Fish Tank Monitor

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# Executive Summary

Our project is an all-in-one fish tank monitor. It will consist of multiple internal sensors and a system to log water parameter paper test results and display them in an organized form. We are aiming to make the product inexpensive and user-friendly to ensure that all fish hobbyists can feel comfortable managing their fish tank’s array of parameters to keep their pets healthy.

The monitor will track a variety of parameters including the level of nitrites, nitrates, ammonia, salinity, pH, temperature, and lighting. It will also include a feeding and cleaning schedule function and log test results. These test results will be exportable through a micro-USB. The device will test various parameters with a color sensor and testing strips, allowing the device to allow for further accessibility. The user interface will consist of a screen with a series of buttons so that all users can easily navigate their options and care for their tank appropriately.

# 1 Fish Tank Monitor Overview

In this Fish Tank Monitor project, Savannah Tanner, Caleb Neill, and Astrid Delestine are collaboratively developing an all-in-one monitoring system tailored for aquarium enthusiasts. This device includes internal sensors that track key parameters such as nitrites, nitrates, ammonia, salinity, pH, temperature, and lighting. Some practical features include a feeding and cleaning schedule, and the ability to log test results, exportable through a micro-USB connection. The user interface is designed for easy navigation with a screen and intuitive buttons. The team places a strong emphasis on inclusivity, aiming to provide an accessible product for fish enthusiasts from diverse backgrounds.

Communication within the team is facilitated through regular meetings and a dedicated Discord server, and documentation is centralized in a shared Google Drive folder. The gap analysis reveals a market need for a comprehensive and affordable solution, as existing products often require multiple devices for testing. The Fish Tank Monitor project seeks to address this gap by offering a single integrated system, making fish tank maintenance more accessible.

## 1.1 Description

This team, consisting of Astrid Delestine, Caleb Neil, and Savannah Tanner has created a device for our senior capstone project at Oregon State University. Our fish tank monitoring system is designed to track and log aquarium parameters including the presence of nitrites, nitrates, and ammonia as well as the pH, temperature, lux, and salinity levels. The system provides real-time alerts for poor water quality, feeding, and cleaning. The device includes a user-friendly interface to help aquarium hobbyists track the health of their tank daily as well as over time. Once installed, this system will reduce the need for manual testing and combine several analysis methods into a single device, enhancing the overall experience for fish enthusiasts. This device is being developed over the course of three quarters of a year, to fill an observed hole in the market.

## 1.2 Team Contacts and Protocols

Savannah Tanner: [tannersa@oregonstate.edu](mailto:tannersa@oregonstate.edu)

Caleb Neill: [neillca@oregonstate.edu](mailto:neillca@oregonstate.edu)

Astrid Delestine: [delestic@oregonstate.edu](mailto:delestic@oregonstate.edu)

| Topic | Protocol | Standard |
| --- | --- | --- |
| Time management | We will meet once or more each week | The Google Drive meetings folder will have meeting notes for each week |
| Task management | We will divide the work for assignments evenly | All work will be complete and each team member will have completed an equal portion of the work |
| Communication | We will use a team Discord server for all team communication not in-person | All project-related discussions will occur in a dedicated Discord server so that the conversations can be accessed later |
| On-time deliverables | All assignment drafts will be completed by a pre-set deadline to ensure the team can review them before submission | Submissions will never be late unless discussed within the team and a record made of the discussion in either Google Drive or the Discord server |
| Documentation | All documentation will be stored in the shared Google Drive folder and organized appropriately | The Google Drive will contain documentation for everything we research and use in our project |

### 1.2.1 Diversity, Equity, and Inclusion Statement

The Fish Tank Monitor Project is committed to fostering a sense of diversity, equity, and inclusivity. We prioritize equitable design and accessibility, seeking to design our project with all backgrounds and resources in mind. We value diverse opinions and various perspectives for collaboration. We strive to ensure we are providing equal opportunities and experiences to create a product that is accessible and fair to all. DEI is an integral part of our project, ensuring that our work benefits all who care for aquatic life.

