GNG1103

Final Design Report

Bird's Eye Island Tour

Submitted by

Bird's Eye Island Tour. E1

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Abstract

The objective of this document is to introduce the reader to the groups design project and how the group went through the design process, as well as what the group learned throughout the process.

The group was given the task to create a VR experience for cancer patients at the Ottawa hospital. With this in mind the group went through the design process steps. First starting with empathy, the group began to ask questions to the client and former cancer patients to understand the problems they are facing and how the group could relive some of the problems. These problems included, nausea, anxiety, stress, depression as well as physical pain. The next step of the process is “define”, and in this phase the group gathers the needs collected from the client and interprets them. The group rank these needs based on importance. With this in mind the group also writes a problem definition, which is a 1-2 sentence definition explaining the main problem the group is designing as well as some attributes that should be included/not included. The group then begins to create a design criterion from the interpreted needs. The reason for this is because the group needs to complete benchmarking to compare with products that are already on the market and to create an engineering design specification to help with engineering analysis. Next the group uses the data from benchmarking and the design specifications to create conceptual designs. The group chooses the best design out of the 12 created, which ends up being the bird flying game. The group then begins to prototype the game and once the final prototype is finished the group was able to test the product. During the testing phase the group tested the audio and flight of the bird within the game as these were the only testable quantities in the game.

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List of Acronyms

Acronym	Definition
VR	Virtual Reality

1 Introduction

1.1 Why the problem is relevant

The groups project problem is important as it makes the overall treatment of cancer (one of the worst possible experiences) a little more bearable. Anything that can reduce the strain a cancer patient experiences should not be dealt with lightly. For our game, the group was given the task to create a VR experience that would not cause any discomfort to the user and would take the users mind off of their treatment process.

1.1.1 Basic user requirements and the differentiation in the design

The user must not become motion sick during the experience, the game must be simple to operate, and the game should not include many aspects with user interaction as they will have limited mobility. Our game gives a tropical experience to the user. The weather is beautiful as is the scenery. The concept is also unique in itself as it is doubtful that one will ever be able to sit on a bird as it fly around a tropical paradise, so this game is a surreal experience that captivates the user. The user does not have any control of the game as it may induce extra stress on the user which is not wanted. All the user needs to do is wear the VR headset and headphones to experience the game which is quite easy and non-stressing.

2 Need Identification and Product Specification Process

After deliberation with the client in the first meeting the group was able to gain insight into the life and experience of being a cancer patient. The group learned about the different types of treatment and how patients feel during the treatment. The group was able to collect the clients needs and then interpreted the needs to create a needs identification. Below is a list of the interpreted needs the group came up with.

- Game is easy to use
    - Patients do not want to learn to play a complex game as they have many other things to worry about. This need is critical.
- Game is relaxing
    - The game does not have to be relaxing it may be something exciting. This need nice but not needed.
- Game is empowering
    - The game does not have to be empowering it may be something else. This need is nice but not needed.
- Game is enjoyable
    - Patients should enjoy playing the game to distract them from what they are going through. This need is critical.
- Game is viable in tight spaces
    - Radiation patients should be able to play the game to its maximum potential in the small space they are in. This need is critical.
- Game is slow paced

    - The game can be quicker but is advised to be slower to minimize motion sickness. This need is highly desirable.
- Game is viable for the general population
    - The game can be generalized to a specific age group if wanted. This need is not important.
- Game is distracting
    - Distraction is key to help patients feel better about their situation. This need is highly desirable.
- VR head moves when real head moves
    - Movement should be in sync as it does not cause motion sickness or nausea. This need is very important.
- Game is viable with one hand
    - For chemotherapy patients the may, be only able to use one of their hands. This need is critical.
- Game is playable without the chance of nausea
    - Cancer patients are susceptible to nausea as they are very weak from the treatment. The game is not to induce nausea. This need is critical.

With these needs listed and prioritized the group derived a problem definition that will be followed through the design process. The problem statement is: A need exist for cancer patients at the Ottawa hospital to relieve them or distract them from the vast amount of emotions experienced during cancer treatment. The game is to be easy to use, non-nauseating and viable to use in small spaces, with one hand and with the use of little movement.

With the problem statement in hand, the group now completed the design criteria to ensure the completion of the benchmarking and engineering design specifications. These attributes are extremely important to the groups design as it ensures that the groups product will be effective and unique compared to those on the market.

Table 1: Design Criteria

Interpreted Needs	Design Criteria
Game is easy to use	Head Movement Control Controller movement
Game is relaxing	Calming influence
Game is empowering	Feels strong
Game is enjoyable	Brings joy Brings positivity
Game is viable in tight spaces	Movement is minimal
Game is slow paced	Velocity(m/s) Story satisfies time constraint
Game is viable for the general population	Diversified
Game is distracting	User interacts with game
VR head moves when real head moves	Head Movement synced

Game is viable with one hand	Controller is easy to maneuver
Game is playable without the chance of nausea	Objects slow paced Movement slow paced Head movement is synced in game

Functional Requirements:

1. Game is to be used to relieve/distract chemotherapy and radiation patients with the emotions they face when going through the process
2. Operating conditions: one arm, in a small space

Non-Functional Requirements:

1. Aesthetically Pleasing
2. Game sounds/soundtracks are suitable for all ages
3. Game must not cause motions sickness to not disturb the patient.
4. Game should be distracting
5. Game should spread positivity

Constraints:

1. It is required that playing of the game takes a minimal movement.
2. The budget to create the game is $100.00.
3. Limited head movement in the game to reduce VR sickness.

Benchmarking:

Table 2: Benchmarking

Specifications	Importance	Red = 1, Yellow =2, Green = 3		
Study		The effect of virtual reality on pain and range of motion in adults with burn injuries.	Virtual reality hypnosis for pain associated with recovery from physical trauma	Virtual reality pain control during burn wound debridement in the hydrotank.
Cost	5	N/A	N/A	N/A
Aesthetics	4	N/A	N/A	N/A
Controls	5	N/A	N/A	N/A
Movement	5	N/A	N/A	N/A
Speed	5	N/A	N/A	N/A
Distraction level from pain	4	31%	44%	50%
Diversity (ages)	2	35	31.8	27
Final Score		10	12	14

Engineering Design Specifications:

Table 3 Engineering Design Specifications

Design Specifications	Relation (=, >, <)	Value	Units	Verification Method
Functional Requirements				
Game is to be used to relieve/distract chemotherapy and radiation patients with the emotions they face when going through the process	=	Yes	N/A	Test
Operating conditions: one arm, in a small space	=	1	N/A	Test
Non-Functional Requirements				
Aesthetically Pleasing	=	Yes	N/A	Analysis, Final Testing
Game sounds/soundtracks are suitable for all ages	=	Yes	N/A	Test, Analysis
Game must not cause motions sickness to not disturb the patient.	=	Yes	N/A	Test
Game should be distracting	=	Yes	N/A	Test
Game should spread positivity	=	Yes	N/A	Test
Constraints				

Game takes a minimal movement.	=	Yes	N/A	Analysis, Final Test
Cost	<	100	$	Estimate, Final check
Limited head movement in the game to reduce VR sickness.	=	Yes	N/A	Analysis, Final Check

3 Conceptual Designs

The group conceptualized many designs through the brainstorming phase. Each one was unique and had a different view of solving the problem given. Below is a list of someone of the designs the group came up with.

1) 1 on 1 Soccer Game (See figure 1 in the appendix III)
2) Zombie Lightsaber Survival Game (See figure 2 in the appendix III)
3) Battleship Style game (See figure 3 in the appendix III)
4) One-Timer Hockey Game (See figure 4 in the appendix III)
5) First Touch Strike Soccer Game (See figure 5 in the appendix III)
6) Baseball Batting Simulation Game (See figure 6 in the appendix III)
7) Orchestra Conducting Game/Experience (See figure 7 in the appendix III)
8) Mountain Climbing Game (See figure 8 in the appendix III)
9) Underwater Ocean Experience (See figure 9 in the appendix III)
10) Tubing Water Sports Game (See figure 10 in the appendix III)
11) POV Roller Coaster Experience (See figure 11 in the appendix III)
12) Bird Flying Around Tropical Environment Experience (See figure 12 in the appendix III)

As shown above the group brainstormed a variety of ideas for our collaborative design solution. The group tried to cover all aspects of the understanding of the customer needs at that point to present a lot of options in terms of what direction the group wanted to direct the game in. Ultimately, the group chose the Bird Flying Experience because it best fit all the customer's needs and didn't raise any glaring concerns with the customer in terms of risks such as nausea or stress-inducing potential.

4 Project Plan, Execution, Tracking & Bill of Materials

The groups project plan was to create a bird flying experience for cancer patients at the Ottawa hospital. To do this the group analyzed what they needed to complete. The group decided that the game should include two different islands, a bird to fly on, wind sounds, wave sounds, a bird's flight path around the islands, as well as not giving the user the stress of learning how to play the game as everything will be programmed within in the game to make it easier on the patient. To follow the plan and to make sure the group was able to complete the required tasks and execute the final product to its fullest potential, the group created a schedule for everyone to follow. Below is the schedule the group followed:

Table 4: Schedule until 3rd client meeting

Name	Task	Beginning date to end date	Amount of days
Nathan Villar	Design the island's landscape	February 17 - March 1	13 days
Shane Armstrong	Design trees for the island	February 17 - March 1	13 days
Ben Hogan	Design the bridge walking onto the island	February 17 - March 1	13 days
Ricardo Chan	Design the bird for the island	February 17 - March 1	13 days

Nathan Villar	Begin to develop the birds flying route	March 1- March 7	6 days
Client meeting March 8th			

Table 5: Milestones for 3rd client meet

Name	Milestone
Nathan Villar, Shane Armstrong, Ben Hogan & Ricardo Chan	Deliverable F (February 26)
Nathan Villar, Shane Armstrong, Ben Hogan & Ricardo Chan	Deliverable G (March 5)

Table 6: Schedule until 4th client meeting

Name	Task	Beginning date to end date	Amount of days
Nathan Villar	Finish the development of the birds flying route.	March 8 - March 11	3 days
Shane Armstrong	Develop in-game soundtracks	March 8 - March 11	3 days
Ben Hogan	Develop in-game text for the introduction	March 8 - March 11	3 days

Ricardo Chan	Implement the birds flying route into the game	March 11- March 28	18 days
Nathan Villar	Develop in-game controls for choosing options	March 11- March 28	18 days
Ben Hogan	Develop the in-game speed of the bird	March 11- March 28	18 days
Shane Armstrong	Develop a trademark tree for the island	March 11 - March 20	9 days
Client meeting March 29th			

Risks:

With this part of the development of the game, there are risk associated with the development of the birds flying route and speed of the bird. The reason for this is because the bird's flight must long enough to endure a whole radiation treatment (15-20 minutes) as well as making sure the bird does not crash into anything as if it does crash the group must create a in-game mechanic of what will happen when the bird crashes. The bird's speed must also be a slower pace due to the fact that it may induce nausea for the patients.

