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COSC 829 Advanced Virtual Reality and its
Applications

Project Title: VR Social Club

Assignment Due: December 9th, 2021

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Goals and Objectives

1.1 Introduction

- My anticipated project is to build a multiplayer game called VR Social Club.
- The game is like Rec Room where players will be able to join in and be able to hangout with their friends.
- In the game players will be able to choose between two scenarios, one of them will be in a university gym setting where players will be able to join in and participate in activities such as playing basketball or watching TV, just chatting.
- The second scenario will be at a camp setting where players will be able to hang out at the camp, go for a swim, hike, etc.
- Most of this game module is built in Unity and 3ds Max.

1.2 Target Audience

- The main target audience are employees from various companies who are craving for social events like office parties which have been difficult to hold due to the current pandemic.
- Currently there are not many videogames in the market which have a socialized theme implemented to them.
- Companies like Xbox game studios, Amazon Lua, Google Stadia (when it existed), and Steam are actively seeking independent developers to make video games like these for their platforms.

1.3 Application Usefulness

- Currently this game is in its beta state, so there are not many features implemented to the game such as the ability to play basketball or table tennis.
- In the future I am hoping to implement these features which will improve the player's overall experience.



Modeling

2.1 Planned Geometry

- Assets for Home, World Outdoor and World School Gym scenes were imported from website called Turbosquid and were scaled down or up in 3ds Max.
- Similarly, other assets such as NPCs, table tennis tables, nerf guns, boxes, television sets, etc. were also imported from websites such as CG trader and Turbosquid, and were either scaled down or up on 3ds Max. The terrain was built inside the Unity Engine.
- Figures on the next few slides describe the building of these assets.

