Networked Arcade Platform

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Background

- Over the years, there's been arcade machines residing in Coover Hall's TLA
  - Used to give residents in the TLA stress relief and create a positive environment
- However, they are out of commission
  - Worse for wear
  - Events of tampering and theft
- Solution
  - Create a new machine that will last more than 5 years and use as a showcase for ISU engineering

Concept Sketch

The initial design included:

- Two systems, communicating with each other
    - Each having a 32" screen and 2 controllers
- 2 different style of controls
    - Arcade or Modern (GameCube)
- Cooperative/Competitive mode
    - Give a more welcoming or professional format

Functional Requirements

- <u>Portable:</u> Able to move the unit through standard-issue doors and elevators
- <u>Arcade & 6th Generation Controls:</u> Able to switch from arcade controls to GameCube controls at ease
- <u>Modern Screens:</u> Able to run on HDMI screens
- <u>Structurally Sound:</u> Cabinet is strong enough to handle stress of users and avoid tipping.
- <u>Controllable Sound:</u> Able to adjust sound from outside the machine
- <u>Concise Wiring:</u> Should not stick out and place in a single area to connect the back of the unit
- <u>Integration of Networking:</u> Able to network between the set of cabinets and play games together or separately
- <u>Main Menu:</u> Have a functional menu to select the number of players and games to play

Non-Functional Requirements

- <u>Usability:</u> Able to be used by any student/administrator, and able to use necessary controls for games
- <u>Security:</u> All equipment secured in cabinet to avoid theft and manipulation
  - Locks
  - Security Tether
- <u>Availability:</u> 24/7 accessibility for the user.
- <u>Maintainability:</u> Lasting at least 5 years with minimum repairs.
- <u>Cost:</u> Each Arcade Unit does not exceed $1,000

Operational Environment

- Work in TLA or any indoor building for events
- Use for short/long periods of times
- Offer a variety of video games
- Handle conditions involving dirt, sweat, and grime

What makes our project unique?

- Allows different controls than just one standard
- Able to play the same game session between 2 different cabinets
- Adjustable volume control
- Modern screens
- A variety of games for all ages

Hardware/Software
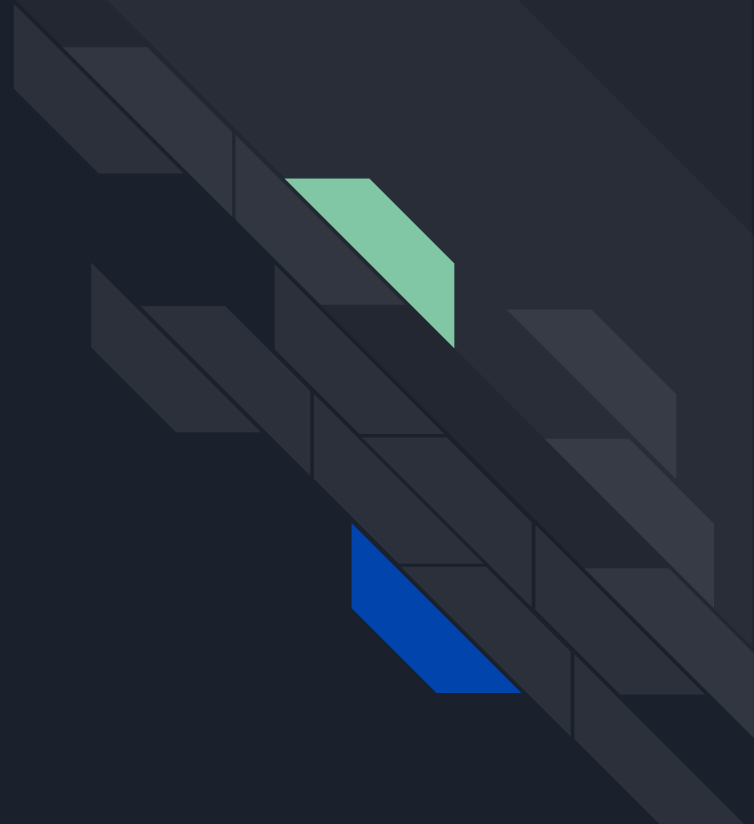
Construction-Cabinet

- Each cabinet has 2 set of controls, either Arcade or Gamecube
- Display board on the bottom front to showcase hardware
- 2 Backdoors on each cabinet: Top section for TV, audio, and control components, and bottom for Computer and power management components.

