The Hydrus Project

Autonomous Aquatic Vehicle for Water Quality Monitoring

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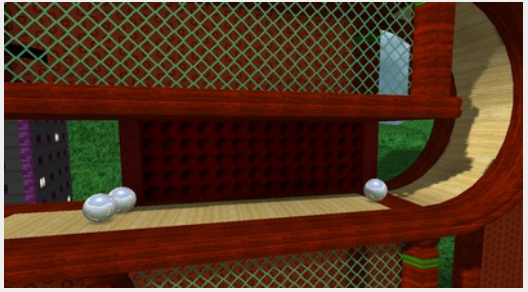
Who is this guy?

- Mechatronics Engineering student at Federal University of Santa Catarina.
- Researched real-time operating systems under Prof. Giovani at LISHA, published paper.
- 1-year exchange program at University of Tampere, Masters Degree Program in Software Development.
- Worked with Intel Finland on a project developing use-cases and a proof-of-concept for RealSense.
- FOSS nerd :)

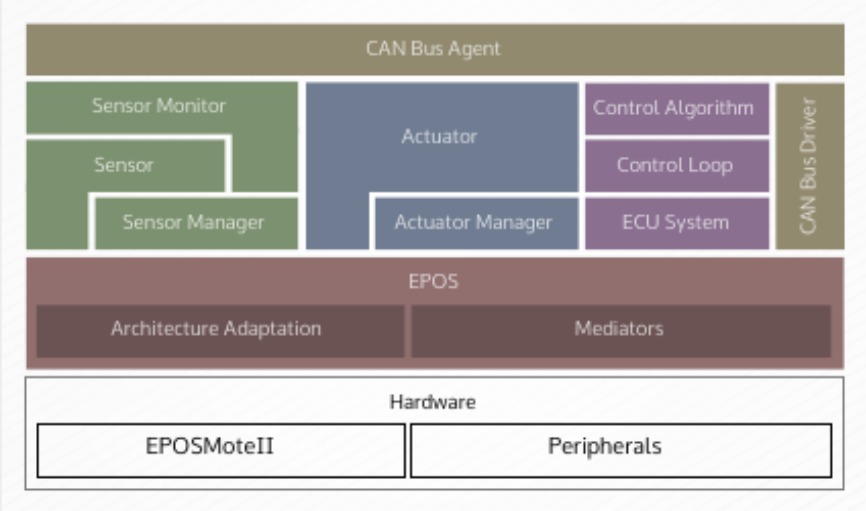
Instrumentation and control

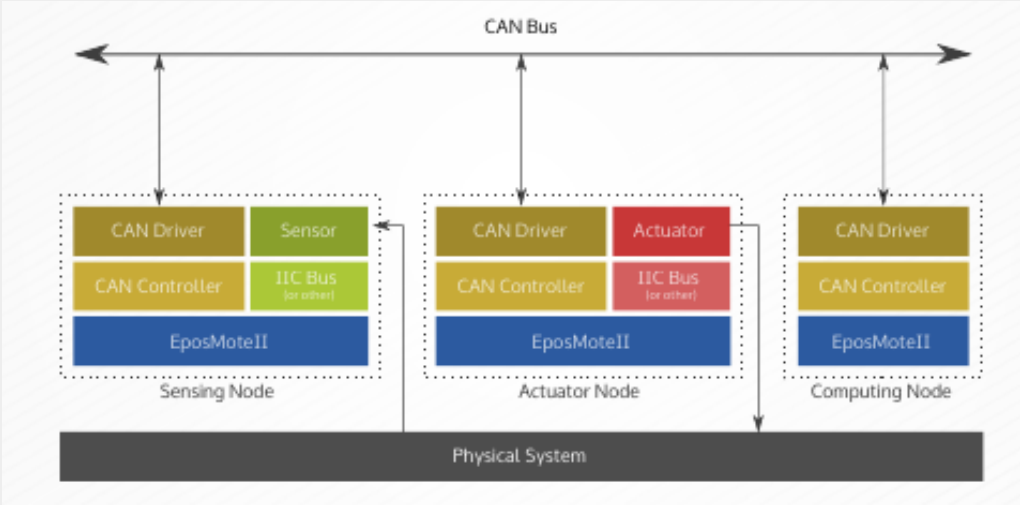


Game engine development

Research at LISHA

- Focused on RTOS and their application in control systems.

