MEMORANDUM

To: Alena Chercover
CC: Mel Dundas
From: Sebastien Robitaille, Braden Trigg, Eric Samer, Kayleb Stetsko
Date: September 20th, 2024
Subject: Project FishWorks Proposal

Summary

Building off Kayleb Stetsko's passion for aquariums and fishkeeping, we at Project FishWorks are designing a broad-spectrum modular control system that will be customizable to the needs of the user. Focusing on the use case of an aquarium, we are going to use modern microcontrollers to power a website-based application allowing the user to view and manage all aspects of their fish tank. We will be using the resources available to us through the Camosun Capstone program while self-funding, and plan on presenting a functional demo in December.

The History,

and the path.

Kayleb started his current aquarium project, *Figure 1*, in the late 90's, but his passion for fish keeping goes back well before that. Through his experience and time spent in both terrariums and aquariums, he has compiled a wealth of knowledge and grievances in both the biological and mechanical systems that are required to clean and maintain a healthy environment.

Figure 1 - Kayleb's current aquarium.

Traditionally these systems are maintained through experience and manual monitoring. Many of the factors that create a healthy environment are not visible and must be monitored using water tests and chemical reagents. Although some consumer systems are available that monitor some parameters electronically, many are non-modular, prohibitively expensive and lack fail-safes for emergency situations making fishkeeping a costly and stressful endeavor.

Using Kayleb's experience to guide the project, we will design and prototype a modular control system that will incorporate monitoring, parameter control, and emergency management. It is his goal that creating a low cost modular system that can be potentially brought to market, and will open the accessibility of fishkeeping to a larger audience.

What we are going to do,

and how are we going to do it.

The aim of Project FishWorks is to realize Kayleb's goal, and design and manufacture a user controllable modular monitoring and control system for multi tank aquariums. We are looking to leverage a small controller to connect to the internet and connect to other sensors and peripherals to monitor and control various aspects of the aquarium through a web app. While the system can be used for numerous devices and scenarios, we will focus on basic control and monitoring required for a home aquarium.

From above:

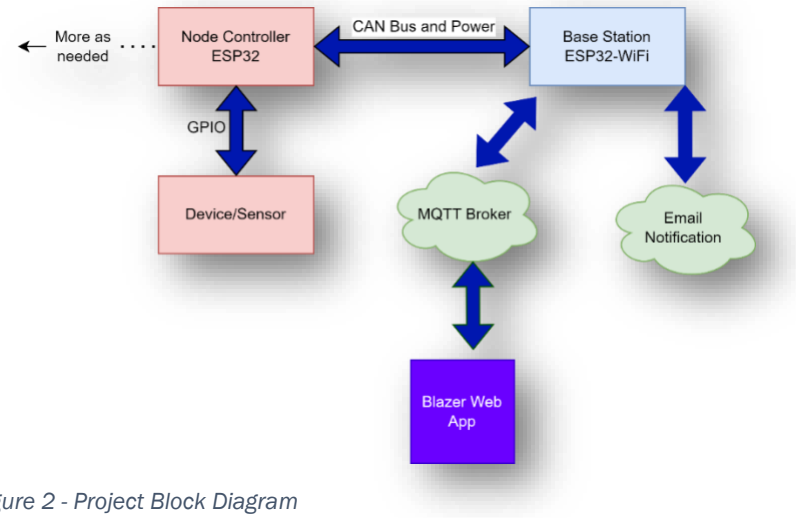


Figure 2 - Project Block Diagram

Our fishtank solution will be centrally controlled by a base station. As shown in *Figure 2*, the base station will connect to other nodes which will control and monitor peripheral devices such as temperature and utilize this information to implement fail-safes. The base station will be connected to WiFi to allow peripheral devices to be accessible through a web app allowing for real time monitoring, historical data, and direct system control.

Each peripheral device will be powered by its own Node Controller and will interface with various devices and sensors to relay the data through the CAN-Bus network to the base station. The system is expandable up to 20 Nodes per base station, allowing for a variety of system configurations. The user will be able to define alarm limits off these values and will be able to receive email alerts when parameters are outside of these limits.