### 1.2.2 Communication Analysis

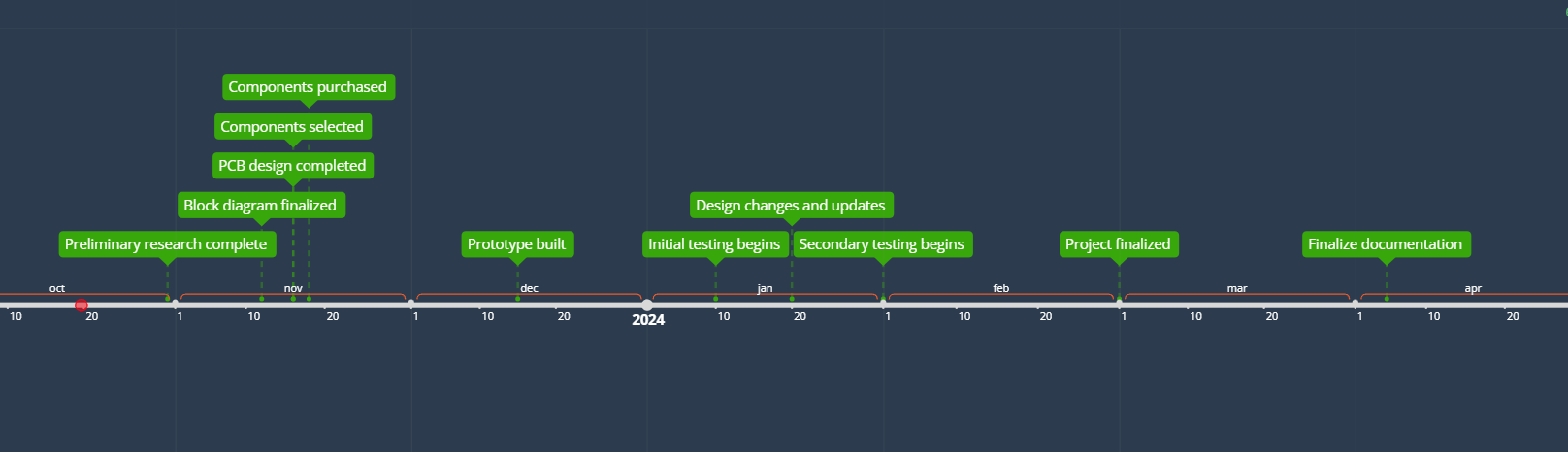
The target market for this product would include fish tank hobbyists, fish sellers, and large-scale aquarium owners. The hobbyists may have less technical expertise than fish sellers so the communication should be concise and free of most technical jargon. Regular communication through email is preferred so that they can be updated on project improvements as they are made. Retailers and fish sellers are interested in the product’s pricing, marketing materials, and availability. They may also lack certain technical expertise so communication should remain free of technical jargon but include more information about the advancements of the product from a marketing standpoint. Large-scale aquarium owners would require updates on the capabilities of the product and the scale at which it is operational. Larger aquariums require different varieties of testing, so this would mean updates similar to those of the hobbyists.

## 1.3 Gap Analysis

Maintaining a healthy fish tank environment requires testing various parameters on a regular basis. Each of these tests must be done in order to ensure that the water is safe for aquatic organisms to survive. Despite the need for this testing, there are no products available to fish tank hobbyists which accurately test a large number of parameters at once and compile the information so that users can keep track of the health of their aquarium while being inexpensive. For instance, the company Seneye is known for its fish tank monitoring systems which continuously track water parameter changes, but the only parameters that the system tests are pH, ammonia, and temperature [4]. Regular testing should include testing for pH, ammonia, temperature, nitrites, nitrates, hardness, and chlorine [5]. This is because producing a sensor to test for a single parameter requires complex calibration as the sensors are detecting chemical changes in the water [3]. Fish tank hobbyists often have to spend hundreds of dollars on devices and tools for testing and then using all of these devices on a regular basis. As such, the hobby becomes difficult and fewer people are interested. By creating a product which can conduct a variety of tests in a single integrated system without requiring user interaction, keeping a healthy fish tank becomes easy, convenient, and cost effective.

## 1.4 Timeline and Task List

Depicted below is our expected timeline for this project.



Task Timeline

**Task List**

| **Task Description** | **Impact Risk** | **Expected Hours** | **Due Date** | **Champion** | **Actual Work Hours** |
| --- | --- | --- | --- | --- | --- |
| initial user interface design | 8 | 3 | 10/31 | Savannah | 5 |
| selecting screen | 8 | 1 | 11/15 |  |  |
| Color Sensor Picking | 7 | 1 | 11/3 | Astrid | 1 |
| Finalize UI V1 | 6 | 2 | 11/8 | Savannah | 1 |
| ESP32: potentiometer interaction | 7 | 1+ | 11/20 |  |  |
| ESP32: color sensor interaction | 8 | 1+ | 11/20 |  |  |
| ESP32: temp sensor interaction | 8 | 1+ | 11/20 |  |  |
| ESP32: screen interaction | 8 | 1+ | 11/20 |  |  |
| Shared Schematic Implementation | 8 | 1+ | 11/6 | Astrid | 1 |

## 1.5 References and File Links

### 1.5.1 References

[1] AlfredH1 and Instructables, “Everything you need to know about colour sensors,” Instructables, <https://www.instructables.com/Everything-you-need-to-know-about-colour-sensors/>, (accessed Oct. 19, 2023).

