Network Arcade Cabinet

Project Plan
Team 23

Client & Advisor Information

Client: Joseph Zambreno
Advisor: Joseph Zambreno

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List of Abbreviations

- ETG: Electronics Technology Group. A group located in Coover Hall that handles parts and computer renting & repairs.
- TLA: Transformative Learning Area. This is a room in Coover Hall that houses a myriad of computers and lab stations. It has housed most of the arcade cabinets at ISU.
- ECpE: Electrical and Computer Engineering Department. The department that handles Electrical, Computer and Software Engineering operations at ISU.
- NES: Nintendo Entertainment System. One of the consoles whose games are included in the system.
- N64: Nintendo 64. One of the consoles whose games are included in the system.
- GameCube: Nintendo GameCube. One of the consoles whose games are included in the system and whose controllers are included on the exterior.
- NTSC: National Television System Committee. The format that most American DVDs and media forms adhere to, including video games.
- CAD: Computer Aided Design. A type of design creation that involves creating a design using computations and computers.

1 Introductory Material

1.1 Acknowledgement

The client, Dr. Joseph Zambreno, has agreed to assist with the project in regards to technical assistance, equipment, and a general budget of around $1000 with a projection of designing an arcade cabinet set. ETG has been involved in donating equipment and assisting in ordering of parts and supplies needed for the project.

1.2 Problem Statement

Coover Hall's large transformative learning area (abbreviated as the TLA) has housed a multitude of arcade machines in the past, mainly from other senior design projects. These machines were designed to entertain students with visual flair and, in some cases, accommodate for multiple people to play together. At this time, however, none of the machines are in working condition. Common issues that have come up in past projects are wear and tear, tampering, and theft. As a result, the machines sit unused and no longer serve the public.

This project is designed to create a new machine. Learning from the mistakes of past projects, we will manifest a system with an expected lifespan of 5+ years. The new machine also intends to account and prepare for the shortcomings of previous arcade systems developed at Iowa State University.

1.3 Operating Environment

The end product is designed to work in moderately intense environments and is user oriented. While the product will typically reside in the TLA, it is designed in mind that it can be shared and presented at events. It is designed so that a user can use it for a short or long amount of time, with software selection aiming for a variety of different purposes. Continuous wear and use, over an extended period of time, is expected.

In terms of operational conditions, the end product is aimed to be used primarily indoors. Weather conditions are not anticipated to be a concern during operation, but conditions such as dirt, sweat, and grime are expected.

1.4 Intended Users and Intended Uses

The product is designed for usage with up to 4 individuals. The expected user is a high school-age individual or older. The product is designed in mind for heavy strain as users are not expected to handle the product gently. A trusted individual, likely the client, will hold onto the methods to access the internals of the product. This is mainly for repair and replace any broken or defective parts.

The uses for this product is to provide stress relief to the users, provide entertainment, and to create a friendly environment. After a day of work or during a break, individuals can use the product to eliminate stress. Also, the product will provide an enjoyable experience that will create an environment that will invite other individuals to join in. The product will also be portable allowing it to be showcased in events. This provides a unique attraction and show the capabilities of Senior Design and the ECpE Department.

1.5 Assumptions and Limitations

Assumptions:

- The maximum number of players that can play on a single side is 2.
- The maximum number of players that can play a game is 4.
- The end product will be able to connect back to back or side to side.
- The end product will be able to play retro arcade games, NES games, N64 games and GameCube games (NTSC preferred, can be international).
- The end product will be able to withstand the pressure of multiple users leaning on the product.
- The end product will keep internal parts locked inside of the system, accessible via keys.
- The end product is designed to last around 5 years.
- The end products are designed to communicate with each other.

Limitations:

- The cost of the project shall not exceed over $1,000.
- The size of one cabinet cannot exceed a width over 34” and a height of 82”.
- The physical cabinet cannot be made with magnetic material.
- The wiring of the end product must not be seen in plain sight.
- The weight of a single cabinet can’t exceed over 350lbs.

1.6 Expected End Product and Other Deliverables

- Design Document (Spring 2019)
    - The design document, which details the inner workings of the expected end deliverables and the design.
        - To be delivered at the end of the Spring semester.
- Project Plan (Spring 2019)
    - The project plan, which details the initial planning and procedures of the project.
        - To be delivered at the end of the Spring semester.
- Demonstration Report (Spring 2019)
    - A demonstration to the client that shows the progress of the product and the system in its current state.
        - To be delivered at the end of the Spring semester.
- Parts List (Spring 2019)
    - A list of all parts including buttons, controllers, hardware and software used. This is included to give the client exact details of parts so that, in the case of defective or broken parts, they can have an idea of what parts to order. Also, the desire to buy cheaper alternatives and know the general operating requirements.
        - To be delivered at the end of the Fall semester.

- The Arcade Cabinet System (Fall 2019)
    - One two-set arcade cabinet system. These are to be powered by a traditional electrical socket.
        - To be delivered at the end of the Fall semester.
- Operations Manual (Fall 2019)
    - A short document that explains the basic functions to the reader, including powering, selecting games, and troubleshooting.
        - To be delivered at the end of the Fall semester.
- Security Access (Fall 2019)
    - The necessary set of security options (intended to be a set of keys) to access the inner workings of the system. Prior systems have been prone to theft or tampering, thus necessitating this decision on the team's end. The keys will be kept together in a ring and maintained by the client for the foreseeable future, once the product's development has formally concluded.
        - To be delivered at the end of the Fall semester.

2 Proposed Approach and Statement of Work

2.1 Objective of the Task

The goal of this task is to design an arcade cabinet that is networked together to provide multiplayer entertainment with the use of arcade style games and controls. To accomplish this, a custom “main menu” will need to be designed to network the arcade cabinets together. The final arcade cabinet should be capable of letting the user choose how many players will be playing and switching between different emulators to run a variety of games.

2.2 Functional Requirements

Some basic functional requirements are below.

