection

2.1 Design (Mechanical, Electrical)

Concept Generation
Completed by previous years.

Decision to Make:
Redesign of the RoboSub.

Advantage:
It could be more efficient and allow for different types of controllers/processors or accessories, in addition to being lighter.

Disadvantages:
The sub is already built and the team does not have a mechanical engineering student, nor the funds and time to allow for such an undertaking.

Selection:
It was decided that the team would maintain the current design with almost no changes. The goal of this project is to continue on the programming and completion of tasks. However, some small changes may be made if systems fail (such as a new battery, new depth sensor, or new seal), but will still follow the overall design created by previous teams.

2.2 Code Structure

Concept Generation
Completed by previous years.

Decision to Make
Rewrite code completely or build upon existing code.

Advantages:
Rewrite Code – The team would have complete understanding of the code structure and functionality, which might be more efficient, faster, clearer, and cleaner (i.e. indentation, commenting, etc).

Build upon existing code – This would save a large amount of time. The current code works for the most part and is only in need of expansion and slight adjustments.

Disadvantages:

Rewrite Code – This would take a large amount of time and be wasteful of resources.

Build upon code – The team would have to spend time learning the current code.

Selection:

The team decided to build upon the existing code. The current code is poorly commented, and largely unclear, but has been shown to work. Furthermore, perfect understanding of the existing code is not necessary. For example, if the theoretical function getColor successfully returns the expected color, it does not to be fully understood how it did. The time spent deciphering the existing code will certainly be less than the time spent starting over completely. The main goal will be to add more tasks to the existing archetype with one significant change (see 2.3).

2.3 Path Implementation

Concept the Generation:

The current code has a place to add tasks to the one existing task (Gate). However, it is set up such that there are multiple separate Path tasks, which come linearly in between each main task. An alternative would be to use a single separate thread for the Path (the most needed task), which is activated upon the completion of a task.

Decision to Make:

Continue linear path implementation or switch to a dynamic style.

Advantage:

Linear – This would require less coding by unique lines.

Dynamic – This method would be more, well, dynamic. It would be able to act more efficiently and probably correct for errors more easily. It would also be less re-stated spaghetti code.

Disadvantages:

Linear – It has little adaptability and looks unprofessional.

Dynamic – This would require a whole new thread implementation and slight design modification.

Selection:

The team selected the use of dynamic style. The ability to dynamically call a single routine to follow the path is worth a little extra effort. If it proves much more difficult than expected, it can be still reused for the linear style, but the opposite would be harder to achieve.

3. Proposed Design

3.1 Overview

As the RoboSub has already been constructed, the physical design is already complete. Furthermore, the interface design between the components is unlikely to change very much. Although, since the rules for this year will be different than last year's, some redesign may be necessary. The primary goal of this project, however, is to improve upon the existing code to allow the RoboSub to complete more tasks at the competition. Thus the flow of the sub's code is the most pertinent to understanding of this project.

3.2 Component Interface

This block diagram below details the connections of the primary hardware components. There are two microcontrollers used to interface with the CPU and control the sensors and motor controllers (L298 MC). An Arduino UNO interfaces with the depth sensor, while the Arduino MEGA constitutes the primary control, interfacing with the smaller controllers for the thrusters and the IMU (Inertial Measurement Unit). The cameras interface directly with the CPU (through the database and subroutines seen below).

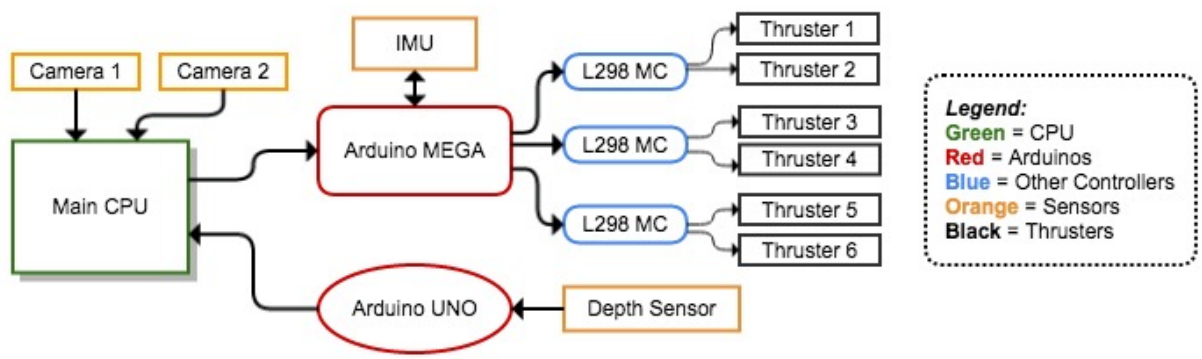


Figure 2: Electrical Component Interface Diagram

3.3 Software Flow

This block diagram below shows the high-level design of the sub's programming. Primary hardware pieces are also included to provide a clear understanding of the functional hierarchy. Threading was used to create a high level of parallelism, most evident in the four independent lines coming from the main routine (RoboSubControl_v2), and the cluster of processes spawning from Gate. The Task Manager and DMCS (Decision Making Control System) interface through the missonTasks stack, and control what task is activated. Since the complicated thruster interface is detailed in 3.2, a single "Thrusters" block in included in this diagram to simply show the general flow of data. Most of the blocks represent completed existing code (although image processing through the Database is incomplete), but the red blocks represent intended new code. These are the primary tasks this project will be tackling.

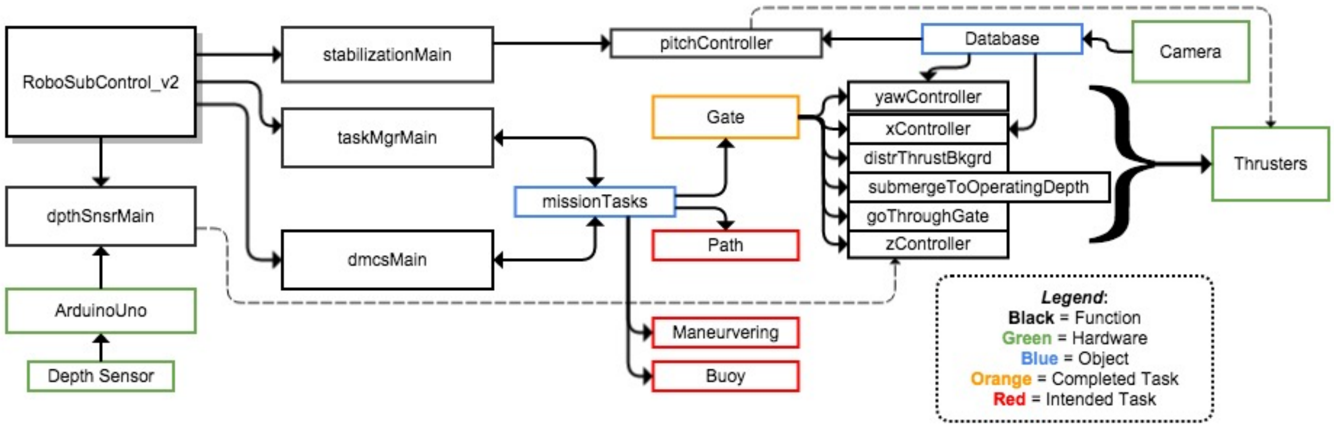


Figure 3: Software Functions Diagram

4. Statement of Work

4.1 Task 1: Project Management

Every member of the team is tasked with administrative responsibilities according to their strengths. Thus the team very much acts as a whole, even when physically working apart. Elliot Mudrick is the team leader. He coordinates meetings with the group as a whole as well as times to test at the pool. He also sets up and updates the timeline. Dennis Boyd is the lead programmer and will be responsible for distributing coding assignments. Kevin Matungwa is the vice team leader and the testing coordinator. Thus we will also organize meetings to a lesser degree, but will primarily be responsible for overseeing testing. Bjorn Campbell will oversee all electrical components such as wiring and power systems, as well designing the testing apparatuses. Samantha Cherbonneau is responsible for maintaining group minutes on the group blog/website as well as finalizing reports and development and maintenance of the website.

4.2 Task 2: Acclimation

4.2.1 Objectives

The primary objective of this task is to get sub to the functioning point it was at at the end of the spring 2014 semester and to ensure that all parts and components are functioning as expected.