Table 7: Milestones for 4th client meet

Name	Milestone

Nathan Villar, Shane Armstrong, Ben Hogan & Ricardo Chan	Deliverable H (February 26)
Nathan Villar, Shane Armstrong, Ben Hogan & Ricardo Chan	Deliverable I (March 5)
Nathan Villar, Shane Armstrong, Ben Hogan & Ricardo Chan	Design Day Presentation (March 28th)

Table 8: Schedule for final presentation day

Name	Task	Duration
Nathan Villar, Shane Armstrong, Ben Hogan, Ricardo Chan	Develop a poster explaining and displaying the final product	March 28 - April 5
Nathan Villar, Shane Armstrong, Ben Hogan, Ricardo Chan	Prepare for final presentation	March 28 - April 5
Presentation day (April 5)		

Table 9: Milestone for final Presentation

Name	Milestone
Nathan Villar, Shane Armstrong, Ben Hogan & Ricardo Chan	Deliverable J (March 29)

Nathan Villar, Shane Armstrong, Ben Hogan & Ricardo Chan	Deliverable K (April 15)

To track the completion of each members progress, the group held weekly meetings every Saturday afternoon at 1:00 pm in the design commons room in the STEM complex. During these meetings each member would show each other what has been completed and state if they are having any trouble with any of the tasks given. One of the problems that had occurred during the design process was the completion of combining both the main islands onto the same file. With this problem, the group had lost time and suffered because of it. With this lost time the group was unable to add in game options or an introduction.

To execute the plan, each member learned how to use unity3D in order to complete their desired task. To do this each member watched the clients, Elisha Pruner's, YouTube videos explaining the different requirements within the unity3D app. Once each member learned unity3D, the group was able to complete most tasks with little difficulty. The completion of theses tasks ensured the completion of the final product to be presented at design day.

Due to the group not spending any money on the project, the group did not create a bill of materials.

5 Analysis:

Due to the concept our project the group did not have to calculate anything related to the project as it was done over the app unity3D. All the analysis the group did was during the testing phase of the project. This included the testing of the audio within the game as well as the birds flight path. The reason the group needed to test this was because when a patient is doing treatment and they are just playing the game but can still hear their surrounding sounds it may not have the same effect as it would if the had audio in the game to make them feel as if the bird's flying experience is more realistic and this may have a better effect on the patient to reduce their emotional and physical pain. For the bird's flight the groups main concern when testing it was to ensure that the flight would not induce nausea for the patients as they have a more probable chance of experiencing nausea compared to healthier individuals due to the medications they take. The group analyzed the bird's flight path by continuously playing with the flight and putting on the VR headset and seeing if it will induce nausea. After many trials the group concluded on one flight bath which lasts about 750 seconds, which relates to how long a radiation treatment lasts.

6 Prototyping, Testing and Customer Validation.

The first prototype was made up of multiple scenes and figures: two islands, tree concepts, and the bird figure. It was at this point that we were just learning the Unity software so our testing at that time consisted of learning how to add things like texture, dimension, and colour to our scenes and creations. (See figure 13, 14, 15 and 16 in appendix III)

While creating the second prototype, we had started to incorporate some dynamic movements into our game like the birds' flight path and its speed. In addition to these new aspects, we put the finishing touches on the islands and models from the previous prototype. The birds flight path created a lot of opportunity for testing using the virtual reality headset as we had to see if the point of view of the user was in the right position, and if the game had any nauseating effects. This part of the testing was performed with much trial and error. (See figure 17 and 18 in appendix III)

The third and final prototype for our game included a polished flight path, a new main island design, new accessory islands in the background of the scene, and many small attributes like waves, sound, falling coconuts, etc. The completion of this prototype forced us to expand our knowledge on the Unity software and go through a lot of testing to make sure the various moving parts of our game ran together smoothly. There were some significant aspects we had to test constantly such as, the brightness of the virtual world due to the reflection off of the water at the different angles of our flight path, the sound of the ocean to create the most authentic experience possible, and the speed of the bird's flight while ascending or descending around the tropical landscapes. (See figures 19, 20, 21, 22)

Due to the type of project the group had, the testing part was only done once the project was finished. The only part of the project that needed to be tested was that the audio was playing when riding on the bird and that the bird's flight path was slow and did not cause any problems such as nausea. To do this the group met up at the design commons and took turns playing the game to ensure none of us felt sick when playing it. The group also allowed other classmates try to game to make sure when they played there was no motion sickness. Once the group verified that the game does not induce nausea they showed the product to the client, Elisha and she was satisfied with the group's product.

7 Final Solution

The final product is a VR game that is a bird flying around a tropical landscape giving the user nice scenery as they go through radiation treatment. The flight of the bird is slow and uniform as to not cause any discomfort or motion sickness. The flight starts on the main island where the user starts their journey. The main island is home to many palm trees and coconuts. After the bird performs a loop around the first island, it moves to the second island. On the second island is a mountain and many palm trees. The bird explores both as it makes its way around the island. After that tour, there are two additional smaller islands that the bird flies around before returning to the main island. These two islands each have two palm trees on them and a few coconuts.

The game performs well, there are no sharp turns or sudden changes of speed, thus minimal motion sickness is to be experienced by the user. It is apparent that there should be a start option for the game rather than it starting as soon as the game is turned on. This would improve the game by allowing the user to start whenever they are ready. (See appendix III to view final solution)

8 Conclusions and Recommendations for Future Work

In conclusion, throughout the process of creating a virtual reality game for cancer patients at the Ottawa hospital to help with emotions and pain faced during the treatment the group learned a lot that will be beneficial to them in the future. The group learned about teamwork and how to work with each other in certain situations. The group learned how to communicate any problems they had to ensure these issues would not disrupt the quality of the final product. The group also learned how to trust each other as each member had to rely on each other to finish their own work for the project. The group also learned the importance of scheduling and how much following a schedule can keep members on task and driven to finish each task on time. The group also learned how to create VR games and how to lead each other in different scenarios.

The final product chosen was the bird flying game as it satisfied most of the requirements and did not cause nausea for the users. The group followed a strict schedule and did various research to ensure the quality of the app was optimized. This included, talking with the client, understanding her needs, benchmarking data, engineering design specifications, conceptual designs as well as prototypes and testing/analyzing the final product.

For future work, it would be ideal to include an interactable menu that the user will use to start the game. This would have to have a simple design. The group could have the user walk up to the bird to activate the flight path or a simple menu option with a start icon then the user must press. Other improvements could be more landscapes, more climates, an interactable flight path, different birds that the user can choose from, etc.

9 Bibliography

No academic outside sources were used in the completion of the report

APPENDICES

APPENDIX I: User Manual

The features of the product include many different scenes. These scenes include two main islands as well as two smaller islands to add more scenery to the game. The game also includes a bird and topical trees. The game also includes rocks and coconuts scattered around the islands. The functions of each scene are to have a distracting effect among the user when they are embraced into the experience. The game also includes audio of waves and winds to further allow the user to feel embraced into the experience which helps with the distraction level of the game. Due to the type of product the group created there is no maintenance required since it is all saved onto a file. If an error occurs with the files there will be maintenance to be had but impossible as it is saved upon multiple USBs devices so if one fails, the group has a backup file.

To create this project, one must begin to learn unity3D, whether it be from YouTube videos or reading about it online. The main part that the individual should begin to create is the different islands within unity3D and create the bird in a 3D modelling app should as Sculptris. Once this is created they should transfer all the files into one file, so the individual can add the main parts of the game such as the birds flight and the audio. To create the bird's flight, one must use the animation blender within the unity3D app. To learn how to do this one should watch a YouTube video about it or ask an expert. To add audio, one must find an audio clip online or within the unity app and simply submit the audio clip onto the terrain. The user then will need to position the camera to be on the back of the bird and insert the VR headset to be synchronized into the game. This was done through the use of the client's expertise but can also be learned through online resources. To ensure the bird's flight is functional and non-nauseating one should test the

game themselves and ask others to play the game as well and see if it induces nausea or motion sickness of any kind.