2.1 Planned Geometry

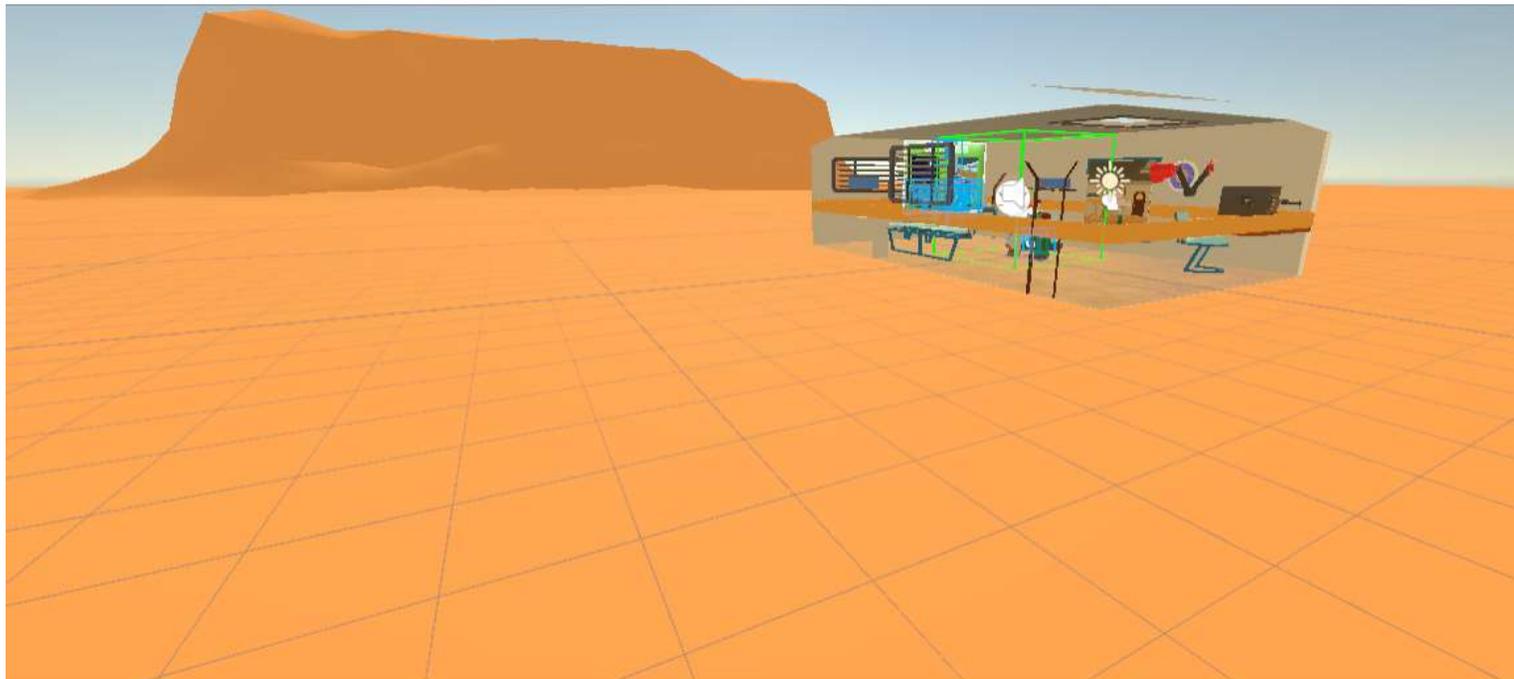


Figure 1: Terrain and Environment building inside Unity

2.1 Planned Geometry



Figure 2: The building of UI canvas in Unity

2.1 Planned Geometry



Figure 3: Table tennis model and stereo system imported from Turbosquid and scaled down in 3ds Max along with applying textures to the model in Unity.

2.1 Planned Geometry



Figure 4: Suited man asset imported from CG trader. The figure shows implementation of an animation state.

2.1 Planned Geometry

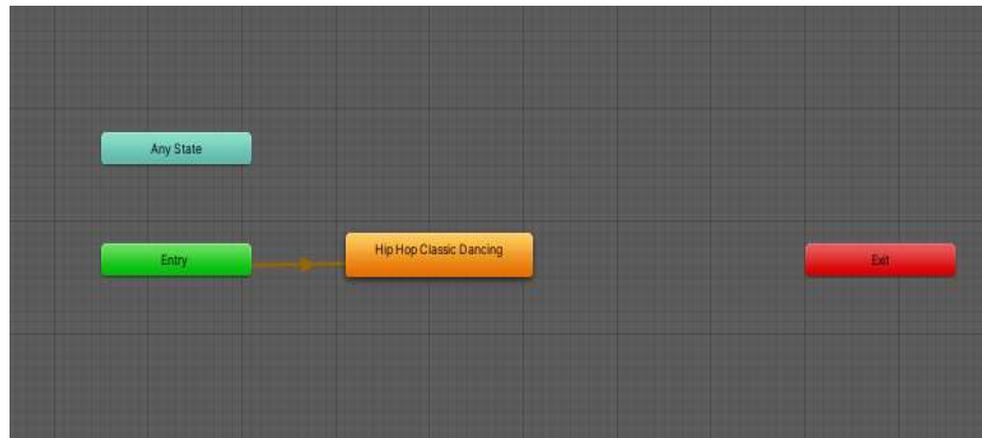


Figure 5: Animator controller for the suited man avatar and the parameters implemented to it.