4.2.2 Approach

To accomplish this, the team will study the code, test each functionality that was claimed to be completed, and familiarize themselves with everything that was done last year.

4.2.2.1 Subtask 1: Reinstall Electronics

4.2.2.1.1 Objectives

The team needs to re-connect the electronics of the previous design in an intuitive manner.

4.2.2.1.2 Approach
Last year's user manual will be followed and the team will be familiarized with how/why everything is connected the way the schematic is laid out.

4.2.2.1.3 Test/Verification Plan
The first thing to do is to make the connections as described, ensure power is being supplied properly, and connect voltmeter and measure input/output voltages.

4.2.2.1.4 Outcomes of Task
The goal of this subtask is fully functioning electronics that perform properly while paying close attention to the system's current and voltage specifications.

4.2.2.2 Subtask 2: Computer Interface

4.2.2.2.1 Objectives
The objective is to understand how to properly connect the sub to a computer interface during testing.

4.2.2.2.2 Approach
The team will conduct tests on land to verify that the logger is displaying the proper output on the computer screen.

4.2.2.2.3 Test/Verification Plan
To test the functionality, the team will check the logger output within the code for specific sections. Then compile and run that section and verify that the proper message is displayed.

4.2.2.2.4 Outcomes of Task
Get the status updates remotely as the sub takes on the tasks. This interface will be very useful in the testing and debugging phase.

4.2.2.3 Subtask 3: Checks of Thrusters, Pitch/Yaw, x-y-z Calculations

4.2.2.3.1 Objectives
The objective is to verify which thrusters correspond to each array position within the code. Also to verify the pitch, yaw, and x/y/z coordinates received from the Razer AHS.

4.2.2.3.2 Approach
The team will independently test components to verify that they work properly and can identify the thrusters' identification numbers.

4.2.2.3.3 Test/Verification Plan
To test, the team will individually turn on each thruster to tie them to their corresponding number in the source code. They will then change the orientation of the Razer AHS chip and verify it's readout.

4.2.2.3.4 Outcomes of Task
Confirm that valid data is being received from the AHS chip. Gain an understanding of the location of thruster 0 through 5.

4.2.2.4 Subtask 4: Gate Movement

4.2.2.4.1 Objectives
The objective is to get the sub to move through the gate.

4.2.2.4.2 Approach
Test the sub in the water with the gate to make sure it can do what it was able to do last year.

4.2.2.4.3 Test/Verification Plan
Make appropriate pitch, yaw, and thruster adjustments through a series of tests until the sub consistently makes it through the gate.

4.2.2.4.4 Outcomes of Task
The sub will successfully move through the gate.

4.2.3 Test/Verification Plan
After testing of all subtasks is complete, and overall test can be performed to ensure that the sub is fully functioning and at the point it was last spring.

4.2.4 Outcomes of Task
It is expected that the sub will be able to pass through the validation gate, thus utilize all the functions that last year's team implemented.

4.3 Task 3: Course Component Construction

4.3.1 Objectives
The objective is to repair and construct various components of the competition course.

4.3.2 Approach
The team will examine current gate, price component parts, functional design for storage, test.

4.3.2.1 Subtask 1: Validation Gate

4.3.2.1.1 Objectives

The objective is to create a functional validation gate what has the specifications of last year. The gate will also need to be designed to be stored easily.

4.3.2.1.2 Approach

The current gate will be recycled for parts. The treasurer will price needed parts(horizontal section, 90 degree connectors, center connector). The team will then cut 10’ pipe into 5’ sections(required for easier storage), paint the Gate black, and create two 4’ blaze orange vertical sections.

4.3.2.1.3 Test/Verification Plan

The gate will be assembled at Morcom pool and placeed in pool to determine if glue is needed. If the gate remains connected without glue, the test was successful. If the gate disconnects, holes will need to be drilled in the connector and dowels added.

4.3.2.1.4 Outcomes of Task

The Validation Gate specifications shall be met and the gate is functionally storable and submersible at any depth.

4.3.2.2 Subtask 2: Orange Path

4.3.2.2.1 Objectives

The objective is to create 6” by 4’ line segments that are blaze orange. The line segments need to be 1 to 2 feet off the floor of the pool. The line segments need to be parallel to the floor of the pool.

4.3.2.2.2 Approach

Find low cost materials that are 6” by 4’ long that can sink or float. If they sink create a riser allowing them to be off the ground. If they float attach a rope and a weight.

4.3.2.2.3 Test/Verification Plan

Put the line segments in the pool test. Make sure that the segments are at the correct depth off the floor. Check to make sure the line segments are parallel.

4.3.2.2.4 Outcomes of Task

Line Segments will be off the ground, and point the Sub in the correct direction.

4.3.2.3 Subtask 3: Maneuvering Structures

4.3.2.3.1 Objectives

The objective is to create the submerged Maneuvering Structure from last year's Robosub competition. This year's Maneuvering Structure may vary and because of this, the design should be easily alterable.

4.3.2.3.2 Approach

The treasurer will price the parts of last years competition. Parts include piping, red and neon green tape, and lines, glue, weights, 90 degree connectors, T connector, and caps (ends of the pipes). After the parts are bought, the pipes are to be sealed and colored, and mooring lines will be attached to the weights. The center red pole will connect to the T connector and the two horizontal pipes. Sealing the pipes will create buoyancy.

4.3.2.3.3 Test/Verification Plan

The caps of each of the pipes need to be tested for waterproofness. The 90 degree connectors, and T Connectors need to be tested for waterproofness. Also will test the entire structure for waterproofness. The structures buoyancy will determine the amount of weights needed and extra weights may need to be added. Mooring lines will be used to test that the structure can be submerged.

4.3.2.3.4 Outcomes of Task

Maneuvering Structure can submerged and is functional. The dimensions of the structure will be accurate and allow for proper testing of the Maneuvering task.

4.3.2.4 Subtask 4: LED Buoys

4.3.2.4.1 Objectives

Create the control panel buoys. 2 different types of buoys required. Buoys require LEDs to illuminate the buoys.

4.3.2.4.2 Approach

There are two different approaches for completing this task:

Method 1: Obtain one cylinder and 2 spheres that meet the design requirement sizes. The cylinders can be made of plastic or foam. Instead of using LEDs, use glow sticks as the light source. Glow sticks should be cost effective compared to creating a more complex buoys. Another alternative is to avoid

Method 2: Create a waterproof cylinder. Inside the cylinder have a simple circuit what has a power supply, switch, and three different strands of LEDs. The circuit will need to toggle between the different strands of LEDs. For the Spheres a very simple circuit involving a power source and and several LEDs.

4.3.2.4.3 Test/Verification Plan
Test the foam or plastic spheres and cylinder for buoyancy and waterproofness at the pool. Add glow sticks to the spheres and cylinders and check for proper illumination of the buoys. For the cylinder the glow sticks will need to be changed out underwater. This glow stick colors will need to be changed every five seconds, which will be done by someone manually changing them.

The spherical and cylindrical containers will need to be tested for waterproofness at the pool. The circuits containing the LEDs will require power analysis. The buoy will need to be tested for toggling of the LED strands. After proper toggling of the buoy LEDs the buoy will need to be tested for shock causing the LED strand to stop toggling.

4.3.2.4.4 Outcomes of Task
Have functioning buoys. Depending on the design of the buoys, manually changing the color or switching the LEDs may be required.

4.3.3 Test/Verification Plan
Tests for each of the structural components will be completed individually. After buoys are completed, all task structures will be completed. This will allow for recreation of the first three tasks of the competition.

4.3.4 Outcomes of Task
After completion of the components the sub can be programmed to complete each task.

4.4 Task 4: Color Recognition

4.4.1 Objectives
The sub should be able to recognize multiple colors: orange, red, green, black, and blue using the camera affixed to the front of the sub.

4.4.2 Approach
The programmers of the team will build upon the code that was begun by last year’s team.

4.4.3 Test/Verification Plan
The color recognition software will be thoroughly tested using multiple objects of various colors. The objects will be placed in front of the camera to see if it recognizes the proper color. Once this is successful, the software will also be tested with those objects in the water because the water may require alteration of the color values to give a proper reading.