APPENDIX II: Design Files

1) Deliverable A - Team Contract
    - Establishing team procedures
    - Identifying expectations
    - Specifying the consequences for failing to follow these procedures and fulfill these expectations
2) Deliverable B - Needs Identification and Problem Statement
    - The group identified the main problems and customer's needs from the first client meeting. Besides, gather more requirements online
3) Deliverable C - Design Criteria
    - Turning the customers' requirements and problems into design criteria and created a benchmarking base on the problem statement.
4) Deliverable D - Conceptual Design
    - Coming up twelve ideas (three from each team member) that satisfied the client requirements and benchmarking. Compare the cost, complexity and group ability and then made the final decision. We eventually decide to build a first-person view on a bird that flies around a island on the ocean
5) Deliverable E - Project Schedule and Cost
    - Calculate more details about the ideal plan cost and separate the work with a precise schedule to each team member.
6) Deliverable F - Prototype 1 and Customer Feedback
    - Build the first prototype and present to the client. Gather and summarize the feedback. We made the main island and import the sky and ocean animation

7) Deliverable G - Prototype 2 and Customer Feedback
    - Fixed the first prototype with the feedbacks and present to the client again. Gather and summarize the feedback again. We added the second island and finished the three different kinds of the prototype of birds.
8) Deliverable H - Prototype 3 and Customer Feedback
    - Fixed the second prototype with the feedbacks and present to the client last time. Gather and summarize the eventual feedback. Moreover, fixed and confirm the final project. We imported one of the birds and created the path for the bird. Besides, we inserted the sounds, VR headset camera setting and other details.
9) Deliverable I - Presentation Materials of Design Day.
    - Prepare the presentation materials for the design day like PPT, poster, presentation speech and so on. Then present during the design day.
10) Deliverable J - Final Presentation
    - The final presentation of all the work to the class

