

2 Project Plan

2.1 PROJECT MANAGEMENT/TRACKING PROCEDURES

We will be using an agile approach to this project. The agile process will aid in our project development throughout the project in many ways including input from the clients themselves. We will be completing this project in small manageable phases, whilst getting input from the client on each small step that we pass. We are developing this project in such a way that it is a fluid process to jump between phases we are currently working on depending on the needs of the clients themselves. Once we are able to have tangible prototypes, our team will be putting these prototypes in the hands and eyes of the clients to follow the process of getting complete and informative input from the users themselves.

We are managing our Agile process through our “stand-up” meetings over discord team call every Sunday. The main goal of this meeting is to go over the generalities of what each team member worked on in the previous week. As well, we will be assigning week-long tasks to each individual in these meetings to ensure we are keeping on track and utilizing our teammates' skills to their fullest. During this meeting, we will also talk about any blockers that each team member might have as well.

We will be using Gitlab to track our progress as a team and to identify areas where we are falling behind. Issues will be assigned to team members when a task needs to be completed, and during the stand-up meetings, these issues will be re-evaluated if they need more time, people, or resources. This will help our Agile process move along as fluidly as possible.

2.2 TASK DECOMPOSITION

In order to solve the problem at hand, it helps to decompose it into multiple tasks and subtasks and to understand interdependence among tasks. This step might be useful even if you adopt agile methodology. If you are agile, you can also provide a linear progression of completed requirements aligned with your sprints for the entire project.

Frontend

- Mockup Design
- Initial Frontend Development
 - Research useful libraries
 - Create React components
 - Test cases for usage
- Connect with Backend
 - Implement components with data from backend
 - Ensure data is displayed properly
- Give demo to clients

- Ensure that clients are able to use application with ease
- Clients should be able to use application on their own
- Publish to App store

Backend

- Backend Ideation
- Initial Backend development
 - Creating REST controllers
 - Setting up database
 - Creating dataflow
- Cloud deployment
 - Test google firebase
 - Evaluate it's effectiveness
- Full system integration
 - Verify that data flow works between backend, frontend and firmware

Hardware/Enclosure

- Enclosure Ideation
- Enclosure Prototyping and measurements
- Enclosure Testing
 - Test feeding apparatus
 - Test motor speed. May need adjustment in gear ratio for speed
 - Test fish tank mounting
 - Test food containment/input
 - Receive input on the device looks
- Enclosure Final Design
- Produce Final Design

Hardware/Chip-Down

- Research development boards for prototype
- Purchase development boards
- Configure a complete prototype device consisting of development boards
- Choose the final components for the device
- Design a custom PCB
- Produce PCB
- Assemble final product boards

Firmware

- Development board actions
 - MCU/Wifi Development Board
 - Connect to internet
 - Send mock requests to a service like POSTman for testing purposes
 - Send requests to our external backend service
 - Handle requests from the backend service
 - Be able to store information in non-volatile memory

- Feeding Schedule and last fed time
 - Configure an RTOS timer to keep track of scheduled timings
 - Complete device states in accordance with device sensors and schedule
 - Identify state of Wifi connection and motor to display problems to LED
- Temperature Development Board
 - Use the MCU development board to communicate with the temperature sensor development board
 - Send requests to configure the temperature sensor chip
 - Receive data from the temperature sensor
 - Test received data from the temperature sensor for accuracy
 - Send data from temperature sensor to MCU development board
- pH Development Board
 - Use the MCU development board to communicate with the pH sensor development board
 - Send requests to configure the pH sensor chip
 - Receive data from the pH sensor
 - Test received data from the pH sensor for accuracy
 - Send data from the pH sensor to the MCU development board
- Motor
 - Use the MCU development board to turn the motor on and off
- LED
 - Use the MCU development board to turn the LED on and off
 - Use the MCU development board to turn the LED on any requested color
- Custom PCB
 - Confirm the device works as the development board prototype
 - Refine code that was necessary with development boards
 - Test device actions
 - Test device communication with the backend
 - Test device pH reading
 - Test device temperature reading
 - Test device motor actuation
 - Test device LED modes
 - Test device process actions

2.3 PROJECT PROPOSED MILESTONES, METRICS, AND EVALUATION CRITERIA

What are some key milestones in your proposed project? It may be helpful to develop these milestones for each task and subtask from 2.2. How do you measure progress on a given task? These metrics, preferably quantifiable, should be developed for each task. The milestones should be stated in terms of these metrics: Machine learning algorithm XYZ will classify with 80% accuracy; the pattern recognition logic on FPGA will recognize a pattern every 1 ms (at 1K patterns/sec throughput). ML accuracy target might go up to 90% from 80%.

In an agile development process, these milestones can be refined with successive iterations/sprints (perhaps a subset of your requirements applicable to those sprint).

