X-ABILITY

YOUR DREAM GAME CONTROLLER

By Group Z11

GameAbility

0.
Agenda

Timeline of this Presentation

Agenda

PART 1

1. Customer needs and problem statement
2. Market Research and Target Specifications
3. Concept and Final Choice
4. Business model and Economics
5. Feasibility Study
6. Final Project Plan

Agenda

PART 2

7. BOM, Prototyping and Testing Plans
8. Prototype 1 review
9. Prototype 2 and its challenges
10. Final prototype and its challenge
11. Live demo

Agenda

PART 3

12. Skills Acquired
13. Lessons Learned
14. Future Endeavours

1.

PART ONE

A quick summary of our previous deliverables;
The groundwork of our project

Client needs statements

No.	Client needs statements	Priority
1	A remote adapted to any kind of video game	5
2	The remote controller is compatible with the Xbox and PC	5
3	The remote controller is inspired by the Axis controller model	3
4	The remote integrates an interface to configure each button	5
5	The remote software has a macro that allows action to be made by clicking one button	5
6	The remote is easy to use	4
7	Buttons can be spaced in any way	2
8	The remote is simple/doesn't have lot of buttons	3
9	The remote can be made in a short amount of time	4
10	The remote is inexpensive	4
11	The remote is custom made	3
12	The remote is robust/The remote is made of high quality products but as low-cost as possible	5
13	The remote includes a sticky trigger	5
14	The remote's sticky trigger has an on and off toggle	5
15	Remote is comfortable	5
16	The software's user interface is accessible	5
17	The remote's design is ergonomic	5
18	The remote has a reasonable weight	4
19	The controller is portable	1
20	Sensitivity of buttons and joysticks can be configured	3
21	The controller have is adapted to the tremors	2

Problem Statement

" Design a robust, programmable and accessible remote controller that is compatible with both Xbox and PC for disabled gamers. "

Market Research

Axis 1 Pro

expensive accessible controller.

Xbox adaptive controller

Xbox's proprietary solution to adaptive controllers

Target specifications

Portability

of the remote

Modularity

of the button implementation

Modularity

of the sticky trigger implementation

Cost

Manufacturing and Design

Target specifications cont'd

Shape

Controller shape and dimensions

Accessibility

of the interface and setup

Compatibility

with other devices

Low lag

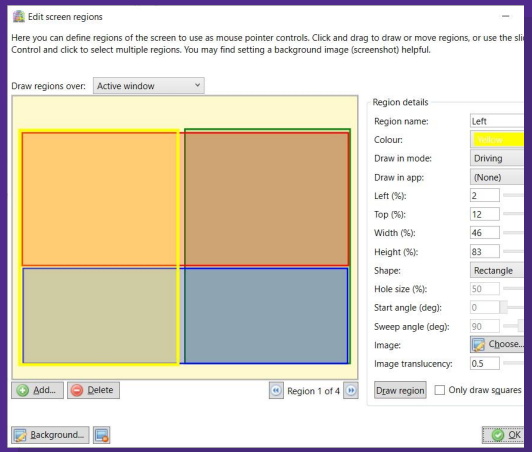
Low delay input

CONCEPTS

1. Taking apart regular controller

2. Use arduino with Xinput firmware

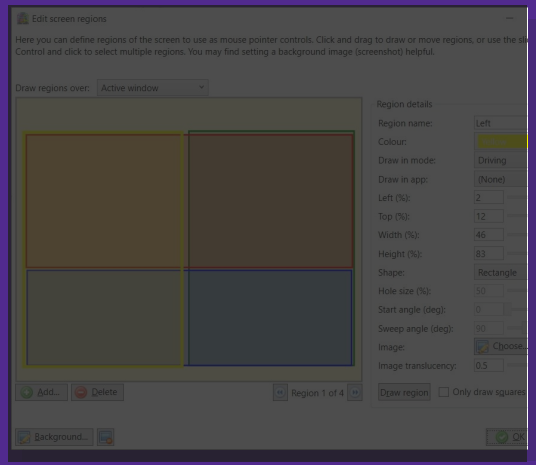
3. Reverse engineer GIP protocol + use Xbox controller to send signals



