Autonomous Robotic Boat Platform

Leah Cramer, Noah Dupes, Ryan Burke, Darren McDannald, Mr. Nick Schmidt, Dr. Jose Sanchez, Dr. Gary Dempsey

Introduction

The autonomous robotic boat platform was designed to be capable of performing basic tasks necessary for autonomous vehicle operation. These tasks include Global Positioning System(GPS) navigation, visual navigation, and object detection.

Background

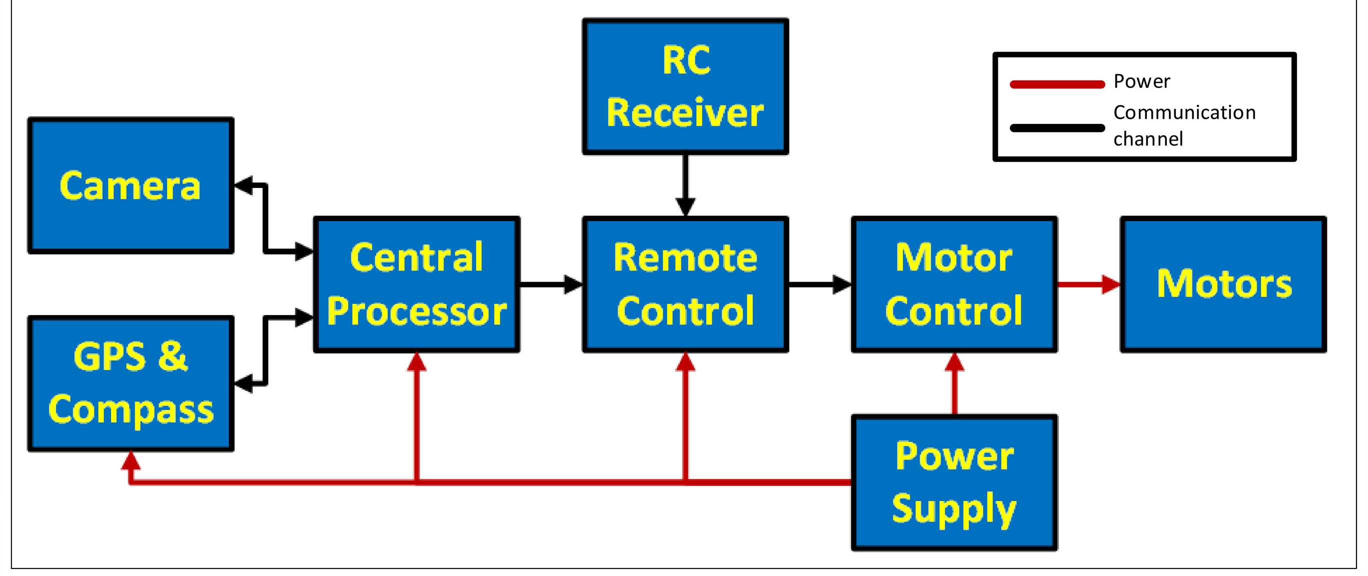
For the past seven years, the International Roboboat competition sponsored by the AUVSI foundation has challenged universities to design an autonomous surface vehicle (ASV) that can accomplish a variety of tasks and missions. Bradley University entered the Roboboat competition in 2012 and 2013, in which they placed 8th and 5th, respectively.

Motivation

Competing in the International Roboboat Competition and developing the complex vessel motivated each team member during this project. The complexity of the system is due to the multiple disciplines of engineering that were involved in the creation of this platform. These disciplines include communications, embedded programming power electronics, and image processing.