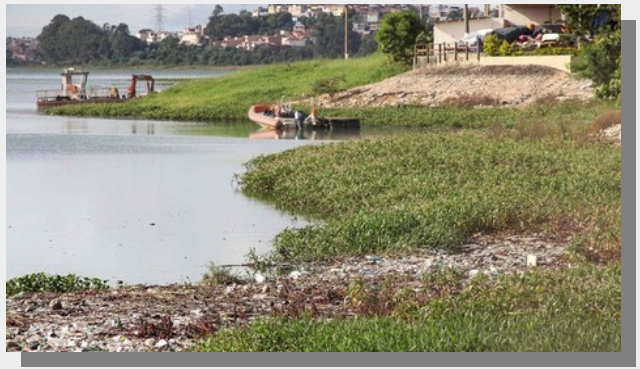




Control architecture integrated into EPOS, the operating Sytem developed at LISHA

Context

- Brazil has a lot of problems concerning basic sanitation
  - 65% of sewage in Brazil is dumped untreated (IGBE + SNIS 2014)
  - Manual monitoring of water in reservoirs is expensive, slow, and sparse
  - Hopefully, advances in technology and lowering costs can improve monitoring speed and functionality

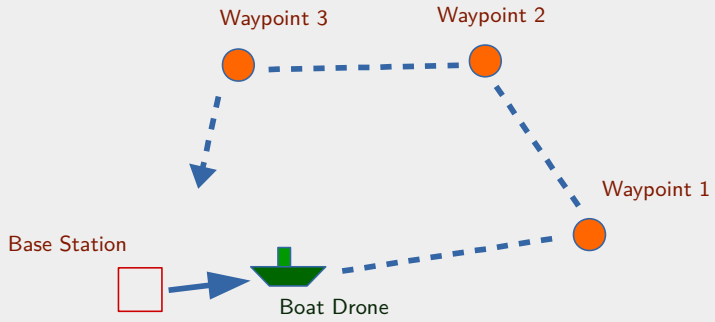


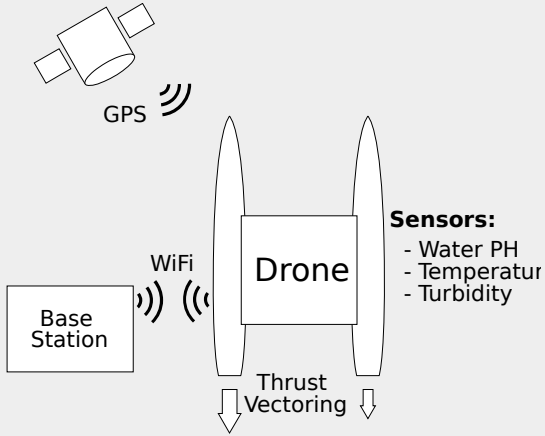
Garbage floating in a SP reservoir

Open sewage near João Pessoa, PB

The Hydrus Project

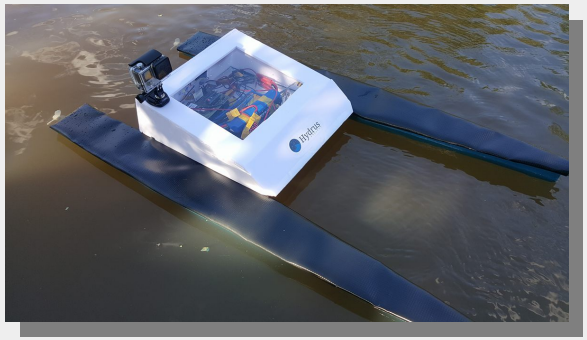
- An autonomous boat drone for data acquisition, and water quality sensing.
- Able to navigate autonomously, via GPS, and collect water quality data along the way.