2.1 Planned Geometry

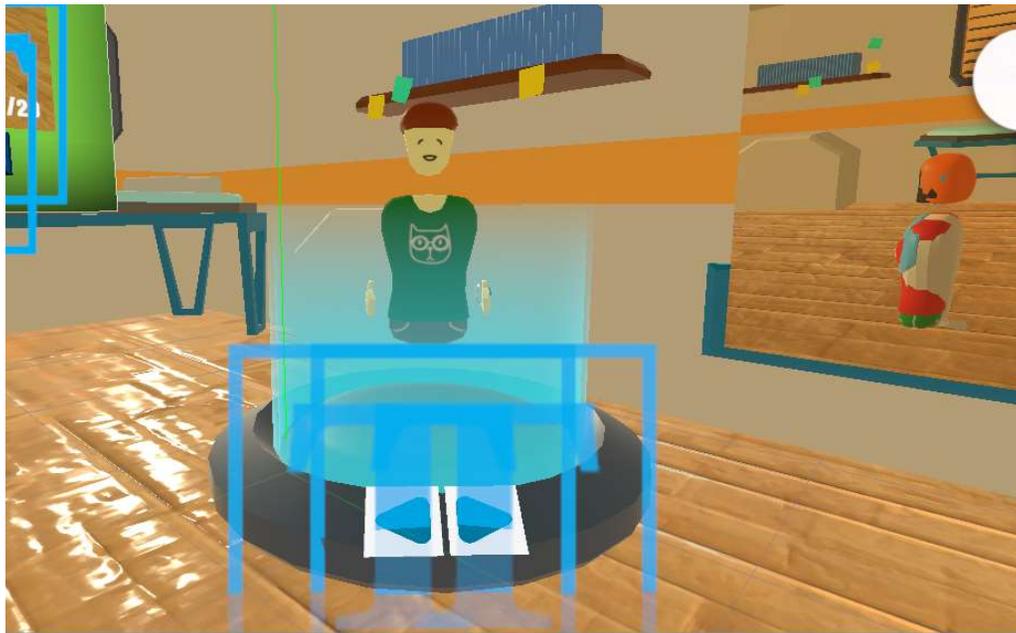


Figure 6: Avatar selection avatar asset imported from Unity. The figure shows implementation of avatar selection system.

2.2 Application Usage

- As described in section 1.2, the main target audience are office employees. As the game begins, the player will first login using a unique ID, they can also login anonymously.
- Since this is a multiplayer game, multiple users will be able to login with a unique ID and interact with the environment.
- Once the user logs in, the user will have the ability to pick between two open-world environments which are namely the “World-Outdoor” and “Word-School”. Figures on the next few slides describe the gameplay mechanics:

2.2 Application Usage

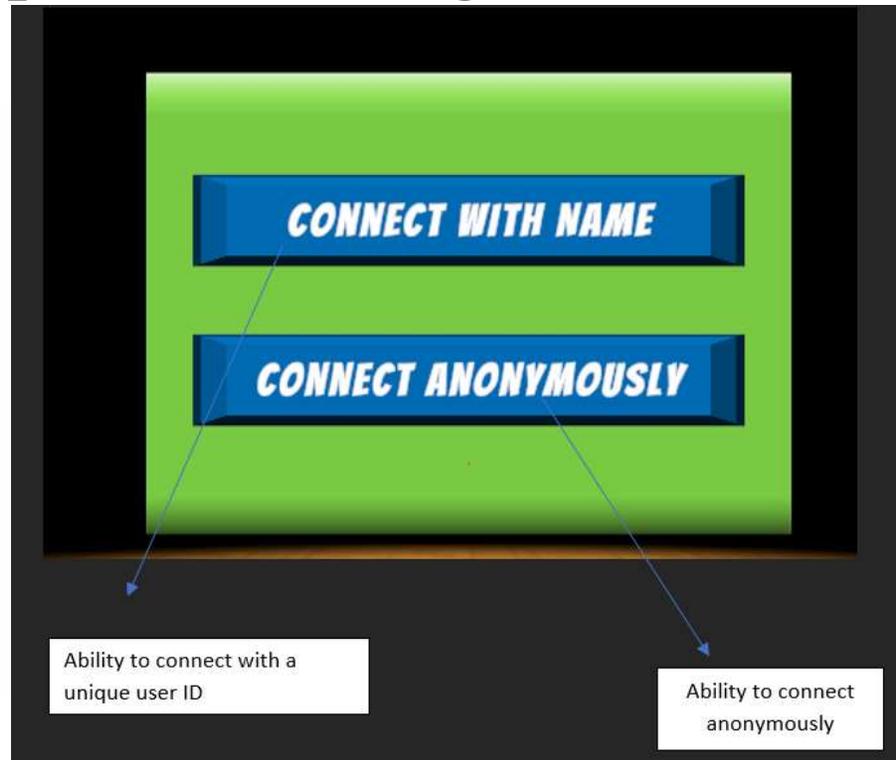


Figure 7: A figure describing the ability of the user login either anonymously or with a unique ID

2.2 Application Usage



Figure 8: A figure describing the ability of the user to type in with a unique ID and connect to the environment.

