4 Design

4.1 Design Context

4.1.1 Broader Context

Describe the broader context in which your design problem is situated. What communities are you designing for? What communities are affected by your design? What societal needs does your project address?

List relevant considerations related to your project in each of the following areas:

Area	Description	Examples
Public health, safety, and welfare	• fire hazard from the heat of the electronics. • could cause individuals to have a vitamin D deficiency from playing all day. • could cause extensive blue light exposure.	• with the heat of the electronics in an enclosed area it could cause a fire that could be a safety and welfare hazard for users if not properly cooled. • if the user stays inside all day playing they could develop vitamin D deficiency by not getting enough sunlight which could lead to multiple health concerns • users could be exposed to blue light from the display which has potential to cause different health concerns
Global, cultural, and social	How well does your project reflect the values, practices, and aims of the cultural groups it affects? Groups may include but are not limited to specific communities, nations, professions, workplaces, and ethnic cultures. • Our product will positively impact the social groups that still are interested in old arcade games. These communities are low in numbers but our product may also bring younger generations into these groups	• A group could buy these and min-max the settings to help them in a game. • The controls are adaptable, so new players used to modern controllers could still play using what they are experienced in
Environmental	What environmental impact might your project have? This can include indirect effects, such as deforestation or unsustainable practices related to materials manufacture or procurement. • air pollution	• power needed to run machine will result in more coal/gas burning

	• power consumption	
Economic	What economic impact might your project have? This can include the financial viability of your product within your team or company, cost to consumers, or broader economic effects on communities, markets, nations, and other groups. • Our product would need to be cheap, as it only runs some older games. It could be marketed to college towns as a simple group project, sold in parts and explained how to build. It would be sold as a kit to EE 186 students	average salary for college students = 32,070 https://www.ziprecruiter.com/Salaries/College-Students-Salary--in-Iowa#:~:text=How%20much%20does%20a%20College,%2Fweek%20or%20%242%2C483%2Fmonth.

4.1.2 Prior Work/Solutions

Include relevant background/literature review for the project

– If similar products exist in the market, describe what has already been done

– If you are following previous work, cite that and discuss the **advantages/shortcomings**

– Note that while you are not expected to "compete" with other existing products / research groups, you should be able to differentiate your project from what is available. Thus, provide a list of pros and cons of your target solution compared to all other related products/systems.

Detail any similar products or research done on this topic previously. Please cite your sources and include them in your references. All figures must be captioned and referenced in your text.

- On Amazon, there is a cheap handheld version of an arcade cabinet. (Found here: https://www.amazon.com/Arcade-Machine-Handheld-Gaming-System-electronic/dp/B00S4HI1NY) Pros are that it is small and cheap. It also requires just a battery for power. Cons are that it is small, controls are very hard to use both hands and it can not accept new games or controls

- There have been some senior design groups that have had similar design projects as ours. one can be found here https://sddec19-23.sd.ece.iastate.edu/docs.html the difference between ours is size and price, ours is smaller and can be moved easier and cost far less

4.1.3 Technical Complexity

Provide evidence that your project is of sufficient technical complexity. Use the following metric or argue for one of your own. Justify your statements (e.g., list the components/subsystems and describe the applicable scientific, mathematical, or engineering principles)

1. The design consists of multiple components/subsystems that each utilize distinct scientific, mathematical, or engineering principles –AND–
2. The problem scope contains multiple challenging requirements that match or exceed current solutions or industry standards.

Component/subsystem	Justification
Audio/Speaker system	Needs knowledge of Gain/operational amplifiers and how that can be controlled with potentiometers to have a working audio system
Raspberry Pi	Needs basic knowledge of computers such as processors, I/O ports, and specifications and how they limit what we can do
Buttons/Inputs/Display	Know how to read/write inputs of the buttons and wire them up to the correct pins
Software	know how to write software that is able to run arcade games without crashing or lagging.
Lighting/Cooling	Know how to do certain functions using pins on the Pi to control lighting and cooling
Power	Know how to take 120Vac, step it down, and regulate it at 5Vdc to power needed components
UI	Creating a startup display to select the game you want to play. This will choose the emulator or exe file and start it up
System for uploading new games	know how to format files in a way such that the software can read and run the games
Adapting controls to keyboard strokes	Know how to map controls of a set controller to specific keys on the keyboard.

4.2 Design Exploration

4.2.1 Design Decisions

List key design decisions (at least three) that you have made or will need to make in relation to your proposed solution. These can include, but are not limited to, materials, subsystems, physical components, sensors/chips/devices, physical layout, features, etc. Describe why these decisions are important to project success.

(To use a Raspberry Pi or a modern laptop)

- Our code will function differently depending on the operating system.

(material for physical build)

- Using wood will give an authentic look and feel. Using acrylics or clear plastics will show the wiring inside and allow for LEDs to glow through.

(to use a pre-built emulator or create our own)

- Creating our own is going to be a ton of work but will allow us complete control in the games. Using a pre-built emulator will be easier but may pose problems when trying to change the controls.

4.2.2 Ideation

For at least one design decision, describe how you ideated or identified potential options (e.g., lotus blossom technique). Describe at least five options that you considered.

-One major decision we had to make was choosing how we wanted to run the games, it seems very infeasible for us to write our own emulator to play the original versions of the game so we had to brainstorm some other ways to run the games we want to run. Some of the solutions we thought of were

Run exe games from our own program

Use MAME to run original versions of arcade games

Write our own emulator to run original versions arcade games

Include a couple different emulators to run multiple types of games

Use our own program to run exe games and launch emulators to play original versions of games

4.2.3 Decision-Making and Trade-Off

Demonstrate the process you used to identify the pros and cons or trade-offs between each of your ideated options. You may wish to include a weighted decision matrix or other relevant tool. Describe the option you chose and why you chose it.

Selection Criteria	Criterion Weight	EXE Runner		MAME		Create Emulator		Multi-Emulator Launcher		EXE and Emulator Launcher	
		Score	Total	Score	Total	Score	Total	Score	Total	Score	Total
Simplicity	0.4	5	2	4	1.6	0	0	3	1.2	3	1.2
Authenticity	0.3	2	0.6	5	1.5	4	1.2	5	1.5	5	1.5
Game Selecti	0.3	4	1.2	2	0.6	2	0.6	4	1.2	5	1.5

on											
Total	1.0		3.8		3.7		1.8		3.9		4.2

We decided to go with a program that includes multiple emulators and an exe launcher as it has the highest rating on the decision matrix. Even though it has a higher complexity to write, it allows us to run any game we want. This also allows us to give more work to the 4 SE majors we have.