4.4.4 Outcomes of Task
Upon completion of this task, the sub will be able to properly recognize the necessary colors (orange, red, green, black, and blue) underwater.

4.5 Task 5: Follow Course Path

4.5.1 Objectives

The sub should be able to follow the course path, and stay on that path.

4.5.2 Approach

The main subtasks for this task involve recognizing the path, aligning the sub with the path, moving along the path while maintaining proper alignment, and any possible navigational error checking, should the sub get lost while navigating the course.

4.5.2.1 Subtask 1: Recognize Orange Path

4.5.2.1.1 Objectives

The sub will distinguish an orange color tape used to determine the flight path.

4.5.2.1.2 Approach

The approach will be to utilize the onboard forward facing camera and the color recognition function to recognize the orange tape.

4.5.2.1.3 Test/Verification Plan

Place multiple 6 inch (15 cm) by 4 feet (1.2 m) orange tape segments at the bottom of pool and make sure the sub can identify the tape.

4.5.2.1.4 Outcomes of Task

The sub will spot the orange tape at far distance and move towards it at a reasonable speed in preparation for the alignment stage

4.5.2.2 Subtask 2: Initial Alignment with Path

4.5.2.2.1 Objectives

The sub shall orient itself accordingly to match the 4 feet orange tape direction.

4.5.2.2.2 Approach

The yaw thrusters will be adjusted to make sure that orange tape stays at the center of the bottom facing camera vision.

4.5.2.2.3 Test/Verification Plan

A test engineer shall continuously alter the subs orientation and make sub can self adjust its orientation by re-centering the orange tape on the bottom cameras vision.

4.5.2.2.4 Outcomes of Task

The sub will continue to travel in straight path after achieving the correct alignment that corresponds to the orange tape.

4.5.2.3 Subtask 3: Move Along and Maintain Alignment with Path

4.5.2.3.1 Objectives
The sub will travel in straight path to the next task area.

4.5.2.3.2 Approach
Even power will be distributed to the forward propelling thrusters to make sure that the sub does not change course.

4.5.2.3.3 Test/Verification Plan
The ability of the sub to travel in a straight path will be tested by placing it at one end of the pool and making sure it can travel in a straight line to the other end of the pool.

4.5.2.3.4 Outcomes of Task
The sub will continue to follow its flight path to the next task area destination and not get lost along the way.

4.5.2.4 Subtask 4: Navigational Error Checking

4.5.2.4.1 Objectives
The sub should be able to recognize that it has lost the path and properly find and follow it again.

4.5.2.4.2 Approach
Use the cameras to keep track of position. If the sub is veering too far to the side (an error relative to when it aligned itself is too high), correct for that movement (likely by adjusting yaw) appropriately. If the sub has lost the path, begin looking for orange tape. Once the tape is found, begin following it again. If it arrives at an already completed task, turn around and follow the tape the other way.

4.5.2.4.3 Test/Verification Plan
Force the sub off track (likely by pushing it lightly) and see that it can correct for the error. Simulate the sub getting lost by moving away from the tape and verify that it can recognize its state and find the path again.

4.5.2.4.4 Outcomes of Task
The sub correctly corrects for small errors in position or alignment, and can get back on the path if it gets lost.

4.5.3 Test/Verification Plan
The sub will be tested in the water using the constructed obstacle course to determine if each of the above subtasks works properly in conjunction with each other.

4.5.4 Outcomes of Task
The sub can follow the course to travel between other tasks.

4.6 Task 6: Maneuvering Around Objects

4.6.1 Objectives
The primary objective of this task is to increase the versatility of the sub's maneuverability. Specifically, to enable the sub to move in a tight circle around a red PVC pipe while avoiding contact with smaller green PVC pipes below.

4.6.2 Approach
Implement the ability to recognize the red pipe as well at the smaller green pipes. Enable the sub to position itself close to the pipes without touching them. Enable the sub to move around the pipe in a circle while maintaining distance and depth.

4.6.2.1 Subtask 1: Identify Vertical Red Pipe

4.6.2.1.1 Objectives
Enable the sub to find the red PVC pipe.

4.6.2.1.2 Approach
Use the sub's color recognition to identify the red PVC pipe within this specific task. The sub should know when to search for the pipe and when not to.

4.6.2.1.3 Test/Verification Plan
Conduct tests on dry land to see if the sub properly identifies a red PVC pipe. Once the land test is successful, repeat the test in the water.

4.6.2.1.4 Outcomes of Task
The sub will be able to identify the red PVC during the maneuverability task.

4.6.2.2 Subtask 2: Identify Horizontal Green Pipe

4.6.2.2.1 Objectives
Enable the sub to find the green PVC pipe.

4.6.2.2.2 Approach
Use the sub's color recognition to identify the green PVC pipe within this specific task. The sub should know when to search for the pipe and when not to.

4.6.2.2.3 Test/Verification Plan
Conduct tests on dry land to see if the sub properly identifies two green PVC pipes positioned near each other. Once the land test is successful, repeat the test in the water.

4.6.2.2.4 Outcomes of Task

The sub will be able to identify the green PVC pipes during the maneuverability task.

4.6.2.3 Subtask 3: Orientation with Pipes

4.6.2.3.1 Objectives

Once the red and green pipes have been identified, enable the sub to position itself approximately two feet above the green PVC AND approximately one foot in front of the red PVC pipe. The sub should be able to stop and maintain this position.

4.6.2.3.2 Approach

Independently ensure that the sub can position itself above an object and in front of an object. Verify that the sub can maintain its position (both depth and lateral) in the water.

4.6.2.3.3 Test/Verification Plan

Conduct land tests where a pipe is held at different distances from the sub. Verify that the proper thrusters activate depending on if the pipe is too close or too far from the sub. This land test will be done both below and in front of the sub. Next conduct the true tests in the pool.

4.6.2.3.4 Outcomes of Task

The sub will be able to properly position itself near the PVC pipes in preparation of moving circularly around them.

4.6.2.4 Subtask 4: Circular Movement

4.6.2.4.1 Objectives

After positioning itself properly with respect to the red and green PVC pipes, the sub needs to move in a circle around the red pipe while maintaining depth and its distance from the red pipe. No PVC pipes should be touched in the process.

4.6.2.4.2 Approach

Design a process to maintain the subs position relative to the pipes while moving in a circle around the red pipe.

4.6.2.4.3 Test/Verification Plan

Physically move the sub while it is on the cart (on land) with a green PVC pipe below it and a red pipe in front of it. Verify that the proper thrusters activate when the sub moves too far/close from the red pipe or if it moves too far/close from the green PVC pipe. This test happens while the circular motion thrusters are activated. Once this test is successful, conduct the true test in the water.

4.6.2.4.4 Outcomes of Task
The sub will be able to move circularly while maintaining proper position with respect to the PVC pipes.

4.6.3 Test/Verification Plan
Ensure that all the subtasks for this section work in conjunction with one another.

4.6.4 Outcomes of Task
The sub meets the requirements of the maneuverability task as defined by the Milestone 1 Report and by the AUVSI official competition rules.

4.7 Task 7: Buoy Contact and Recognition

4.7.1 Objectives
Enable the sub to detect and approach the moored buoys. Implement a 'bumping' process to touch the buoy until the green LED is activated.

4.7.2 Approach
First implement the ability to identify and stop in front of the buoy with the LEDs on it. Next enable the sub to identify when the proper LED is lit. Finally, enable the sub to bump the buoy and continue to bump it until the green LED is lit.

4.7.2.1 Subtask 1: Stop Directly Before Object (Buoy)

4.7.2.1.1 Objectives
Enable the sub to stop in front of the buoys.

4.7.2.1.2 Approach
Implement the process from the maneuverability task to stop in front of an object except for the buoy instead of the PVC pipe.

4.7.2.1.3 Test/Verification Plan
Conduct a test on land to ensure the proper thrusters activate with the buoy test object at different distances from the sub.

4.7.2.1.4 Outcomes of Task
The sub will be able to stop and maintain distance from the buoy.

4.7.2.2 Subtask 2: Identify Color Change of Object

4.7.2.2.1 Objectives
Ensure the sub can identify what color LED the buoy currently has activated.

4.7.2.2.2 Approach
Implement color recognition code for use in buoy color identification.

4.7.2.2.3 Test/Verification Plan
Place LEDs in front of the sub and check that the logger data that is sent to the monitor matches the color of the LED. Once this test is successful on land, it will be done again in the water.