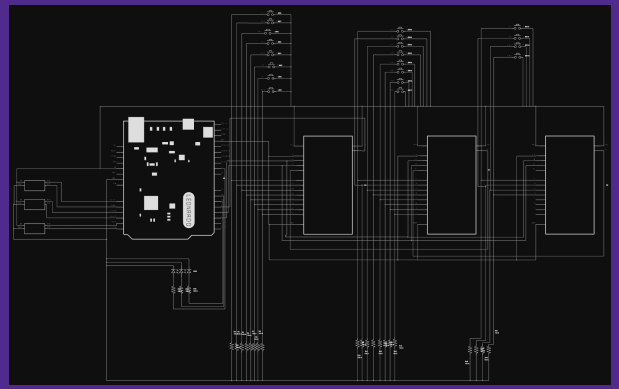
4. Use external open-source platform (Alt Controller)

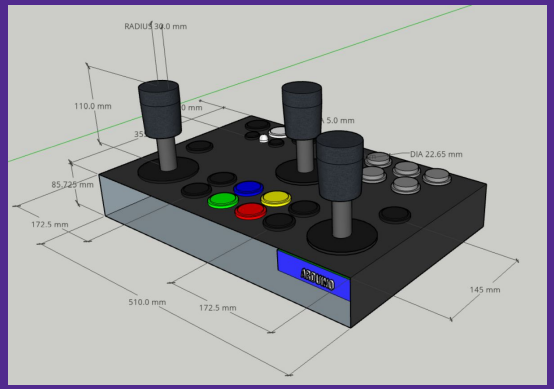
FINAL CHOICE

2. Use arduino with Xinput firmware



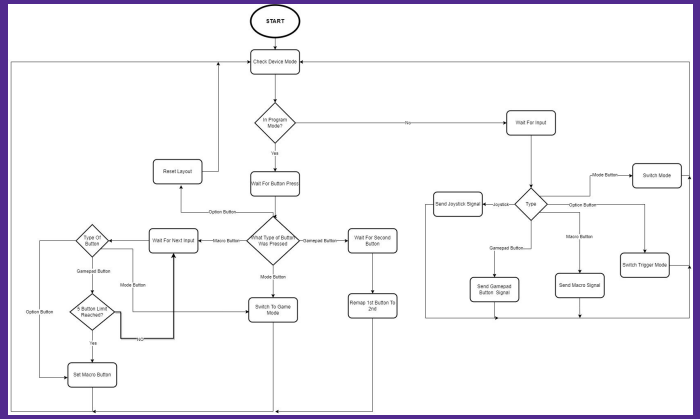
Detailed Design





Assumptions

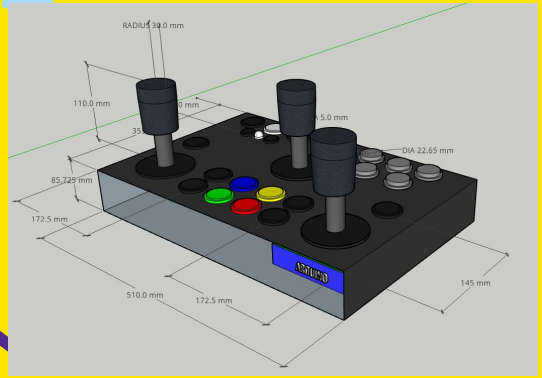
- Micro chips would have enough power
- Minimal input lag
- Remappable macros