APPENDIX III: Figures

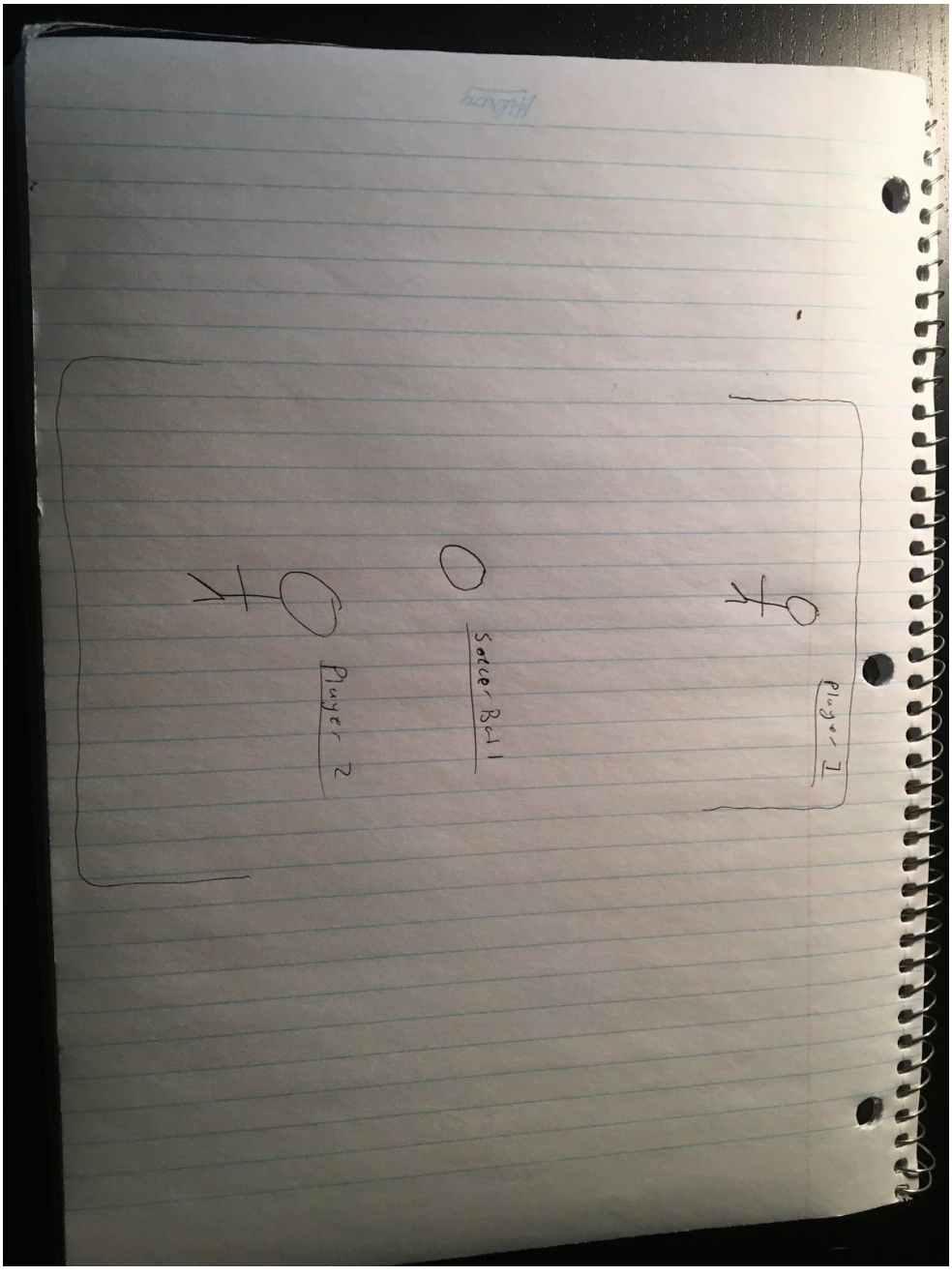

Figure 1: 1 on 1 Soccer match

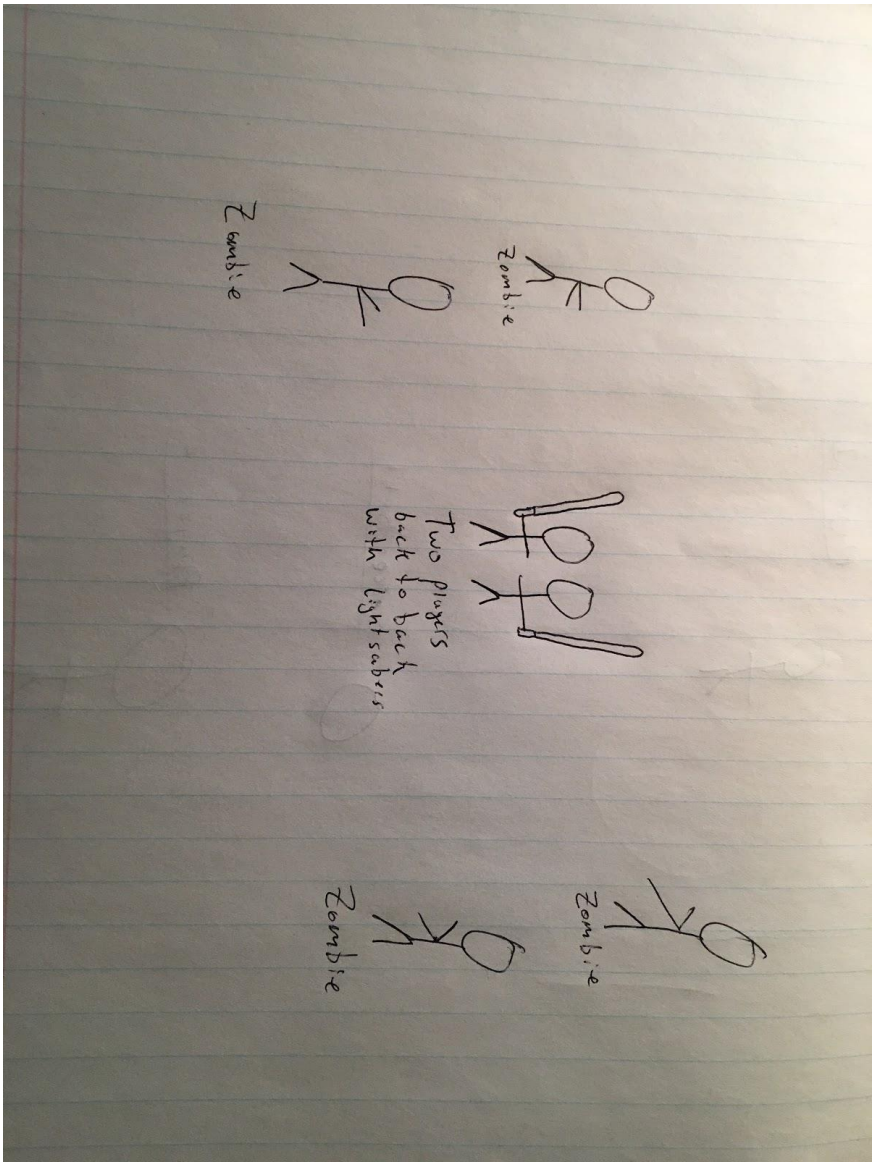

Figure 2: Zombie Lightsaber Survival Game

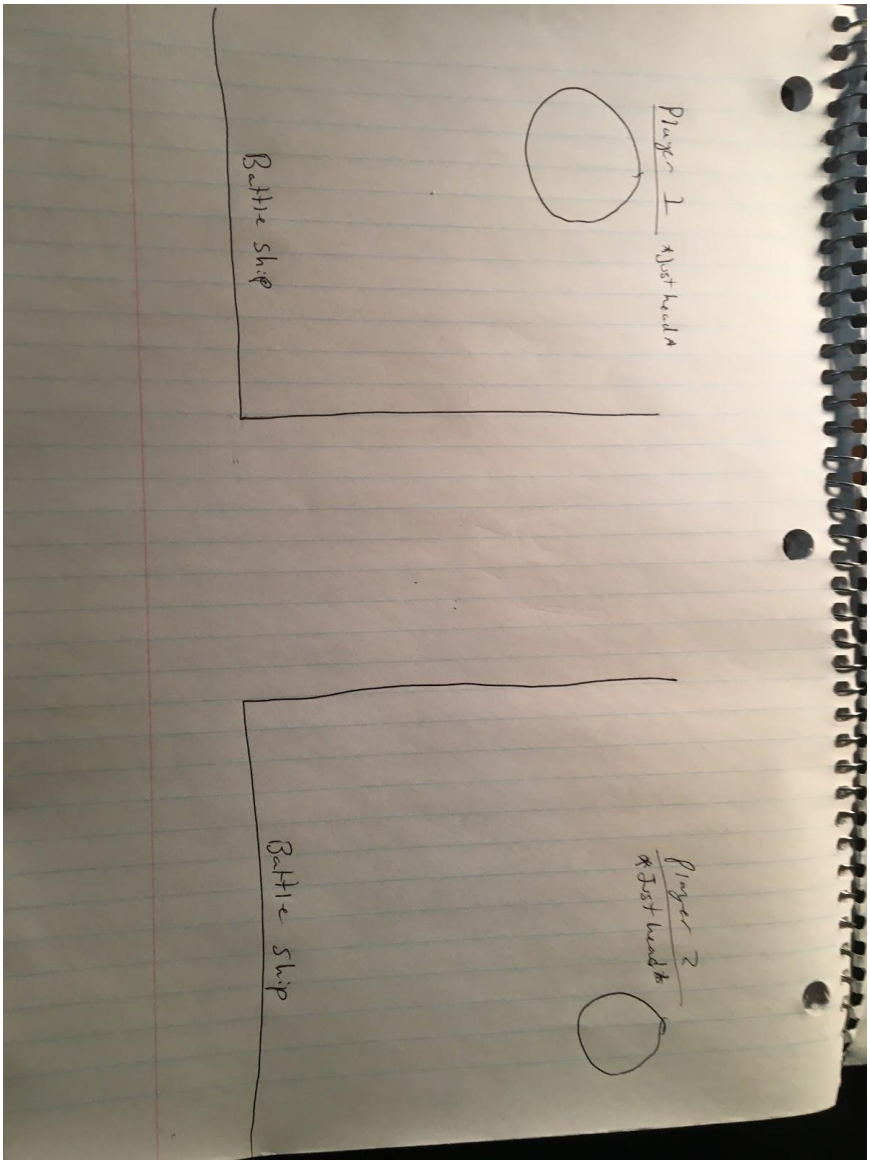

Figure 3: Battleship game

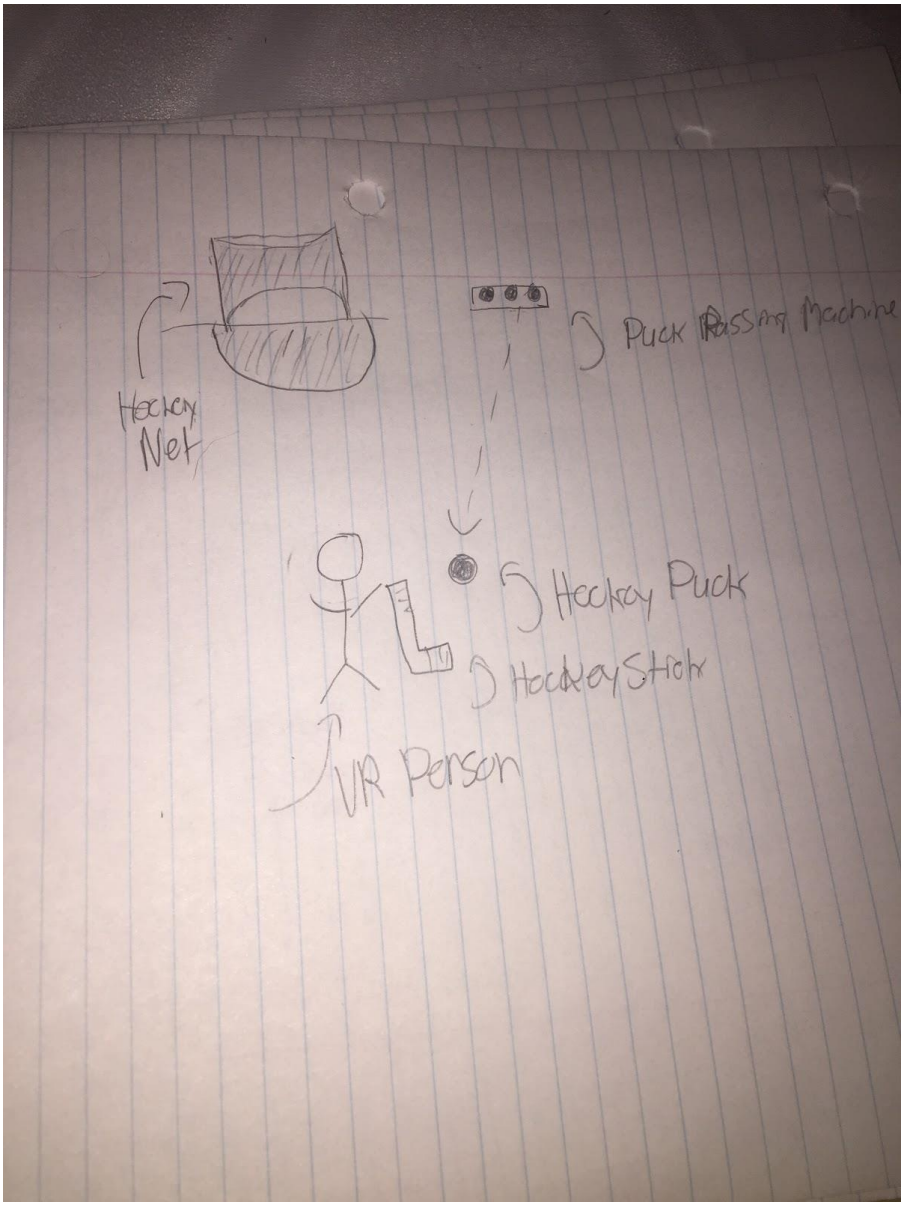

Figure 4: One-Timer Hockey Game