4.7.2.2.4 Outcomes of Task
The sub will be able to distinguish when the sub is the proper color or not.

4.7.2.3 Subtask 3: Bump Object

4.7.2.3.1 Objectives
Enable the sub to relatively lightly bump the buoys. This involves moving forward slightly to make contact and moving away again so contact isn't maintained.

4.7.2.3.2 Approach
The sub will begin this task from a stationary position. It will move forward abruptly and then move back to a small distance from the buoy.

4.7.2.3.3 Test/Verification Plan
Conduct a land test with our test buoy, which ensures the forward thrusters activate when the buoy has yet to make contact with the sub. Ensure the thrusters move in reverse as soon as the sub makes contact with the buoy.

4.7.2.3.4 Outcomes of Task
The sub can successfully bump the buoy.

4.7.3 Test/Verification Plan
Ensure the sub can implement the buoy task as defined in the Milestone 1 Report and by the AUVSI official competition rules.

Ensure all subtasks of this section can work in conjunction with one another. (After subtask 3) After contact has happened, ensure the thrusters return to maintaining close position to the buoy. Ensure the sub prepares to bump the buoy again if it is not green. Ensure the sub stops attempting to bump the buoy once it turns green.

4.7.4 Outcomes of Task
The sub can now complete the buoy task as defined in the Milestone 1 Report and by the AUVSI official competition rules.

4.8 Test Plan

Upon completion of the above tasks, a multitude of test and diagnostics will be performed to assess the cohesion of all systems and components. At this point, all individual units should be working properly, and many have been tested with other units because they were necessary to the operation of the sub. Full runs of the competition course will be done to ensure that all sub abilities are fully functional. These abilities include: depth sensing, movement, color recognition, maneuvering, and identification of certain objects.

4.9 Documentation

Multiple reports will be filled out as part of milestones, along with presentations of those reports. Testing forms will be completed upon testing each task and/or subtask of this project and submitted as a way of keeping track of the testing. In addition to these items, each team meeting will result in the creation of minutes from that meeting, which can be found on the team blog. The team website will have all up-to-date minutes, reports, and deliverables, as well as all other information pertaining to the project.

5. Risk Assessment

5.1 Physical Risks

5.1.1 Transportation of Sub

Risk

Transportation of the sub is where the most damage is likely to occur, since the majority of testing will require transporting the sub to the Morcom Aquatic Center. This is due to the terrain that the transportation cart must be pushed along. If the surface is not completely smooth (i.e. pavement) then it causes a large amount of vibrations, which cause the entire cart, sub included, to shake vigorously. It is this type of movement that could result in loosening of parts and cause parts of the sub to fall off and/or break.

Solution

Move the cart slowly and in a careful manner, so as to limit the amount of severe vibrations. When transporting the sub via automobile, drive safely and cautiously. Potentially look into shock-absorbing wheels if the vibrations become a large issue.

5.1.2 Waterproof seal

Risk

At any point the waterproof seal surrounding the sub could wear to the point of becoming no longer effective. If this is not addressed before submerging the sub in the water, it could lead to the destruction of the electronics enclosed within the sub.

Solution

Be vigilant about checking the waterproofness of the seal. Check the functionality of the seal prior to testing the sub with the electronics inside. If the seal is no longer waterproof, this quick test would make the team aware of the faulty seal and would not risk damaging the electronics.

5.1.3 Plexiglas lid

Risk

There are currently small cracks in the Plexiglas lid of the sub, which could be exacerbated with increased depth and pressure. As the team only has access to a 17 ft deep pool and the competition pool is 38 ft deep, it will not be known until competition time if the increased depth will increase the pressure enough to cause the small cracks to weaken. If the cracks weaken enough, it could result in large cracks that allow water into the sub, thereby no longer making it waterproof. In order to have a good enough seal around the lid, the bolts must be incredibly tight. Tightening the bolts too much could also result in the small cracks becoming larger.

Solution

Be very careful when tightening the bolts on the lid and do not tighten them past the appropriate point. Additionally, keep a close watch on the small cracks in the lid to ensure that they do not become large enough that they would be susceptible to breaking under a large pressure increase.

5.1.4 Error in system while in motion

Risk

An error could result in the navigation system while testing in the pool, and this could result in the sub suddenly changing direction and colliding with a pool wall and/or other obstacle.

Solution

Have at least one team member in the water with the sub at all times, along with a functioning kill switch that can be accessed at any time to completely stop the sub.

5.1.5 Lighting under water

Risk

The TRANSDEC pool is made to mimic ocean conditions with low visibility. At greater depths visibility could become even worse. This would result in the sub being unable to navigate properly or complete tasks in the course.

Solution

Attach a small light to the camera (pointing in the same direction as the camera) which would always supply the same amount of light to what the camera is reading. This would increase visibility and make the readings of the camera more reliable.

5.1.6 Burnout of components

Risk

Any any point the thrusters and/or electric boards could burn out due to overuse or overheating. This could cause them to become unusable.

Solution

Ensure that the sub is not overheating and all wiring is properly done. If such a burnout does occur, the team shall be prepared to quickly order a replacement part.

5.1.7 Universal battery life

Risk

The output connection is slightly damaged and any sudden movement could sever the connection, resulting in a loss of power to the sub. The current life of a full charge is very limited, which decreases the amount of time of a testing session.

Solution

Order another rechargeable battery that can hold a charge longer. The current one can be used as a back up should something happen to the new battery. This new battery will allow for more reliable testing and functioning of the sub.

5.2 Timeline and Requirement Risks

5.2.1 Delays

Risk

Relying on an outdoor University facility to test the sub could result in delays due to weather or scheduling conflicts because of University-sponsored events being hosted at the pool. This could potentially delay testing of the sub which could delay the entire project.

Solution

Be aware of prior reservations at the pool and schedule testing around those dates. Also, identify more than one day/time of possible testing so if there is a delay due to weather, the alternative day/time can be used without a significant delay.

5.2.2 Official Rules Publication

Risk

The official RoboSub competition rules for the upcoming competition will not be released until sometime during the spring semester. This could result in significant changes needing to be made to the sub and the abilities it must have in order to compete.

Solution

Make the sub capabilities generic enough that they can be easily adapted to fit possible changes in the competition rules.

6. Qualification and Responsibilities of Project Team

6.1 Overall Expertise of Team

This year's RoboSub team is made up entirely of computer and electrical engineering students who have a solid background in various programming languages and technical knowledge. The vast majority of the tasks the team is wishing to accomplish this year are either electrical or programming-based, thus the skill set that the team collectively shares will prove to be more than adequate to succeed on this project.

6.2 Task Assignments

Table 1: Task Assignments

Task Number	Task Name	Engineer	Skills
Task 2	Get Depth Sensor	Bjorn	Electrical systems
Task 2 Subtask 1	Reinstall Parts	Bjorn	Electrical systems
Task 2 Subtask 2	Computer Interface	Kevin, Dennis	Computer Programming
Task 2 Subtask 3	Check Thrusters	Elliot	Computer Programming
Task 2 Subtask 3	Check Measurements	Dennis, Elliot	Computer Programming
Task 2 Subtask 4	Yaw	Dennis	Computer Programming
Task 2 Subtask 4	Pitch	Elliot	Computer Programming
Task 2 Subtask 4	X/Y/Z Coordination	Kevin	Computer Programming
Task 2 Subtask 4	Thruster Adjustments	Sam	Computer Programming
Task 3 Subtask 1	Repair Gate	Bjorn	Electrical systems
Task 3 Subtask 2	Path Construction	Bjorn	Electrical systems
Task 3 Subtask 3	Maneuverability Construction	Bjorn	Electrical systems
Task 3 Subtask 4	Buoy Construction	Bjorn	Electrical systems
Task 4	Color Recognition	Dennis	Computer Programming
Task 5 Subtask 1	Recognize Orange Path	Sam	Computer Programming
Task 5 Subtask 2	Path Alignment	Kevin	Computer Programming
Task 5 Subtask 3	Path Traversal	Kevin	Computer Programming
Task 5 Subtask 4	Debugging	All	Computer Programming, Electrical systems
Task 6	Debugging	All	Computer Programming, Electrical systems
Task 6 Subtask 1	Identify Vertical Red PVC	Dennis	Computer Programming
Task 6 Subtask 2	Identify Horizontal Green PVC	Sam	Computer Programming
Task 6 Subtask 3	Orientation	Kevin	Computer Programming
Task 6 Subtask 4	Circular Movement	Elliot	Computer Programming
Task 7	Debugging	All	Computer Programming, Electrical systems
Task 7 Subtask 1	Move to objects	Elliot, Kevin	Computer Programming
Task 7 Subtask 2	Identify Changing Object Color	Dennis	Computer Programming
Task 7 Subtask 3	Bumping	Sam, Dennis	Computer Programming

6.3 Team Member Qualifications

Team member resumes are located in the Appendix of this report.