- Portable
    - A single unit will be suspended on wheels and able to move through a standard-issue door or elevator.
- Arcade controls & 6th console generation controls
    - Standard joysticks and push buttons are to be included with the project. In addition, GameCube controllers, from the 6th console generation, are included per person.
- Modern Screens
    - The system will run on HDMI-screens as opposed to component cables.
- Structurally sound
    - The cabinet will be strong enough to support a human body leaning on it and have a wide enough base to prevent it from tipping over.
- Controllable sound
    - The cabinet sound can be adjusted from the outside of the machine to accommodate different game audio levels.
- Concise and uniform wiring
    - The cabinet’s wires should not excessively stick out and mainly protrude from a single area to connect to the back unit.
- Integration of networking
    - One set of a unit is expected to be able to network within itself and to play select games together or separately.
- Main Menu
    - Each cabinet should have a functional menu that allows them to select the amount of players and the game they wish to play.

2.3 Constraints Considerations

2.3.1 Constraints and non-functional requirements

- Usability - The Network Arcade Cabinet will be used by any student or administrator. Users must be able to use and access all the necessary controls for arcade games.

- Security - All the necessary hardware and software must be secured inside the cabinet in order for no manipulation or theft to occur during closed hours.

- Availability - The Network Arcade Cabinet can be used 24 hours a day, 7 days in the week for the TLA or special events.

- Portability - The Network Arcade Cabinet can be mobile and can be transported on wheels from place to place for events and showcases.

- Maintainability - After the task is finished, the product should last for at least 5 years and have very few maintenance repairs (routine and rudimentary cleaning is expected).

- Cost - The cost of the arcade cabinet set should not exceed $1,000.

2.3.2 Standards for Group Members

A basic set of ethics is listed below for members to follow.

- Members are expected to treat fellow workers, client and advisor with respect, and follow the IEEE Code of Ethics.
- Members are expected to complete their delegated work in a timely fashion to meet the schedule outlined in Section 3.1.
- Work done by members is expected to be professional and legal.
- Members are expected to make an effort to attend meetings and put in the time expected within the weekly reports.
- If members are unable to complete tasks within reason, or are unable to make meetings for extraneous reasons, it is expected that the member will inform the rest of the group.
- Members are expected to keep within contact of the group through the selected communication channels.
- If there are outstanding group issues, members are expected to speak with the advisor to resolve issues.
- Failure to follow ethics or notable reduced effort can result in a reduced grade or removal from the group.

2.4 Previous Work And Literature

The idea of a stand alone machine that only plays video games is not a new concept and has been done many times. A quick online search of a do-it-yourself (or DIY) arcade cabinet will result in many guides on how to build your very own arcade machine. These DIY guides usually have the reader purchase a raspberry pi and download an emulator, as well as various read-only-memory files, or ROMs. Most guides will then give you a cabinet design and instructions on how it is built. An example of a guide that the group has viewed is by Todd Moore, in link (12). Todd Moore gives a brief overview with what is need to make the system and what needs to built and designed. The team will then take that information and customize and improve on the system that we will talk about more below.

When it comes to the arcade machine the team plans on building will use multiple emulators instead of one like the DIY guides. The Network Arcade Cabinet is designed to have a unique cabinet layout, so that the cabinet is easy to move and provides cooperative or competitive play. The hardware required to run the multiple emulators will need to be more powerful than the raspberry pi most guides recommend. Due to the use of multiple emulators, a custom main menu will need to be created that will let users switch between games and select the amount of players.

The software system will require the use of different emulators that are available on the internet for free.

2.5 Proposed Design

The design at this point in the semester, the team has came up with the idea of a battle station design that is split up into two cabinets, which is shown in the figure below. Users will be able to play co-op which means the unit will be side by side, or they can by solo which the unit will be back to back. Positioning of the unit is important because there is a sensor that tells the system which games can be played. Only certain games can be played in co-op mode and vice versa for solo.

In the unit with have nice 4”-5” speakers to immerse the user into the games. User will be looking into a 32” monitor with very good resolution but still that reto feel to it. Outside the usit users will have 6 buttons, 1 joystick and a gamecube controller. From these controllers the user will have multiple options on how to play the games. Using Retropie, LAN cable and a customized main menu the team plans to network the unit in order to use co-op mode.

The following design has been approved by our client as it has met the requirements the client has asked for at the beginning of the semester. The requirements were: reliability, portability, maintainability and connectivity. Reliability is met as the team designed and developed a strong security precaution. Portability is met as it will have wheels at the bottom of

the unit, along with height and width measurement to allow easy access out the door. Maintainability is met as the team designed to have easy access to the main components of the unit at the base, right where the access door of the system is. Finally connectivity is met as networking of the system is what the project is all about and bringing together multiple users for one great game experience.

Figure 1: Initial Prototype

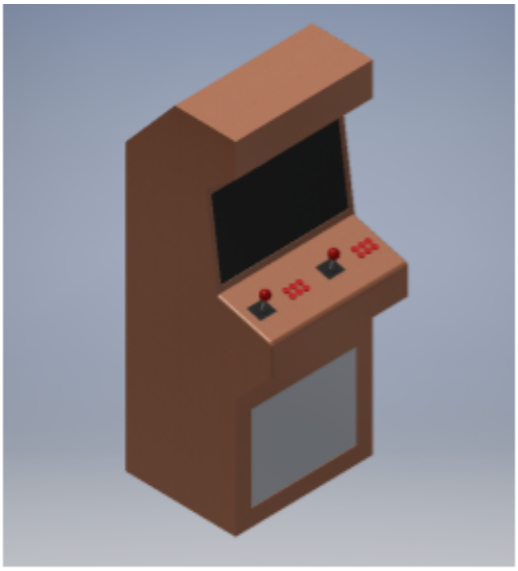

Figure 2: CAD Model (One side shown)

For the team's initial proposed design, we have have combined a battle station design and split it in half. These units will allow two separate parties of two users to play there desired games, or they can come together and have 3-4 party session on any game they desire. With this split game approach comes with software and hardware that can be used over networking cables, the main menu with be customized to our requirements we feel necessary.