2.2 Application Usage

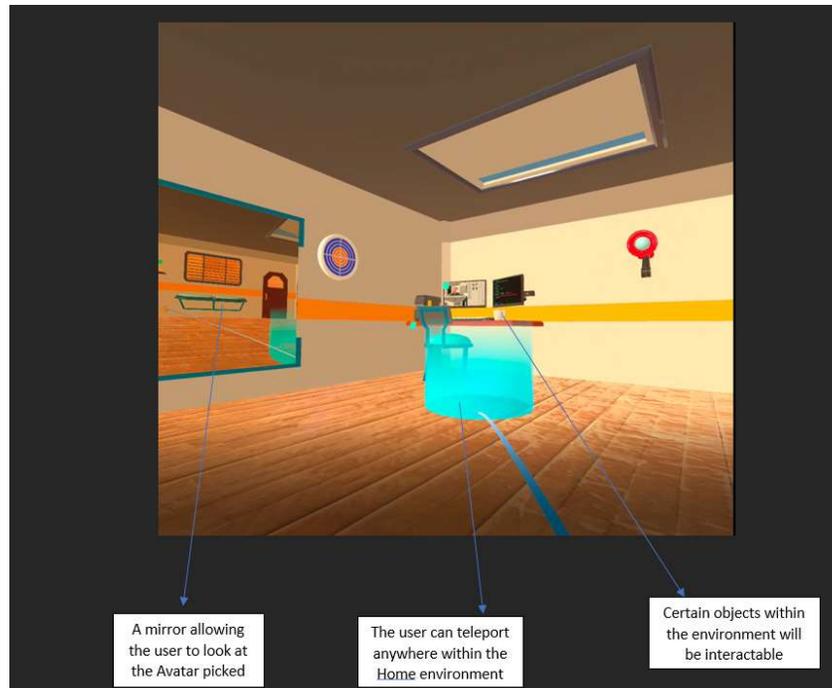


Figure 9: A figure describing the Home Login scene after the user enters either anonymously or with a unique ID.

2.2 Application Usage



Figure 10: A figure describing the ability of the player to pick between two open worlds which are the World-School environment and the World-Outdoor environment.

2.2 Application Usage

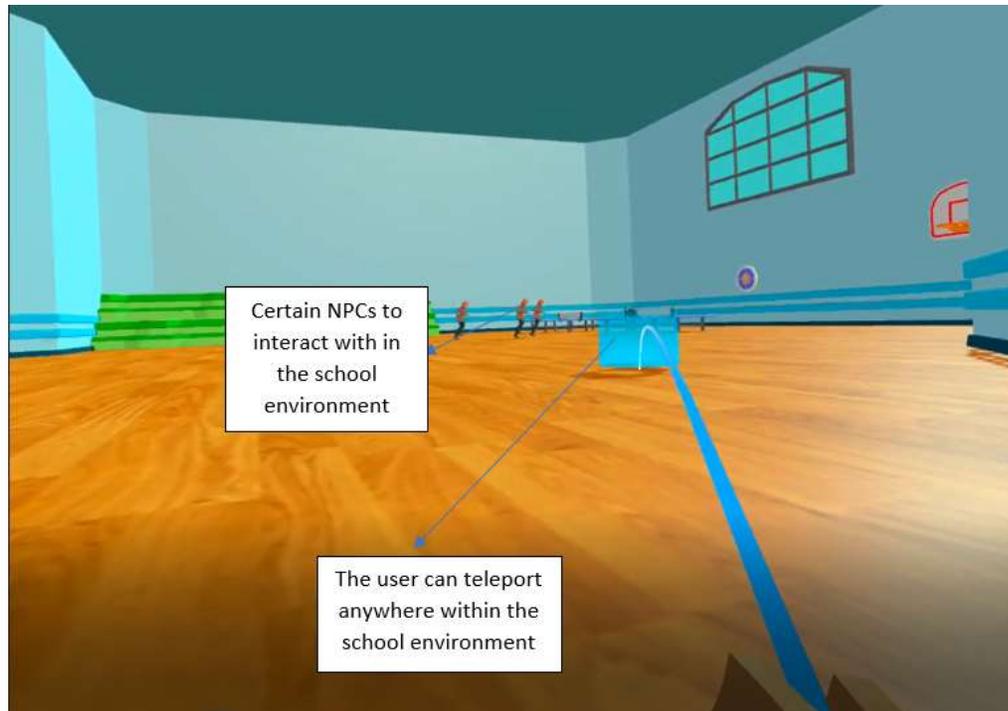


Figure 11: A figure describing the World-School environment.