Software & Firmware

Project FishWorks will make extensive use of software and firmware throughout the project. This area will be split into four major categories: A web app to allow users to interact with the system, base station firmware that will act as an interface between the web app and system along with sending alerts to the user. As well, the node controller core library communicates between all the devices and the base station, and device firmware that will facilitate processing data from the devices.

The web app will act as the primary user interface for the system, allowing users to view and change parameters for all devices connected to the base station. This app will be written using the Microsoft Blazor framework allowing the user to access it in a web browser, anywhere they have internet. An artist concept of the app interface is shown in *Figure 3*. A MQTT broker transfers data between the base station and the app. The project will use HiveMQ's free serverless broker for the prototype to avoid server hosting costs and administration.

Figure 3 - Artists Rendition of the Web App

The base - station firmware will useswill be connected to the CAN- Bus network to transfer data to and from the connected devices. This data will then be sent to and received from users of the app via the MQTT- broker. As well all device data will be logged to an SD card for future analysis and to allow the app to request historical data as required. It will also handle sending email alerts to the user. via email.

The node controller core library provides the functionality shared between all devices, such as sending and receiving data over the CAN-Bus network and synchronizing time with the base station. Device specific firmware, running on the node controller will make use of the node controller core library and handle any functionality not shared between devices, such as data processing from sensors, controlling relays, and triggering alarms.

Who's behind Project FishWorks

and where did they come from.

Having met in their first year of studies, all taking the Camosun Access Program for the Electrical Computers Engineering Technologies (ECET) Diploma program, they quickly formed a close group, calling it the Think-Tank and learned to rely on each other's strengths, allowing for the whole team to find success, which followed them all into the ECET program in the following years. They have stayed together since and have teamed up to help bring this project to fruition.

Kayleb

He is the dude whose idea it was. Above all he is a loving father, who would do anything for his children. Beyond that, anything alive he treats like his own, including the fish of the world. His love for technology and engineering got him to where he is today. His beard is legendary.

Eric

He is the dude who knows the electricity. Eric worked as a Red Seal Electrician until an accident forced him off his feet and has since decided to follow his love of technologies. He has a huge passion for space and science (and his cats). His beard is also legendary.

Sebastien

He is the dude who knows all the programing. He is the youngest of the group, but probably the smartest and his drive to learn and get things done is probably going to change the world. In his spare time, he helps track the bird populations and plays with computers. His beard, by the way, is legendary.

Braden

He is the dude who likes to write. He spent 16 years in hospitality working as a Chef and has since moved into IT. He is a passionate video gamer and is looking forward to furthering his passion in electronics, computers and science in general. He can't grow a beard but is still legendary.

Logistics and Financials

and the nitty gritty of the project.

We will be utilizing all available resources at Camosun College including faculty support, computer labs, 3D printing facilities and test equipment. We have decided to self-fund, and as such will be using a mix of Camosun resources and our own for sourcing project supplies and materials.

We are confident that we will be able to complete this project within the 14 weeks available during the Capstone Semester. We have set clear completion milestones for all parts of the project and have equally distributed the work between all members of the team. We have set a target completion date of November 24 for all hardware development, leaving two weeks of buffer and final documentation time. Details of these milestones can be found in our Gantt chart (Appendix #2).

Project Fishworks aims to have a fully functioning demonstration system for the capstone symposium in December that will monitor an aquarium to showcase the core features of the project.

Money Stuff

Table 1 (next page) outlines an estimate of project costs. This includes materials to construct a few additional controllers and nodes to use for future prototypes outside the scope of this project. This budget does not include some costs incurred during research and development completed before the start of the project (September 2024) that will not be used in the final prototype. Full breakdown of the budget can be found in Appendix #1.

This funding will primarily be provided by the group, split evenly between all members. Camosun College's Electronic Technologies department will be providing a PH sensor to facilitate the development of interface between our system and Atlas Scientific Sensors. All labour costs are estimated based on entry level engineering rates and are for illustrative purposes only and will not be incurred by any parties.

Table 1 – Budget Totals

Items	Price (CAD)
Materials	$1030
Materials – Camosun Funded	$250
Labour	$124,200
Total	$125,230

Parting Words

but fear not, there will be more.

