Nautical Autonomous System with Task Integration (NASTI)

Functional Requirements List & Performance Specifications

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Introduction

The Nautical Autonomous System with Task Integration is an autonomous system based around a hovercraft platform. The platform will be designed in such a way that it can autonomously navigate a channel of water buoys. Ultimately, the robotic platform is intended to compete in the AUVSI (Association for Unmanned Vehicle Systems International) Foundation and ONR's(Office of Naval Research) 5th International RoboBoat Competition. This competition is based around the main goal of navigating an unknown path of water buoys, and running through a speed test straightaway. If a vehicle can complete this, then there are sub tasks that can be completed for extra points. This project will focus on completion of the main navigational task.

Functional Description

This autonomous system is comprised of many subsystems being integrated into one functional hovercraft design. Figure 1-1 on the following page outlines these subsystems and how they are interconnected within the overall system.

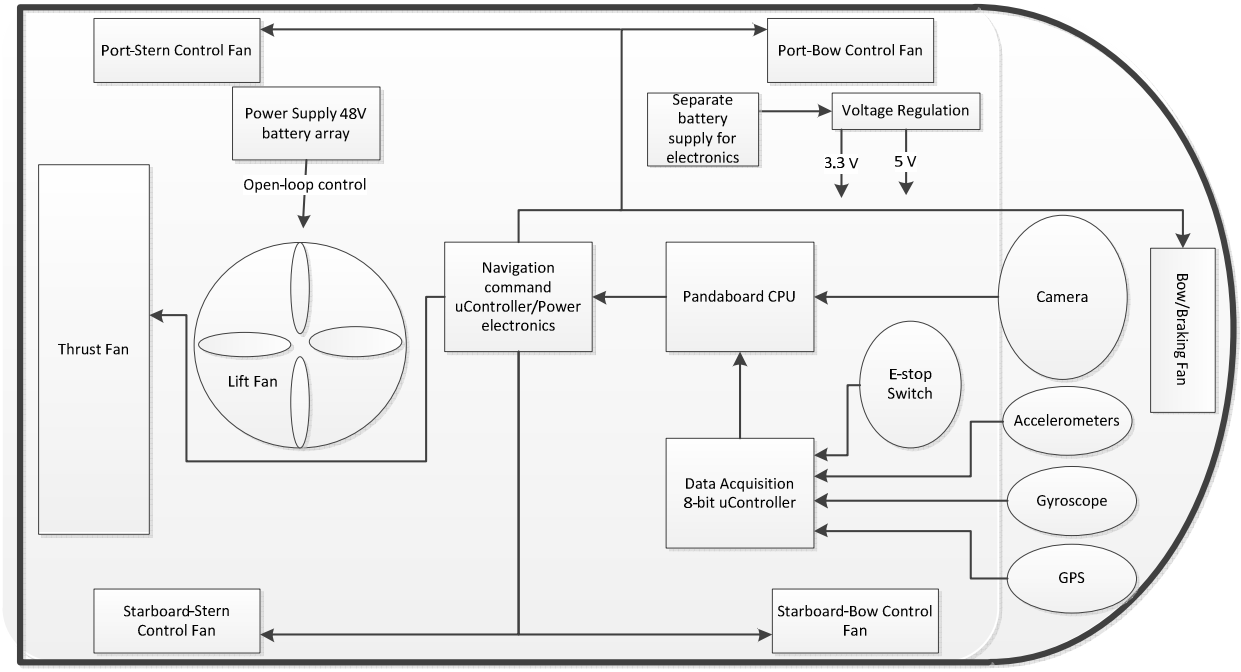

Figure 1–1 – Functional System Diagram

Input/Output

Table 2-1 input/output signals to/from control units

	Inputs	Outputs
Pandaboard	Camera Images	Thrust Control Signal
	Inertial data	
	Wireless Communication	Wireless Communication
Data Acquisition uController	Accelerometers(2+)	Inertial Data
	Gyroscope	
	GPS	
	E-stop switch	
Thrust uController	Thrust Control Signal	Thrust
		Starboard-Stern Control Fan
		Starboard-Bow Control Fan
		Port-Stern Control Fan
		Port-Bow Control Fan
		Bow/Braking Control Fan

Performance Specifications

This section will list all of the technical requirements and performance specifications

Data Acquisition

- A camera parallel to the surface of the water shall be the main method of collecting data
- An additional camera shall be mounted higher and aimed downward for a bird's eye view
- Gyroscopes and accelerometers shall be used for stability control
- The gyroscope and accelerometer data shall be fed into 8-bit microcontrollers
- The 8-bit microcontrollers and cameras shall be fed into a Pandaboard for further processing
- The Pandaboard shall have an embedded linux installation with OpenCv installed for image processing

Stability

- The inertial data shall be used as the input to a stability control system
- The control system shall utilize a propeller at the rear of the vehicle for thrust and 4 smaller fans (2 on each side) for precision steering

Navigation

- The system shall first locate the horizon of the image
- The system shall then locate the buoys below the horizon of the image
- The system shall then classify the colors of the buoys, and assign distances based on geometry
- The final path shall be planned based on these distances
- The system shall keep the red buoy on the right [1]

Mechanical Characteristics

- The weight shall not exceed 35 lbs
- The maximum speed shall be 10mph
- It shall take a maximum of 10 seconds to accelerate to the final velocity
- There shall be 5 lbs of thrust from the rear propeller

References

[1] *“The Four Elements" 4th International RoboBoat Competition Final Rules*. Arlington, VA: AUVSIfoundation. PDF.