Dennis Boyd

Dennis is a Florida State University senior seeking a degree in Computer Engineering. He is an experienced programmer, having begun Java programming in high school. He has completed related classes, such as AP Computer Science, Programming I, Unix, Object-Oriented Programming, Discrete Math, Computational Intelligence, and Microcontrollers.

Dennis is responsible for primary programming and overseeing all other programming that occurs. He will be responsible for helping all other programmers in the completion of their assigned tasks. He also makes final decisions (in the event of a voting tie) as to the design approach of the programming and its hierarchy.

Bjorn Campbell

Bjorn is an electrical engineering major at Florida State University. The following classes qualify him as the electrical systems specialist: Power Electronics EEE 5317, Fundamentals of Power Systems EEL 3216, Electromagnetic Fields II EEL 3473, Solid State Electronic Devices EEE 3451. Previous courses completed include: EEE 3300, EEL 3216, EEL 3472, EEL 4746. Other experiences include an internship at Newport News Shipbuilding. This internship involved working with the power distribution of the Virginia class submarine. He is also managed the budget of the FAMU/FSU IEEE Student Branch and is currently the IEEE Student Chair.

He is responsible for monetary allocation and management and will also research and purchase any required parts. Pertaining to the design, he will be responsible for power distribution inside the sub and ensuring proper heat dissipation, in addition to performing necessary circuit design, wiring, and positioning of components.

Samantha Cherbonneau

Samantha is seeking a Bachelor of Science degree with a major in computer engineering. She is an active member of Phi Mu Fraternity and has held multiple leaderships positions within the organization. This past summer she completed a software engineering internship with Harris Corporation working on the GOES-R system that was commissioned by NOAA. During her internship she also served as the team leader for a group working on a Microelectronics IRAD and presented their work to a board of executives. She is most comfortable programming in C, C++, assembly, and Python. Completed courses that qualify her to work on this project are as follows: Intro to C++ Programming, Object-Oriented Programming, Intro to Unix, Data Structures, Digital Logic Design, Microprocessors, Intro to FPLDs, and Electronics.

As secretary, she is in charge of taking group minutes during meetings and posting them to the group blog/website. Additionally, she will formalize and finalize all documents and their formatting. Her secondary role is to develop and maintain the website and all things related to the website and blog. She is also responsible for designing and coding the assigned sub module(s) and providing feedback to other group programmers during the code reviews.

Kevin Matungwa

As a computer engineering major, Kevin is fascinated by the entire automation industry along with the heavy programming. His programming experience has been mostly through academic learning and assisting others. He is more comfortable programming in C and C++ as he has taken the following classes: COP3014, COP3330, COP4530 and EEL4746.Putting together all the knowledge that he has acquired through the mentioned classes, he does qualify to take on a programming role in this team. As a programmer, testing goes hand in hand with programming and so he is also excited to be the lead tester of the team.

In the absence of the team leader, he will assume team leader responsibilities. He is also responsible for designing and coding the assigned sub module(s) and providing feedback to other group programmers during the code reviews. Kevin will also be responsible in overseeing testing.

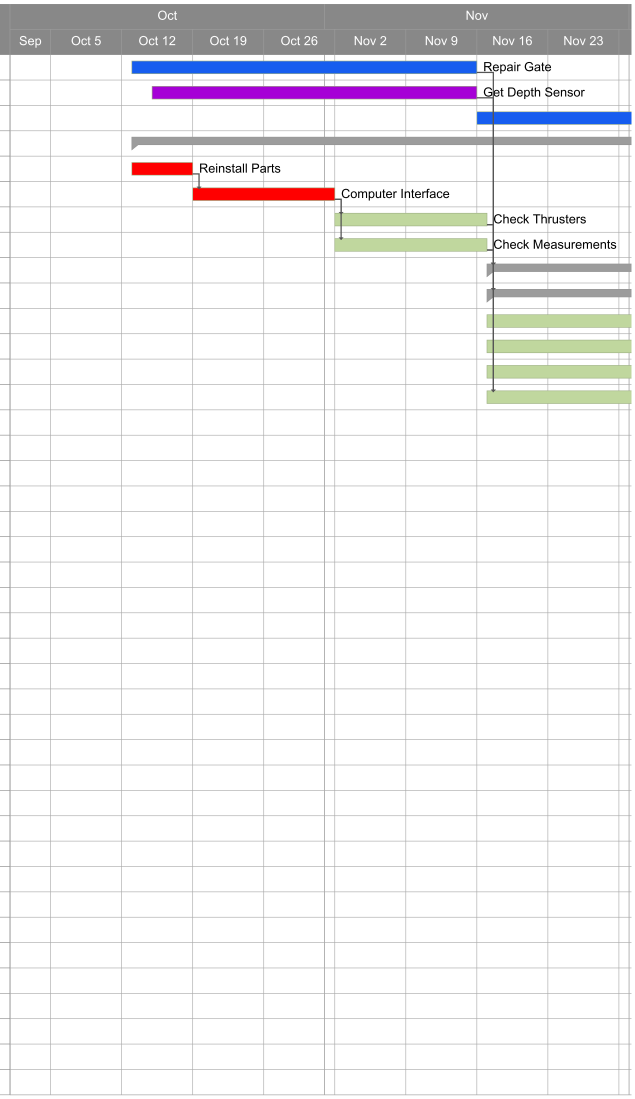
Elliot Mudrick

Elliot comes to the team with leadership experience as a FSU Student Senator representing the College of Engineering in spring and fall of 2012, as well as currently holding the Vice President position in the FSU IEEE student chapter. He also will act as a subordinate programmer for the team by putting his course knowledge from Introduction to C++, Object Oriented C++ Programming, Data Structures, Digital Logic Design, and Microprocessor Based System Design. He hopes to utilize his two years of expertise as a math tutor to hone his holistic fundamental mathematical understanding and direct it toward efficient solutions in coding the RoboSub.

As team leader, he is responsible for the general coordination of the team, specifically development of deadlines and the project timeline. Elliot will also oversee team meetings, both internal and with advisors. Additionally, he is responsible for assigned programming tasks and assisting in general programming.

7. Schedule

	Task Name	Start	Finish
1	Repair Gate	10/13/14	11/15/14
2	Get Depth Sensor	10/15/14	11/15/14
3	Path Construction	11/16/14	12/06/14
4	Familiarization	10/13/14	12/05/14
5	Reinstall Parts	10/13/14	10/18/14
6	Computer Interface	10/19/14	11/01/14
7	Check Thrusters	11/02/14	11/16/14
8	Check Measurements	11/02/14	11/16/14
9	Test Gate Movement	11/17/14	12/05/14
10	Measurement adjustments	11/17/14	12/05/14
11	Yaw	11/17/14	12/05/14
12	Pitch	11/17/14	12/05/14
13	X/Y/Z Coordination	11/17/14	12/05/14
14	Thruster Adjustments	11/17/14	12/05/14
15	Milestone: Caught up	12/06/14	12/06/14
16	Maneuverability Construction	01/07/15	02/08/15
17	Line Following	01/07/15	02/08/15
18	Color Recognition	01/07/15	01/24/15
19	Recognize Orange Path	01/07/15	01/24/15
20	Path Alignment	01/07/15	01/24/15
21	Path Traversal	01/07/15	01/24/15
22	Water Testing	01/25/15	02/08/15
23	Debugging	01/25/15	02/08/15
24	Milestone: Line Following	02/09/15	02/09/15
25	Buoy Construction	02/08/15	03/22/15
26	Maneuverability Task	02/09/15	03/22/15
27	Identify Vertical Red PVC	02/09/15	03/01/15
28	Identify Horizontal Green PVC	02/09/15	03/01/15
29	Orientation	02/09/15	03/01/15
30	Circular Movement	02/09/15	03/01/15
31	Water Testing	03/02/15	03/22/15
32	Debugging	03/02/15	03/22/15
33	Milestone: Maneuverability	03/23/15	03/23/15
34	Buoy Task	03/24/15	04/24/15
35	Move to objects	03/24/15	04/10/15
36	Identify Changing Object Color	03/24/15	04/10/15
37	Bumping	03/24/15	04/10/15
38	Water Testing	04/11/15	04/24/15
39	Debugging	04/11/15	04/24/15
40	Milestone: Buoy Task	04/25/15	04/25/15
41	FINISHED	05/09/15	05/09/15