We are confident that our goals and the challenges they will present will be surmounted. Our combined experience, ranging from design and manufacturing, software development, electrical engineering and project management, will be able to hold us to our values, and successfully complete the project. With most of the alternate solutions in fishkeeping being targeted to industrial and large-scale tanks, we are confident that our solution will bridge the gaps that exist between the small consumer tanks and large setups.

We hope to gain your support in this project, and we are confident that we will be able to achieve our goals within the required time. We are excited to show the world our system in the coming months. Please reach out to us with any questions or concerns.

Team Members Contact Information

Name	Telephone	Email
Eric Samer	(778-678-4638)	eric.samer@gmail.com
Braden Trigg	(250-507-8508)	triggbraden@yahoo.ca
Sebastian Robitaille	(778-700-1448)	sebastien@robitaille.info
Kayleb Stetsko	(250-885-1734)	kayleb_s@hotmail.com

Appendices

#1 – Budget Tables

Table 2 - Materials

Items	Price (CAD)
Base Stations	$200
Node Controllers	$300
Lighting Assembly and Control	$150
Tank Mechanical	$250
Temperature/Humidity	$20
Leak Detector	$10
A/C Outlet Control	$100
Total	$1030

Table 3 - Labour

Item	Rate	Hours	Cost (CAD)
Standard Labour	$45/hr	2400	$108,000
Overtime Allowance (10%)	$67.5/hr	240	$16,200
Total		2640	$124,200

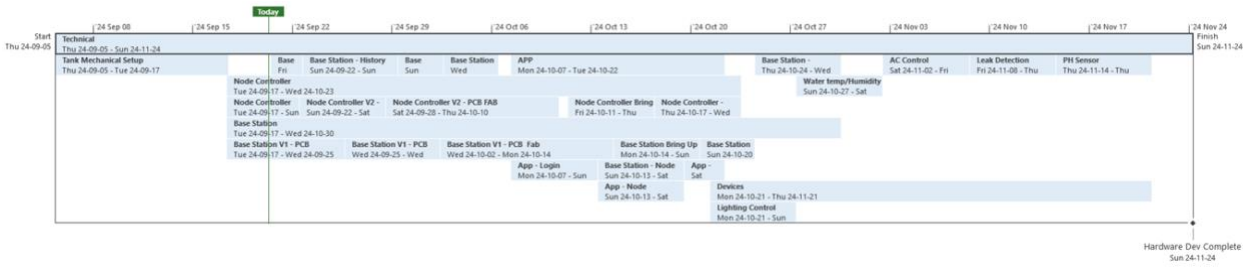
Table 4 – Camosun Funded Material

Items	Price (CAD)
PH Sensor	$250

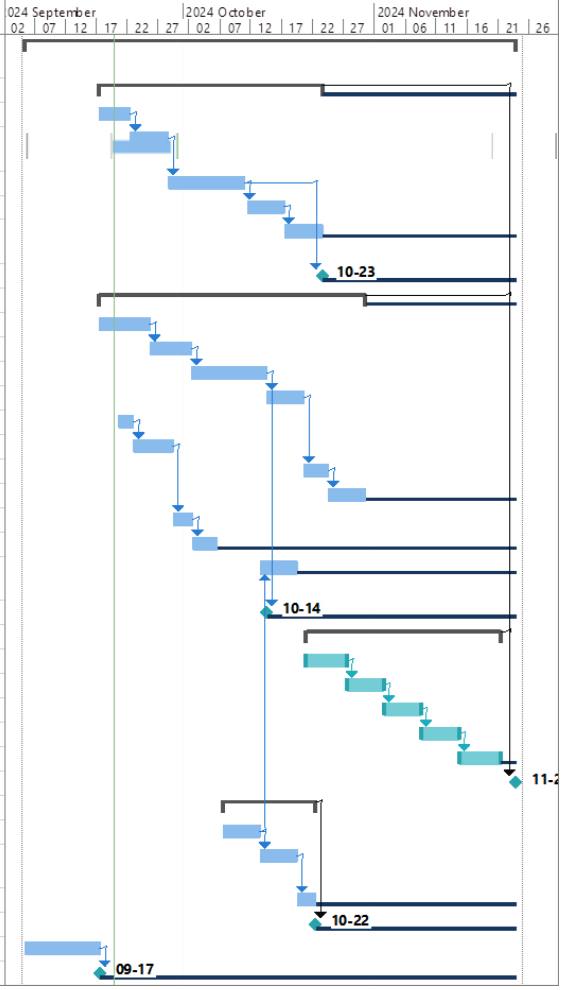
Table 5 – Totals

Items	Price (CAD)
Materials	$1030
Materials – Camosun Funded	$250
Labour	$124,200
Total	$125,460