[2] “Detection based on ‘light’what is a color sensor?,” KEYENCE, https://www.keyence.com/ss/products/sensor/sensorbasics/color/info/, (accessed Oct. 19, 2023).

[3] "Ammonium & Ammonia sensors for water testing,” AquaRead, https://www.aquaread.com/sensors/ammonium-ammonia (accessed Nov. 12, 2023).

[4] “Seneye,” seneye, https://www.seneye.com/ (accessed Nov. 12, 2023).

[5] “How (and how often) to test aquarium water for healthy fish and plants,” Op, https://www.aquariumcoop.com/blogs/aquarium/aquarium-water-testing (accessed Nov. 12, 2023).

### 1.5.2 File Links

[ESP32 Datasheet](https://drive.google.com/file/d/1LZmSpgBcTSkA72qA32ZNZrJ2Q4c14Vzr/view?usp=share_link)

[Color Sensor Notes](https://docs.google.com/document/d/1tmPK-S2oo9aXApMzLYQliIJt_JYLfn_S148TjRFearc/edit?usp=sharing)

## 1.6 Revision Table

| 11/12/2023 | Caleb Neill: Revised overview paragraphs |
| --- | --- |
| 11/12/2023 | Savannah Tanner: team contacts, protocols |
| 11/12/2023 | Savannah Tanner: gap analysis edits |
| 11/12/2023 | Astrid Delestine: description, gap analysis edits |
| 10/19/2023 | Savannah Tanner, Caleb Neill, Astrid Delestine: section 1 draft completion |
| 10/19/2023 | Savannah Tanner: initial document creation |

# 2 Impacts and Risks

## 2.1 Design Impact Statement

**Note: Impact assessment underway. Please request additional information if needed.**

*Section to be created in Spring using a summary of our completed design impact assessment.*

## 2.2 Risks

| **Risk ID** | **Risk Description** | **Risk Category** | **Risk Probability** | **Risk Impact** | **Action Plan** |
| --- | --- | --- | --- | --- | --- |
| 1 | Team member needs to take personal time unexpectedly | Organizational | M | M | Team member informs group as soon as possible, group forms a plan to ensure work can be completed effectively, group informs professors about the situation |
| 2 | ordering PCB during Chinese New Year through China-based company [1] | Organizational | M | H | Avoid purchasing from China-based companies around Chinese New Year |
| 3 | water leaks into system | Safety | M | H | disconnect the device from power and remove it from the tank then locate and repair the leak |
| 4 | team member misses a deadline | Organizational | H | M | alert the team member about the deadline and meet to plan how to avoid this in the future; to avoid this we will discuss all deadlines during weekly meetings |
| 5 | wrong materials are used that are unsafe for aquatic life [2] | Environmental/safety | M | H | Remove the device from the tank and replace the material; to avoid this we will ensure all materials are safe for aquatic life before using them |
| 6 | system goes over budget | Organizational | H | M | re-evaluate our budget and components and, if necessary, seek to expand our budget |
| 7 | sensors are reading incorrectly | Technology | M | L | test the sensors with known values and re-calibrate; if the sensors are not working properly and the issue does not stem from any software problems, seek replacements |

## 2.3 References and File Links

### 2.3.1 References

**[1] C. Lau, “Chinese New Year 2023: Have you prepared your PCB orders?,” *PCB   
 Connect Group*, Oct. 11, 2022.   
 https://www.pcbconnectgroup.com/chinese-new-year-2023-have-you-prepared-  
 your-pcb-orders/ (accessed Nov. 12, 2023).  
[2] “Plastics Leach More Toxins Into the Water Than Previously Known,” *The Maritime  
 Executive*.   
 https://maritime-executive.com/editorials/plastics-leach-more-toxins-into-the  
 -water-than-previously-known#:~:text=All%20of%20the%20products%20  
 leached%20chemicals%20into%20the (accessed Nov. 13, 2023).**

### 2.3.2 File Links

[Types of materials that would be safe for aquarium use](https://docs.google.com/document/d/1fMSwbjMEzXV5rulFBDCrEdgdNqxRAWWHuxoPyYMSAGM/edit?usp=sharing)

## 2.4 Revision Table

| Date | Action |
| --- | --- |
| 11/12/2023 | Astrid Delestine: References to Risk Table |
| 11/12/2023 | Savannah Tanner: risk table added |
| 11/12/2023 | Astrid Delestine:   * Header and page numbers * Rachels's suggestions for * Overview * Gap Analysis |
| 11/12/2023 | Savannah Tanner: section 2 created |