Other design alternatives included portable tablet devices, a fully connected cabinet, and a battle station style. Although these designs could be used, we did not pursue them further because they did not hit our requirements that we felt were essential in the team's project design. The requirements of focus are reliability, portability, maintainability and connectivity.

2.6 Technology Considerations

The Network Arcade Cabinet will require emulators, like Dolphin, to run the games that are selected by the team. After researching the requirements for these emulators, the decision was made to use a computer with suitable specifications. Using a computer will allow the games to run smoother than they would on a microcomputer, like the Raspberry Pi. More powerful hardware will also be necessary to run the planned custom main menu.

The budget will require that pricing research is done to ensure that the cost of the hardware remains low. However, the quality of the hardware should not be sacrificed so that the cheapest part is always purchased. Purchasing quality parts will help the machine have a longer life span and allow for easier maintenance.

Strengths:

- More games & better hardware
    - Our system will have a unique variety of games and focus on having actual arcade titles.
- Faster loading times
    - With newer hardware compared to previous machines, our unit will be able to load games at a good pace.
- Lighter design
    - Our design is built with portability in mind, so can be easily moved.
- Variety of games
    - Our games include single, cooperative and competitive games of different genres.
- More modern games
    - Instead of looking towards only 8-bit games, we're planning on running games from the 6th and 7th generations of consoles and arcades.
- Networking
    - Our machine will be able to network together and play select 4-player games together.
- School pride/show-off piece
    - Like previous arcade style machines, our machine will be able to be showcased for events.

Weaknesses:

- Higher costs
    - Given the scope, the machine will cost more than previous projects.
- More research required
    - As our ideas are more complex and not all group members are experienced with machine design, we require more research.
- Heating issues
    - More intensive games will make the system use more power, causing it to heat up quickly.
- More failure points
    - There are a variety of points where the system can fail and cause issues.
- Power consumption
    - We will need to look into seeing benchmarks, as weaker systems may not be able to run multiple instances of emulators.

Solutions :

- Cost
    - By researching for effective avenues to purchase parts, we can budget effectively.
- More research
    - Dedicating more time to this project than average will allow the team's research to be more effective.
- Heating
    - Account for heating issues can be done by allowing for more air vents.
- Failing components
    - We can account for faulty parts or issues by budgeting properly.
- Power
    - While we can not force power limitations without sacrificing game potential, we can scope properly and make sure the games we want to run are actually possible.

2.7 Safety Considerations

The Network Arcade Cabinet will have more physical safety concerns since there is very little software concerns. One safety concern that is eliminated due to system isolation is the potential hacking of programs.

Issues:

- Tipping
    - The product may tip under excessive weight from a user.
- Electrical shock
    - Poor wiring or users prodding into the machine can result in electrical shock.
- Sound
    - Excessively loud sound or lack of sound control can result in hearing damage with prolonged use.
- Flashing colors
    - Heavily flashing colors can result in epileptic seizures in individuals.

Solutions:

- Making the design with a low center of gravity can deter tipping from occurring.
- By wiring the machine properly, we can mitigate electrical issues to improper usage of the machine.
- Allowing audio to be controlled from the machine will allow us to better manage auditory concerns.
- Selection of games should be considered to try and avoid games with bright flashing colors, or look into updated versions which can often mitigate or address

these concerns. A warning can also be introduced in the main menu to warn users about the risk of epileptic seizures.

2.8 Task Approach

To begin the design process, the team had a meeting with our client to discuss requirements for the Network Arcade Machine. From these specifications, the team was able to formulate a multitude of designs and then select one that satisfied the client. Once so, the team researched more about the design and figure out the appropriate equipment and software in order for our machine to work.

Once all the researching is done, the team will begin creating a prototype cabinet and testing on various areas to see if there is any issues on the prototype that needs to be address and fixed. When that is done, the team will create a final version of the arcade machine to be presented to the public and client. Figure 1 is our block diagram for the arcade cabinet that demonstrates the functional components.