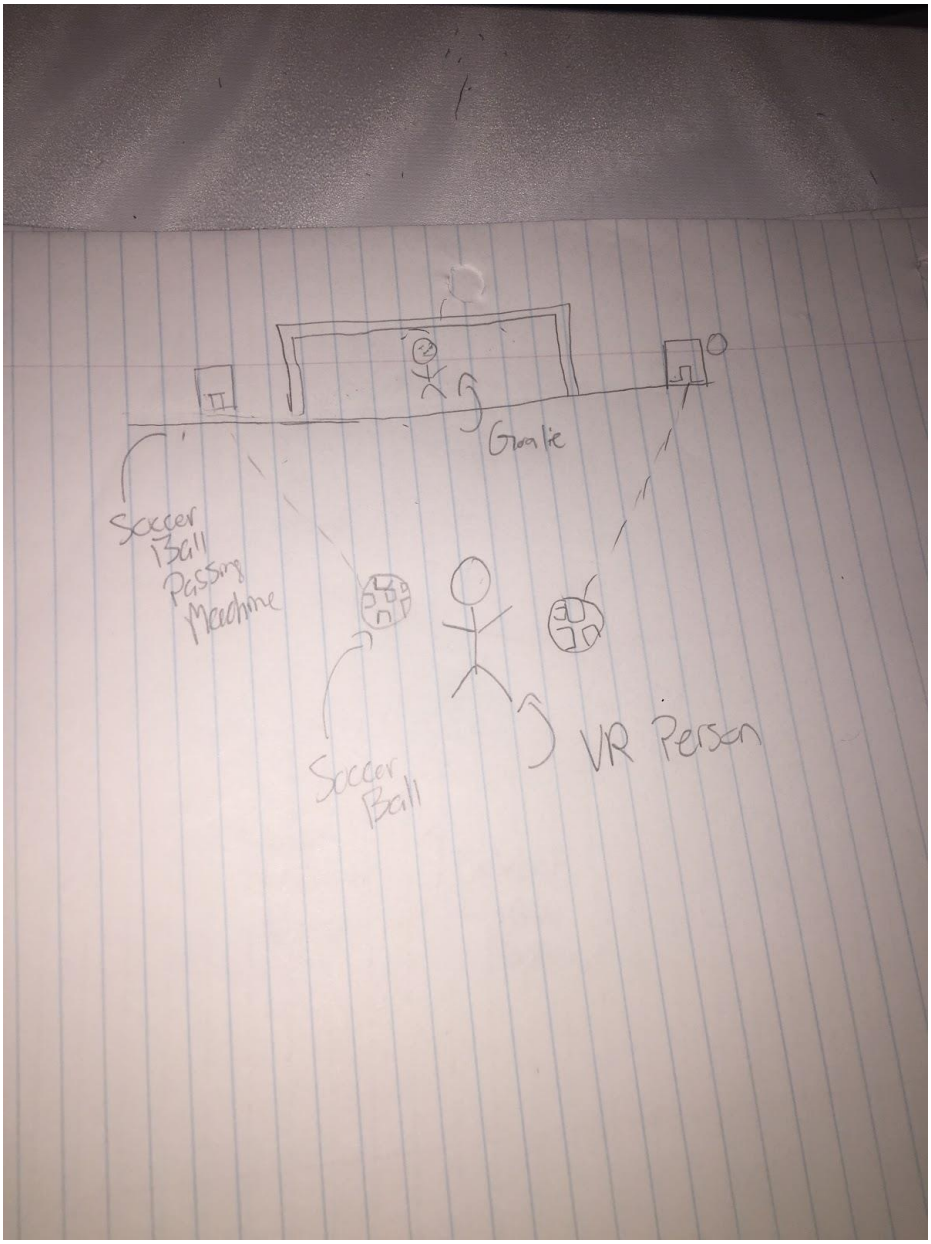

Figure 5: First Touch Strike Soccer Game

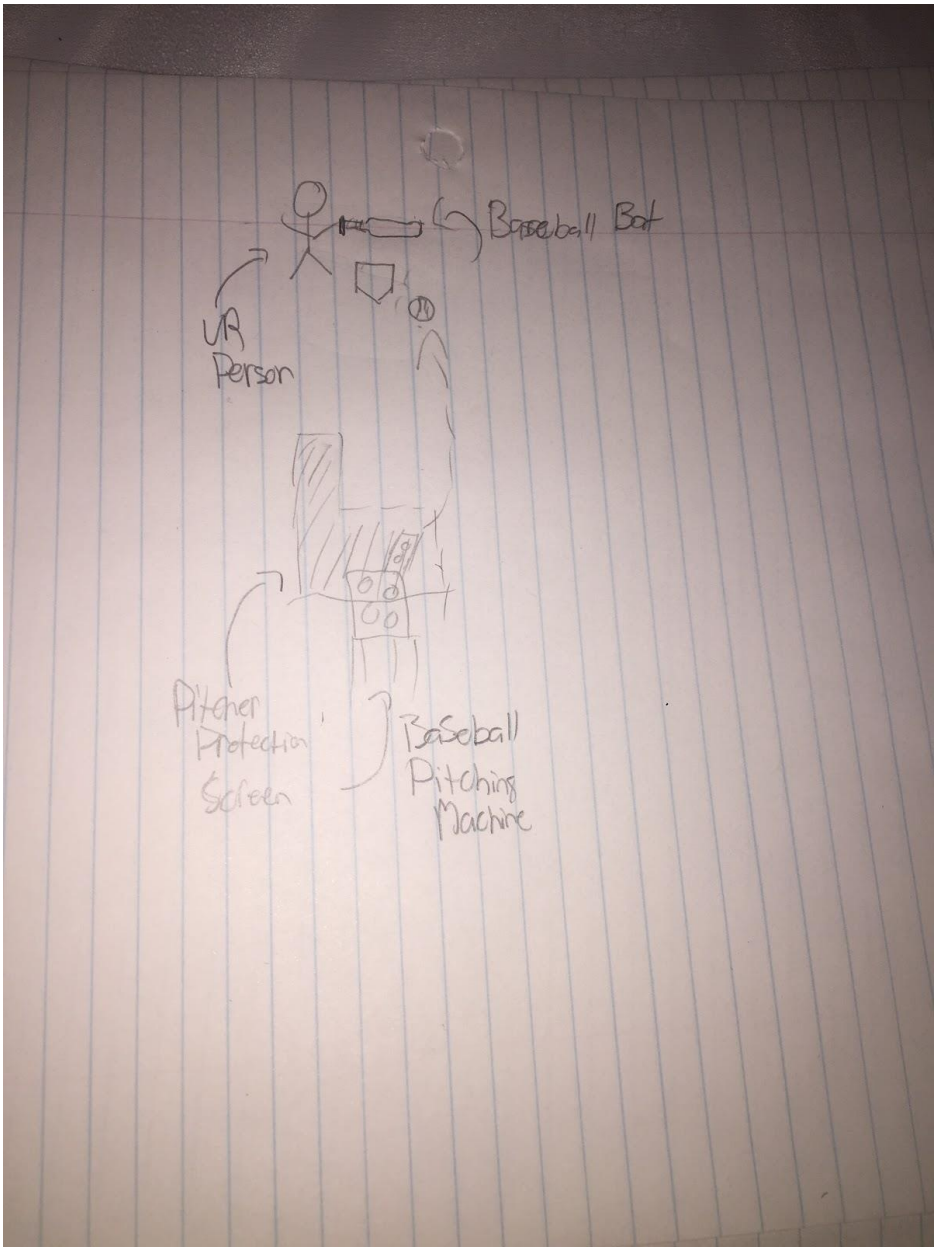

Figure 6: Baseball Batting Simulation Game

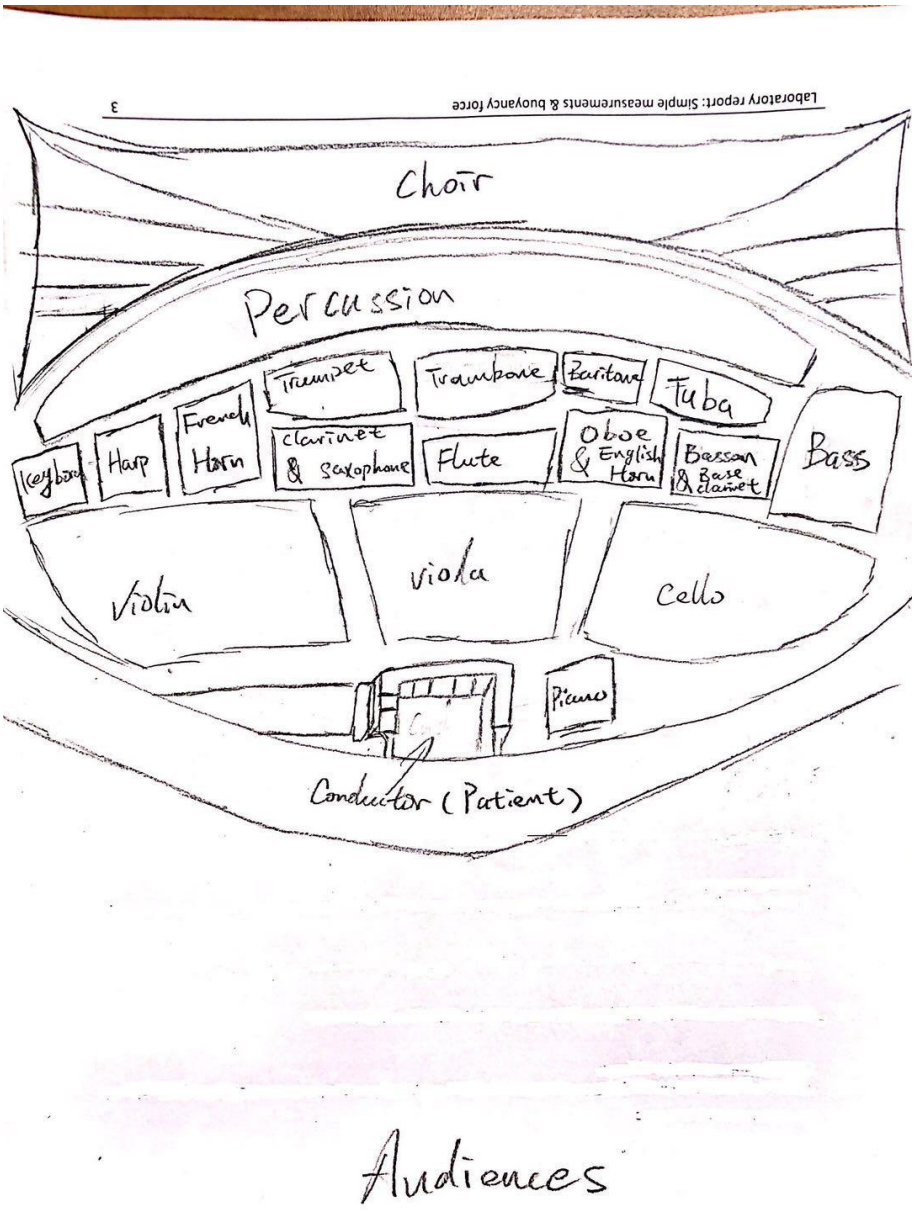

Figure 7: Orchestra Conducting Game/Experience

Figure 8: Mountain Climbing Game

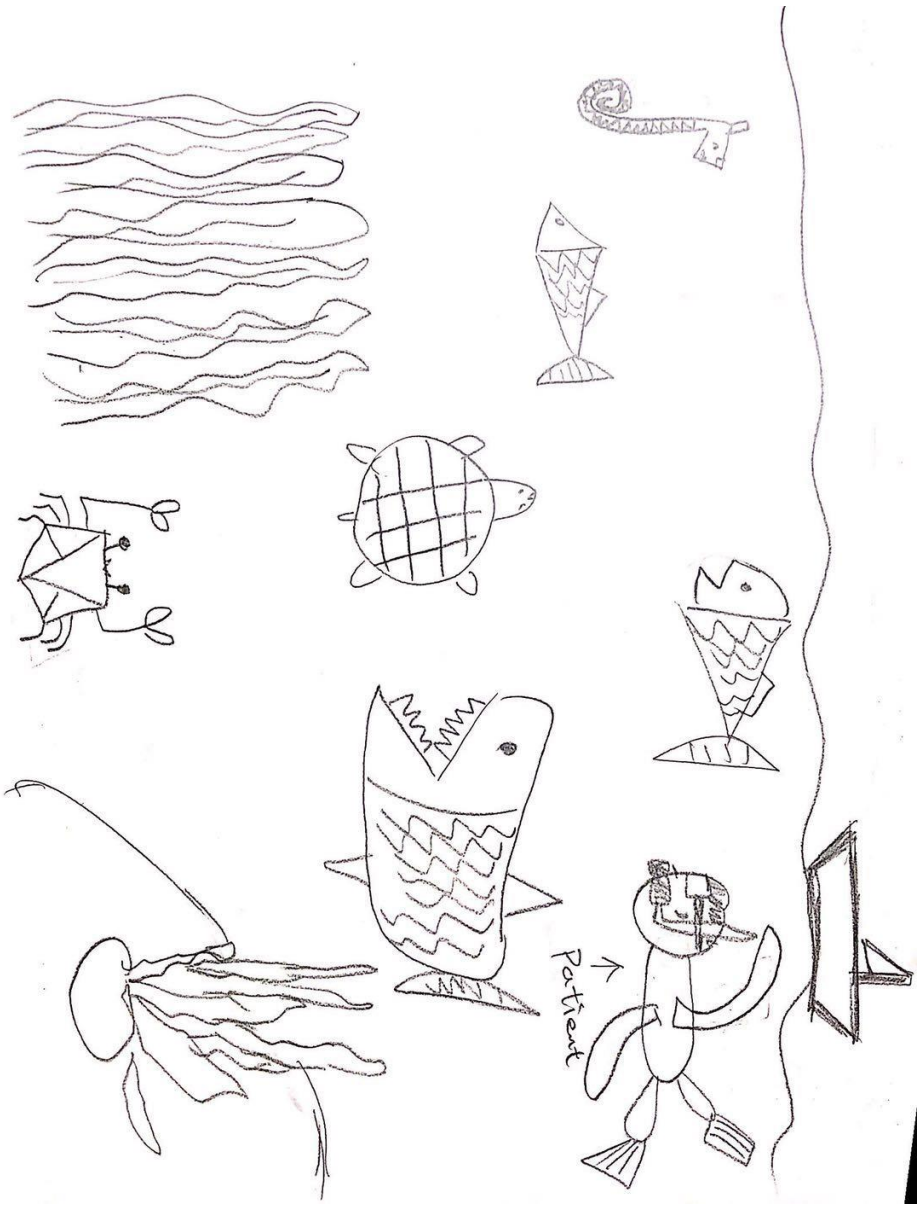