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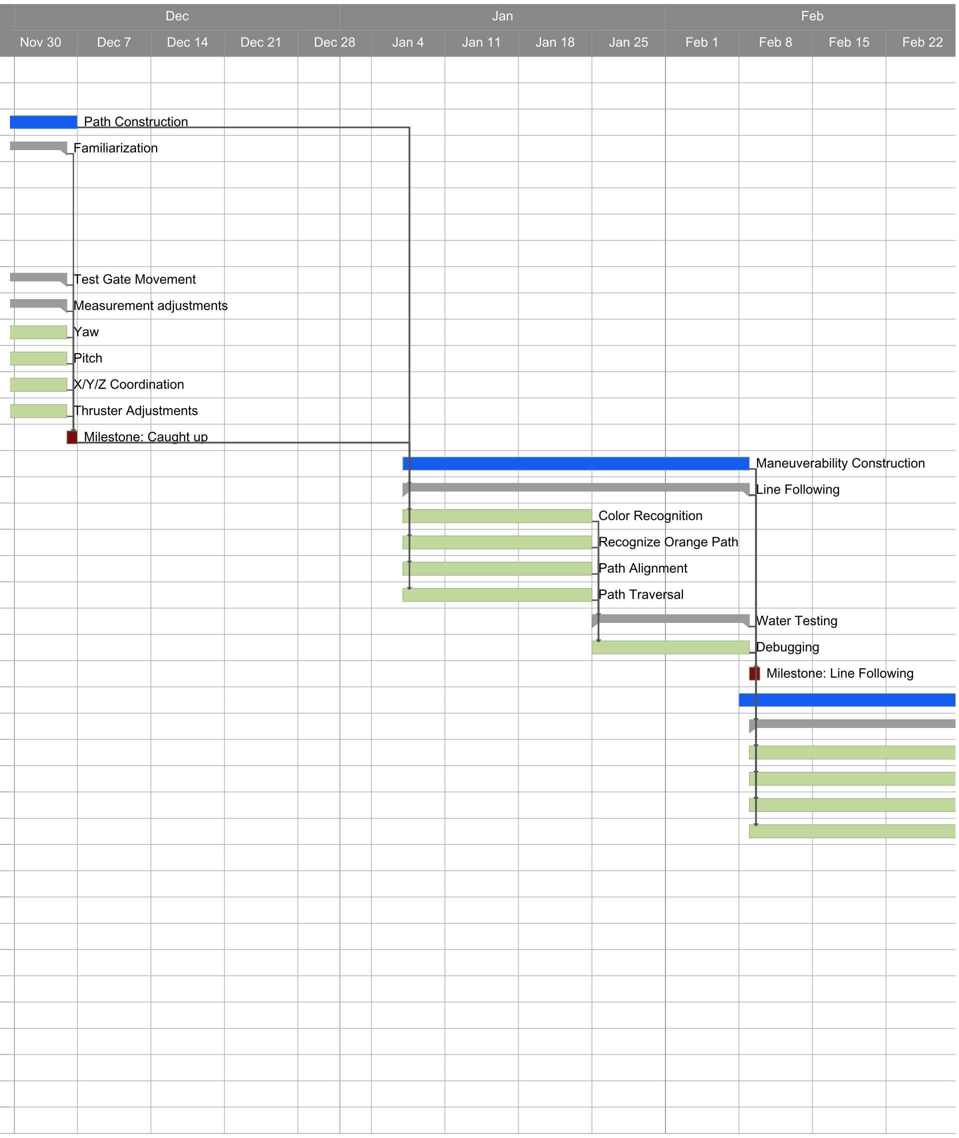

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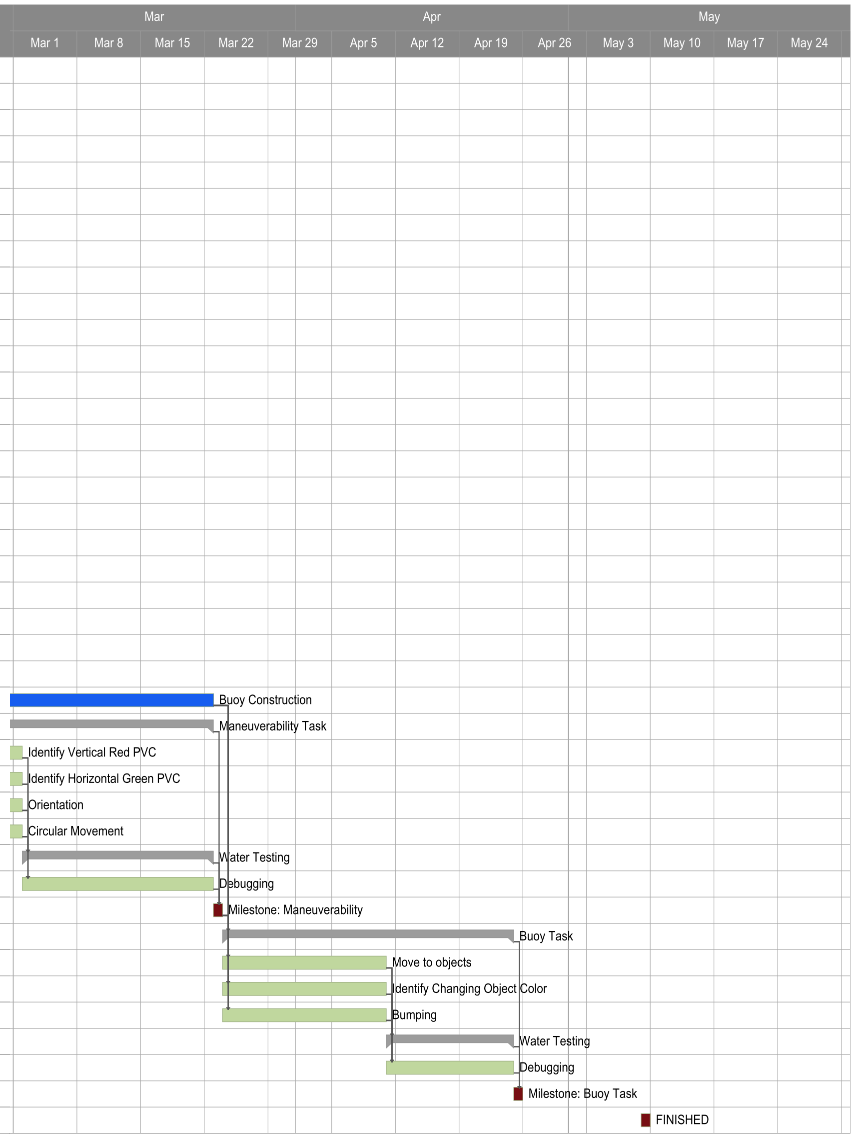

8. Budget Estimate

Table 2: Estimated Personnel Budget

A. Personnel	Total Hours	Hourly Wage	Total Pay
Elliot Mudrick	360	$30.00	$10,800.00
Dennis Boyde	360	$30.00	$10,800.00
Smantha Cherbonneau	360	$30.00	$10,800.00
Kevin Matungwa	360	$30.00	$10,800.00
Bjorn Campbell	360	$30.00	$10,800.00
		Wage Subtotal	$54,000.00
B. Fringe Benefits			$13,500.00
C. Total Personnel Cost			$67,500.00

