

# AQUAMODS

Team C3

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



# USE CASE

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

ECE Areas: Software, Circuits, Hardware



# THE PRODUCT

## THE GAME

2-player co-op game to pilot a submarine



## THE CONTROLLER

2 controllers, 6 different control modules

Trade, disassemble, and reassemble control modules to pilot the submarine



# Requirements

**Portability:** light enough to easily set up and carry around

- The total weight should be  $< 500$  g
- The Nintendo Switch weighs 422 g

**Cost:** more affordable than an arcade cabinet

- Cost of parts required to build controllers should be  $< \$150$
- Arcade machines on the market cost around \$500-\$600

**Ease of module switching:** the act of switching modules should be natural, so as to not distract players while playing the game

- $< 3$  s to remove a module and replace it with another

# Requirements

**Controller latency:** game is reasonably responsive to controller input

- < 20 ms delay from module insertion in controller to detection in software
- Xbox One controller has 5.54 ms latency
- The industry standard for gaming controller latency is < 15 ms for professional gaming

**Module durability:** modules are durable with repeated use

- Each module should function well past 30 games of nominal use

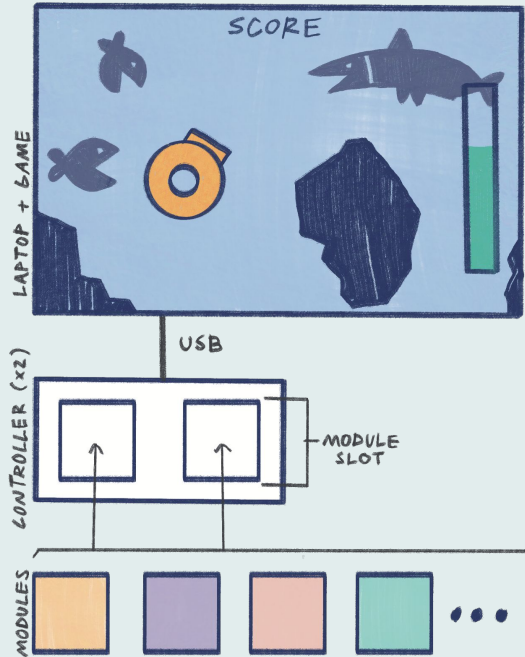
**Enjoyment:** game is fun

- > 85% player satisfaction
- Overcooked has 93% satisfaction, Lovers In a Dangerous Spacetime has 94% satisfaction

# Technical Challenges

- **Module Ease of Use**
  - For players to enjoy the game, it is important that the hardware works seamlessly
- **Detection of Modules and Inputs from Controller**
  - Our custom designed modules need to be detected by the game quick enough
  - There should be no noticeable delay between user responses and actions in the game
- **Enjoyability of the game**
  - The game and custom controller interface needs to be fun for this product to be a viable alternative as a portable arcade game

# SOLUTION APPROACH



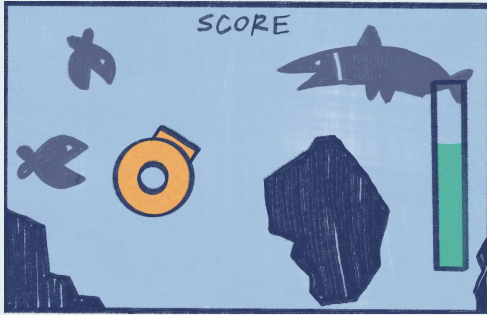
**Game:** built using Unity

**Control panels:** panels will communicate with laptop using an Arduino Leonardo, which has built-in USB communication.

**Modules:** modules will have 3D printed, unique designs that will house passive peripherals such as buttons and potentiometers



# SOLUTION APPROACH



## Gameplay details:

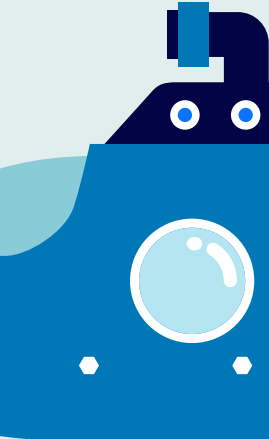
- 2 players work together to pilot a submarine descending through randomly generated terrain while being attacked by fish
- Manage the submarines battery (health) while maximizing score (depth traveled)
- 1 player controls a net gun, the other controls a harpoon

## Module details:

**steering:** turn a wheel / **speed:** adjust slider / **aim gun:** turn dial  
**fire gun:** press button / **charge battery:** hold button / **shield:** turn dial to aim



# TESTING, VERIFICATION, METRICS





REQUIREMENT	METRIC	METHOD
<b>Total Weight</b>	< 500g	Electronic scale
<b>Cost</b>	< \$150	Track purchases
<b>Latency</b>	< 20ms	Measure frame delay with high speed camera
<b>Ease of Module Swapping</b>	< 3s each to remove and then add module	Measure average time to swap while playtesting
<b>Module Durability</b>	> 30 games	Check status of modules after playing a game
<b>Fun</b>	> 85% positive survey results	Visit playtest nights at Hunt Library to gather survey feedback

# TASKS



CATEGORY	TASK	PEOPLE
Control Panels	CAD and assembly of case	Alan
	Arduino code	John
Modules	CAD and assembly of modules	Alan
	Circuit designs	Angela, John
	Connection to Arduino	Alan, John
Game	Game Design	Alan, Angela, John
	Sound, Art, Music	Alan, Angela, John
	Game Programming	Angela, John
	Controller Integration	Angela



# SCHEDULE

	Week 4					Week 5					Week 6					Week 7					Spring Break					Week 8					Week 9					Week 10					Week 11					Week 12					Week 13					Week 14															
	2/5	2/6	2/7	2/8	2/9	2/11	2/12	2/13	2/14	2/15	2/17	2/18	2/19	2/20	2/21	2/23	2/24	2/25	2/26	2/27	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/11	3/12	3/13	3/14	3/15	3/16	3/18	3/19	3/20	3/21	3/22	3/24	3/25	3/26	3/27	3/28	3/29	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/8	4/9	4/10	4/11	4/12	4/13	4/15	4/16	4/17	4/18	4/19	4/20	4/22	4/23	4/24	4/25	4/26	4/27
General Deadlines	Proposal Presentation										Design Presentation																				Interim Demo										Final Presentation																														
Modules											PCB Design																																																												
Electronics Design	Circuit + protoboard										PCB Design																																																												
Selection of electronic peripheral parts						Choose parts																																																																	
CAD											Design outer casing					Individual module designs																																																							
3d printing and assembly																																																																							
Panels																																																																							
CAD design of casing																																																																							
Laser cutting and assembly																																																																							
Game																																																																							
Level design	Art Direction										Level, Enemy Design										Sound Direction										UI Design																																								
Asset creation / Implementation						Sub and Module Sprites										Enemy Sprites										Level Art					SFX + Music																																								
Programming	Github setup / Basic Mechanics										Controller Pairing					Enemy AI										Level Generation										Effects					UI / Menu																														
Integration																																																																							
Arduino connection with game											Response to Arduino																																																												
Module connection to game																																				Module + Arduino + Game																																			
Module connection to panels (+ game)																																									Module + Panel + Arduino + Game																														
Playtesting/Slack																																																																							

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# Minimum Viable Product

- Our minimum viable product is a functional game with at least 1 level
- We also will have functioning controllers and modules
- All the interfacing to connect the hardware and software will be complete