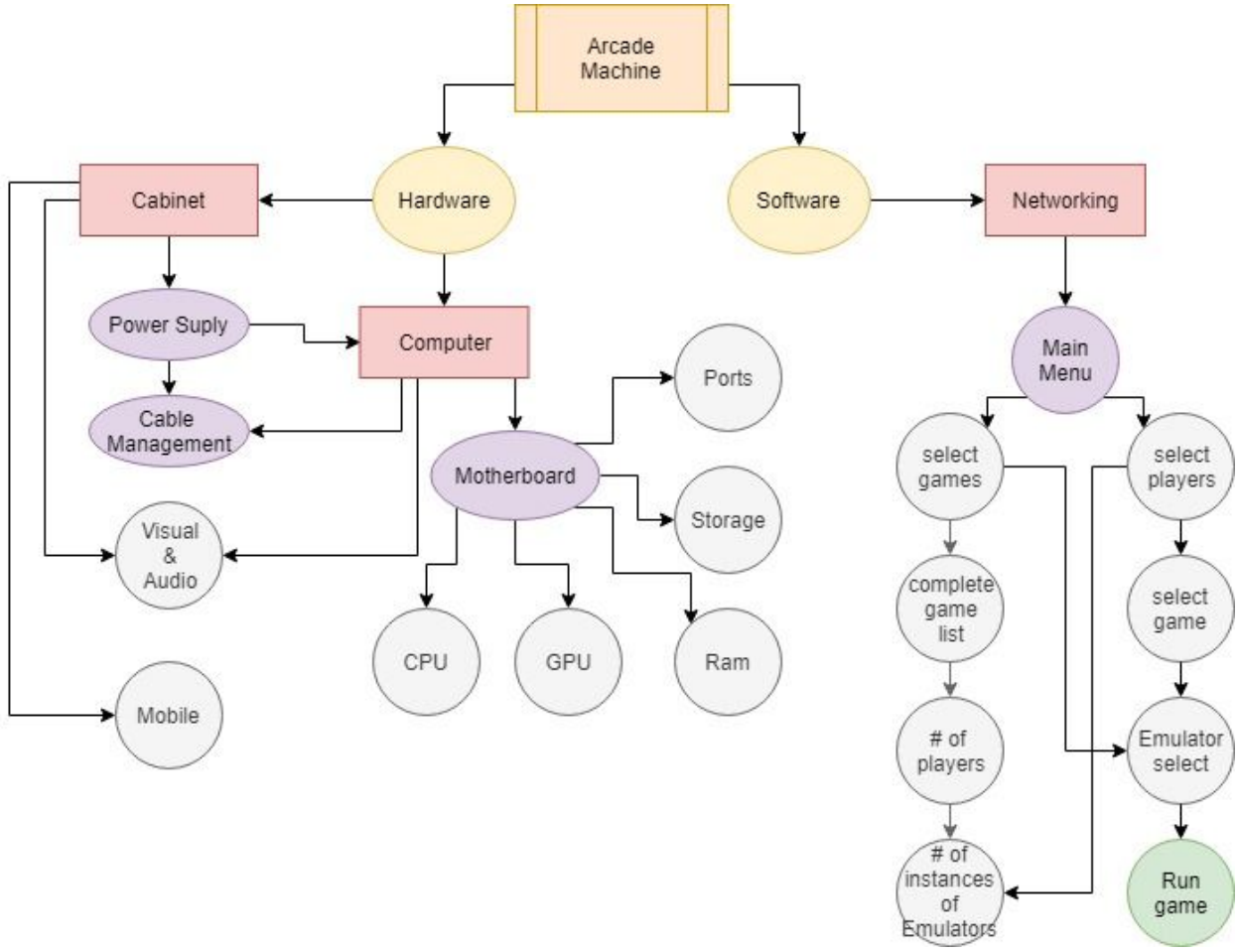

Figure 3: Block Diagram.

2.9 Possible Risks And Risk Management

Possible risks and understanding of how to accommodate them are listed below:

- Learning to program and code the machine to meet our requirements may be a slow and time consuming process.
- Integrating multiple machines may pose unknown problems.
- Costs of parts and components may add up and using certified ISU stores may cost more than the most effective routes of purchase.
- Ordering materials may take longer than expected, causing delays in task associated with them.
- The team may be unable to design the base as bottom-heavy as we want it to be, forcing swift changes in the design.
- Unexpected hardware failures can halt progress until it is fixed.
- As the majority of the group is not experienced with cabinet design, accuracy and knowledge are crucial.

2.10 Project Proposed Milestones and Evaluation Criteria

For our project we have designed milestones and evaluations criteria to assist in the documentation progress and team expectations. Milestones will be used to create deadlines, located in the gantt chart. Eventually our team will finish the project according to our clients specifications and evaluation criteria that are displayed below.

- Priming the system to play games
    - Setting up our computer to play games through emulation allows us to benchmark what games on our list work well, and what may require extra effort to perform properly.
- Installing compatible and working joysticks/controllers
    - Successfully integrating controllers and joysticks to our computer will allow us to test how users will literally play the games in the finish product, instead of debugging through keyboards.
- Main menu creation
    - By setting up a program to run our emulators and automatically set up games to play, in addition to setting up an user interface for it, we can make an experience that feels more immersive.
- Networking
    - Setting up networking will allow us to remotely test both cabinets together and pass arguably one of the most difficult tasks.
- Cabinet built

    - Building the physical cabinet includes both the hardware design and the literal cabinet construction itself. We can test to see if it works by confirming the mobility of the unit without it breaking.
- Syncing games on screens
    - While a simpler task, syncing both of the screens to match up is an important task that will allow us to create the network experience our client desires.

2.11 Project Tracking Procedures

The team will be keeping track of the whole group's progress and individuals through the Weekly Reports. Through here, we can have a record of what each member has done and/or what needs to be completed. Each weekly report has issues that will need to be addressed in later weeks, and allows us to figure out what each member is working on.

2.12 Expected Results and Validation

The desired outcome for the project will be a single cabinet with a single computer that can run two instances of an emulator simultaneously, supporting up to forty different games. Certain games will use arcade controls, and others will require using GameCube controllers. The design should be secure and not allow any users to get into the arcade hardware without authorization.

The team will design the arcade to be easily portable, so that the client can have the machine wherever and whenever they desire. The arcade should be able to withstand constant use and wear and tear, but should still last at least 5 years from the final presentation and placed in the TLA (or wherever the client would like it to be placed).

2.13 Test Plan

The following is a testing plan for the project split into three different sections: user testing, functional testing, and non-functional testing.

User Testing

One test case is a stress test of the cabinet being able to play a 4-player game without any issues. Another case would be a test to see how the machine will handle with 2 different instances of emulation. Case test 3 is playing the same game but with different input of players.

Scenario 1: Four users decide to play a 4-Player Game.

Case Test 1: Main Menu

Test Steps: Using controls to maneuver through menu.

Case Test 2: Visual and Audio

Test Steps: Sound and screen are working.

Expected Results: The users will not notice any performance issues like lag or long loading times. Users will also be able to select the amount of players and type of game in the main menu, while the main menu selects the correct emulator. The arcade machine screen will not lag and the audio will be able to be adjusted to a comfortable level.

Scenario 2: At least two users decide to play two different games that require the use of different emulators.

Case Test 1: Main Menu

Test Steps: Using controls to maneuver through menu.

Case Test 2: Visual and Audio

Test Steps: Sound and screen are working.

Case Test 3: Integration of the emulators

Test Steps: Select two different games.

Expected Results: The users will not notice any performance issues like lag or long loading times. Users will also be able to select the amount of players and type of game in the main menu, while the main menu selects the correct emulator. The arcade machine screen will not lag and the audio will be able to be adjusted to a comfortable level. Finally, the main menu should select the correct emulators based on the two different games the user selected.

