ENSC 440 Progress Report

Group 5
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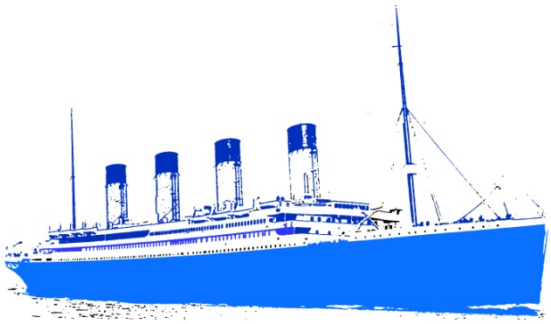

TITANIC

POSITIONING

1. Introduction

Marine vessels are sometimes required to maintain heading and position in situations where anchoring is difficult or impractical. The position of the vessels must be held constant despite exterior forces, such as wind, waves, and tidal pull. A Dynamic Positioning System (DPS) is a control network that uses the ship's thrusters to adjust and maintain the ship's position according to feedback input from the following sensors: GPS, MRU, and Anemometer. The proof-of-concept DPS will be implemented on a 10-meter-long boat on the Fraser River. The DPS will control two outboard stern thrusters and a bow maneuvering thruster to move the boat to the desired position and heading.

2. Scheduling

Table 1shows the milestones outlined in the proposal and current progress. Any milestones that were not achieved on schedule will be explained in section 4: progress and remediation.

Milestones (from proposal)	Planned Due Date	Milestone Achieved date
Prepare Parts list	01/30/2014	01/31/2014
Inspect boat	01/30/2014	01/24/2014
Order Parts	02/15/2014	03/06/2014*
Design and Implement	03/1/2014	In Progress
Integrate and Debug	04/1/2014	In progress

Table 1: Comparison of initial milestones and current progress

* The MRU and GPS were available by the planned date. The embedded computer and Anemometer were ordered later.

The "Design and Implement" milestone included input and output interfacing with each device, programming the PID controller, and programming the display.

3. Finances

Table 2below shows the financial breakdown of the project. Some of the components have been loaned from Think Sensor Research (TSR). TSR financed all other components. The costs for cables, connectors, and use of the boat are approximate.

Component	**Cost ($)**	**Comments**
TSR-100 MRU	8000	Loaned from TSR for project
GPS	500	Loaned from TSR for project
USB to 4-Port Serial	60	Purchased through TSR
Embedded Marine Computer	1500	Purchased through TSR
Vaisala WMT52 Ultrasonic Wind Sensor	1130	Purchased through TSR
Cables, Connectors etc.	500	Approximate
Use of boat (Fuel and Captain's time)	1000	Approximate
Motor Controller for steering Hydraulic motor	220	Purchased through TSR
Linear actuators to attach to throttles	260	Purchased through TSR
Total	**3870 ± 500**	**$500 margin of error**

Table 2: Financial breakdown of project

The total cost for all the equipment as outlined in the table above is $3870 (excluding the cost of loaned components). The total approximate cost of using the boat is $1000. The total costs of project using $500 margin of uncertainty: $4370 - $5370

4. Progress and Remediation

Section 3: Scheduling mentioned that some of the parts were ordered later than the initial plan. We have been using a loaner development board to work on the project until the embedded computer arrives. We also planned to have completed designing and implementation of the project by march 1, which is currently not yet complete.

4.1 Input and output interfacing

The input data from the GPS, MRU, and Anemometer needs to be configured for serial interfacing by accessing and parsing the data into our controller program. The serial interfacing and data parsing is complete for the GPS and MRU. The Anemometer has not arrived yet although it has been ordered and is expected to arrive between March 24th and

26th. The serial interfacing and data parsing can then be implemented for the Anemometer by March 31st.

The output data from the DPS controller needs to be sent to the motor controller. We have access to the motor controller and are currently working on interfacing with it. We expect to have the serial interfacing and the data parsing done by March 31st.

4.2 Controller Programming

The controller is spilt up into the five following sections: PID compensator, wind feedforward system, wave filtering, state estimation, and thruster allocation. The PID compensator, wind feedforward, and thruster allocation sections have been completed. The filter section is currently being programmed and will be integrated into the controller once complete. The state estimator section is not necessary for a DPS-0 proof-of-concept, so we have decided to simplify the project by leaving out the state estimator for the proof-of-concept version, but will be added during the summer to expand the project to a prototype.

The parsed input data from the MRU and GPS is in the process of being integrated with the controller. Since the Anemometer has not arrived the wind feedforward system has been implemented with placeholder values that will be replaced with actual data once the Anemometer data has been parsed.

4.3 Display

A Display interface is currently being coded. The display will show a 2 dimensional boat model on a screen with heading and coordinate information for user feedback. The display requires GPS and MRU data from the rest of the system, which has already been parsed. The Display will be complete by March 31st.

4.4 Testing on the Boat

Once all the components are integrated together the DPS will be taken onto the boat where final testing will be completed. During testing, the experimental values will be adjusted to find the ideal gain values for the thruster allocation, PID control, and wind feedforward.

5. Conclusion

We have successfully extracted data for the MRU and GPS. We are working on interfacing with the motor controller and will start interfacing with the Anemometer when it arrives. We have completed 3 sections of the controller (PID, Wind Feedforward, Thruster Allocation) and are working on completing the filters section of the controller. The state estimator will no longer be included in the project since it is not required for a DPS-0 proof-of-concept. A display is currently in progress and we will be ready for testing on the boat by March31st.