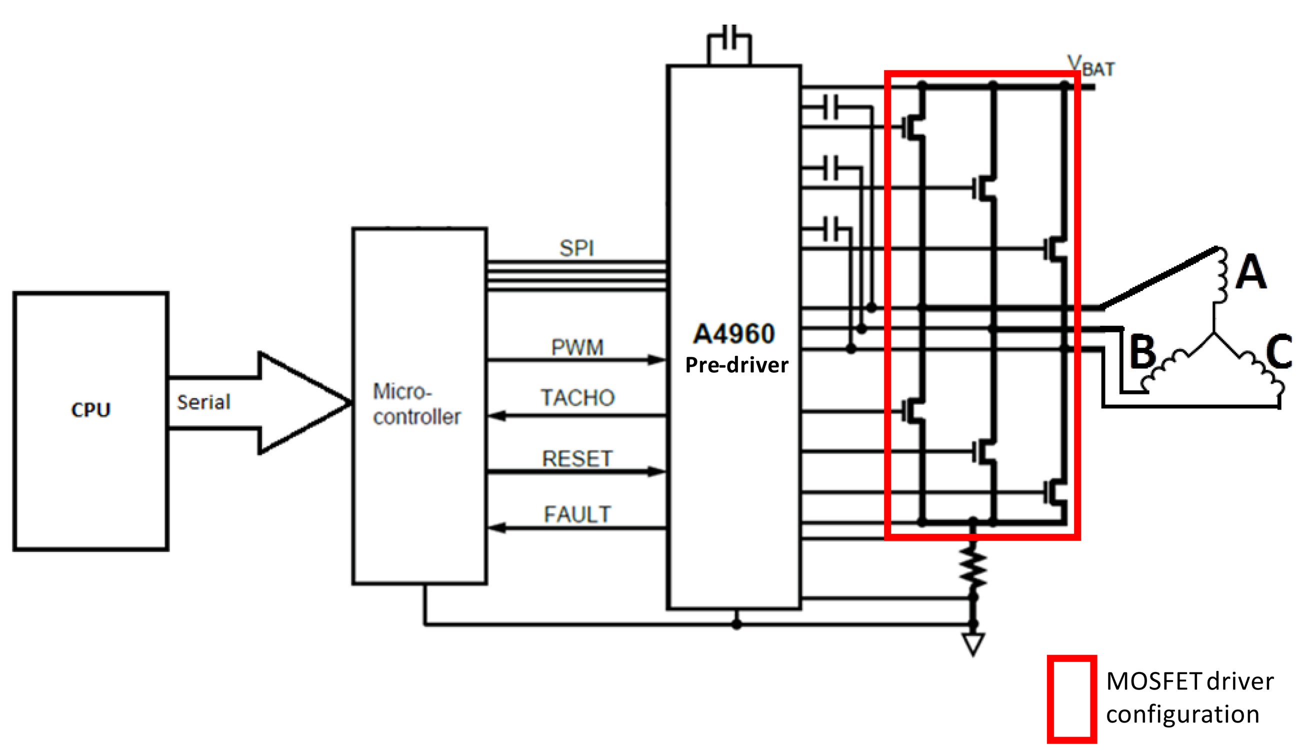
BRADLEY UNIVERSITY

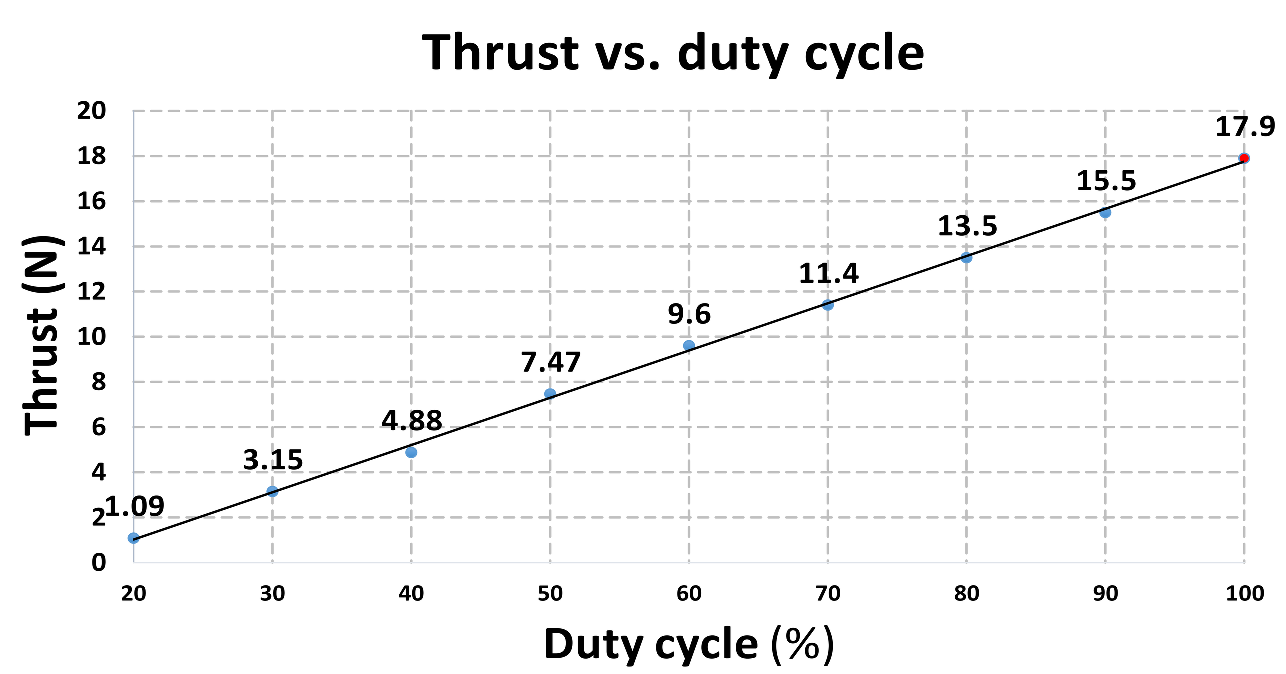
System Block Diagram



Motor Controller Subsystem

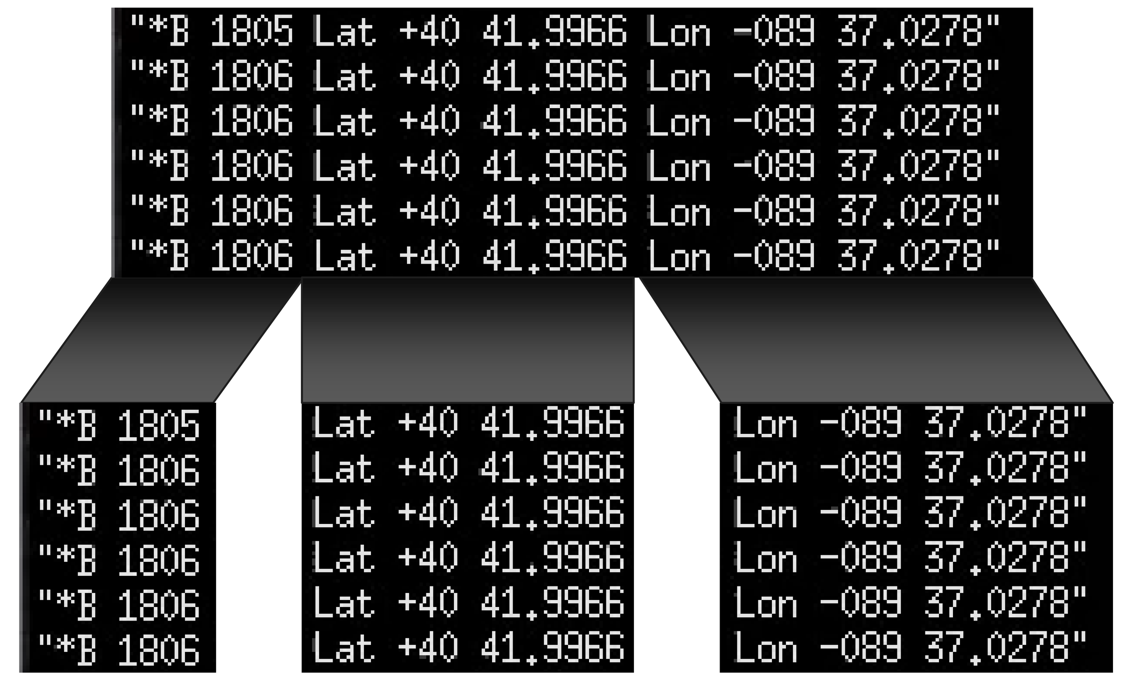
The motor controller subsystem receives motor commands from the remote control subsystem and uses those commands to control the Blue Robotics T100 Brushless DC (BLDC) thrusters. Actuation of the BLDC thrusters is achieved with a commutation driver performing digital commutation.