Scenario 3: Testing out the same game, each time with different amount of users.

Case Test 1: Main Menu

Test Steps: Using controls to maneuver through menu.

Case Test 2: Visual and Audio

Test Steps: Sound and screen are working

Case Test 3: Integration of the emulators

Test Step 1: Select same game.

Test Step 2: Select different amount of players.

Expected Results: The users will not notice any performance issues like lag or long loading times. Users will also be able to select the amount of players and type of game in the main menu, while the main menu selects the correct emulators. The arcade machine screen will not lag and the audio will be able to be adjusted to a comfortable level. Finally, the main menu should allow the users to select the same game, but different amounts of players. This should make the computer run two instances of the same emulator.

Functional Testing

Test procedure 1: Portable

1. Ensure that the cabinet is fully complete.
2. Unlock the wheels at bottom of the cabinet.
3. Roll the cabinet to the nearest exit.
4. Roll through the exit with little to no bumping on the sides of the cabinet .

Success criteria: Was able to move cabinet from room to room.
Failure criteria: Not able to be moved from room to room, being stuck or having the wheels get caught on the system.

Test procedure 2: Arcade controls & 6th console generation controls

1. Ensure all wiring to controls are connected to where they should be.
2. Start up the system.
3. Run a randomly selected game from the system.
4. Use the controls to operate the game that was selected.

Success criteria: The controls will perform their intended acts.
Failure criteria: The controls do not work or are not programmed as intended.

Test procedure 3: Modern Screens

1. Have the screen in place in the cabinet.
2. Connect wiring from the screen to the system.
3. Connect the wires to ensure power to the screen.
4. Start up the system.

Success criteria: The monitor boots up and is displaying the main menu.
Failure criteria: There will get a black screen, or see visual errors from faulty cables.

Test procedure 4: Structurally sound

1. Ensure that the cabinet is fully complete.
2. Force will be applied to the controls to simulate leaning.
3. Force will be applied to the side of the cabinet to simulate leaning.

Success Criteria: Structure will move very little to none and if someone leaned in, then it will not break.
Failure Criteria: Structure will concave, see structural damage or tip over.

Test procedure 5: Controllable sound

1. Speakers have been placed into the cabinet.
2. Start wiring from speakers to the system and volume control knob.
3. Start up the system.
4. Pick a game to play.

Success Criteria: The sound is audible and can be changed.
Failure Criteria: Volume has no changes when turning the knob, or no sound plays.

Test procedure 6: Integration of networking

1. Ensure the systems have been integrated.
2. Start up the system.
3. Put the cabinet in netplay mode, either by starting a game or setting the mode up in advance.
4. Run the same game from the main menu.

Success criteria: Each system is running an identical instance of the game, but is not running off of one system.
Failure criteria: No functionality of the network, or instant desynchronization occurs.

Test procedure 7: Main Menu
1. Start up the system.
2. Use the controllers to navigate the main menu.
3. Select games and or go back on the main menu.

Success Criteria: The user is able to navigate with buttons or the controllers.
Failure Criteria: The system is unresponsive or the buttons are not assigned correctly.

Non-Functional Testing

Test procedure 1: Quick Game Loading
1. Start up the system.
2. A game is randomly selected from each of our main platforms.
3. The game is loaded, and the loading is timed via a timer. Timer stops when memory checking occurs for arcade games or footage is seen for non-arcade games.

Success criteria: Games load in less than or equal to 10 seconds.
Failure criteria: Games load in more than 10 seconds.

Test procedure 2: Concise wiring
1. The system is checked to make sure building has completed.
2. The system's modes are swapped repeatedly and multiple times.

Success criteria: Wiring does not come apart.
Failure criteria: Wiring comes undone.

Test procedure 3: LED Lighting
1. The system is checked to make sure building has completed.
2. Start up the system.
3. The system is left on for a prolonged period of time, past the intended restart period.

Success criteria: LED lighting does not turn off.

Failure criteria: Any lighting failures are seen.

3 Project Timeline, Estimated Resources, and Challenges

3.1 Project Timeline

The team decided to split the gantt chart into two different semesters, which can be seen in Figure 2 and Figure 3.

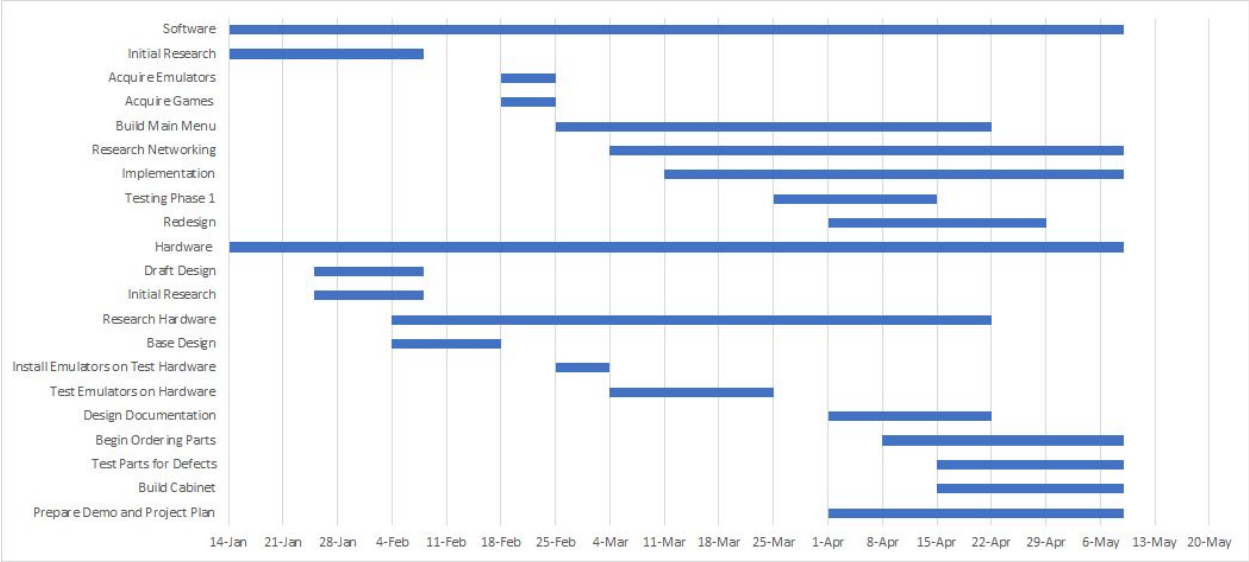

Figure 4: GANTT chart for Spring 2019 Semester (Updated)