Figure 9: Underwater Ocean Experience

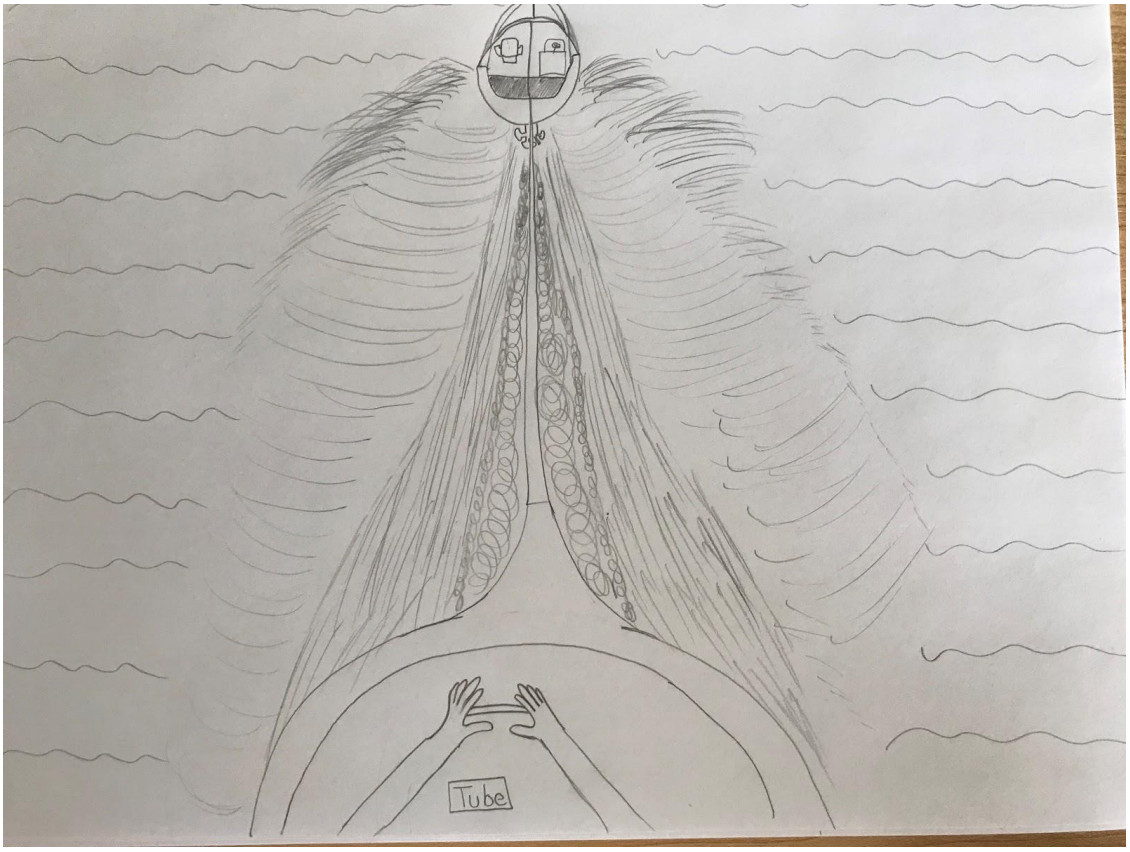

Figure 10: Tubing Water Sports Game

Figure 11: POV Roller Coaster Experience

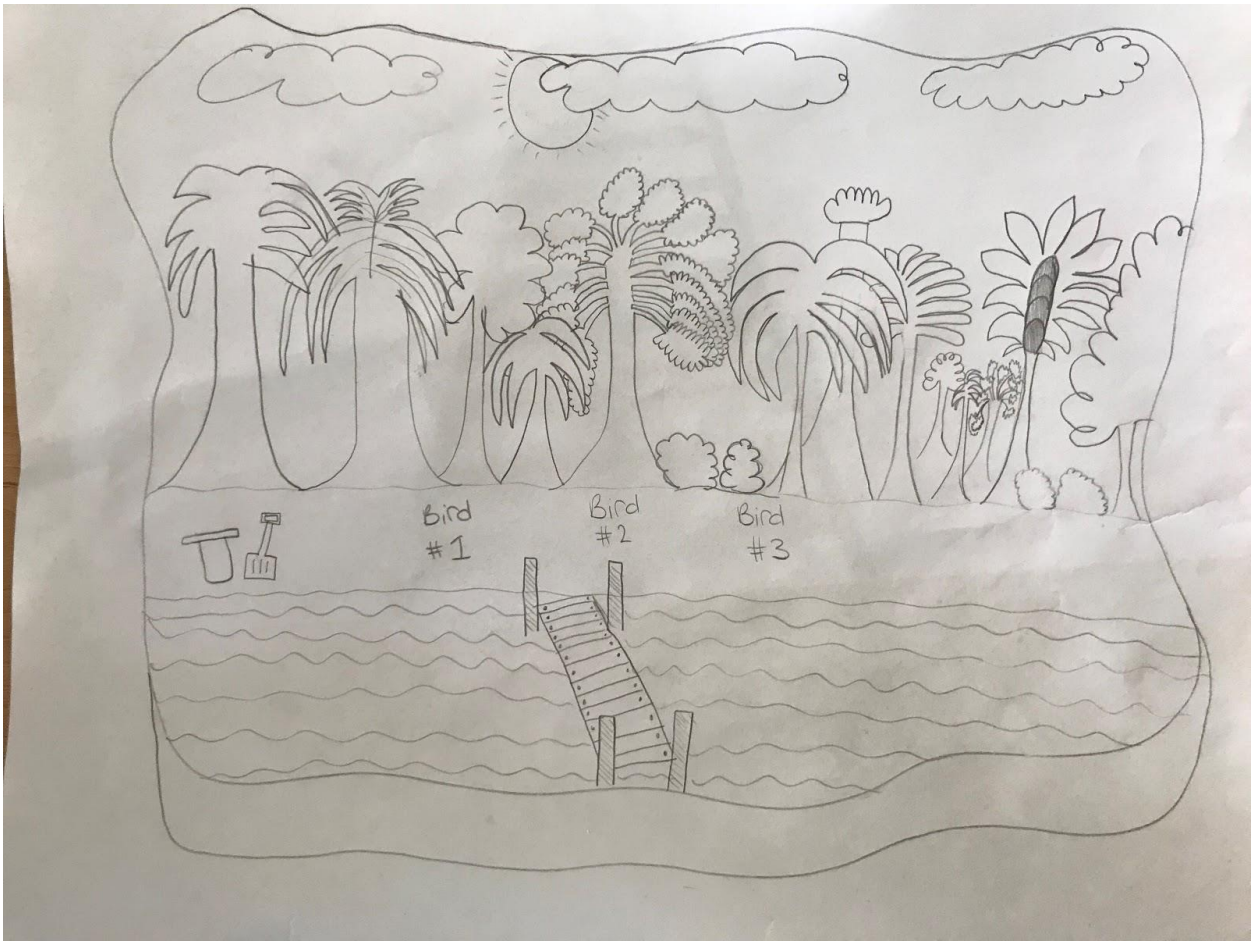

Figure 12: Bird Flying Around Tropical Environment Experience

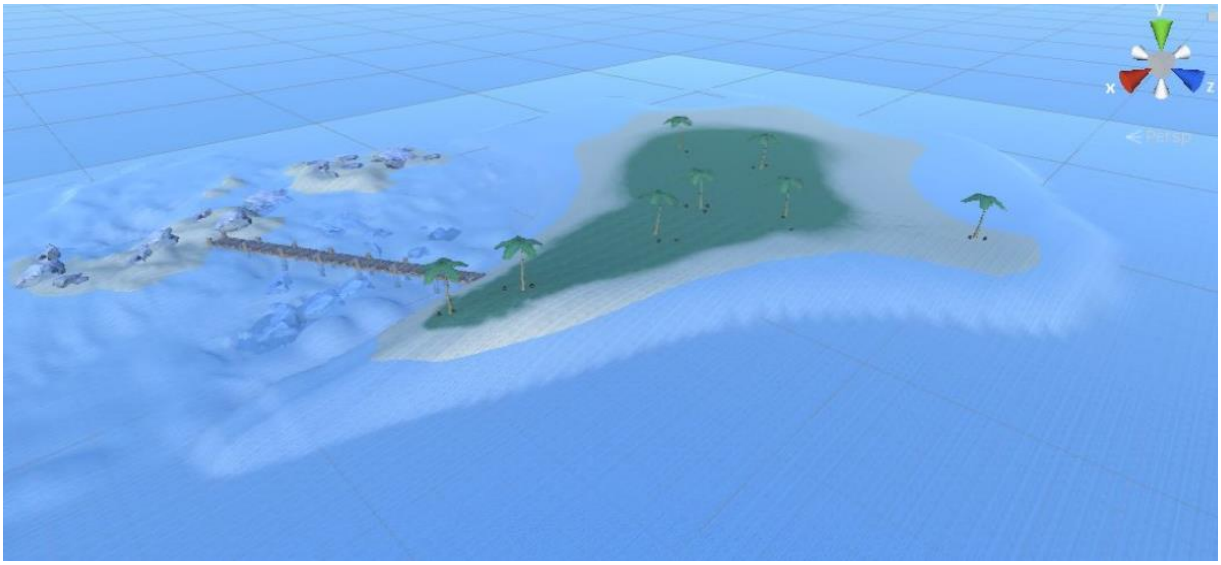

Figure 13: Prototype 1 island