Implementation

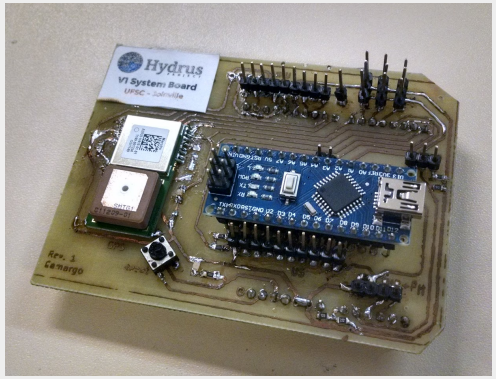
- The boat frame was built from scratch at UFSC, using infrastructure from the Naval Engineering program.
- As per competition rules, the hardware was built around the Galileo Gen 2 platform.



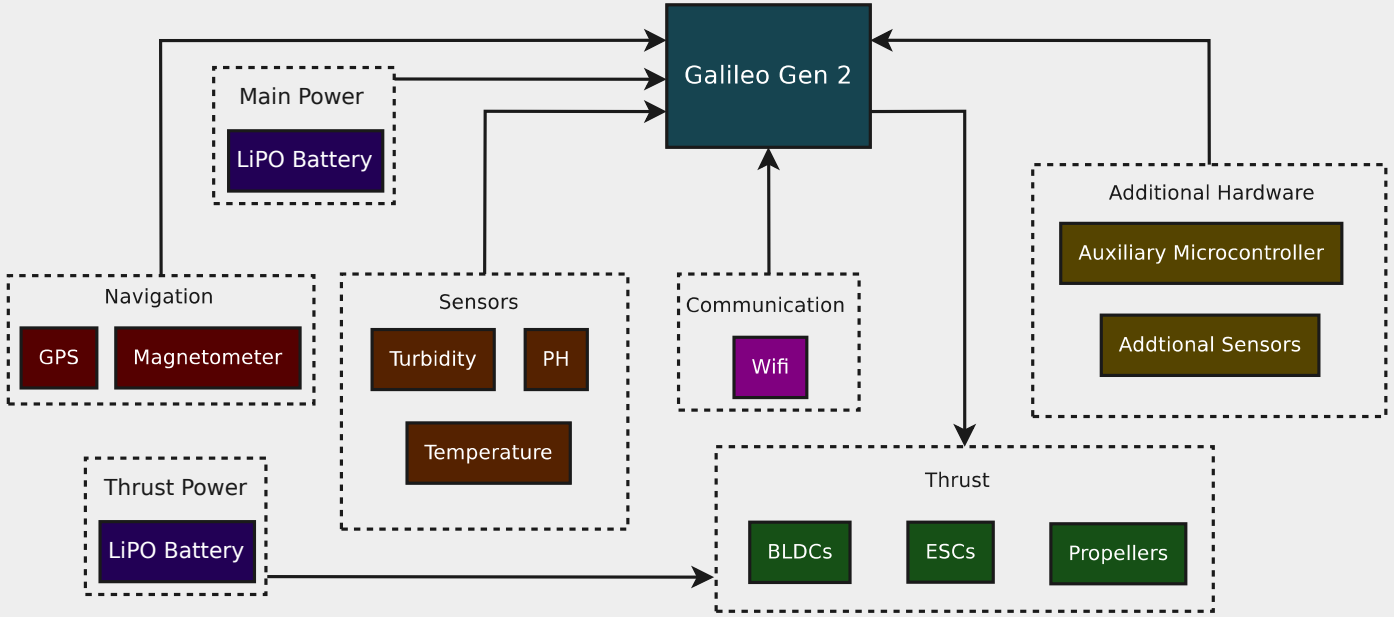
Hydrus v1

Hardware

- GPS and magnetometer for navigation.
- WiFi module for base communication.
- PH, turbidity, and temperature sensors.
- Additional sensors can be connected to auxiliary µC.