Hardware-Arcade Buttons and Joystick

- 2 sets of controls
- Control layout for easy to read button location
- Has a start and select button, which press together will exit the game back to main menu
- Controllable Volume knob to control game sound
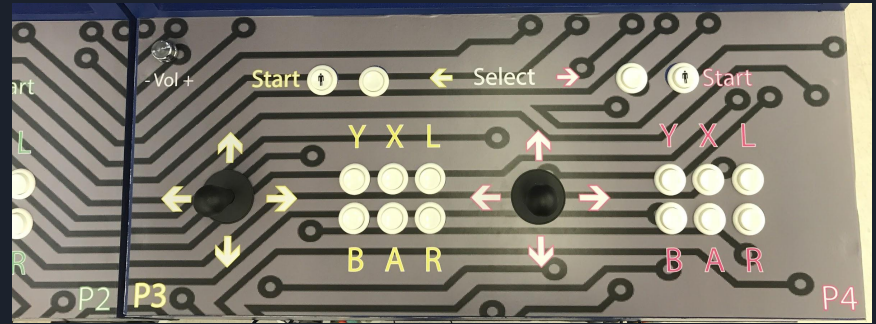
Hardware-Display Board

- Each having the near identical set-up to provide the best results for networking
- Way to showcase how only a few components can run one cabinet
- With having enough room and back door, easily ventilated and causes no overheating
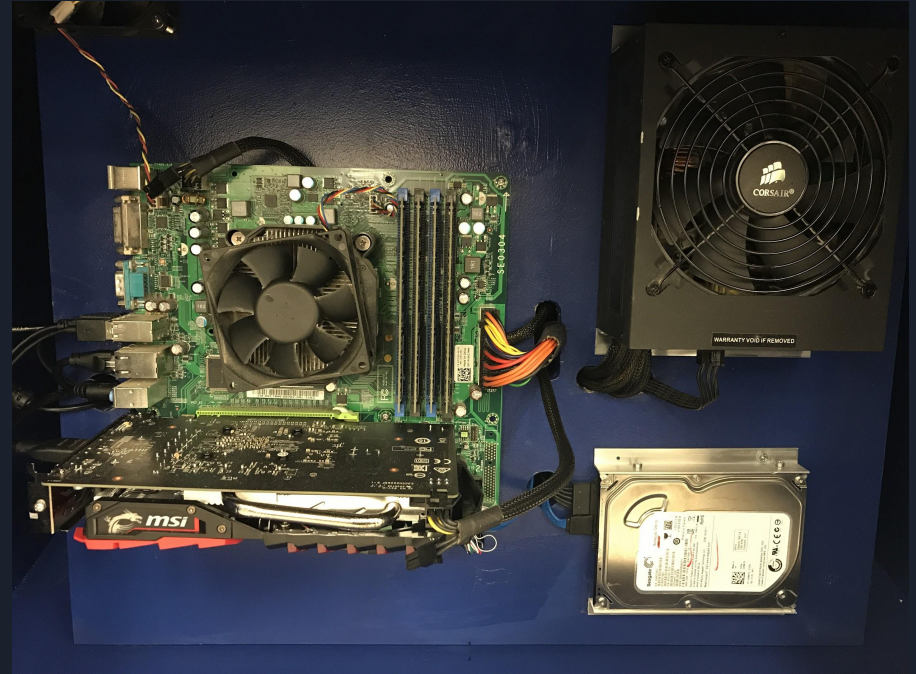
Hardware-Controller Holster

- Holds the GameCube controllers and a limit switch to activate seamlessly from Arcade to GameCube controls
- Each use the USB MUX to activate the switch when controller is lifted off the holster
  - This is the second design after teensy design failed to meet requirements