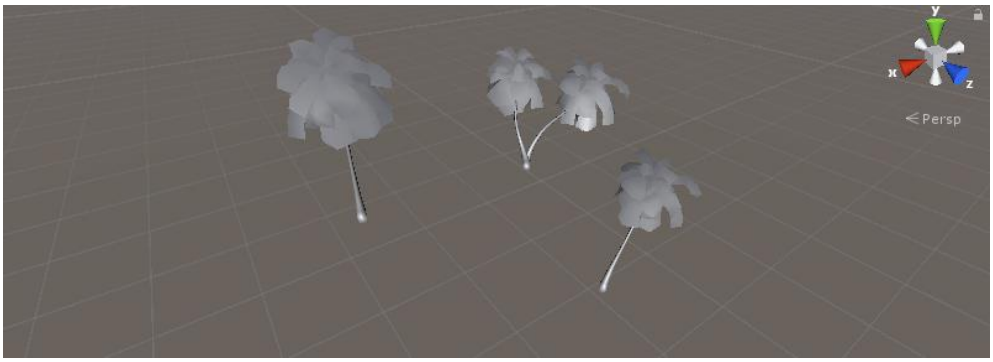

Figure 14; Prototype 1 trees

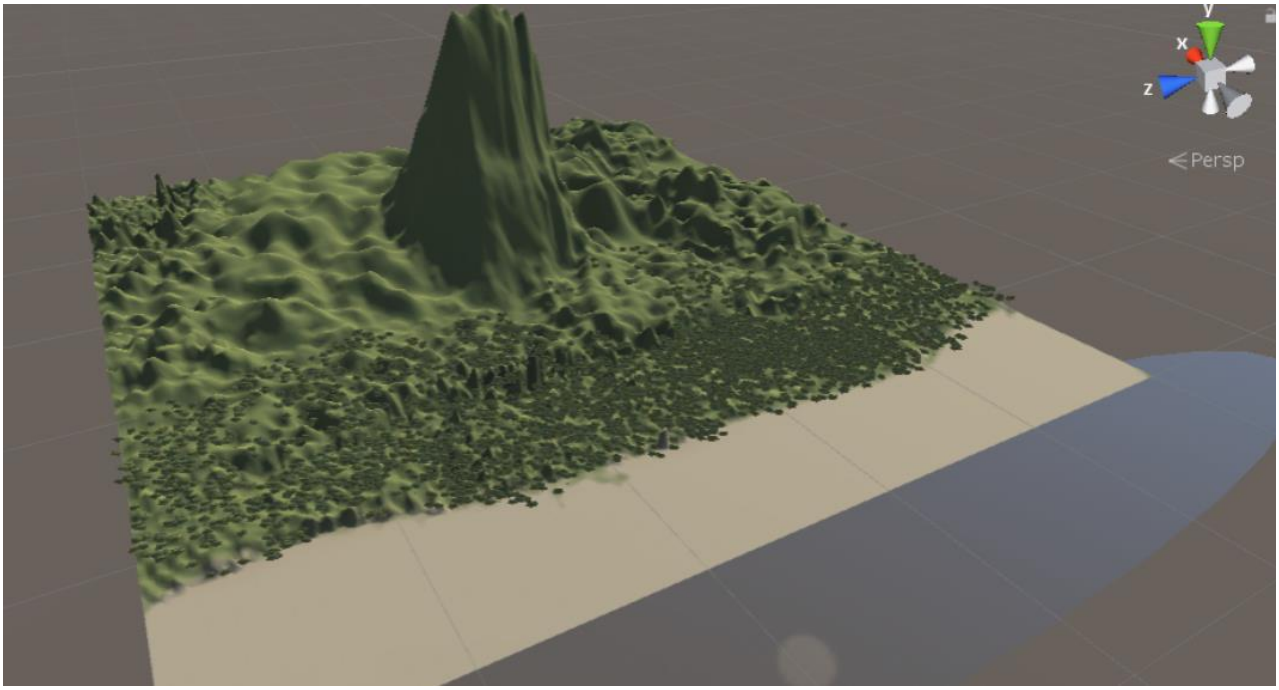

Figure 15; Prototype 1 island

Figure 16: Prototype 1 bird

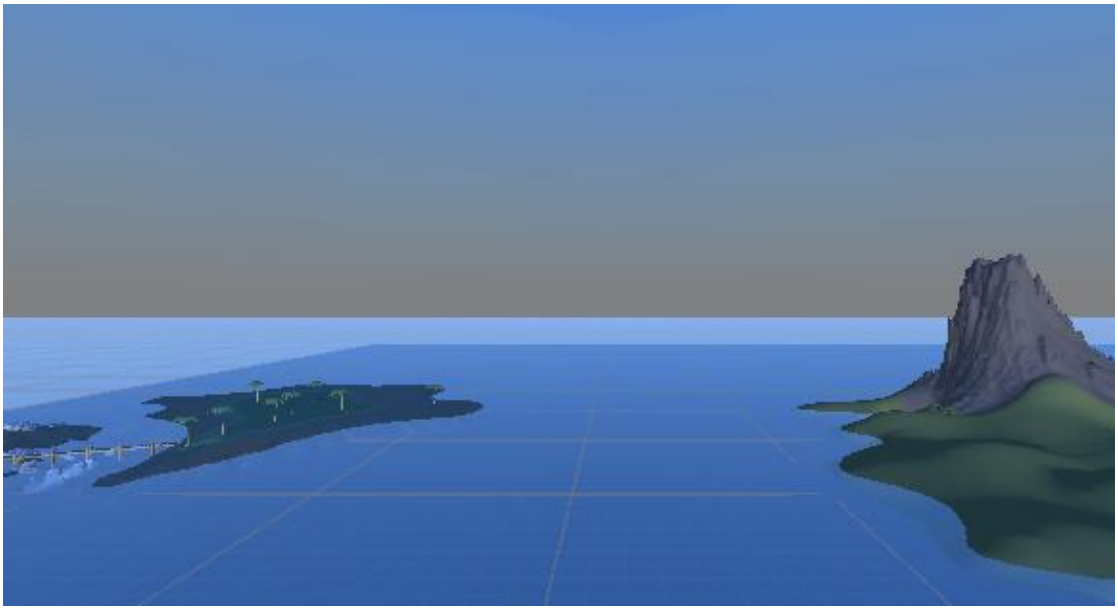

Figure 17: Prototype 2 both islands combined

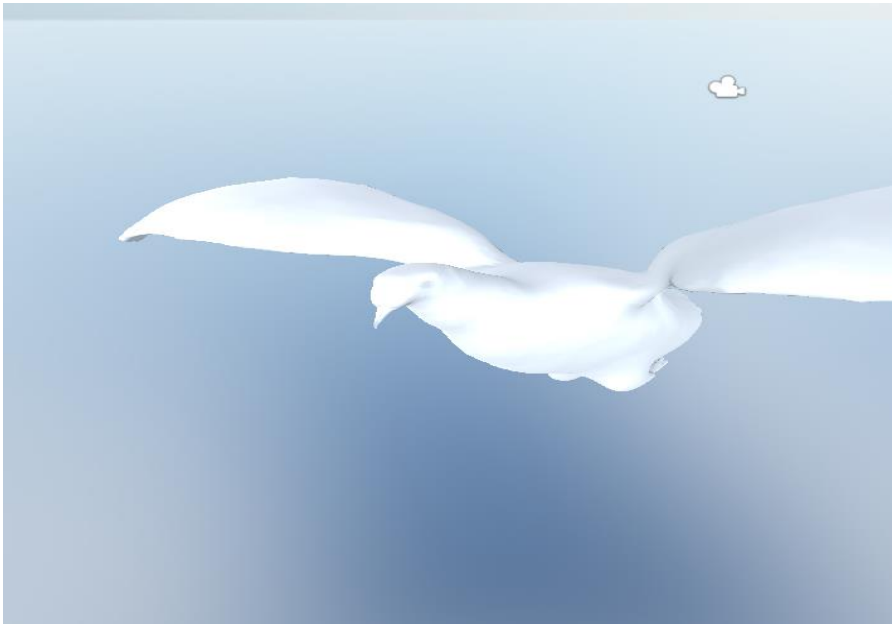

Figure 18: Bird in the game