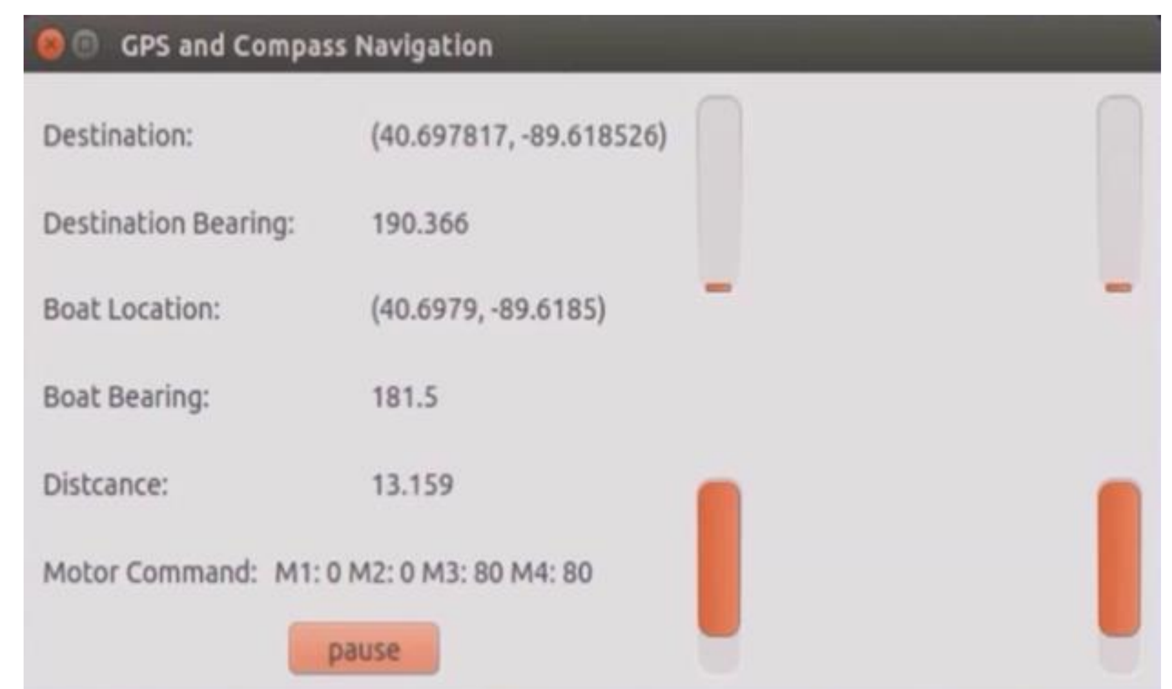




GPS/Compass Subsystem

Knowing a vessel's position and heading are critical to navigate between the vessel's current location and its desired destination. An FGPMMOPA6H GPS Sensor and a CMPS10 compass sensor were integrated into the system using an Atmega1284P microcontroller to provide the system's current GPS coordinates and bearing to the CPU.





Remote Control Subsystem

The remote control subsystem receives signals from the RC receiver and motor commands from the Central Processing Unit(CPU). The instructions are processed and either the manual or autonomous motor commands are sent to the motor controller according to the current mode of operation.

Image Processing Subsystem

Conclusion

All of the subsystems met the requirements and constraints set by the team. Though the system was never fully integrated the methods used to design and test each subsystem demonstrate that the fully integrated would meet all requirements and constraints as a whole.

References

Allegro MicroSystems. (2014). A4933: Automotive 3-Phase MOSFET Driver [Online]. Available: http://www.allegromicro.com/en/Products/Motor-Driver-And-Interface-ICs/Brushless-DC-Motor-Drivers/A4933.aspx