Maritime Vessel Alert System

Executive Summary

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I. Design Problem

Bilge pumps are designed to pump out excess water accumulated in the bottom of a boat, otherwise known as the bilge. When excessive volumes of water are detected, bilge pumps often have an embedded alarm system to alert the crew of a possible leak. On-board alarm systems can also indicate a failure of the pump itself, which can occur due to many environmental factors depending on the type of pump. Although bilge pumps can become critical life-saving equipment when a crew is underway, they also play a large role in preventing a boat from sinking at the dock. When left unattended, boats remain subjected to many of the same environmental stresses and equipment failures that would lead it to sink while underway.

II. Team Approach

To solve this problem, we developed a Maritime Vessel Alert System (MVAS) capable of sending an SMS text message to notify a boat owner as soon as high water levels are detected in the bilge. This long-range alert system is much more desirable than an on-board buzzer, as a localized alarm is only effective when a crew is present. We have teamed up with the Hatfield Marine Science Center to develop an alert response system capable of the following:

- Isolated system running on battery power
- Water-level detection capabilities
- Real-time reliable SMS notifications

The system will use a water detection sensor that will be mounted in a small enclosure and placed in the bilge of a boat. When submerged with water, it will send a signal to a microcontroller, where the system will determine the duration of the submersion. Due to the natural rocking of the boat, uninterrupted submersion of the sensor may not occur until much later. For this reason, the system must have a way to determine the difference between a real flood and a false alarm. This will be accomplished through timers and counters on the microcontroller. Once a significant amount of water has been detected in the bilge, an SMS alert will notify the user of a bilge pump failure. This early warning system allows boat owners a chance to save their boat from sinking before it becomes too late.

We began by meeting with our project partners to get a good understanding of what they had in mind for this project. We made a list of their preferences and requirements, and used this to draft our list of engineering requirements that we would use for designing the actual product. We had a secondary meeting with the project partners in which we reviewed these engineering requirements to make sure they were adequate and complete. Throughout the entire project, we sent periodic updates to the project partners, and met with them about twice a month, to keep them updated on our progress and address any issues that arose.

Our next step was to draft a block diagram for a system that would accomplish these tasks, which helped us identify which key parts would be necessary and important for the final device. After several revisions, we arrived at a block diagram that had two blocks for each member of the team.

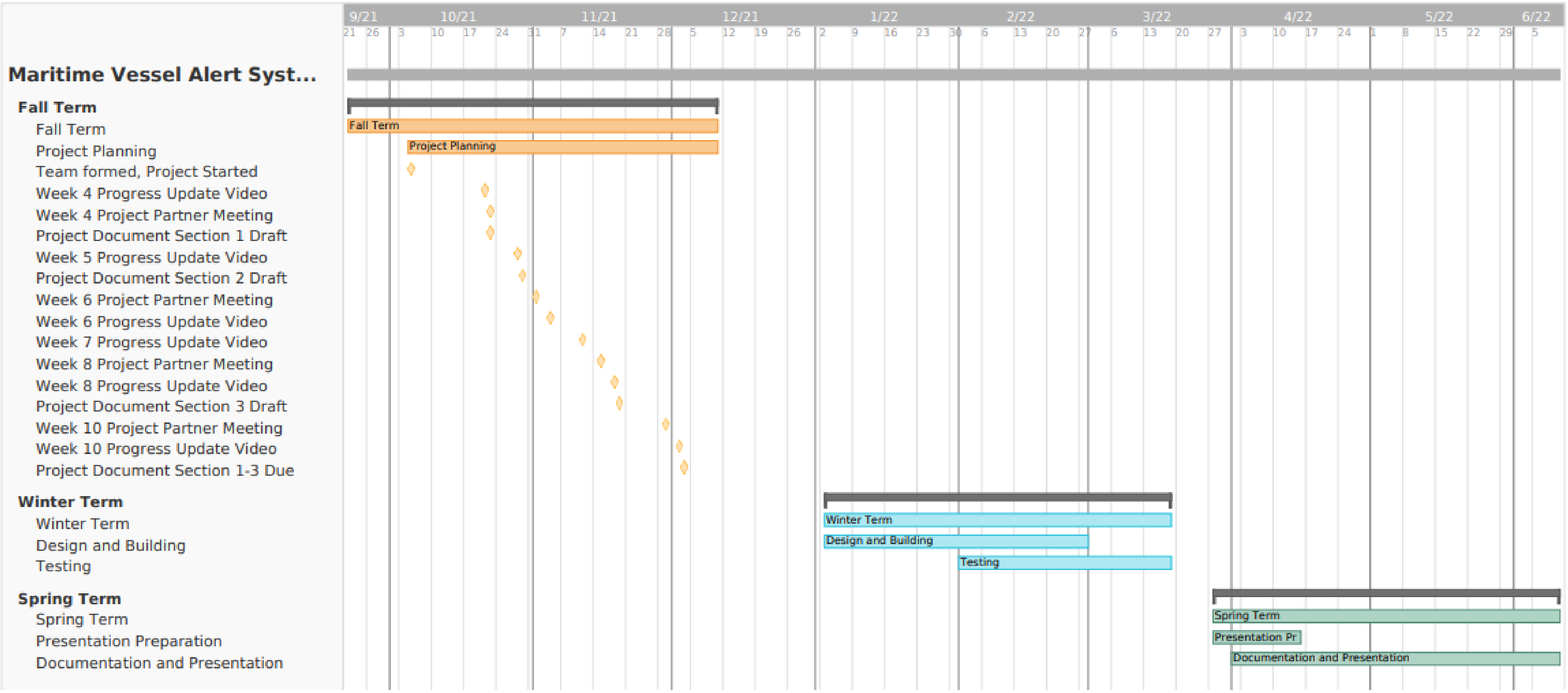
The next step was to define interface properties between blocks. This important step allowed us to work on our individual blocks while ensuring that they would communicate properly with each other. We used many resources, including peer and instructor feedback, to ensure that our interface properties were clear, concise, and thorough.

We then began designing, building, troubleshooting, and revising our blocks, taking care to update the team if changes were required that would affect the interfaces between blocks. Though we each were responsible for our individual blocks, we collaborated extensively throughout this process. Each of the individual blocks went through rigorous testing to ensure that the interface properties would be met under all expected conditions.

We spent a weekend in Newport, Oregon, making good use of the Hatfield Marine Science Center’s Innovation Lab, which is managed by our project partner, Drummond Biles. We used Hatfield’s facilities to build the first integrated prototype of the MVAS, as well as perform some waterproof testing for enclosure prototypes.

Finally, we assembled the device and performed system level verifications to ensure that all the engineering requirements were met.

III. Project Timeline



IV. Key Lessons Learned

- Always budget extra time before deadlines for project partner approval.
- Set up a recurring weekly meeting time. Even if there isn't anything specific to address, hold the meeting to give team members the opportunity to check in, give updates, and ask questions if necessary.
- Use some sort of tool (Excel, Google Sheets, etc.) to track deadlines and progress. Designate one person to update this tool frequently, and keep the tool at least two weeks ahead, preferably four.