Table 3: Estimated Expense Budget

D. Expense	Purpose	Vender	Qty	Price	Total
3” Diameter x 10’ Long PVC	Center Horizontal PVC Pipe, Vertical PVC Pipes for Gate	Home Depot	2	$14.68	$29.36
90 Degree Elbows 3” PVC	Connectors for the Gate	Home Depot	2	$2.38	$4.76
R/O Specialty Camo Black Sray Paint	Color white PVC black	Home Depot	1	$3.76	$3.76
Blaze Orange Duck Tape	Vertical color of vertical PVC pipes	Home Depot	1	$3.37	$3.37
1”x6” – 8 FT Weather Shield Wood	Path Lines	Home Depot	2	$5.37	$10.74
Blaze Orange Duck Tape	Vertical color of vertical PVC pipes	Home Depot	1	$3.37	$3.37
Weight Set	Needed to moor structures	Walmart	1	$29.00	$29.00
Hallow Braid Poly Rope (1/4” x50’)	Needed for mooring lines	Home Depot	1	$5.60	$5.60
2” Diameter by 6’ Long PVC	Maneuvering parts, Horizontal and Vertical	Home Depot	2	$8.22	$16.44
90 Degree Elbows 2” PVC	Connectors for the Maneuvering Platform	Home Depot	2	$0.83	$1.66
2” Clean Out Tee PVC	Connect center PVC of Maneuvering Platform	Home Depot	1	$3.26	$3.26

Carriage Bolt (¼" X 3-1/2")	Possible to need if Gate test fails	Home Depot	4	$0.78	$3.12
1/4" Nut	Possible to need if Gate test fails	Home Depot	4	$0.14	$0.56
PVC Glue	Need to seal maneuvering structure to become buoyant	Home Depot	1	$4.87	$4.87
2" PVC Caps	Seal vertical	Home	2	$1.64	$3.28
Polycarbonate 10" globe (Smooth)	Buoys	Lighiting Louvers, Lenses, & Globes	2	$37.50	$75.00
Acrylic 6" Cylinder	RGB Buoy	Lighiting Louvers, Lenses, & Globes	2	$4.95	$9.90
Bread Board	Structure for LEDs	Ebay	1	$4.19	$4.19
LEDs Red, Green Blue	LEDs for RGB Buoy	superbrightleds.com	21	$0.59	$12.39
16/19 V Ah LI-Ion Universal External Battery	Old Battery output damaged, battery life is limited, two batteries increases testing durations.	AA Portable Power Corp	1	$62.48	$62.48
Depth Sensor	Required for sub, max budget $300		1		$300.00
Plane tickets	Necessary to compete	TBD	3	$250.00	$750.00
Sub Transportation	Necessary to compete	TBD	1	$150.00	$150.00
Car Rental	Necessary to compete	TBD	6	$75.00	$450.00
				Expenses Subtotal (including tax)	$2,110.00
E. Total Direct Costs (C+D)					$69,610.00
F. Overhead Costs (45% of E)					$31,324.50
G. Total OCO					$100,934.50

9. Deliverables

The following sub-sections list the various deliverables and the form that they will be in. Note that for sections 9.3 and 9.4, only the Fall 2014 semester deliverables are listed as we have not yet begun the Spring portion of the Senior Design course.

9.1 RoboSub Competition

- The competition-ready AUV by summer 2015.
- Introduction paper for competition
- Compete in San Diego, CA in summer 2015.

9.2 Weekly

- Meeting minutes posted to the blog
- Individual team member journals

9.3 Reports

- Code of Conduct
- Milestone 1: Needs Analysis and Requirement Specifications
- Milestone 2: Project Proposal and Statement of Work
- Milestone 3: System-Level Design Review
- Team Evaluations
- Spring 2015 Reports

9.4 Presentations

- Milestone 1: Needs Analysis and Requirement Specifications
- Milestone 2: Project Proposal and Statement of Work
- Milestone 3: System-Level Design Review

10. References

Appendix

The following pages contain the resumes of each team member in alphabetical order.

Dennis Boyd

4616 Janet Road, Cocoa, FL 32926
Phone: (321) 806-9299 E-Mail: dcb11c@my.fsu.edu

Objective

To obtain a career in Software or Computer Engineering.

Education

Florida State University, Tallahassee, Florida

Bachelor of Science in Computer Engineering, expected graduation May 2015.

GPA: 3.8

Relevant Course Experience

Florida State University **August 2011 - Ongoing**

- Calculus I-III, Linear Algebraic Structures, Ordinary Differential Equations, Discrete Math I, Signals and Systems, Digital Communications, Object-Oriented Programming, Intro to UNIX, Data Structures, Computational Intelligence.
- Circuits I, Advanced Circuits, Digital Design Logic, Electronics I, Microprocessor-based System Design; all with lab.
- Currently enrolled in: FPLDs, Computer Architecture, Photovoltaics, Senior Design I.
- Experienced with C/C++, Unix, MATLAB, and Java.

Volunteer Experience

Central Brevard Humane Society Volunteer **September 2005 – May 2011**

- Assisted in a plethora of off-site events, mostly working with animals. Helped in set-up, running booths, feeding animals, and adopting of pets, as well as whatever else was needed. Some examples include running a booth at The Cocoa Craft Fair each year, Paws at the Peer, and Paws in the Park.

Leadership Experience

Edgewood Jr/Sr High

- President and co-founder of Guitar Club: scheduled meetings and tutored guitarists of all skills.
- President of Mu Alpha Theta, Math Honors Society: led meetings and tutored students in mathematics.

Honors

- FSU Honors Program.
- Phi Eta Sigma.
- President’s List.

Bjorn Campbell

bec12@my.fsu.edu ♦ 941-757-7846
2855 Apalachee Parkway, Apt 264 Tallahassee, Florida 32301

OBJECTIVE: Obtain an internship with Southern Company, to utilize a background in Electrical Engineering along with strong leadership, analytical, and problem-solving skills to deliver value and measurable results.

EDUCATION:

Florida State University, Tallahassee, Florida
Bachelor of Science in Electrical Engineering, **May 2015**
Minor: Physics
GPA: 3.63

Tallahassee Community College, Tallahassee, Florida
Associates of Arts, General Studies, **May 2012**
GPA: 3.87

RELEVANT COURSES:

Electro. Fields I	Stat. Topics in EE	Digital Com.
Electronic	Sig. & Lin. Syst.	Microprocessors
Circuit Analysis I-II	Digital Logic Design	Modern Physics
Thermodynamics	Engineering Mechanics	Linear Algebra
Physics I-II	Differential Equations	Calc w/Analytic Geometry I-III

TECHNICAL / COMPUTER SKILLS:
Proficient in MATLAB, Multism, Elvis II, and Microsoft Office (PowerPoint, Word, Excel

RELATED LEADERSHIP EXPERIENCE:
Institute of Electrical and Electronics Engineers **Chair** **May 2014– Present**
- **Vice Chair** **August 2013 - May 2014**
- Attended an IEEE Leadership Conference
- Planned and organized a group IEEE trip to a Plant Farley
- Organized the planning of all IEEE meetings before semester started
- Helped design, order, and price IEEE T-shirts,
- Manage a budget to optimize the amount of group activities planned and create a fun experience for members

INTERNSHIP:
Newport News Shipbuiding, *Newport News, Virginia* **May to August 2014**
- Wrote work instructions for electrical components construction
- Worked with the systems that provide power to the Nuclear Reactor for Virginia Class Submarines
- Completed Shipyard Operations Course

EXPERIENCE:
Fed-Ex, *Palmetto, Florida* ***Pre Loader*** June 2010 – Aug. 2011
- Recognized for providing the Purple Promise, for performing above and beyond what was required, and providing excellent customer service
- Organized and loaded 450-800 outgoing packages, achieving 100% scanning ratings
- Perfected time and stress management while effectively multi-tasking

Kenneth Cole, *Ellenton, Florida* ***Sales Manager*** Nov. 2008 – Sept. 2009
- Managed a team of four, directing and supervising their duties
- Maintained productive sales through effective strategy and valuing each customer's preferences
- Increased Value to Kenneth Cole team by taking initiative and handling unpredicted issues in a timely manner

Samantha Cherbonneau

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Education

Florida State University, *Tallahassee, FL* — **January 2012 - Present**
Bachelor of Science in Computer Engineering
Minors in Mathematics, Computer Science, Physics
GPA: 3.48

George Washington University, *Washington DC* — **August 2011 – December 2011**
Bachelor of Science in Biomedical Engineering
GPA: 3.60

Experience

Software Engineering Intern — **May 2014 – August 2014**
Harris Corporation
- Completed a Python script that builds a list of confirmed machine IDs by reading in hostnames and checking various credentials.
- Compile filters and views from a primary WAPPI GUI based on the XML file, reformat the information, and create a new XML file to send to the secondary GUI that syncs the two GUIs.
- Create a Python script that takes the rules files from one environment, and syncs it with all other environments and servers, performs a syntax check, and then sends a confirmation signal to all hosts.
- Team lead for group intern project on MicroAssembly IRAD dealing with assembling microelectronics in vacuum chamber.