Hardware-Power Management

- Able to turn off/reboot cabinet incase of any errors or if not in use
- Located in lower section side of cabinet, to avoid any accidentally presses if on control panel
- Each system has its own, but each can also be able to turn both off if hold down for more than 10 seconds
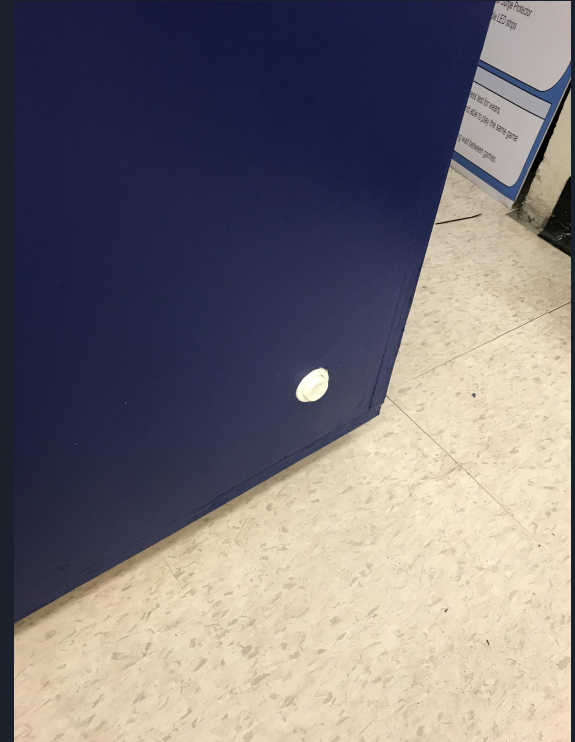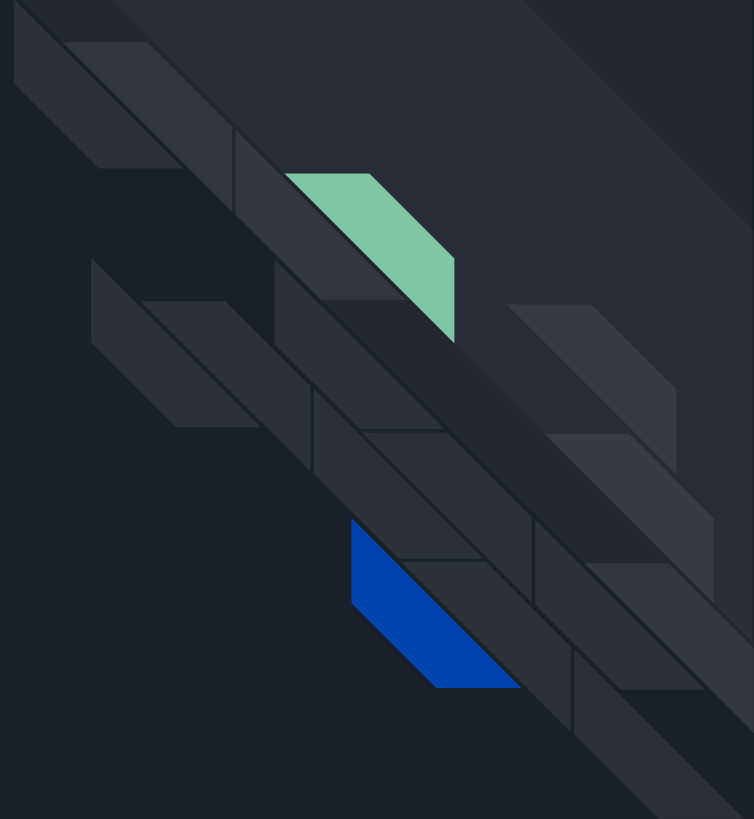
Software-Main menu

- Each game arranged in different collections
  - Number of players (1,2,3, or 4 players)
  - Co-op or Competitive
  - System Specific
- Netplay occurs when during boot up of game, pops open a menu that each cabinet needs to confirm to activate
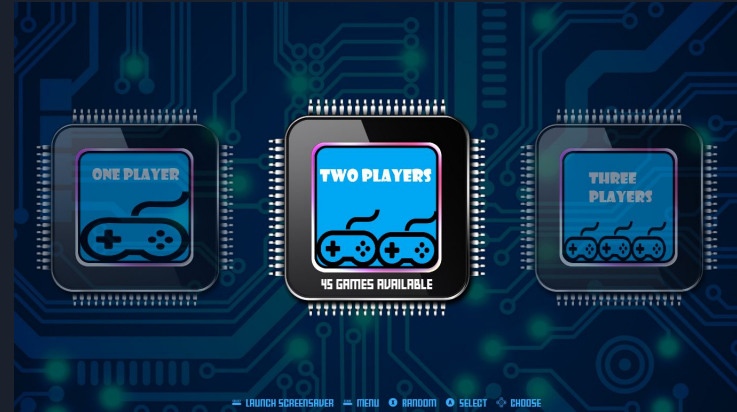
Testing and Results