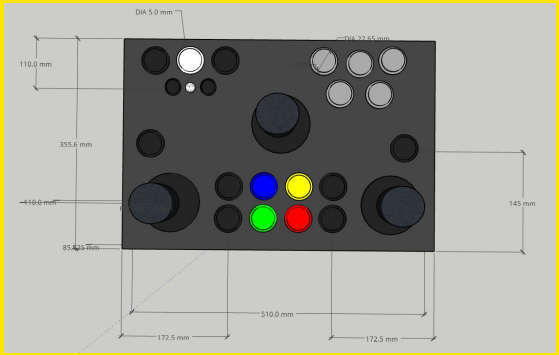
CAD

- Circuit
- Case with buttons

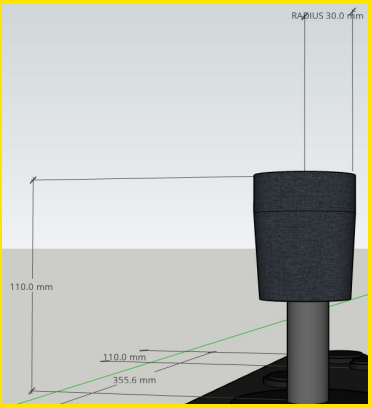
PHYSICAL DESIGN



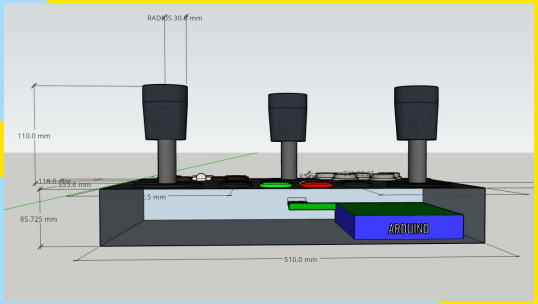
Overall view



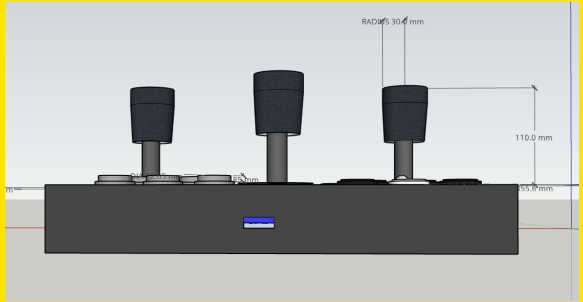
Top view



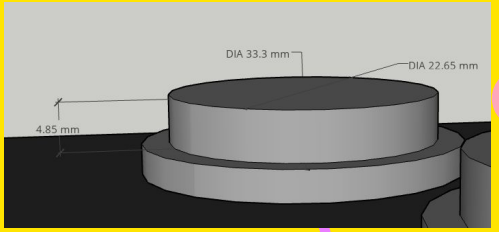
Joystick view



Front view



Back view

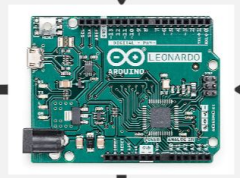


Button view

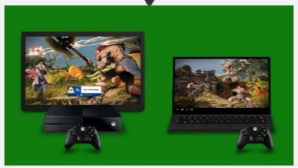
Functional Circuit Decomposition

read Joystick inputs

Send LED signal

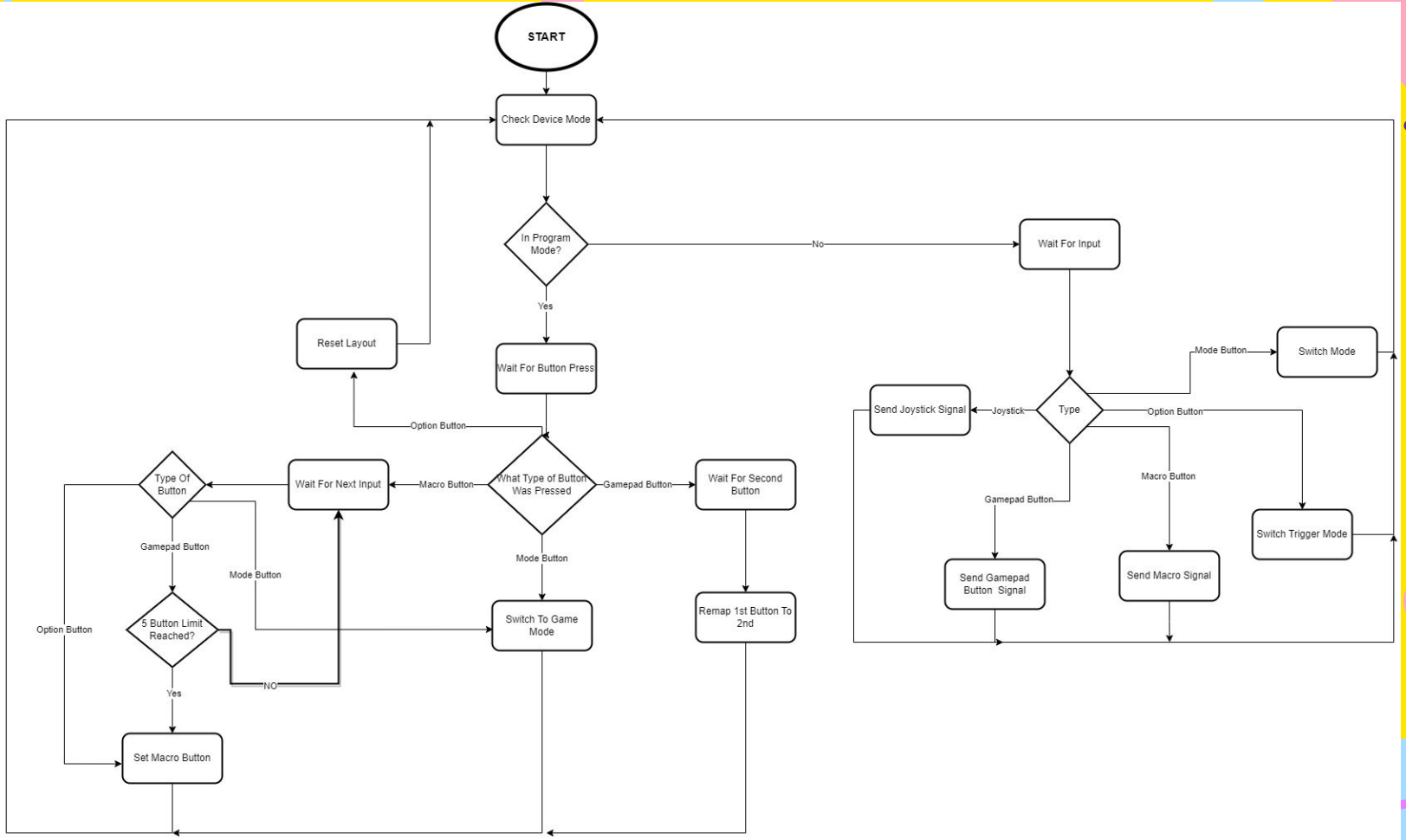


read Button inputs



send Xinput signals

SOFTWARE DESIGN



SWOT ANALYSIS

STRENGTHS

Price & Features
(Macros + Trigger Modes)

S

WEAKNESSES

W

Only For PC & Xbox

OPPORTUNITIES

Different Models For
Different Systems

O

THREATS

T

Microsoft makes a 1st party controller with proprietary features

Triple Bottom-Line Business Model

Key Partners

Makerspace

Brunsfield center

AbleGamers

JLCPCB

Texas instruments

Key Activities

Product development

Implementation of the Arduino code

User network

Key Resources

Xinput library

SN74HC166N PISO shift registers

Value Proposition

We are making adapter remotes for people diagnosed with tremor disfunction

Our design will be reliable and easy to use

Customer Relationships

Costumer service

Manual user Term and conditions

Controller assistance

Channels

Third party websites

Mobile apps

Customer Segments

Gaming community

Gamers with limited mobility

Non profit organisations

Cost Structure

Materials

Product development

Marketing and sales

Revenue Streams

Supplying to third party websites and other companies to sell our products

To be able to get profit, and by analyze market prices we are planning to sell our product at $249.99

