

AQUAMODS

Team C3

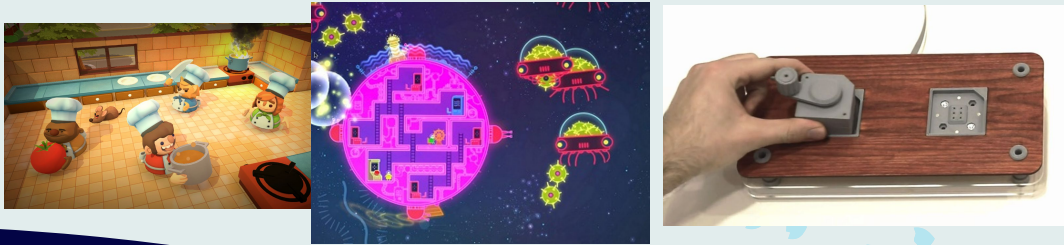
Alan Abraham, **Angela Xu**, John Pedraza



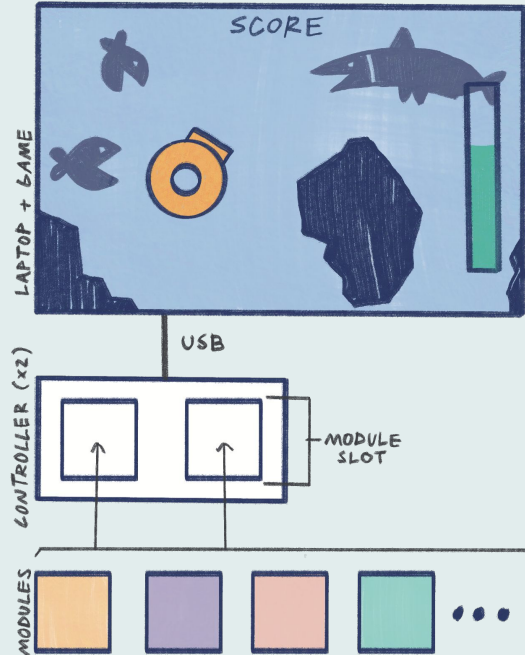
USE CASE / APPLICATION

A multiplayer video game with a unique controller which gives users the experience of playing an arcade game with friends while being cheap and portable.

Requirements: portable, affordable, durable, responsive to input (low latency), fun to play



SOLUTION APPROACH



Gameplay details:

- 2 players work together to pilot a descending submarine while being attacked by fish
- Manage the submarine's battery (health) while maximizing score (depth traveled)
- 1 player controls a net gun, the other controls a harpoon

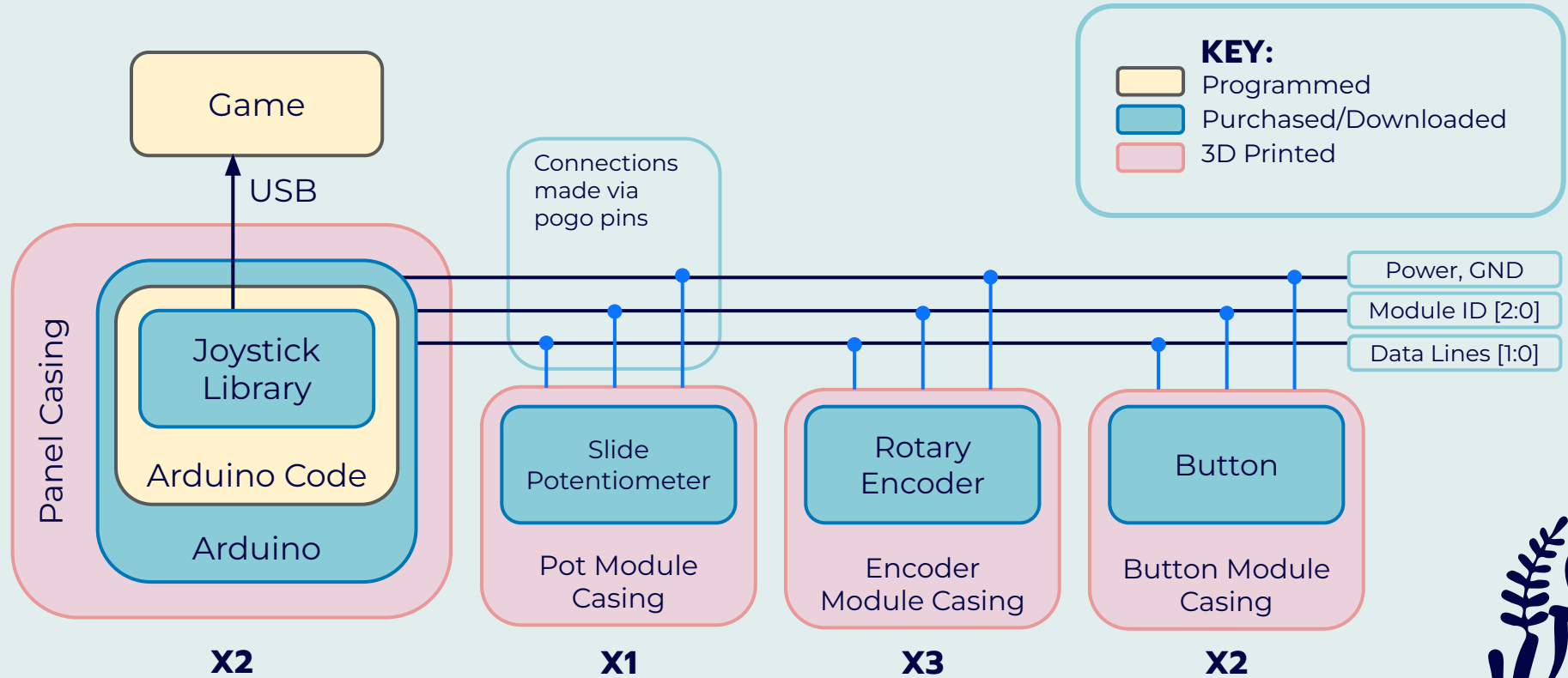
Module details:

