UCF Senior Design 1

Lab Toolkit Data gathering for Scientist, Lake Analysis

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Divide and Conquer 1.0

Group 07

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1.0 Project Description

1.1 Project Narrative and Motivation

The purpose of our project is to design and build a Lab Toolkit. This will consist of a medium-sized floating laboratory which will be able to be maneuvered by remote control. Our target for this project is to deploy our floating laboratory in ponds and lakes that interest scientists in Florida. The goal being to monitor these bodies of water remotely. This will be achieved by providing real-time data about the lake to a cloud database accessible by a website or mobile app. Which can later be analyzed with artificial intelligence, or the preferred method used by the scientists.

The Toolkit will provide a flow of information from onboard sensors and can also take water samples at any point in the lake. Also, with the addition of capturing mosquitoes at any point of the lake. (To better understand their behavior and prevent mosquito-borne illnesses)

A potential buyer for our project is the State of Florida. This is because they have demonstrated the importance of research to prevent infections in lakes and stationary bodies of water. With a focus on dangerous bacteria and pathogens carried by mosquitoes that can be developed under certain lakes and environmental conditions. This is important because of outbreaks of mosquito-transmitted epidemics in Florida. Our project will provide a reliable data source for scientists to understand lakes better and help the people of Florida.

1.2 Project Components

To design a “floating autonomous biological control lab” that can read various parameters from static bodies of water to understand possible chemical or biological hazards that could exist or potentially be developed. The lab will be a floating vessel equipped with

- Real-time pH sensors
- Water intake to help with bacteria analysis, chemical analysis, microorganism analysis, and gas analysis.
- Mosquito capture tool
- A variety of temperature, CO2, and humidity sensors outside
- Solar panels with backup battery
- GPS card Arduino
- Remote controlled

A radar that is able to have a real-time count of bigger animals, for example, fish or alligators. This can be used to study their behavior and to count the number of fish in the lake. This is important because scientists could introduce more fish in the lake to reduce the concentration of mosquito larvae if needed. (The radar component of the project is a feature that will not be implemented in this moment

for senior design because it is not a priority for the kind of research in water quality but will be implemented in the future to build a more complete analysis tool)

Features of the project:

- pH Sensor (Autocalibration)
    - The device will measure the pH of the water it is on.
- Data Array (Store, send to Cloud, Flush, Repeat)
    - The device will send to the cloud information it has collected.
- Bacteria analysis tools (Sample taking)
    - The device will permit additional analysis in a lab since it will collect sample(s) of water.
- Mosquito recollection tool (Analysis counting)
    - The device will be able to collect mosquitoes in the water for additional analysis. It will be a static net attached to the floating device.
- Outside air sensor
    - The device will contain sensors to give information about the outside air (e.g., humidity, CO2 level, etc.)
- Connection to WiFi
    - The device will be able to connect to WiFi to transmit data.

Benefits for user:

- Provides reliable data source in real time.
- Provides the possibility of data sampling.
- Provides 24/7 availability in the study field.
- Can be used to feed AI in big data for research.

2.0 Requirements Specifications

No	Requirements	Units
1	The system shall measure the water's pH	1x per hour*
2	The system shall transmit the readings to the cloud	1x per hour*
3	The system shall collect samples of water	≥ 30 mL
4	The system shall collect bugs in the water	1 min minimum
5	The system shall detect the water's temperature	1x per hour*
6	The system shall detect the outside temperature	1x per hour*
7	The system shall have solar panels that charge rechargeable batteries	1-2 solar panels,
8	The system shall be waterproof	IP67
9	The system shall be moved with a remote controller	Response time < 2s

