

Florida International University

Fall 2025 Senior Design Project

Water sampling with applied Microcontrollers



Students: Steven Luque, Jesus Elespuru, Angie Martinez, Christopher Perez
Mentor: Dr. Gregory Murad Reis, Knight Foundation
Instructor/Faculty: Seyed-Masoud Sadjadi, Florida International University

PROBLEM

Biscayne bay is facing many threats such as pollution, rising water temperatures, and much more human activities are causing harm. Manual sampling has been used but it is not efficient and this is why we want to create an autonomous way of doing this. The autonomous solution is faster and scalable, detecting fish kills before it happens.

CURRENT SYSTEM

Currently we are using big autonomous boats that are inefficient. They take a lot more to power, harder to maneuver, and more difficult to transport.



REQUIREMENTS

We need autonomous boats that use an EXO II tube to collect and research the data. We also need them to be more efficient. This means not needing as much power to maneuver them in the water, easier to carry around, and not needing as much charge for the trips. We also need to be able to have more in the water to cover as much area as possible

SYSTEM DESIGN

Our system is composed of a lightweight durable hull equipped with sensors for temperature, pH, salinity, and dissolved oxygen. It is supported by two rechargeable batteries for continuous operations. It uses solar powered energy for sustainable environment use.



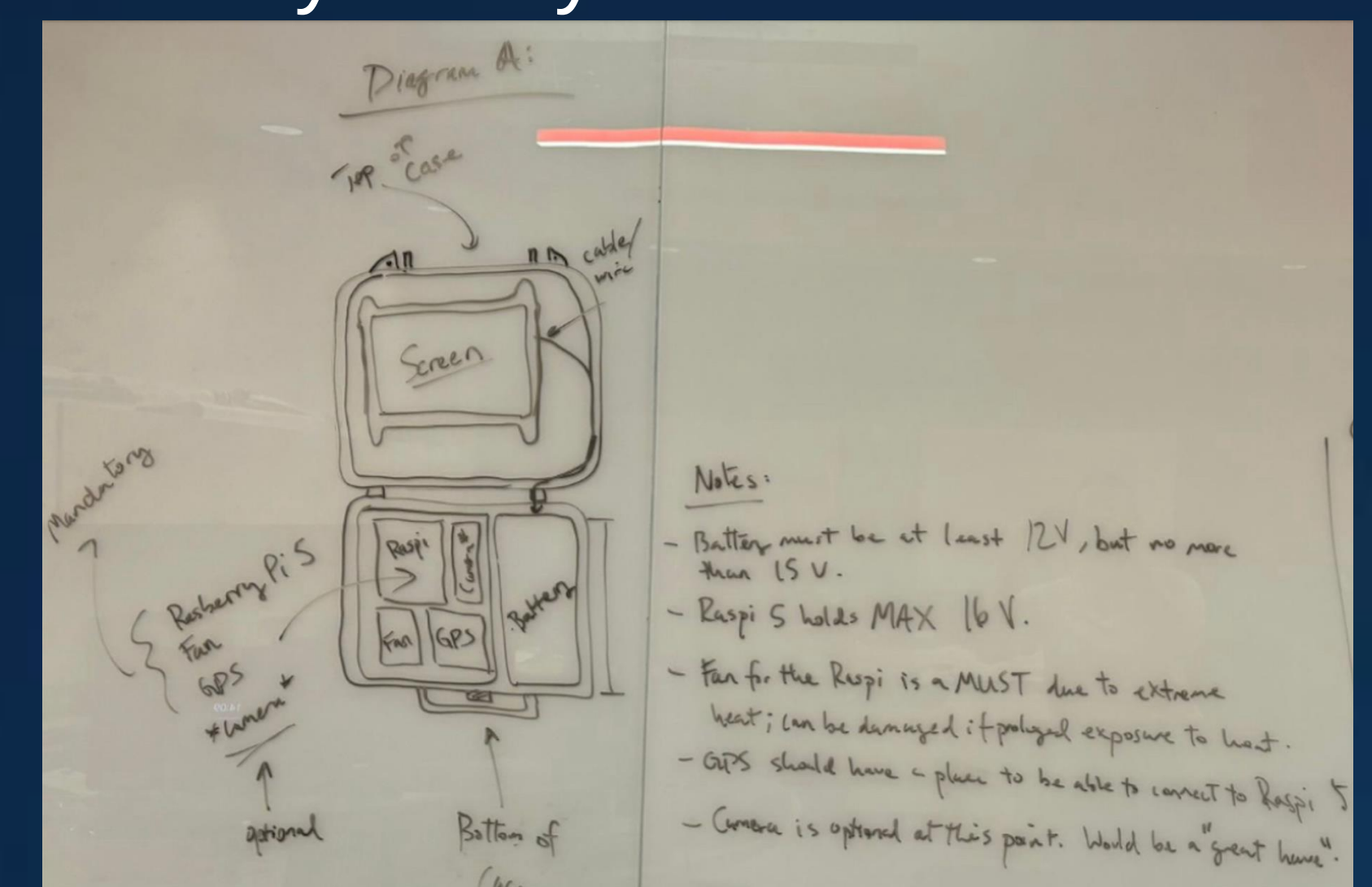
OBJECT DESIGN

Our object design is composed of form factor, as we want it to be as easy possible to transport and maneuver. We wanted it to be flexible for any modifications that have to be done. It also had LEDs so that we don't lose it and safety features in case it flips over.



IMPLEMENTATION

This is a prototype which will keep improving until we get to a point where we are happy. We will continue to create and refine algorithms for the autonomous movement and field test it at Biscayne bay.



VERIFICATION

To verify that everything is working as it is supposed to. We did performance testing, Coverage analysis, and data validation. For our performance testing we measured battery life and the temperature inside the case while testing. Coverage analysis to see how much area the boat can cover and how much we need to scale it. And the data validation, to make sure the data the boat collected is accurate.

Conclusion

The new boat design has made transporting it easier, better to maneuver in the water, easier to recharge, and the flexibility has made it easier to modify depending on our needs.

REFERENCES

- Ltd, Raspberry Pi. "Raspberry Pi." *Raspberry Pi*, www.raspberrypi.com/.
 "Multiparameter Water Quality Sonde for Unattended Monitoring | Ysi.com." *Ysi.com*, 2024, www.ysi.com/exo2?srsId=AfmBOoqgx32k_Nx_4XJ1unkohOatG_pSh051luqDsj/zTkFybmyZqD8O. Accessed 2 Dec. 2024.
 "Village of Key Biscayne, FL." *Keybiscayne.fl.gov*, keybiscayne.fl.gov/village_services/resiliency___sustainability/our_beach/beach_water_quality/index.php.