- **steering:** turn a dial (rotary encoder)
- **aim (gun):** turn a dial (rotary encoder)
- **aim (shield):** turn a dial (rotary encoder)
- **adjust speed:** adjust slider (sliding potentiometer)
- **fire gun:** press button (button)
- **charge battery:** hold button (button)

DESIGN REQUIREMENTS

REQUIREMENT	METRIC	REASONING
Total Weight	< 1.5lb	Around half the weight of a small laptop - light enough to be portable
Panel Size	< 5.5 x 9 x 2.5 inches	Half the size of a sheet of letter paper
Cost	< \$150	Should be cheaper than an arcade cabinet (\$500-600)
Controller Latency	< 30ms	The time between a button being pressed and the controller sending a message about it should be comparable to other controllers
Ease of Module Swapping	< 10s average to switch module	Switching modules should feel natural and not disrupt the flow of the game
Module Durability	> 30 games	Modules should still be in peak condition after playing 30 games
Fun	> 80% positive survey results	Game should have mostly positive response

SYSTEM SPECIFICATION



INITIAL CASING DESIGNS

Basic Module Casing

peripheral

pogo pins

56.8 x 56.8 x 36.8 mm

Module Connection

76.8 x 76.8 x 10 mm

pogo pins

Combined + Panel Box

Box dimensions:
228.6 x 127 x 50.8 mm

The panel box will contain one Arduino Leonardo and some wiring. A hole will be cut in the back for the USB connector.

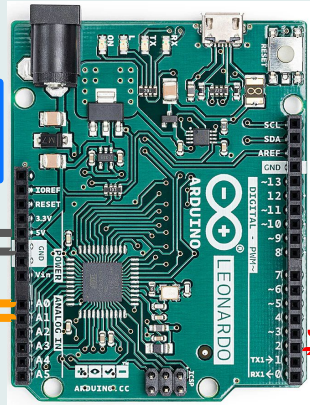
ARDUINO

Module ID Pins

Module 1: D4, D5, D6
Module 2: D7, D8, D9

Power (5V)
+ Ground

Sent to both
modules



Module Data Pins

Analog Data Pins
Module 1: A0
Module 2: A1

Digital Data Pins
Module 1: D2
Module 2: D3

Arduino joystick library allows the Arduino to appear to the laptop as though it is a controller; assign each button, encoder, or potentiometer to a button or joystick value on a standard gamepad.