#2 – Gantt Chart



ID	Task Name	Duration	Start	Finish	Predeces
1	**Technical**	**90 days?**	**Thu 24-09-05**	**Sun 24-11-24**	
2	**Node Controller**	**41 days?**	**Tue 24-09-17**	**Wed 24-10-23**	
3	Node Controller V2 - PCB	6 days?	Tue 24-09-17	Sun 24-09-22	
4 31	Node Controller V2 - PCB - Revisions	7 days?	Sun 24-09-22	Sat 24-09-28	3
5	Node Controller V2 - PCB FAB	14 days?	Sat 24-09-28	Thu 24-10-10	4
6	Node Controller Bring Up	7 days?	Fri 24-10-11	Thu 24-10-17	5
7	Node Controller - Performance Pass	7 days?	Thu 24-10-17	Wed 24-10-23	6
8	Node Controllers Built	0 days	Wed 24-10-23	Wed 24-10-23	5
9	**Base Station**	**49 days?**	**Tue 24-09-17**	**Wed 24-10-30**	
10	Base Station V1 - PCB	10 days?	Tue 24-09-17	Wed 24-09-25	
11	Base Station V1 - PCB Revisions	7 days?	Wed 24-09-25	Wed 24-10-02	10
12	Base Station V1 - PCB Fab	14 days?	Wed 24-10-02	Mon 24-10-14	11
13	Base Station Bring Up	7 days?	Mon 24-10-14	Sun 24-10-20	12
14	Base Station - Alerts	3 days?	Fri 24-09-20	Sun 24-09-22	
15	Base Station - History	7 days?	Sun 24-09-22	Sun 24-09-29	14
16	Base Station - S3 Migration	4 days?	Sun 24-10-20	Thu 24-10-24	13
17	Base Station - Performance Pass	7 days?	Thu 24-10-24	Wed 24-10-30	16
18	Base Station - Time Keeping	4 days?	Sun 24-09-29	Wed 24-10-02	15
19	Base Station - Credentials	4 days?	Wed 24-10-02	Sun 24-10-06	18
20	Base Station - Node Management/Naming	7 days?	Sun 24-10-13	Sat 24-10-19	30
21	Base Stations Built	0 days	Mon 24-10-14	Mon 24-10-14	12
22	**Devices**	**34.94 days?**	**Mon 24-10-21**	**Thu 24-11-21**	
23	Lighting Control	7 days?	Mon 24-10-21	Sun 24-10-27	
24	Water temp/Humidity	7 days?	Sun 24-10-27	Sat 24-11-02	23
25	AC Control	7 days?	Sat 24-11-02	Fri 24-11-08	24
26	Leak Detection	7 days?	Fri 24-11-08	Thu 24-11-14	25
27	PH Sensor	7 days?	Thu 24-11-14	Thu 24-11-21	26
28	Hardware Dev Complete	0 days	Sun 24-11-24	Sun 24-11-24	2,9,22
29	**APP**	**17 days?**	**Mon 24-10-07**	**Tue 24-10-22**	
30	App - Login Managemnent	7 days?	Mon 24-10-07	Sun 24-10-13	
31	App - Node Management/dashboard	7 days?	Sun 24-10-13	Sat 24-10-19	30
32	App - device UI	3 days?	Sat 24-10-19	Tue 24-10-22	31
33	APP Programing Complete	0 days	Tue 24-10-22	Tue 24-10-22	29
34	Tank Mechanical Setup	14 days	Thu 24-09-05	Tue 24-09-17	
35	Tank Basic Set Up	0 days	Tue 24-09-17	Tue 24-09-17	34



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