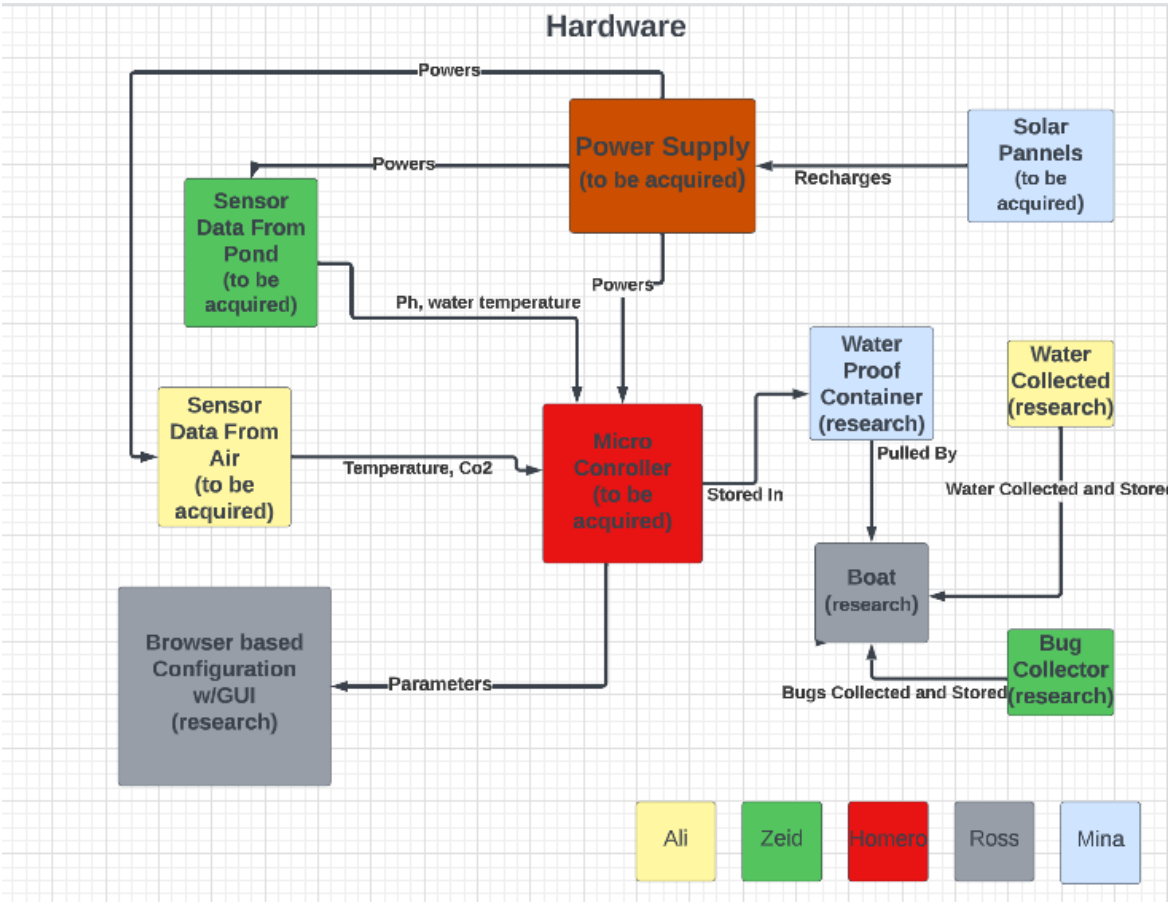
*These units are subject to change after consulting with research experts.

3.0 List of Known Constraints

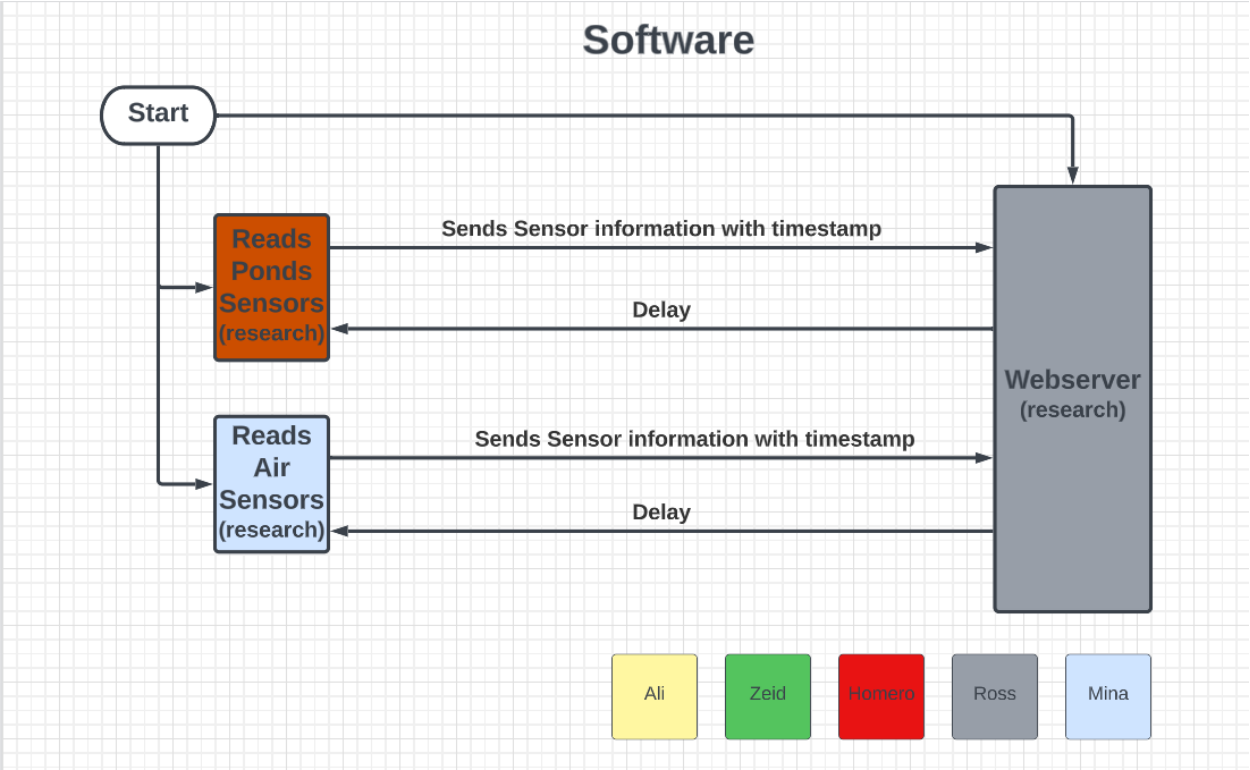
- The system shall not exceed $1,000 in cost.
- The system should be researched, developed, and built-in 2 semesters (Spring 2023 and Summer 2023).
- The microcontroller used will be an Arduino, a parallel system of Arduinos.