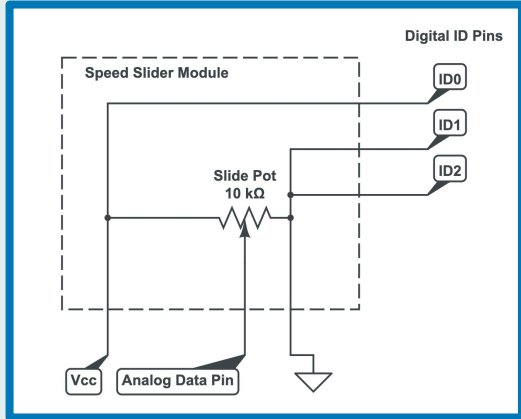
Arduino Loop

Get Module IDs from
ID pins

Set state of gamepad
to match data from
data pins

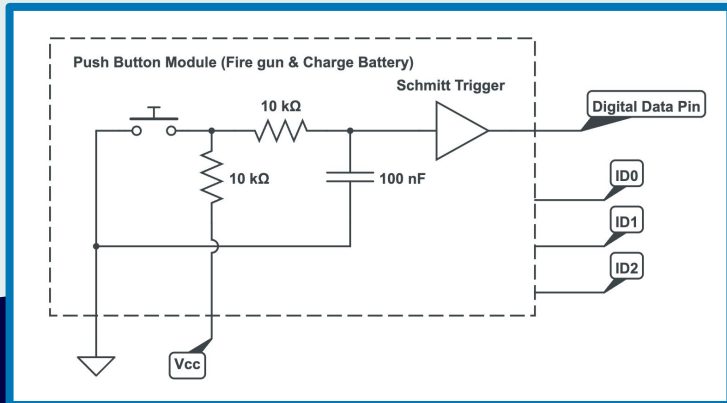
Send updated
gamepad state to
laptop

MODULE SCHEMATICS

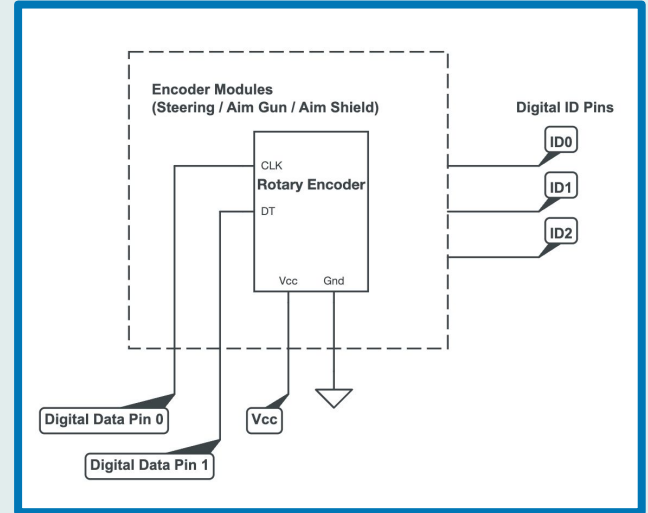


Slide potentiometer module reads analog voltage data

This schematic also shows the internal wiring for ID pins



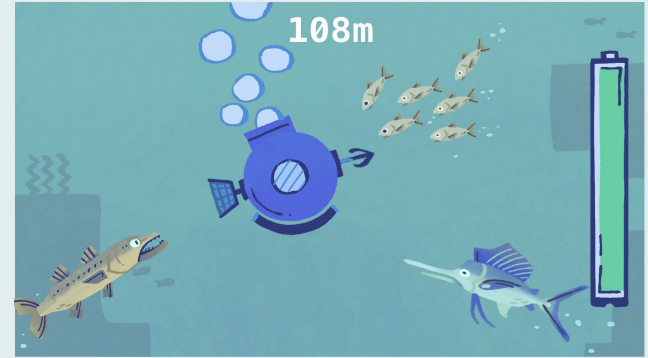
Push button module uses RC filter and Schmitt trigger to implement debouncing



Encoder modules require two data pins

GAME

- The game will be playable with keyboard, standard controller, or custom controllers.
 - Having multiple options will allow us to playtest earlier and compare the experience of using custom controllers with traditional ones.
- Video example of 2 players – one using keyboard, one using standard controller.



TESTING: METHODS AND RISKS

TEST	METRIC	METHOD
Total Weight	< 1.5lb	Measure weight of entire system using electronic scale
Panel Size	< 5.5 x 9 x 2.5 inches	Use ruler to measure dimensions of controller panel
Controller Latency	< 30 ms	Record time between Arduino registering input and sending message to laptop
Ease of Module Swapping	< 10s average to switch module	While playtesting, compute in software the average time that module slots are left empty for
Module Durability	> 30 games	Playtest for 30 games and determine if modules are still playable
Fun	> 80% positive survey results	Visit Hunt Playtesting Nights and have playtesters try our game and fill out feedback survey

Risk Mitigations:

- Experiment with infill amount of 3d printed parts to adjust weight
- Update controller state manually rather than automatically in order to minimize latency
- Start playtesting early to get more feedback



Risk Mitigation

METRIC	RISK	MITIGATION STRATEGY
Total Weight	System is no longer portable	Since the panels are the biggest risk factor toward weight, we can use a lighter material for the panels
Panel Size	Players have more trouble using the reconfigurable controller	IDK (maybe we just delete the row lol)
Controller Latency	Game is significantly less enjoyable due to input lag	Idk
Ease of Module Swapping	Players are distracted from gameplay by trying to switch modules	idk
Module Durability	Players need to more frequently replace their controller parts	Provide additional copies of modules
Fun	Players are less incentivized to buy a game that has poor reviews	Reiterate design of game upon getting feedback to improve the feel of the game