Functional Testing

- Portability : PASS
  - Test to see if the unit was able to be placed in different areas around Coover Hall, and able to go through doors at ease
- Structurally Sound: PASS
  - Perform stress test of users putting weight on the cabinets and observes any wears or tears
  - Tested each side of the cabinet and control panels
- Power Management: PASS
  - Test booting up systems and start up Retropie at the start, with no errors
  - Able to reboot both cabinets within 3 minutes
- Screens: PASS
  - Test if secured inside cabinet

Non-Functional Testing

- Quick Game Loading: PASS
  - Able to load any game within 10 seconds
  - No significant errors in loading games
- Concise Wiring: PASS
  - Wiring hidden well to avoid any blocking of components/motherboard showcase
- LED Lighting: PASS
 - LEDs turn on as machine boots up

Game Testing

- Performance: PASS
    - Each game runs and runs at the intended frame rate and aspect ratio
- Sound: PASS
    - Sound is on for all games and able to be adjusted
    - Sound is coming out fine, no delays or stuttering
- Control switching: Satisfactory
    - Test to see if user can transition from arcade to GameCube controls, and vice versa.
    - GameCube is only active when off holster and joystick is off
    - Laserdisc emulation cannot be switched mid-game.
- Netplay: Satisfactory
    - Test to see if both cabinets can communicate with each other and play the same instance of a game together

Testing Results - Summary and Potential Reasons

- Portability, Screens, Structure, Sound, Main Menu, Quick Loading, Power Supply, Wiring and LED tests passed with no significant errors
- Netplay on GameCube and N64 is unable to connect, even though in the past it was functional
  - Could be caused by updating our machine to a version that made it less functional
  - As a result, decided to remove 3 and 4-player collections since netplay isn't working properly

Q&A
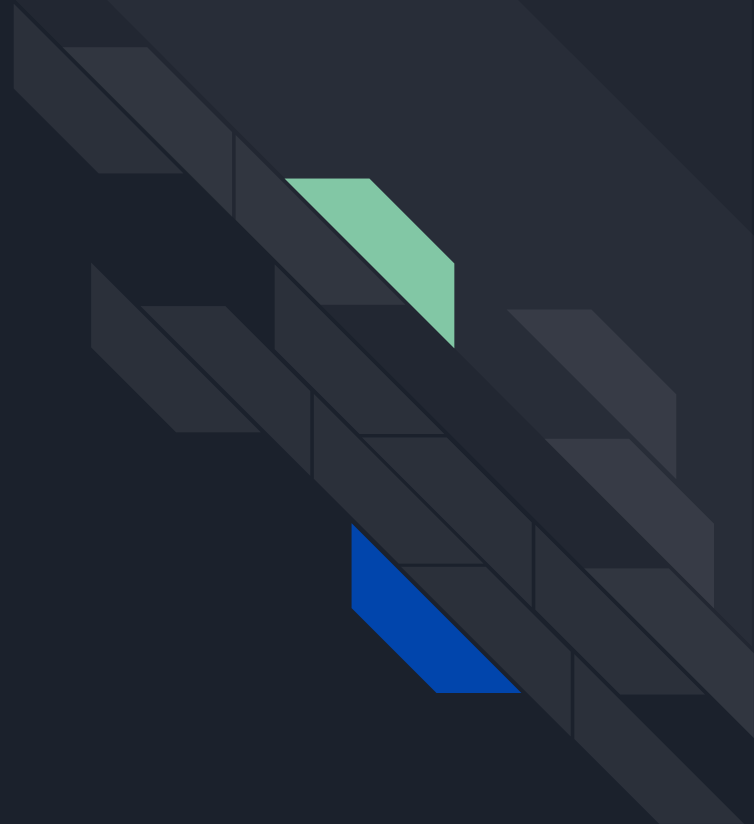
Addendum: Legality

- The majority of emulators are legal
  - Given as long as the emulators do not appropriate proprietary code from the consoles they are emulating
- However, the majority of ROMs do infringe on intellectual property rights or copyrights, except in rare exceptions (okayed abandonware)
  - It is not illegal to own a ROM, given that you did not make it

Addendum: Orientation

- Why have modularity in two modes?
- The cabinet styles encourage various modes of play
- Transportation
  - The side to side cabinet may seem more effective for an area like the TLA
  - But it is not effective in transportation

Addendum: Rugged and Reliable

- How is the system going to be reliable?
    - Lower center of gravity compared to previous systems
    - Traditional lock security
    - Operational datasheet