3-Year Income Statement

GameAbility LLC

Income Statement

Previous 3 Years ended December 31

(in Canadian Dollars)

Description	2022	2021	2020
Sales Revenue	$874,965.00	$499,980.00	$249,990.00
Cost of Goods Sold	$350,000.00	$200,000.00	$100,000.00
Gross Profit	$524,965.00	$299,980.00	$149,990.00
Operating Expenses:			
Salaries	$150,000.00	$150,000.00	$150,000.00
Manufacturing Service	$175,000.00	$100,000.00	$50,000.00
Development	$7,000.00	$6,000.00	$5,000.00
Research	$3,000.00	$2,000.00	$1,000.00
Partnership	$35,000.00	$20,000.00	$10,000.00
Website Domain	$17.00	$17.00	$17.00
Marketing	$20,000.00	$10,000.00	$0.00
Storage	$1,750.00	$1,000.00	$500.00
Total Operating Expenses	$391,767.00	$289,017.00	$216,517.00
Operating Income	$133,198.00	$10,963.00	-$66,527.00

Feasibility Study

Technical: Expertise in circuit design Arduino programming ✔

Economic: We can make a profit at a $249.99 price point ✔

Legal: No legal IP conflicts with current design ✔

Operational: We can quickly learn 3D-Printing and Laser Cutting ✔

Scheduling: The deadlines are reasonable ✔

Simplified Project Plan

#	Task	Time											
		May				June				July			
		W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Team contract & Skeleton of plan												
2	Client needs, Problem definition & Project plan												
3	Detailed design and BOM												
4	Prototype I, Tests & Feedback												
5	Prototype II, Tests & Feedback												
6	Business constraints												
7	Design Day & Final presentation materials												
8	User & Product manual												
9	Project closeout												

◆ means milestone like client meeting, Design Day and final presentation

2.