2.3 Programming



- Several programs were written in C# which provided specific competences within the game.
- The list of programs created are provided below:

SCRIPT NO.	SCRIPTS	DESCRIPTION
1	AvatarHolder	This script allows the user to see the avatar's hands in the VR head along with the movement of avatar's head, body, and hands by calling on script 8.
2	AvatarSelectionManager	This script allows the user to switch between avatars while in the Home Scene.
3	LoginManagerEditor	This script allows the user to connect to the Photon servers.
4	RoomManagerEditor	This script allows the user to pick a specific open world they are interested in exploring.
5	HighlightVoice	This script allows the user to see if there is a communication between the two avatars.
6	MicPermissionHelper	This script allows the user to either enable to disable microphone option.
7	VoiceDebugUI	This script is a test script and allowed the user to see if there is indeed communication happening between the two avatars.
8	ActionBasedControllerManager	This script allows the user's avatar to fluidly move around the environment, such as the movement of head, body, and hands. This script came with the XR Interaction Toolkit installation.
9	AvatarInputConverter	This script allows the user to get avatar movements based on controller inputs. This script came with the XR Interaction Toolkit installation.
10	ButtonInteraction	This is a test script that ensured that the controllers are working properly.

11	LOCALPLAYERUIMANAGER	THIS SCRIPT ALLOWED THE USER TO GO BACK TO THE HOME SCENE.
12	LoginManager	This is a test script that allowed the user to check if there is a connection established between the photon servers.
13	LoginUIManager	While in the Login scene, this script allows the user to either connect either with a name or connect anonymously.
14	Multiplayer VR Constant	This script contains constants that allows the user to implement them in script 18.
15	MultiplayerVRSynchronization	This script allows the user to synchronize head, body and hand movements when in different scenes. This script was taken from Photon's GitHub page.
16	NetworkedGrabbing	This script allows the to grab objects when connected to photon servers while in World-School and World-Outdoor scenes.
17	PlayerNetworkSetup	This script allowed the user to teleport to different areas. The script also allowed for synchronization of teleport-based movements when it different scenes.
18	RoomManager	This script is main script that takes in scripts 9-17. It basically allows the loading of scenes, movement of avatars when a certain room is selected, teleportation, item grabbing and so forth, while connected to Photon servers.
19	SpawnManager	This is a test script that allowed to user to test if the player can spawn to different areas while connected to the photon servers.
20	UI_InteractionController	This script allowed the user to enable or disable user interface based on Oculus controller inputs. This script came with XR Interaction toolkit installation.
21	VirtualWorldManager	This script allows the user to see how many users are currently on World-School and World-Outdoor scenes.

Table 1: The list of programs created along with their brief descriptions.



Functionalities

3.1 Vision



- There were several key functionalities added to the game that allowed the player to feel more immersed into the environment and they are provided below:

In terms of vision the game has the following features:

- Terrain with grass, trees, and hills when in World-Outdoor scene.
- A school gym containing table tennis, basketball hoops, nerf guns, tv, and audio device when in World-School scene.
- A trailer containing a mug, mirror, bed, and work desk when in the Home Scene
- NPC Avatars.
- First person character with real time body movements.