Basic Robot Project — **September 2011 – November 2011**
George Washington University
- Worked as team leader to construct a small, motorized robot and write a program to have it move along a path based solely on sensor readings, turn around at end of path, and return to the starting position.
- Used Interactive C++ for coding the program, and various sensors and motors to create the body of the robot.

Various Computer & Electrical Based Projects — **January 2013 – Present**
Florida State University
- Used VHDL to create a basic goldfish game using the Altera DE2 prototyping board (Spring 2013).
- Used C and HCS12 assembly language to develop a program that properly interfaces with hardware to create a simulation of an electronic lock, using a motor as the lock.
- Multiple projects in C++ courses, including the use of object-oriented programming.

Leadership

Lead Computer Analyst & Strategic Recruitment Director — **January 2014 – August 2014**
Phi Mu Fraternity
- Operate multiple computer programs pertaining to Phi Mu's recruitment at FSU.
- Establish and maintain efficient and productive procedures for operating recruitment.
- Manage and train a team of ten women to effectively execute strategic aspects of recruitment.

Dance Marathon Chapter Representative — **February 2013 – April 2014**
Phi Mu Fraternity & Dance Marathon FSU
- Organize Phi Mu's participation in Dance Marathon by coordinating dancers, volunteers, and fundraisers within the chapter.
- Attend weekly meetings and effectively communicate event and fundraising details.
- Design ways to boost morale within the chapter and encourage participation through inspiration.

Lead Computer Analyst & Reference Chair — **January 2013 – September 2013**
Phi Mu Fraternity
- Implement and manage a new computer program for Phi Mu's recruitment at FSU.
- Develop time-saving and beneficial procedures and methods to utilize throughout recruitment.
- Receive and organize references from alumnae.
- Member of the Membership Selection Board and helped lead the member selection process.

Honors & Awards

FSU Honors Program — Spring 2012 - Present
FSU & GWU Dean's List — Fall 2011, Spring 2012, Fall 2012, Spring 2013, Spring 2014

Activities & Organizations

Phi Mu Fraternity, *Member* — August 2012 – Present
FSU Honors Student Association, *Member* — January 2012 - Present
Society of Women Engineers, *Member* — September 2011 – Fall 2013

Service & Volunteer Work

Dance Marathon FSU *Dancer*	March 2013, March 2014
Phi Mu's Bonnamu benefitting CMN *Volunteer*	April 2013, April 2014
Phi Mu Holiday Toy Drive for Boys & Girls Club *Creator and Coordinator*	December 2012
Light the Night Walk – Leukemia & Lymphoma Society *Participant*	November 2012
Brehon Institute *Volunteer*	November 2012
Brunswick Youth Lacrosse *Head Coach*	February 2010 – June 2010, February 2011 – June 2011

Skills

Programming Languages: C, C++, VHDL, HCS12 Assembly, Python
Theoretical Knowledge: circuits, digital logic design, basic signals and systems
Experimental Knowledge: circuits, micro-controllers, and various programmable logic devices

Elliot Michael Mudrick

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Tallahassee, FL 32304
561-628-0020
emm10k@my.fsu.edu

Education

May 2015 (Expected)

Florida State University, Tallahassee, FL
Bachelors of Science in Computer and Electrical Engineering
GPA 3.414

Relevant Courses

Discrete Math	Microprocessor Based System Design
Calculus I, II, III	Field Programmable Logic Devices
Ordinary Differential Equations	Introduction to C++
Digital Logic Design	Object Oriented C++ Programming
Electronics I	Data Structures
Senior Design	Computer Architecture

Experience

Florida State University, Tallahassee, FL — Fall 2014 – Present
Project Manager, RoboSub Team (AUVSI Competition)

- Creates and maintains schedule for project tasks and milestones
- Develops and implements code assigned by lead programmer
- Schedules and coordinates team meetings
- Facilitates team cohesion through diplomatic problem solving

Florida State University, Tallahassee, FL — Spring 2013 – Present
Math Tutor at the Academic Center for Excellence (ACE) Learning Studio

- Tutors students in College Algebra, Trigonometry, Pre-Calculus, Business Calculus, and Calculus with Analytical Geometry I, II, and III
- Acquaints students with available resources to help reinforce understanding of course material
- Facilitates learning by encouraging good study habits and practice

Florida State University, Tallahassee, FL — Fall 2014 – Present
Vice President of IEEE Student Chapter

- Coordinates and conducts general body meetings for the FAMU-FSU College of Engineering's IEEE student chapter
- Assists in acquisition and distribution of electronics kits for the Electronics I lab, which the chapter provides at reduced cost
- Involves and introduces underclassmen to IEEE

Honors/Activities

Dean's List — Fall 2010 – Spring 2011, Fall 2012
IEEE Student Chapter Project Manager — Fall 2013 – Spring 2014

Skills

Proficient in object oriented C++, VHDL, MIPS, and HCS12 assembly language
Lab experience with oscilloscopes, voltmeters, and ammeters
Familiar with Microsoft Word, Excel, and PowerPoint

Kevin Matungwa

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(850)-225-9098 | matungwakev@gmail.com

OBJECTIVE

To build a career in a high performance organization automating systems by developing and supporting firmware for embedded devices.

EDUCATION

Florida State University Tallahassee, Florida
Bachelors of Science, Computer Engineering *(May 2015)*
GPA: 3.637

RELEVANT SKILLS

- Programming in C, C++, VHDL and Assembly

RELEVANT COURSEWORK

- Microprocessors
- Electronics
- Digital Logics
- Computer Architecture
- Data Structures
- FPLD

EXPERIENCE

Software Development Life Cycle (SDLC) Project Lead Internship, **TOPTECH SYSTEMS** *(May 2014 –Aug 2014)*
Longwood, FL. USA

- Proposed a robust SDLC solution that complied with TOPTECH HPO standards
- Coordinated Project Managers, Dev Managers, Dev team and QA team in evaluating prospect solutions
- Studied departmental applied methodologies : Waterfall & Agile
- Fabricated the SDLC solution philosophy and proposed a feasible execution plan
- Projected the expected progressive impact in delivering quality software
- Projected the expected financial savings driven by the proposed solution
- Trained to delivering a fully primed Terminal Automation Systems for gasoline, light oil, chemicals, fertilizer, and asphalt sites
- Contributed to the initial design of TOPTECH's next generation core hardware system: MULTILOAD 3
- Shadowed firmware engineers during development and code review for the MULTILOAD 2 product

Satellite Operation Control Technician, **WFSU-TV** *(July 2012- present)* Tallahassee, FL. USA

- Manage video server and air multiple Florida Channel shows for 3rd party
- Uplink Florida Lottery to the Satellite
- Authorize satellite access and control traffic
- Cross pole checks and appropriate modulation
- Monitor the Florida Channel video and audio quality
- Manage Florida Channel daily backup server and immediate routing

Computer lab Technician, **TALLAHASSEE COMMUNITY COLLEGE** *(August 2010-present)*
Tallahassee, FL. USA

- Provide assistance to students on Microsoft Office Suite and computer projects
- Aid students with C++ programming projects
- Diagnosis on defective machines
- Manage the department's print queue server
- Inform the students on software availability

INVOLVEMENT

- IEEE
- MEDLife
- Eta Kappa Nu
- Tau beta Pi