

Report Details:

Timeframe: 11/19/25 - 12/02/25

Group number: 21 (*sdmay26-21*)

Project Title: A Smart Aquatic Ecosystem

Client &/Advisor: Md Maruf Ahamed

Team Members/Role:

Griffin Urban — Frontend Developer

Daniel Pender — Hardware

Aden Koziol — AI Population Tracking

Ryan Holden — Backend/Frontend Developer

Marina Mannan — Embedded Systems Engineer

Carson Irving — Backend/Frontend/AI

Max Purvis — Hardware

Weekly Summary

This week we updated our project to display the most recent actual data from the server and the most recent image available. We added additional security by switching everything to use HTTPS. Additionally, we continued to refactor the frontend code to increase efficiency and scalability.

For the hardware side, we set up an extended test with the sensors in the fish tank. We also calibrated the dissolved oxygen sensor and updated the arduino code to work with it.

Past Week Accomplishments

- **Aden:** Continued research on background subtraction techniques. Also, continued research on fine-tuning techniques.
- **Marina:** Worked with Carson on the frontend to display the most recent image on the dashboard. Ensured the image was displayed correctly from the backend.
- **Carson:** Reconfigured the front end, backend, Arduino, and server to move the application to use HTTPS. This allows the traffic to be encrypted, ensuring security when we add authentication in the future. I used Let's Encrypt to obtain a CA certificate and set the server up to automatically renew it. I used DuckDNS to register a subdomain, as you generally need a domain to get a CA certificate. I set up a cron job to renew the domain as well. I created an nginx proxy to handle routing the HTTP requests through the domain. I worked on the front end to request the actual information from the server, and formatted the date (x-axis) to look a little better. I worked with Max to add the dissolved oxygen sensor to the Arduino code and update the code to allow posting through the new domain. Worked with Max to test the sensors inside the fishtank; we also filled it to ensure there were no hairline cracks.
- **Max:** I worked with Carson to set up an extended test of the pH, turbidity, and temperature sensors in the fish tank. I obtained the sodium hydroxide solution, allowing me to finally calibrate the dissolved oxygen sensor and integrate it with the other sensors. I relocated all

the circuitry to a smaller breadboard and rearranged it to make the setup cleaner and more compact. We have also installed the new power adapter, so we can now power all the components simultaneously, allowing us to use everything at once. After that, I worked with Carson to set up another extended test in a cup of water with the dissolved oxygen, pH, turbidity, and temperature sensors, along with the camera, for a bit.

- **Danny:** Since we were on break, I did not manage to complete much for this past week, as I was not able to work with the components. I did manage to work a bit with the extended pH probe testing but found that it was not very accurate and there may be some issue with the inner workings of it. That is something that will need to be addressed. We need to get some pH buffer solution to hopefully calibrate it correctly.
- **Ryan:** Created one integration testing class for the communication between backend to frontend code.
- **Griffin:** Continued work on refactoring the frontend. A majority of the functionality is contained within one file, allowing for reduced code duplication. Working on moving reusable functions out of the main file to increase efficiency and scalability of the project moving forward. Additionally, I worked on adjusting the time range for the graph feature to allow the user to see different time frames of their choice.

Pending Issues

N/A

Individual Contributions

<u>NAME</u>	<u>Individual Contributions</u> <i>(Quick list of contributions. This should be short.)</i>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Aden	• Researched Background Subtraction • Researched Fine-Tuning	5	55
Marina	• Worked on the frontend dashboard image display • Ensured correct backend integration and verified image retrieval	6	58
Carson	• Reconfigured Frontend, Backend, Arduino, and Server configurations to allow for HTTPS support • Registered a subdomain with DuckDNS and set up auto-renewal • Requested a CA certificate from Let's Encrypt for HTTPS and set up auto-renewal • Adjusted graphs on the frontend to grab real data, and a realistic range • Formatted dates under the frontend graph to make it look a little nicer • Sensor Testing with Max • Tank Inspection	12	73
Max	• Extended test of pH, turbidity, and temperature sensors in the fish tank • Calibrated the dissolved oxygen sensor and added it to the circuit • Moved the circuitry to a smaller breadboard and set it up with the new power adapter • Sensor and camera testing	10	62
Danny	• Work with the tank and ensure that our sensors are still working within • Ensure all sensors are functioning properly with the new circuit.	6	58

Ryan	Created an integration testing class	4	53
Griffin	- Worked on Frontend refactor, organizing code and de-cluttering - Worked on changing the time range for graphing data	10	66

Comments and Extended Discussion

- N/A

Plans for Upcoming Week

- **Aden:** Make an API Endpoint for detections. Focus on researching background subtraction and fine-tuning further.
- **Marina:** Help Griffin with the frontend, because 3D printing is not yet feasible. Recent hardware requirements have emerged, so the design needs to be adjusted; printing now would risk not accounting for these changes.
- **Carson:** Order lenses for the camera and work with it to get it taking reasonable pictures of the entire tank. Work with Aden to implement running the AI model container image from the backend when an image is uploaded.
- **Max:** If the new servo motor gets here, set up the fish feeder with it and add it to the circuit. Order KCL solution to maintain and repair the pH sensor probe. If that arrives in time, I'll soak the pH probe in it for a while and then use the buffer solutions to recalibrate the sensor. Consider how to keep the camera cool; it was getting quite warm while we were running it.
- **Danny:** Help Max set up the fish feeder if the motor gets here in time. Try to solve the inaccuracy with the pH probe. Finalize the circuitry to ensure it fits in the case when or if we get a lid.
- **Ryan:** Create more test classes and merge to the main branch. Prepare for our final presentation next week.
- **Griffin:** Implement my changes into the main branch, and finish refactoring the frontend to make it more efficient. Help Marina add image support.

Summary of Weekly Advisor Meeting

N/A