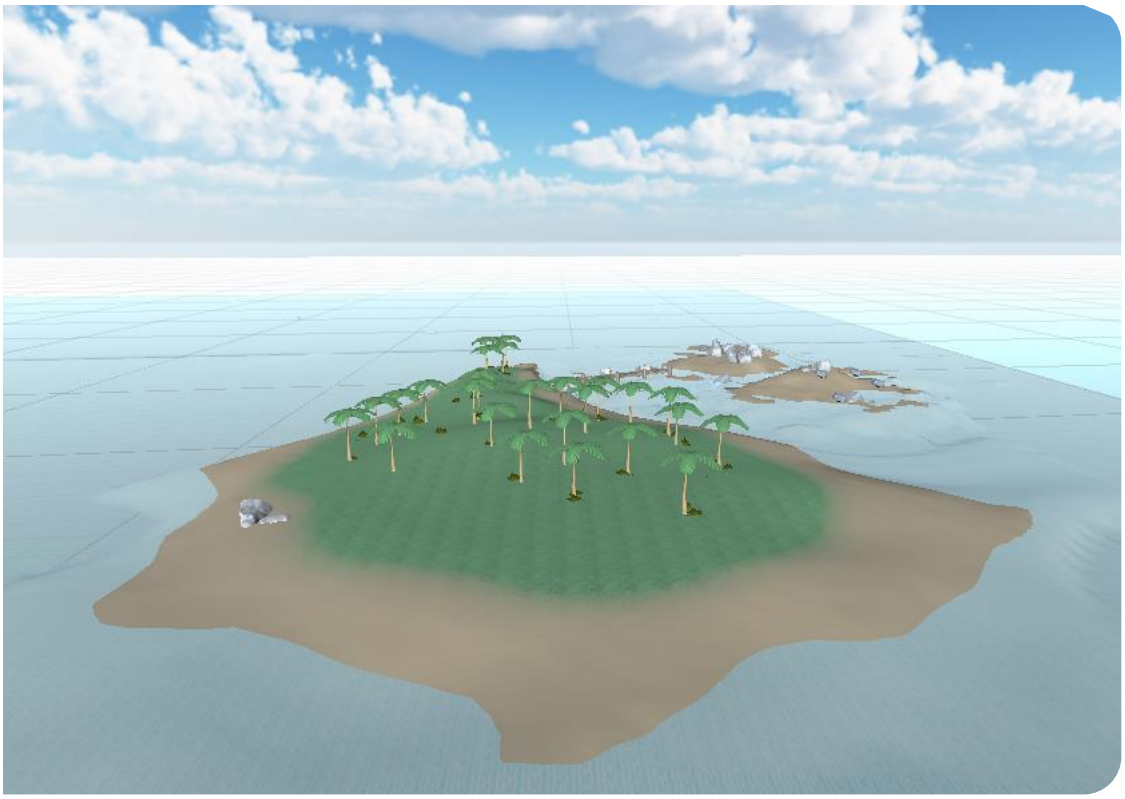

Figure 19: Starting Island Prototype 3

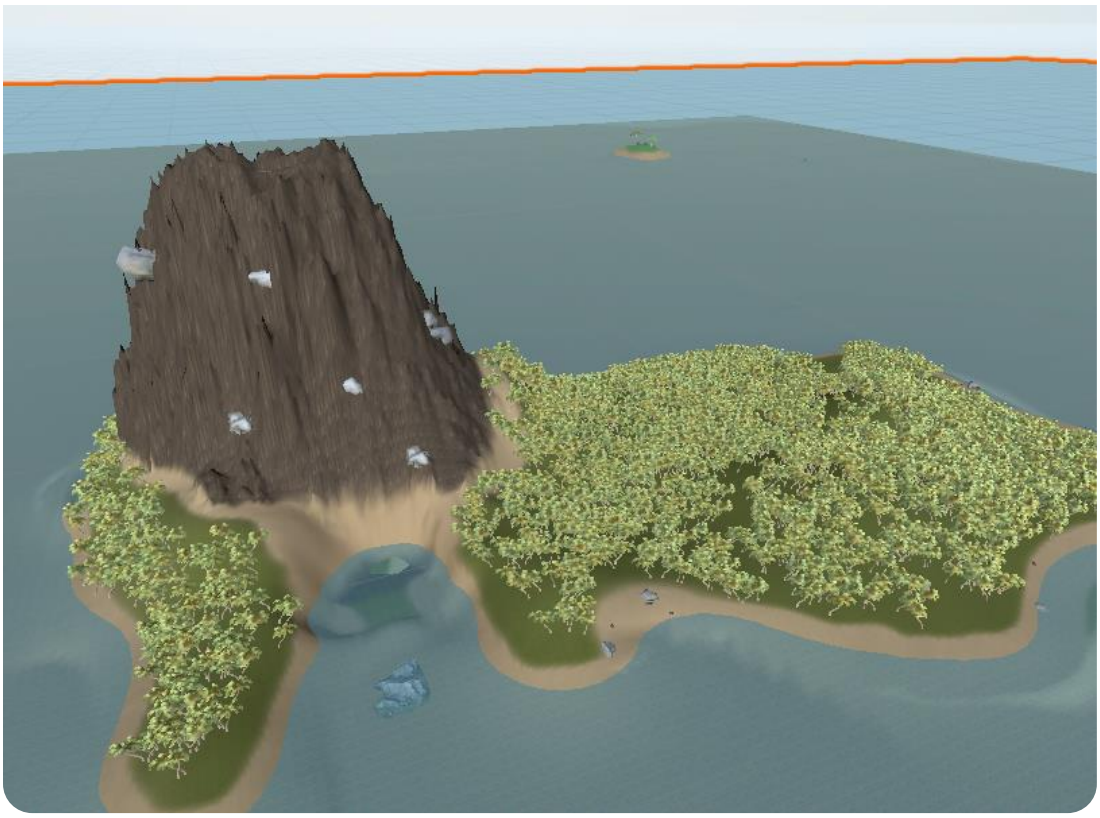

Figure 20: Prototype 3 second island

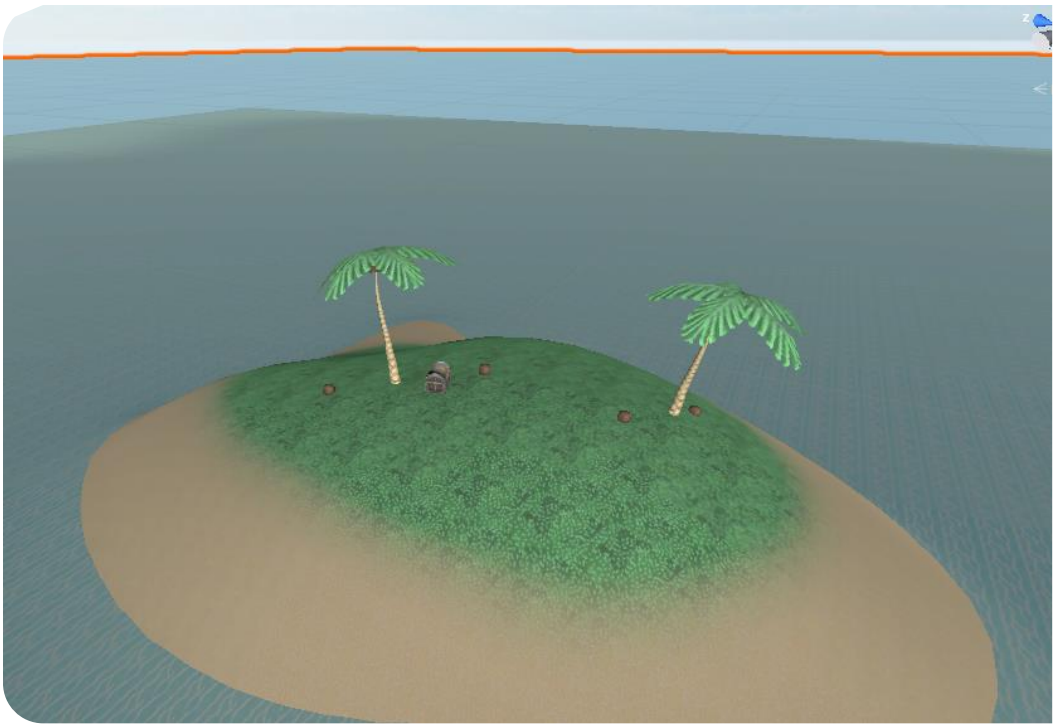

Figure 21: Prototype 3 small island (2 of them)

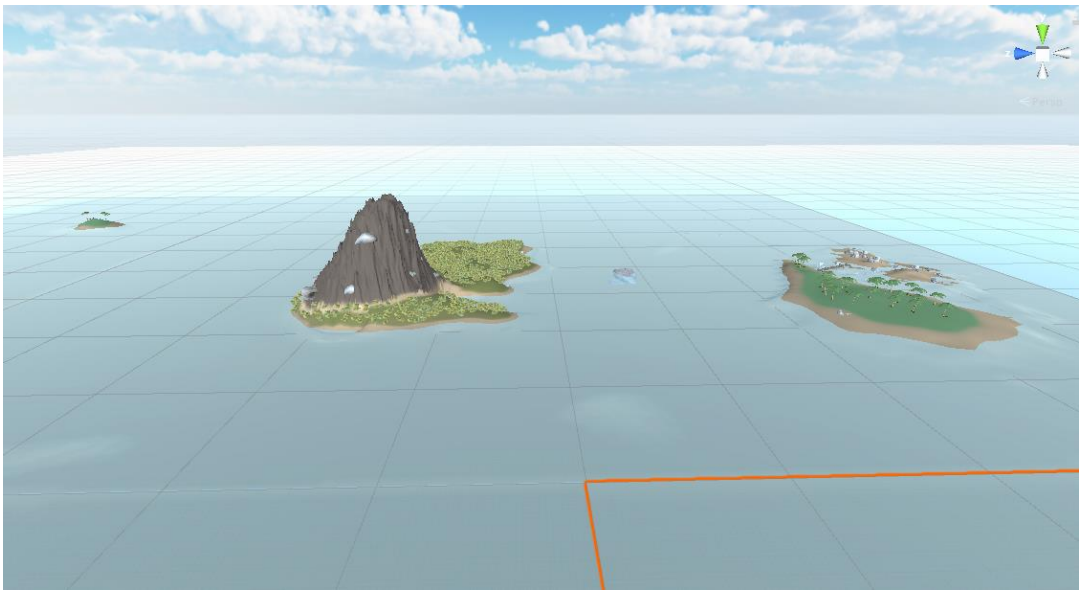

Figure 22: Prototype 3 side view of scene