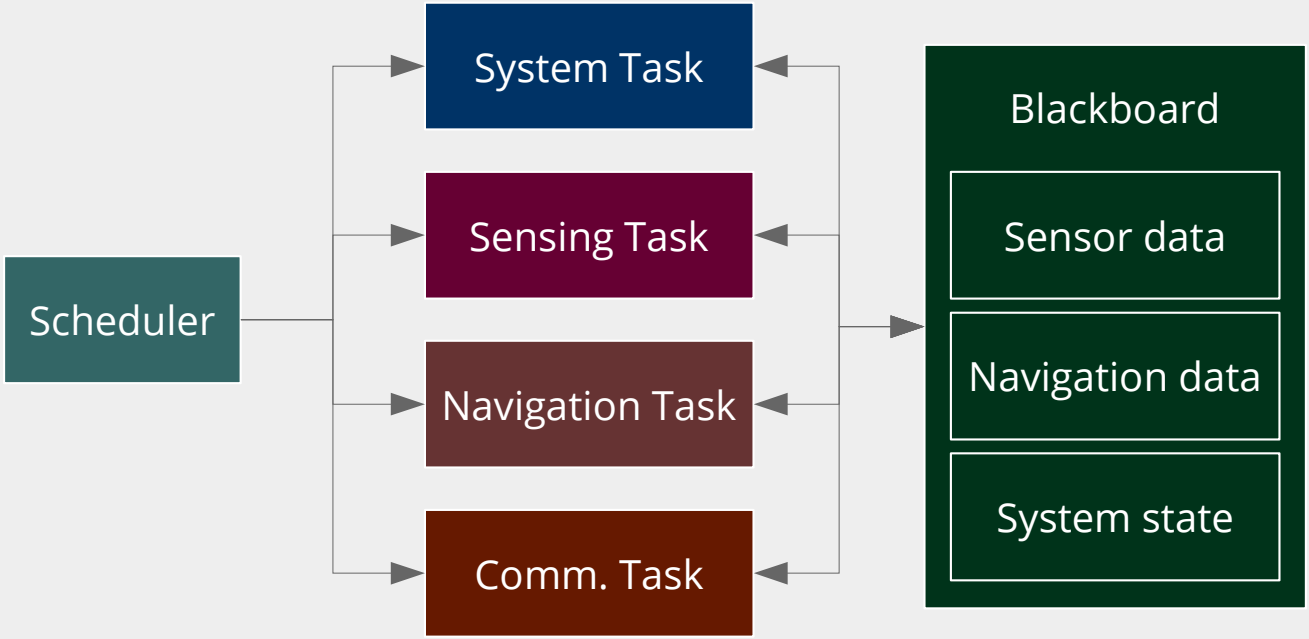


Custom shield for Galileo



Embedded Software

- Custom built C / C++ firmware, atop standard IoT image.
- Cyclic executive scheduler + blackboard architecture.

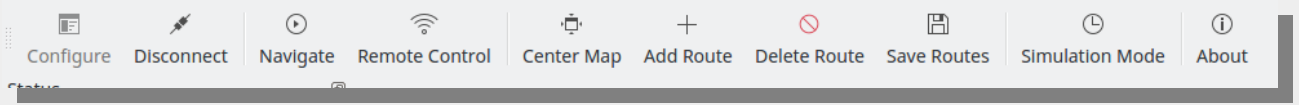


Task	Execute (A)	Execute (B)	Period
System	✓	✓	0.02s
Sense	✓	✓	0.02s
Nav	✓		0.04s
Comm		✓	0.04s

