FRED Navigation & Communication Subsystem

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Overview

The goal for this project is to design and prototype two subsystems; a navigation and communication subsystem and a power subsystem. The navigation and communication subsystem will allow for tracking location, remote control of the vehicle, operational status and environmental conditions monitoring. The power subsystem will use solar power to operate the overall FRED system. Our objective is to integrate these subsystems with the other USD Clear Blue Sea team?s final prototype. This report discusses our objectives, requirements and functions of our subsystems. After extensive research on different components, we decided on utilizing high-quality and low-cost autopilot hardware. Rather than build from scratch our subteam switched gears and unanimously decided on using a flight controller and open drone software. This flight controller would then manage all the sensors and motors on the FRED unit itself, as well as allow for communication between the FRED system, a computer, and a handheld controller for manual inputs. For the power subsystem, it consists of 3 main parts: a solar panel, a battery and two motors. Solar panel converts solar energy into electric current, then power the thruster and the motor. Part of the generated electric power is stored into the battery for later use.

Background

- Great Pacific Garbage Patch (GPGP) is destroying marine and human health in coastal communities
- Clear Blue Sea aims to cleanse the oceans of plastic by utilizing an autonomous Floating Robot for Eliminating Debris (FRED)
- Our team will design a navigation and communication subsystem with Clear Blue Sea 1 Architecture team.
- This prototype will be used for education and demonstration purposes

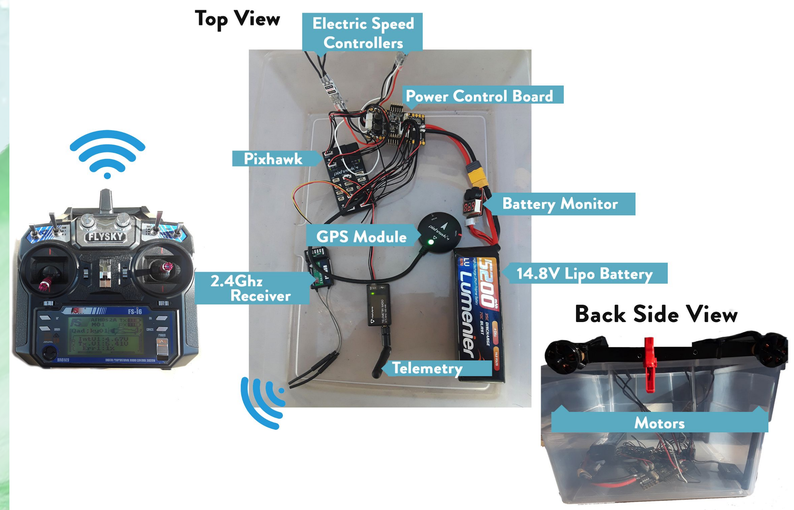
Requirements

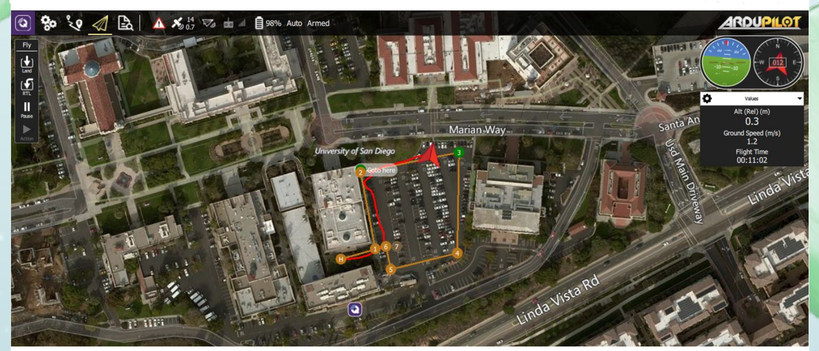
Objectives:
- Monitor environmental conditions
- Semi-autonomous navigation

Functions:
- Monitor and record the location of FRED
- Transmit and receive data to and from a singular control station
- Remote control of FRED
- Graphical user interface
- Use clean energy to power FRED

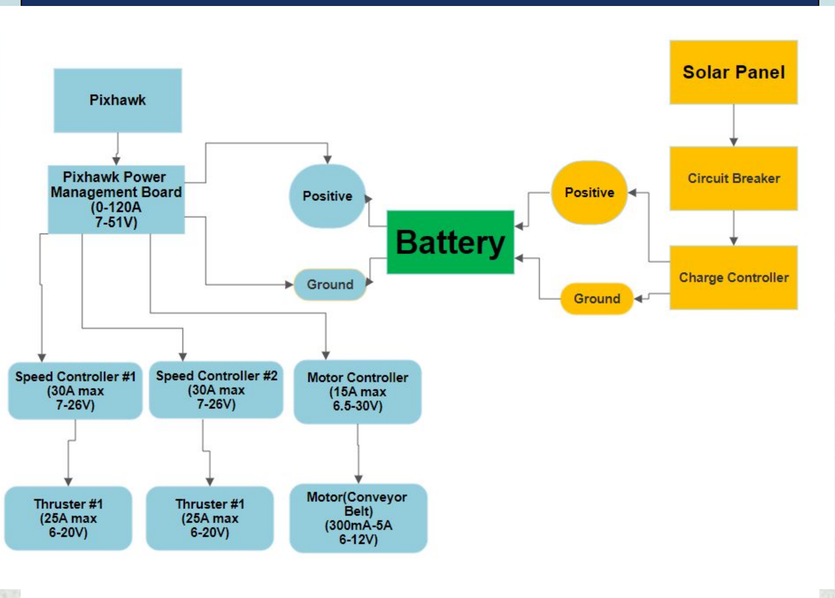
Constraints:
- Control, communicate, and troubleshoot within 250 feet
- Precisely navigate to a position within ±5ft

Control Subsystem





Power Subsystem

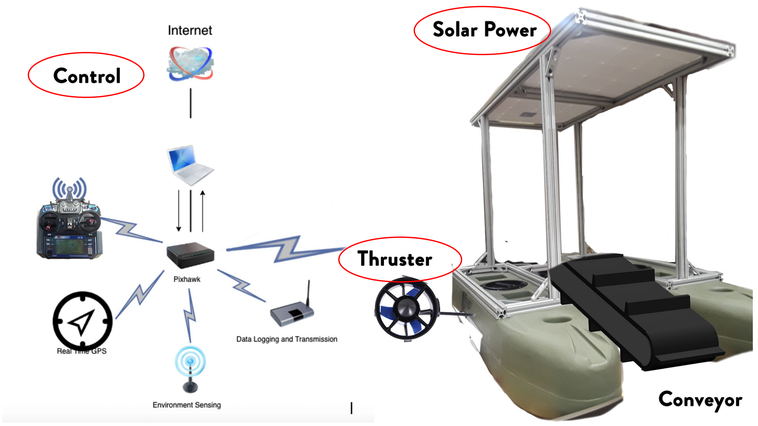


Subsystem's Results

Control Subsystem
- Ground Control Station fully functioning
- Radio Telemetry works within 200 ft
- Tracking with semi-autonomous features

Power Subsystem
- Setting specifications for the power components
- Finish Solar System design

Full System Diagram



Future Work

- Utilizing ArduSub firmware with the control subsystem components
- Install the power subsystem into the boat
- Testing the entire system in the testing pool

Acknowledgements

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