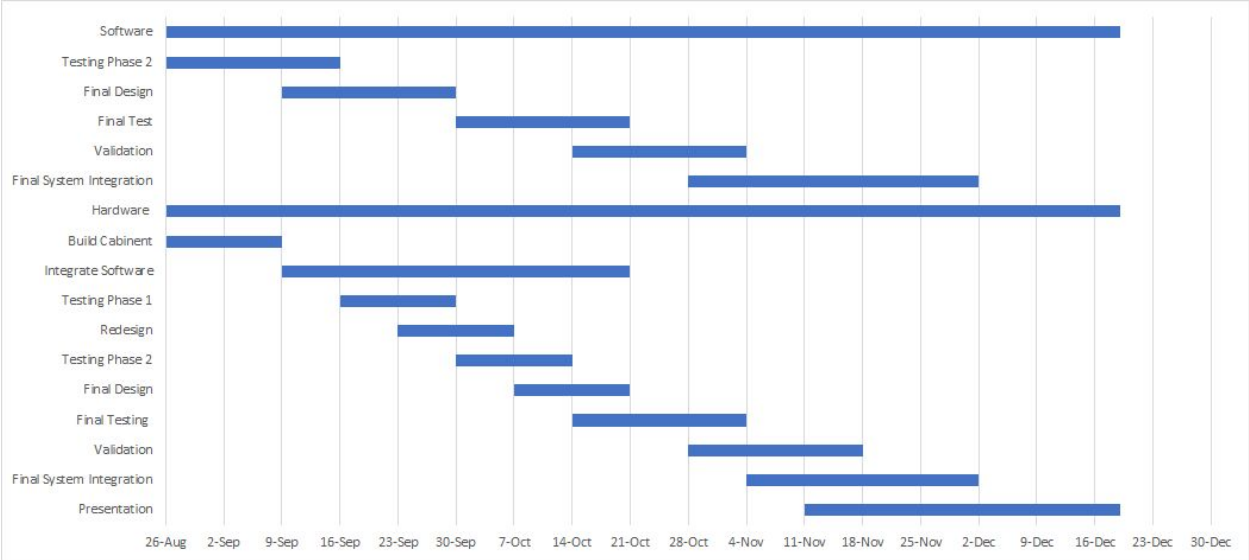

Figure 5: GANTT chart for Fall 2019 Semester

The Spring semester gantt chart can be seen in Figure 2 and demonstrates the schedule that the team expects to follow. During this semester the team expects to spend time on researching, prototyping, and beginning the first testing phase. Development of the main menu for the arcade cabinet will mainly take place during this semester. During this time team members will be expected to spend time on learning the skills that will be necessary to complete the arcade cabinet.

The Fall semester gantt chart can be seen in Figure 3 and demonstrates the schedule that the team expects to follow. During this semester the team expects to spend time on prototyping, testing, and integrating the design. Integration of the software and hardware components of the arcade cabinet will mainly take place during this semester. During this time team members will be spending most of their time testing and verifying the integration of arcade cabinet.

3.2 Feasibility Assessment

Throughout the project over the next 2 semesters, there will be no smooth road that will lead us to the end of the project. There will be lots of challenges and obstacles that we will have to overcome.

- Network of the actual machine: Getting the machine to interact and be able to play the same exact games with more than 1 player or less than 4 players.
- Budget: Being able to get all the necessary components and account for all the equipment needed with a budget of $1000 total.
- Coding: We are all Electrical Engineers and thus coding isn't our strong suit, so being able to code a new main menu that picks the games and numbers of players will be challenging.

- Game accepting new platform: Being able to get the games to do what we want to do will be tricky, in that some games may struggle to perform well on our system.
- Integration of hardware/software: Getting all the new software and modifying them to our requirements and then bringing them together and communicate properly will be a challenge.
- Stability: Not tipping over and hurting users is a big problem that will have to be accounted for.
- Security: Not allowing users to get access to the hardware, messing with wires that damages the system and ruins our promise of 5 years.
- Mobility: Taking the requirement of the client to make the unit mobile and also safe.

3.3 Personnel Effort Requirements

Table 1 is included below of general personnel requirements.

Task	Description	Estimated Time
Research Networking	Research necessary learn how to network two devices together.	20 hours
Research Hardware	Research necessary to determine minimum hardware requirements.	10 hours
Custom Software Design	Design of a custom main menu for multiple emulators.	40 hours
Acquire Emulators	This task will require the team to find an appropriate means of emulating hardware.	4 hours
Acquire Games	This task will require the team to find an acceptable means of obtaining ROMs.	8 hours
Design circuit/logic diagram for hardware	Design a diagram that can be referenced for troubleshooting needs	15 hours
Implement Software and Hardware	This task will require the team to combine the working main menu with emulators and the	40 hours

	controls.	
Test Software	This task will require the team to consider user misuse or find exploits that can be used to break the machine.	20 hours
Test Hardware	This task will require the team to test the safety, security, mobility and stability of the arcade cabinet and computer.	20 hours
Documentation for Hardware/software	Documenting all coding, research and design process. For hardware we need to document all parts, design work and instructions	150 hours

3.4 Other Resource Requirements

In this project, there are a few things that are needed that besides the financial aspect. These include ETG training, Design lab and Research. We need ETG training so we can go into the workshop and build our cabinets. The whole team needs this training to be able to contribute. The team also needs access to the design lab, in order to help test and build aspects of our project, along with storing our materials in a safe area. Research is essential because we have to have background knowledge on how to do coding, design and or compatibility aspects that will go into this project.