3.1 Vision

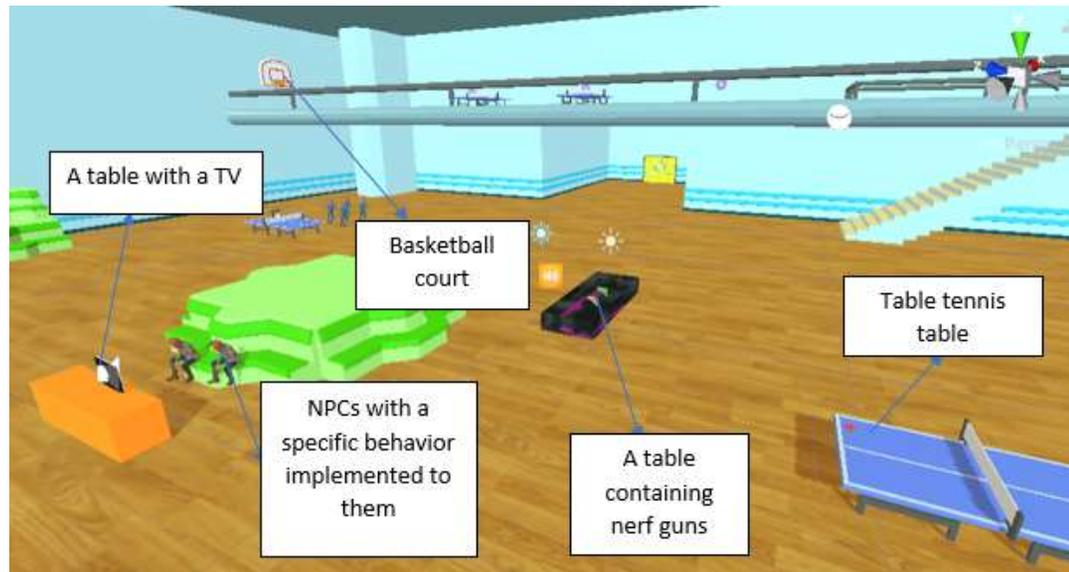


Figure 12: Example screenshot demonstrating the visual aspect of the game when World-Outdoor.

3.2 Sound



- In the login scene, there is a music playing in the background. In the home scene there is music playing in the background along with a sound of an analog clock.
- While in World-School scene there are sounds of the TV along with songs being played on the audio devices.
- While in the World-Outdoor scene there are sounds of the campfire, along with conversations between several NPCs, along with sounds of crickets and wind.

3.2 Sound

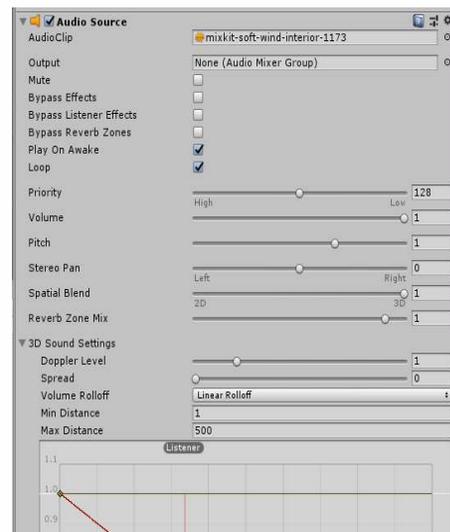


Figure 13: An example of an audio source added to the terrain.

3.3 Animation

- There are several animations associated with NPCs, which include dancing, talking, and laughing animations.
- An example animation of an NPC is shown on the next slide:

3.3 Animation Path

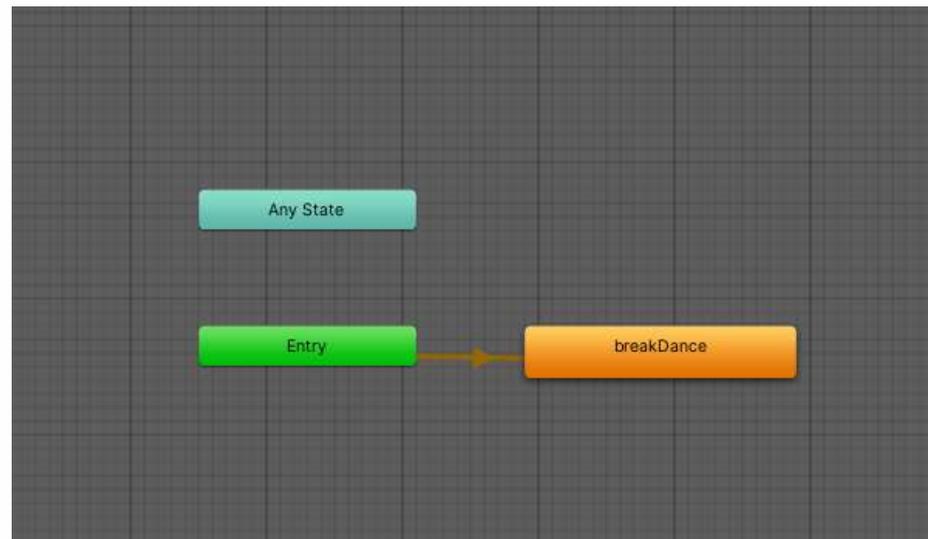


Figure 14: Animation path for a random NPC.

3.3 Animation



Figure 15: Break dance animation implemented to an NPC.