4.0 Block Diagrams

4.1 Hardware



4.2 Software


Software
Start
Reads Ponds Sensors (research)
Sends Sensor information with timestamp
Delay
Reads Air Sensors (research)
Sends Sensor information with timestamp
Delay
Webserver (research)
Ali
Zeid
Homero
Ross
Mina

5.0 Estimated Project Budget and Financing

Our budget for this project will be shared among members of the team since this project is not sponsored. Each member is expected to contribute an equal amount of money as the other members. The prices listed below are only an estimate of how much we believe parts are going to cost us for this project.

Item Description	**Total Estimated Cost**
Arduino Microcontroller (Arduino Uno WiFi)	$60.00
Water Temperature Sensor	$30.00
Outside temperature, CO2, & humidity sensor	$100.00
Net (Mosquito collection)	$10.00
RC Boat	$75.00
Water Holder	$60.00
Solar Panels + Accessories	$100.00
Batteries	$15.00
pH Sensor	$75.00
GPS Card	$20.00
Lab Container + Accessories (Floater, silicone, etc.)	$100.00
Servo Motors	$30.00
MicroSD, 32 GB	$10.00
WiFi connection	$100.00
Total Estimated Cost:	$785.00

6.0 Initial Project Milestone

For Senior Design 1 our initial project milestone is (Important Deadlines)

Date	Details
1/18	Project Conceptual Brainstorming
1/23	Project Idea Discussion
1/25	Project Selection: *Lab Toolkit Data gathering for Scientist*
1/26	10-page DC initial
1/28	Divide & Conquer v1.0 Complete the D&C
2/3	Divide & Conquer v1.0 Due. Submit the completed D&C
2/6	D&C V1.0 Meeting with Dr. Wei Discuss project idea, (approval)
2/10	Divide & Conquer v2.0 Complete. 25 pages approximately
2/17	Divide & Conquer v2.0 Due Submit the final D&C
2/25	Paper V1 50 draft
3/1	Paper V1 75 draft
3/24	75-page Paper V1 Due 75 Pages
3/27-3/29	Group meeting for 75-page feedback
4/7	Updated 75-page draft on website
4/18	Finishing touches
4/25	Final document due
4/25	Order parts

For Senior Design 2 our initial project milestone is

TBD	First day of summer semester goals
TBD	May goals – Build and test components
TBD	June goals – Work on software
TBD	July – work on testing, final paper, and presentation
TBD	Last Day of Class goals – Presentation of the project
TBD	Last day of final exams – Submit the final report

7.0 Conclusion

By creating an “Analysis Lab Toolkit”, it will be possible to collect reliable and relevant data from lakes and stationary bodies of water remotely. This data is an important area of study for the ecosystems, microbiology, and biology of Florida. This information can then later be analyzed by AI or a preferred method by scientists to expand knowledge and prevent the development of dangerous bacteria or mosquito-borne illnesses.

Our project consists of a floating device “Analysis Lab Toolkit” that can measure multiple parameters outside and inside the water using equipped sensors. Additionally, it will be able to collect water samples that could be brought to a lab for analysis and a better understanding of the water. It will also have a system to collect mosquitoes and bugs that can be taken back to the scientist’s lab to verify if they are infected with any contagious pathogen that could affect Human being's health, for example, Zika virus, Dengue, or the Nile River Virus among others. The device will be able to navigate through the waters thanks to a remote control, which would help the user bring it to any desired location for sampling.