Another resource requirement would be safely obtaining the correct ROMs and emulators for our project. These can be found as downloadable files all over the place on the internet. One issue that may arise is accidently obtaining viruses while trying to get ROMs over the internet.

3.5 Financial Requirements

We have been granted $1000. In this $1000, we will have to get all the hardware, software, controllers, base of the arcade, wheels, screens and so on. Much of the hardware costs are expected to come from controllers. Finding specialized controllers for selected number of our game choices can be harder to come by.

Table 2 below contains a high level view of the estimated cost of items for the construction of the Networked Arcade Cabinet. More items will be added to the list as time goes on, but this list serves as a good estimate for the amount of money the team is planning on spending.

Component	Source	Appx. Price (Rounded Up)	Quantity Expected	Full Cost
Audio				
Stereo Amp.	https://www.am	$50.00	2	$100.00
Audio Arcade Kit	https://www.arc	$40.00	2	$80.00
Total Cost				Alternates
Visual				
32-Inch TV @ 120Hz,1080p	https://www.am	$190.00	2	$380.00
Insignia 32" @ 60Hz, 720p	https://www.bes	$100.00	2	$200.00
Total Cost				Varies
Outer Casing				
Melamine MDF Board	https://www.low	$30.00	10	$300.00
Total Cost				$300.00
Controls				
Suzo Happ 8-way Joystick	https://na.suzoh	$12.00	2	$24.00
Suzo Happ Pushbutton	https://na.suzoh	$3.05	24	$73.20
Suzo Happ Player Button	https://na.suzoh	$3.10	4	$12.40
Gamecube Controller	https://www.gar	$30.00	4	$120.00
Mayflash 4-Port Adapter	https://www.am	$20.00	2	$40.00
Total Cost				$269.60
Power				
Garden Extension Cord	https://www.am	$13.00	1	$13.00
Surge Protector	https://www.am	$9.00	1	$9.00
HDMI Cable, 2-pack	https://www.am	$9.00	1	$9.00
Ethernet Cord	https://www.am	$6.30	1	$6.30
Total Cost				$37.30
Cost Sums				
Outer Casing, Controls, Power Sum				$606.90
Total with Stereo Amp + Amazon TV				$1,086.90
Total with Stereo Amp & Insignia				$906.90
Total with AAK + Amazon TV				$1,066.90
Total with AAK + Insignia				$886.90

Table 2 : Parts List (Updated)

4 Closure Materials

4.1 Conclusion

Our goal with this project is to learn from the past mistakes of previous arcade cabinets developed at the university and create a new arcade cabinet system that will meet our client's expectations and last for it's expected time period. The cabinet system can include up to 4 players and allow people to play games by themselves, or together. The team wishes to make a showcasing piece that follows our current design criteria of a networked system and implement features not seen before in these projects. With our methodology and the details outlined in this document, the team feels that it can make a cabinet system worth of the client's desires.

4.2 References

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4.3 Block Diagram

The expected block diagram is included below in Figure 6.