3.4 Interactivity

- There are several interactable objects within the environment that allows to grab and interact with them.
- These objects can be held by both hands.
- These objects will be seen by other players as well.
- Once the user picks an item, the photon network gives the user holding the object a unique ID allowing it to synchronize the view with other players as well.
- An example screenshot demonstrating the interactable object can be shown below:

3.4 Interactivity



Figure 16: A figure describing the ability to interact with the environment.

3.5 Sensor



- There are several sensors in the game. There are proximity sound sensors placed in the environment. For example, as the player approaches the TV in the World-School environment the audio becomes clearer and louder and as the player moves away from the TV the audio sound dissipates as the player moves away from the TV.
- Similarly for the audio devices, as the user approaches an audio device the sound becomes clear and louder, and as the player moves away from the audio device, the audio sound dissipates over time.

3.6 Avatars

- There are several NPCs in the game with different animations. In the World-School scene there are several NPCs with a dance animation associated to them, along with several NPCs having a laughing animation associated to them.
- In the World-Outdoor scene, there are several NPCs having conversational animations associated with them. A screenshot below shows an example of an NPC with a specific animation:

3.6 Avatars



Figure 17: NPCs in the World outdoor environment. Talking animation is implemented to these NPCs.

3.7 Multiplayer Functionality

- This game has a multiplayer functionality which allows up to 20 players to be in the environment and interact with each other at the same time.
- Voice synchronization has been implemented to the game which allows players to communicate with each other and perform various activities between each other. Figures in the next slides describe the multiplayer aspect of this game:

3.7 Multiplayer Functionality



Figure 18: First person character in the World outdoor environment. This is from the perspective of an NPC. As I press the W, A,S,D keys the first-person controller will be able to move around the environment.

3.7 Multiplayer Functionality



Figure 19: An example describing the multiplayer functionality. As we can see one player is present in the environment.



Conclusion

4. Conclusion

- As mentioned in the goals and introduction section of this report, this game module is currently in its beta state. There is still a lot more work that needs to be done.
- I am hoping to implement more features such as the ability to play basketball or table tennis when in the World-School environment, and in the World-Outdoor environment I am hoping to implement the ability to go for a swim or hike somewhere within the environment.
- I am also hoping to improve the overall rendering of the environment to make it more immersive.
- As discussed in the target audience section of this report, currently there are not many games in the market that have a socialized theme implemented to them, which is one of the reasons why companies like Xbox game studios are seeking independent developers to help make these genres of games for their platforms.



References

References



Assets:

- <https://www.turbosquid.com/3d-models/3d-trailer-house-model-1386729>
- <https://www.turbosquid.com/3d-models/3d-office-table-items-model-1198135>
- <https://www.turbosquid.com/3d-models/3d-old-dirty-bed-pillows-1412086>
- <https://www.cgtrader.com/3d-models/interior/other/school-gym-c43dca01-ee0c-424c-989f-622e5cbfb14c>
- <https://www.cgtrader.com/free-3d-models/sports/equipment/pingpong-table>
- <https://www.cgtrader.com/free-3d-models/interior/living-room/smart-tv-c075ac00-05c7-42ab-8665-aed7b0d575b5>
- <https://www.turbosquid.com/3d-models/subwoofer-woofer-3d-model/527825>
- <https://www.turbosquid.com/3d-models/isometric-style-model-1318759>
- <https://www.turbosquid.com/3d-models/3d-model-school-old-chair-1541002>
- <https://www.turbosquid.com/3d-models/toy-water-gun/775253>
- <https://www.turbosquid.com/3d-models/3d-man-business-suit-t-pose-1518255>
- <https://github.com/BlackStartx/VRC-Gesture-Manager>

Animations:

- <https://www.mixamo.com/#/>

Code:

- <https://github.com/AwesomeSauceLabs/vrkb-manual>
- <https://docs.unity3d.com/ScriptReference/SceneManagement.SceneManager.LoadScene.html>
- <https://github.com/quintesse/PlayoVR>
- https://github.com/emotitron/Simple_Addon_for_Pun2
- <https://github.com/mtaulty/SharingPUN/tree/master/PhotonTestProject/Assets/Photon%20Unity%20Networking/UtilityScripts>
- <https://github.com/lyuma/Av3Emulator>
- <https://github.com/julice/April-Tag-VR-FullBody-Tracker>