OpenArcade
Anish Paramsothy, paramsa
Chris Palermo, palerc
Mitchel Cox, coxm12
Shivom Sharma, shars119
Jacqueline Leung, leungw18

McMaster University

Project Goals and Development Process

MECHTRON 4TB6, McMaster University

Date Submitted: September 27th, 2025

Due Date: September 28th, 2025

Contents

1 Project Goals

1.1 Project Description

Design and development of an arcade/box style controller series of modules (with a module containing: buttons, joysticks, d-pad, etc), that can be mechanically connected to each other to allow for gamers to develop their own combination and style of controller. Along with the idea that gamers can combine modules together, we want to give them the option to play using the modules separately. These modules will be connected to a central main hub which will communicate the inputs of the modules to the game.

1.2 Rationale

Currently, there are several game controllers that follow the ideology of "1 size fits all", preventing gamers that may be injured, disabled, or lacking fine motor skills to play the games they want. This could be the case due to a variety of reasons:

- The controller itself is too small and is required to be held.
- Several controllers require a grip that becomes uncomfortable to the plaer after hours of gaming.
- Buttons and joysticks are close together and require the user to place their hands in positions that can potentially be uncomfortable.
- There is little room for customization, and alot of controllers follow the one ideology of "one size fits all".

1.3 Goals

We have several goals that we want to outline for the controller. We want to accomplish these to some degree of effectiveness.

1.3.1 Level 1 Goals

These goals are the most important for the functionality of the controller.

- **Modularized**: The controller should include multiple modules, and for these to work together to play games.
- **Customizable**: The controller should be able to be attached to each other (if A and B are modules, to be attached in either A-B or B-A formats), or be able to be utilized as separate and detached modules. The joysticks should also be swappable and include additional customization options.
- **Input Delay**: producing the lowest amount of input delay as possible, to prevent any scenarios where games become unplayable because the inputs are not responsive enough.
- **Comfort**: The controller should be attempting to be an ergonomic substitute to other controllers, so providing better options for buttons and joysticks and their placement should be a heavy consideration. Along with this, the location of where the controller will be (either in lap or on table) will also provide an improved gaming experience for the user.
- **Functional**: The controller modules should be able to fit correctly together without any mechanical issues. Along with this, the controller should function correctly in terms of gameplay, where specific inputs (button presses or joystick movement) relate to the correct outputs.

- **Robust**: The controller should meet the basic needs of staying together and not falling apart when subject to stress. This could include the force created when pressing a button, or potentially the user resting their arm on the device while playing.
- **Intuitive**: The controller should not be confusing to use, the modules should attach in a simple manner to prevent confusion.
- **Connectivity**: The controller should be able to connect to different types of devices, with the main priority being computer.

1.3.2 Level 2 Goals

These goals are added optional goals that we want to strive towards to optimize the product.

- **Aesthetically pleasing**: The controller should look nice in order to draw in consumers.

2 Development Process

2.1 Meetings

Meetings are planned to be held weekly during 3 core timeslots:

- Tuesdays from 11:00AM to 12:00PM
- Thursdays from 4:00PM to 6:00PM
- Fridays from 12:00PM to 1:00PM

These timeslots are meant for planning individual tasks and goals for the following meetings. The time slots are to be considered an open time to meet, but not a requirment. Group discussion outside of these meetings will be conducted to determine the next appropriate meeting date.

The group will also strive to meet at different times as well, such as the weekend, or whenever everyone is available.

Group members are meant to come to meetings with some individual work done, and all work completed is to be documented in meetings notes on google drive.

2.2 Overall Process Workflow

Below is a list of steps that outline the workflow in which the OpenArcade controller will be designed and fabricated.

1. Discussion of Hazard Analysis: Meet in a few group meetings to identify hazards related to all aspects of design, including hazards during development, and hazards during use. This will all be noted in a hazard analysis document. To complete this task, all possible hazards should be identified.
2. Development of System Requirements: Outlining the hardware/software/mechanical required to complete the various milestones of the project. This document will be modified during the entire timeline of the project, as the group will define what is needed for the *proof of concept*, *rev 0* and *rev 1* milestones. The document will include a list of software and hardware used, along with the material that will be used for the casing. This will aid in drafting a bill of materials (BOM).
3. Concept Design 1: Drafting an initial concept design to show as the proof of concept. This should include showing the functionality of buttons on a simple scale. The goal is to develop a written plan of what the proof of concept should be, and finalizing what hardware will be required for that.

4. Proof of Concept: The proof of concept will be used to outline basic functioanlity of the design. This will include:
   - Ability to communicate between main board and computer.
   - Functionality of smaller boards (attached to buttons/joysticks) to a breadboard with LEDs
   - BOM including hardware choices

   The proof of concept will be succesful if the button and joystick inputs correspond to the correct outputs on the board. Along with this, another succesful test will be if the main board correctly communicates to the computer.
5. Concept Design 2: Begin planning the finalized design. The group will work in determining how the smaller modules (with buttons/joysticks) will communicate with the main central unit, so that direct inputs can result in outputs seen on the computer. A rough mechanical design will be made with cardboard or other simple materials so that the placement of the buttons and joysticks can be determined. Essentially a primilary casing for the controller. The modules will not be attacheable yet.
6. Rev 0: Showcase the the buttons and joysticks communicating to the game itself. The demo will show how the buttons can be configured to specific outputs, and that they communcate the correct outputs for the corresponding inputs. Smaller modules will communicate to the main central unit, which will be communicated to the game.
7. Concept Design 3: Discussion and plannig of the finalized design. This will include the mechanical casing of the modules, along with how they will be attached to each other to form the full controller. The casing should act as a housing for the electrical and hardware components that prevents movement of the internal pieces, while also being able to attach to other modules. emitted heat from the controller should also be considered when developing the casing.
8. Rev 1: The finalized design of the controller. The demo will include two modules that can be attached to each other, and can successfully communcate with the game with the correct outputs. The controller will be compared to other controllers to showcase why it is an effective substitute for the current controllers in the market.

2.3 Group Roles

2.4 Technology