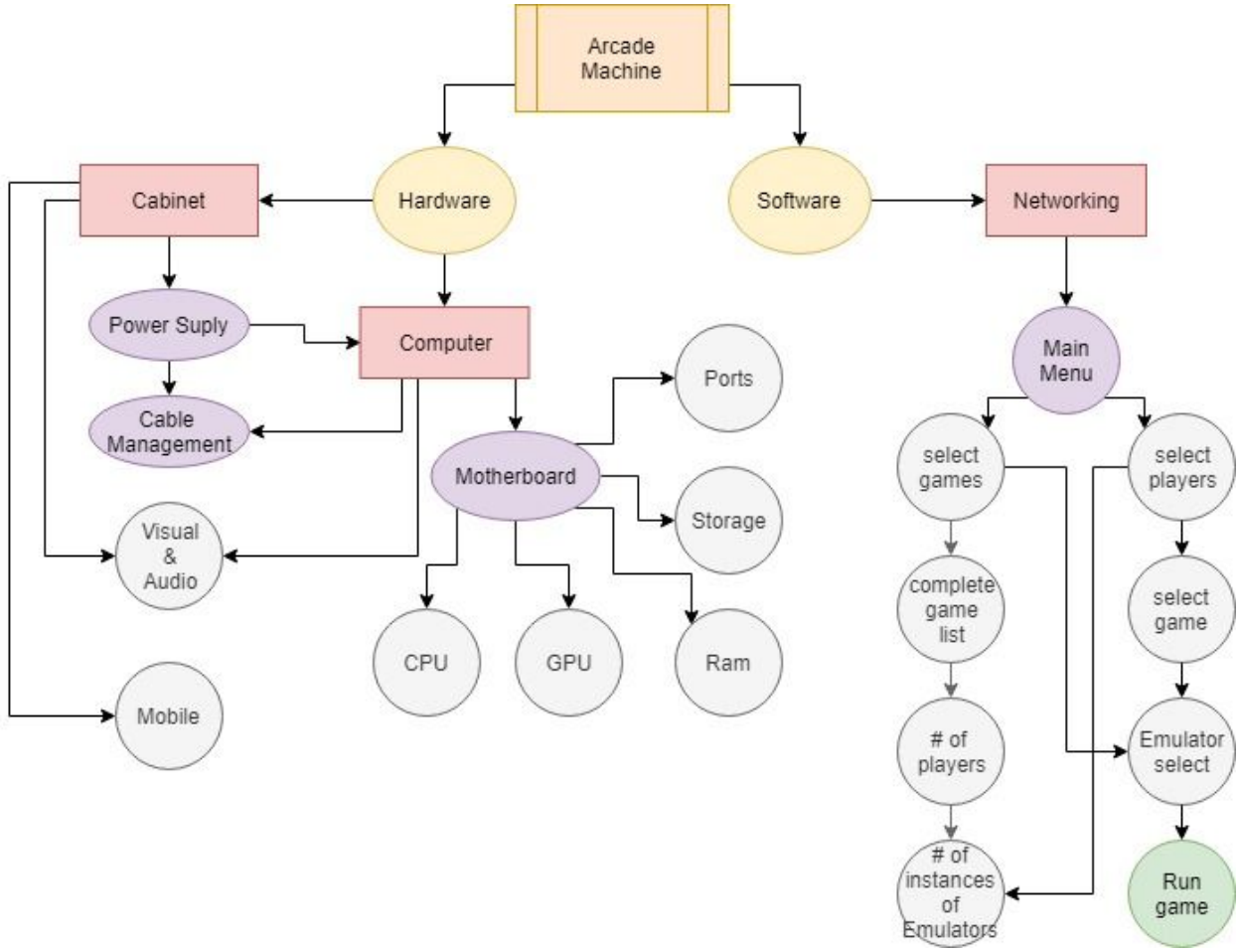

Figure 6: Block Diagram.

The block diagram above shows the flow of how the arcade machine will operate once the data is given to the system. In the arcade it the data will go to either the hardware and or software depending on what is needed. Form there the hardware will have the computer, power supply, and audio systems to coordinate. Software will be mostly focused on the networking and main menu applications.

4.4 Use Case Diagram

The expected use case diagram is included below in Figure 7.

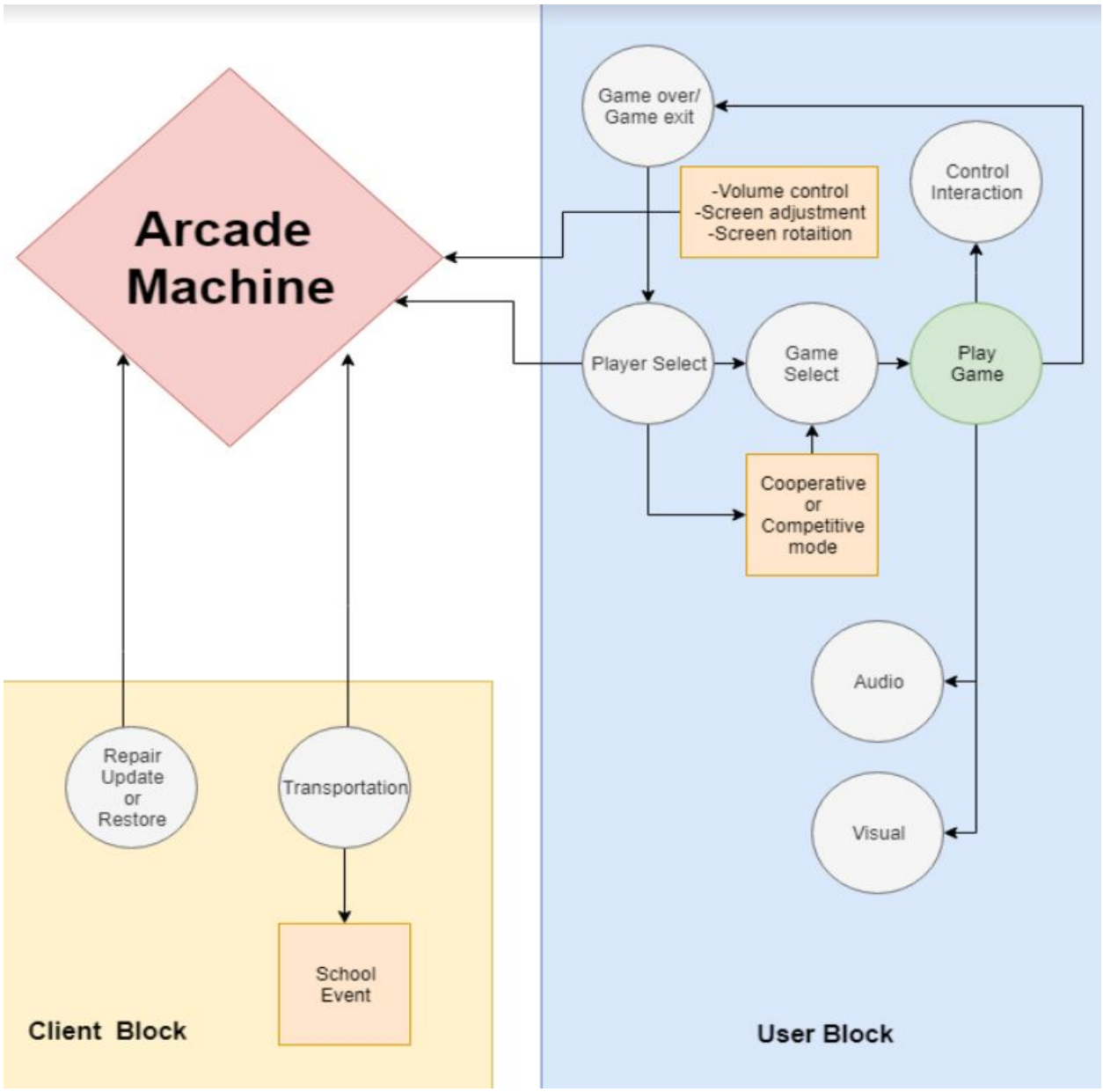

Figure 7: User Case Diagram.

In the following case diagram, the team has a client and then user block that all leads to the end goal of the arcade machine. The client will be involved the the maintenance after the team has left and can no longer maintain it but the cabinet is built for at least 5 years of little to no maintenance. Client is also in charge of the authorization to transport the cabinet to anywhere outside of the TLA.

The user block will be involved in the visual and audio immersement of the games and the cabinet. Users will be in charge of picking the games that they feel is interesting and fun. While playing the games the user will be making inputs that will be sent to the arcade machine where it will process.