<i>Milestone</i>	<i>Metric</i>
Firmware Milestones	
Connection to backend	Able to receive/send a request to/from the backend service
Temperature Reading	Ability to receive data from the temperature sensor and convert this data into a recognizable and accurate temperature
pH Reading	Ability to receive data from the pH sensor and convert this data into a recognizable and accurate pH
Motor Running	Able to start and stop the motor on command from the MCU
LED Running	Able to turn the LED off and on. Also, able to turn the LED to any color requested by MCU
Task Scheduler Functional	This is measured by the ability to perform a task within the MCU based solely on a time delay handled by the MCU. (e.g. perform a temperature reading every 5 minutes)
Offline Feeding Scheduler Function	MCU is able to recognize that it is offline and still able to feed fish on schedule.
Hardware/Enclosure Milestones	
Prototype design	Prototype designed out with measurements of all the parts.
Prototype in 3D printing software	Prototype designed in the software needed to 3D print enclosure.
Final Prototype	Measured out prototype that fits the enclosure and all of our parts correctly.
Hardware/Chip-Down Milestones	
Frontend Milestones	
Create Mockup	Full design is complete with all application

	pages and components
Create Components	All components designed in the mockup are implemented but do not display live data
Connect to backend	Components and application are connected to backend and display live data from database
Test Components	Ensure that all components are behaving correctly and handle changes in data
Publish Application	Make app available for clients to download from the app store
Backend Milestones	
Get service on Firebase	The backend is running and accessible through firebase
Connection to the Firmware	The backend is able to send schedule updates to the firmware
Connection to the Frontend	The backend can send and receive updates from the frontend application
Connect to database	The backend is able to store data within a database and access that information
CI/CD Pipeline	The backend can be continuously deployed when changes are made
Data Storage and Analytics	The backend will store the readings from the sensors and store the information to view trends

2.4 PROJECT TIMELINE/SCHEDULE

- A realistic, well-planned schedule is an essential component of every well-planned project
- Most scheduling errors occur as the result of either not properly identifying all of the necessary activities (tasks and/or subtasks) or not properly estimating the amount of effort required to correctly complete the activity
- A detailed schedule is needed as a part of the plan:

- Start with a Gantt chart showing the tasks (that you developed in 2.2) and associated subtasks versus the proposed project calendar (including both 491 and 492 semesters). The Gantt chart shall be referenced and summarized in the text.

- Annotate the Gantt chart with when each project deliverable will be delivered

• Project schedule/Gantt chart can be adapted to Agile or Waterfall development model. For agile, a sprint schedule with specific technical milestones/requirements/targets will work.

Firmware Gantt chart

10/17	10/24	10/31	11/7	11/14	11/28	12/5	12/12
Waiting for parts to arrive and additional research	In Parallel Designing the enclosure parts to hold the food and attach to motor	In Parallel Designing the enclosure parts to hold the food and attach to motor	In Parallel Designing the enclosure parts to hold the food and attach to motor	In Parallel Designing the enclosure parts to hold the food and attach to motor			
	Connection to backend	Connection to backend	Connection to backend	Connection to backend			
		pH and temperature implementation and testing	pH and temperature implementation and testing				
				Motor working and testing	Motor working and testing		
						Mode identify and LED use for this	Mode identify and LED use for this

1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/6	3/20	3/27	4/4	4/11	4/18	4/25	5/2	5/9
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											3	1	1	2	1	7
Task Scheduler function	Task Scheduler function															
		Offline scheduler	Offline scheduler	Offline scheduler	Offline scheduler											
						Testing(T)	T	T	T	T	T	T	T	T	T	T

Backend

10/17	10/24	10/31	11/7	11/14	11/28	12/5	12/12
Setting up Spring boot							
		Connection to Firmware					
		Connection to Frontend					
				Deploy to FireBase			
					Connect to Database		

1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/6	3/20	3/27	4/3	4/10	4/17	4/24	5/1	5/7
CI/CD															
	Data Storage and analytics														
						Testing(T) / Feature Refinement									

Frontend

10/17	10/24	10/31	11/7	11/14	11/28	12/5	12/12
Figma Design							
		Develop login and main screen					
			Connect to backend				
				TDD, creating tests for components			

1/16	1/23	1/30	2/6	2/13	2/20	2/27	3/6	3/13	3/20	3/27	4/3	To end date
Develop main screen with tank/fish info												
	Test backend connection with features											
		Frontend feed scheduler (making and viewing)										
TDD, tests for components and integration.												
						Code refinement, testing, and documentation						
		Figure out and deploy application for iOS										

2.5 RISKS AND RISK MANAGEMENT/MITIGATION

Consider for each task what risks exist (certain performance target may not be met; certain tool may not work as expected) and assign an educated guess of probability for that risk. For any risk factor with a probability exceeding 0.5, develop a risk mitigation plan. Can you eliminate that task and add another task or set of tasks that might cost more? Can you buy something off-the-shelf from the market to achieve that functionality? Can you try an alternative tool, technology, algorithm, or board?

Agile project can associate risks and risk mitigation with each sprint.

Risks

Risk	Probability
Chip-down parts not being in stock by end of the project	0.25
Device not allowed to connect to Iowa State WiFi	0.1
PCB parts ship date too late	0.2
Google Firebase being difficult to work with	0.1
Cannot publish App to Apple App Store	0.2

2.6 PERSONNEL EFFORT REQUIREMENTS

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be the projected effort in total number of person-hours required to perform the task.

Tasks	Time (Person-Hours)
Learn CAD and design the 2 different hardware designs for prototypes	21
Research Firebase and implement in design	8
Learn React-Native and state management for mobile applications	10
Learn Figma and create design	5

2.7 OTHER RESOURCE REQUIREMENTS

- IOS Device
- Google Firebase access
- Hardware device internet access
- Enclosure
 - Access to 3D Printer
 - 3D Printer Filament
 - Access to 3D modeling software
- Device Hardware
 - MCU/Wifi enabled chip
 - Temperature conversion module
 - K-Type Thermocouple
 - pH Probe
 - pH conversion module
 - 3.3v - 5v DC Motor
 - RGB LED