PART TWO

Our progress throughout each prototype, and the challenges we faced along the way

Bill of Materials

ID #	Name	Description	Unit	Quantity	Unit Cost	Extended Cost
1	Arduino Leonardo	Main logic board	Unit	1	$15.00	$15.00
2	LED	RGB light to display mode info	Unit	1	$2.00	$2.00
3	Arcade Button Type 1	Arcade game pad button	Unit	10	$3.83	$38.30
7	Joystick Cover	3d-printed cover for accessibility	g	30	$0.15	$4.50
11	PCB	PCB to connect electronics to	Unit	1	$5.00	$5.00
13	Header pins	Pins to connect to the PCB	Unit	3	$0.30	$0.90
14	MDF Wood	wood panels to be laser cut for box	m^2	0.56	$17.85	$10.00
17	Resistors 10K	Resistors for buttons	Unit	20	$0.01	$0.20
18	Resistors 220	resistors for RGB LED	Unit	3	$0.01	$0.03
Total product cost (without taxes or shipping)						$75.93
Total product cost (including taxes and shipping)						$93.80 Includes $8 Shipping

Prototype 1 Planned Tests

Input Lag

Xinput lag test

Buttons

Gamepad Tester

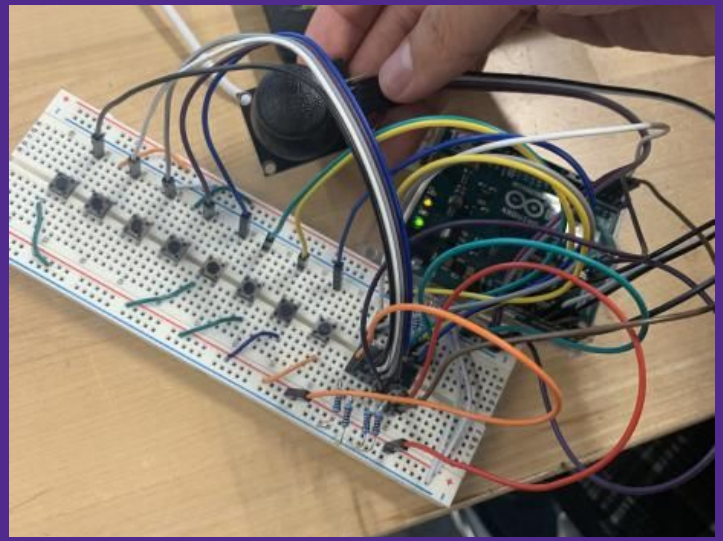
Gameplay

Super Mario Bros

Prototype 1 Testing metrics

- Input lag → < 12ms
- Clock rate → fully working
- Power delivery → works for shift registers
- Shift register functionality → all pins work
- 3D Printing time → enough time to print during a makerspace session (<6 hours)

Prototype 1



RESULTS

	Expected Value	Actual Value
Input Lag Test	<12 milliseconds	9.3086 milliseconds
Gamepad Tester	All 13 Buttons Working	All 13 Buttons Working
SMB Play Test	No Perceived Lag	No Perceived Lag

Prototype 2 Planned Tests

Joystick Cover

“Swipe Test”

Buttons

Gamepad Tester

Case Stability

“Body Weight Test”

Prototype 2
Testing metrics

- Buttons functionality → all buttons work
- Joysticks cover functionality → the joysticks cover fit properly on top of the case
- Case stability → the case is sturdy and stable enough to allow usage for a significant period of time

Prototype 2

RESULTS

	Expected Value	Actual Value
Button and joystick cover fitment test	Snug, No wobble	Snug, No wobble
Case stability Test	Case Holds Up Under Pressure	Stable, incomplete coverage
Button function test	All 13 Buttons Working	All 13 Buttons Working