Cyclic task Schedule. Major period is 0.04s

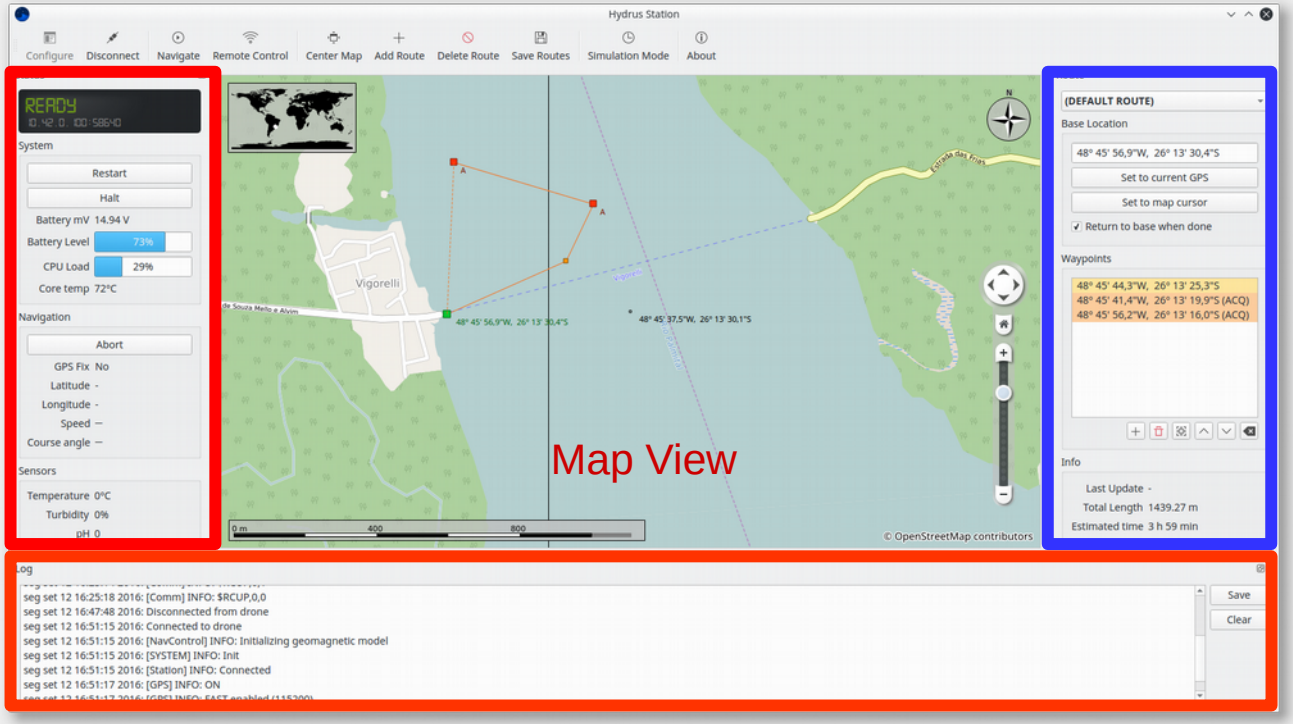
Interface Software

Main toolbar

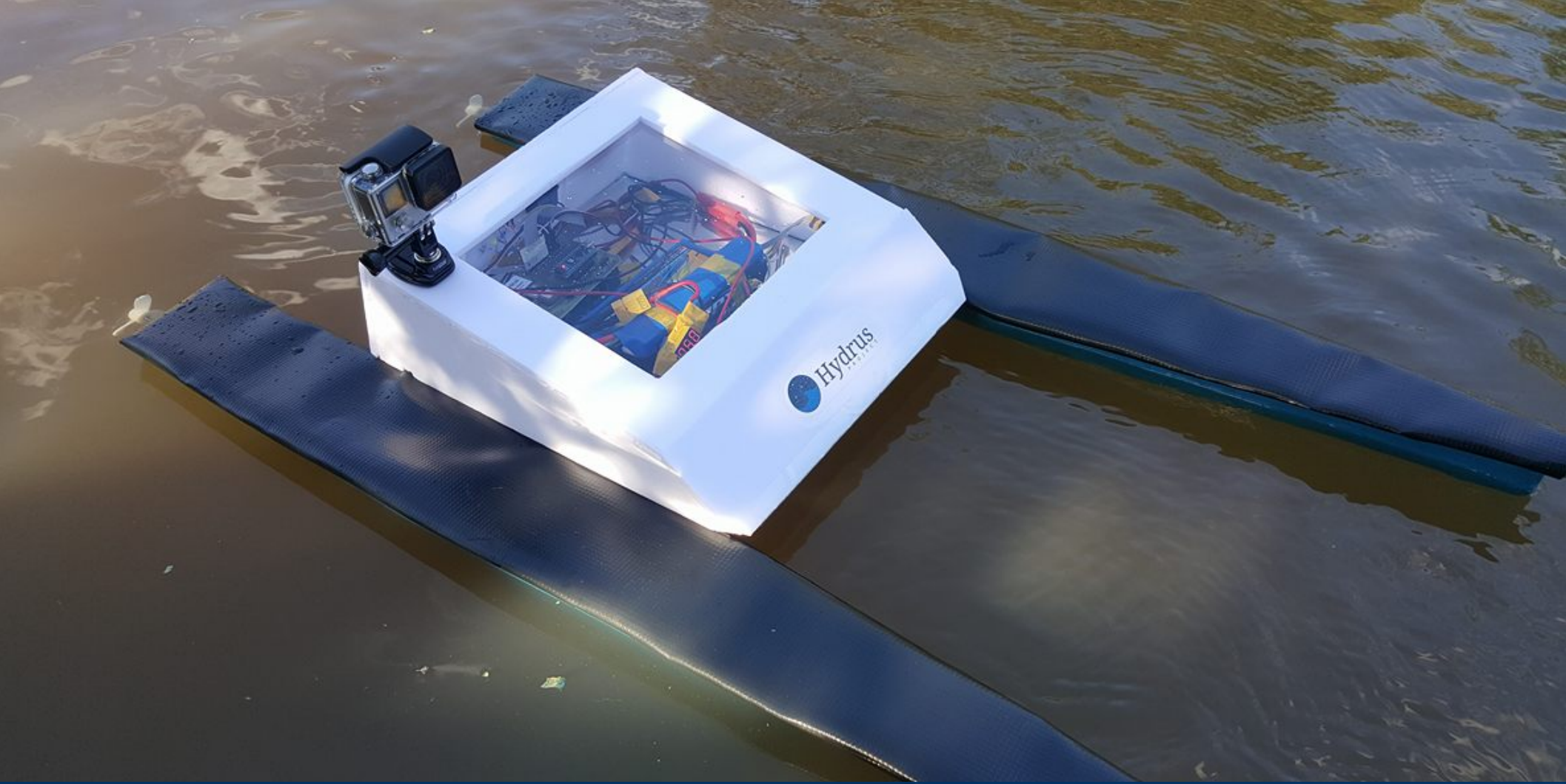


Drone status

Route planner



Log viewer



A better look at the Hydrus v1 autonomous aquatic vehicle

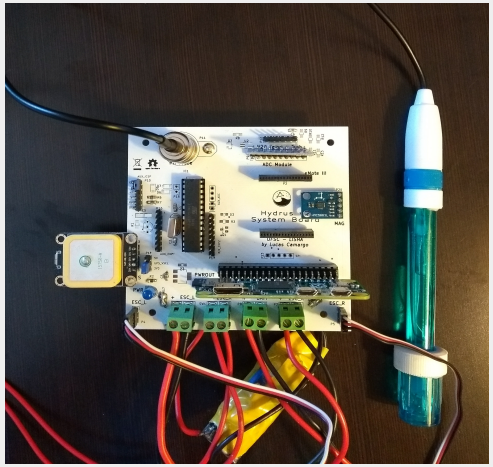
(insert video here)

Current Status

- This project is my current term paper subject. Hydrus v2 is in development.
- The hardware platform is being moved away from the discontinued Galileo towards a dual platform setup:
  - Raspberry Pi Zero W
  - EPOS 2 atop Emote III
- Improvements are mainly hardware consolidation, removal of hacks and workarounds, and preparation for future work.

Future Work

- We have a flexible platform that can be adapted to provide a variety of solutions.
- Next steps involve researching solar power integration, and bathymetry sensors.
- Looking for partnerships and new applications.



Hydrus v2 hardware platform

EPOS Mote III

Thank you!
Any questions?

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