Prototype 3 Planned Tests

Program Functionality

Gamepad Tester

Buttons

Gamepad Tester

Case Stability

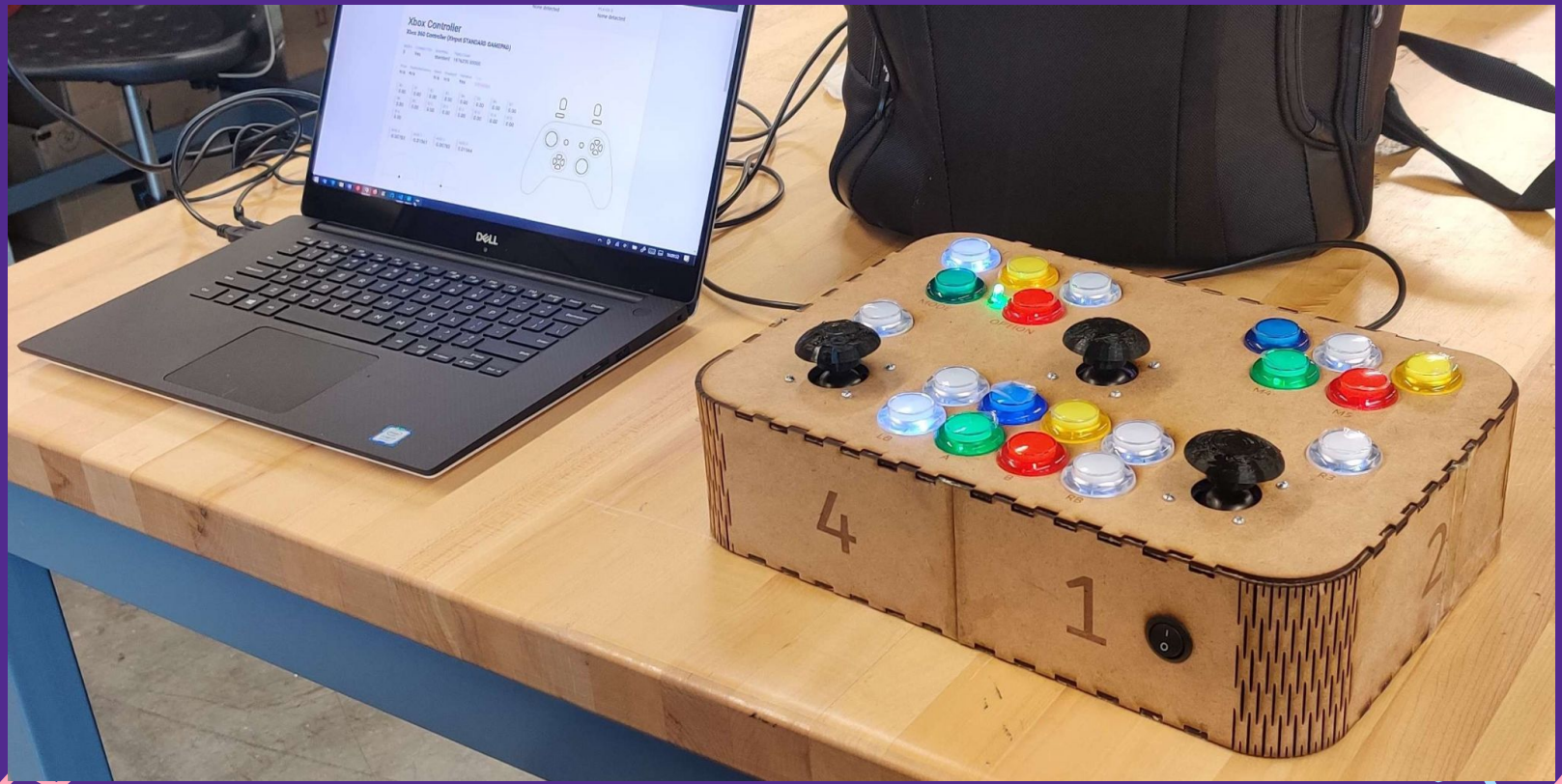
“Body Weight Test”

Prototype 3
Testing metrics

- Buttons functionality → all buttons work
- Program Functionality → All Features Work (8-Way D-PAD, Macros, Trigger Modes)
- Case stability → the case is sturdy and stable enough to allow usage for a significant period of time

Prototype 3

Prototype 3



RESULTS

	Expected Value	Actual Value
Program Functionality	All Features Work	All Features Work
Case stability Test	Case Holds Up Under Pressure	Case Holds Up Under Pressure
Button function test	All 20 Buttons Working	All 20 Buttons Working

LIVE DEMO

3.

PART THREE

Final insights, lessons learned and skills acquired

Skills acquired

- PCB printing
- More comfortable with laser cutting, 3D printing and modelling
- Circuit building with shift registers
- Soldering

Lessons Learned

- Greatly stagger work done in different teams asynchronously, as to not make teams rely on the completion of tasks from other teams
  - PCB printed earlier
  - Soldering Done earlier
- Do not leave unnecessarily leave tasks half-complete
  - Soldering only data wires

Future Endeavours

- Universal Compatibility (PS4/PS5)
- Better case
- Completed PCB
- Better mounts for Joysticks
- Single Button Remapping

Feel free to ask us any questions!