

# Global Illumination for Fun and Profit

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Figure 1: Main Menu

## ABSTRACT

This project will provide a playable environment using a VR set, specifically the Oculus Quest 2, in which the user will be able to interact with a virtual world as a character and enjoy the different challenges the environment will provide to them. The challenges will consist of a set of obstacles different to each other and specific to the different environments. The user will have to pass through all obstacles by jumping, running or moving in order to get to the end of each of the virtual worlds and win each level environment before the time ends..

**Index Terms:** Virtual reality—Game design—Obstacle course—Interaction;

## 1 INTRODUCTION

This game idea is the result of a common interest in our group of understanding the enjoyment from interaction of the user in a game using VR and the different methods used to achieve this goal. All members of the group have tried gaming with technology and found ourselves interested in applying VR to create our own interactive environment and challenge ourselves to create an enjoyable game for the user.

Our objective is to use Unity to create three different scenes in which a character controlled by the user will have to get to the end of the

map avoiding different obstacles along the way by jumping and running away from the objects created to stop the character.

The game will provide an enjoyable environment for the user to get distracted from the stress of the real world and find interactive challenges that will be fun to overcome while using the Oculus Quest 2 headset. Our goal is to produce a running VR obstacle game containing three levels, forest, desert, and city. This game is intentionally designed to have increasing levels of difficulty as levels progress. The overall goal is to have people playing this game engage in the fun challenging levels we designed and also have a great time.

## 2 RELATED WROK

### Review of VR application area

Previous researches like Evaluating Enjoyment, Presence, and Emulator Sickness in VR games based on first- and third- person Viewing Perspectives. In this research, Monteiro *et. al.* [2] found out that when using VR headset in a virtual environment game based on a first-person perspective can lead to simulator sickness and discomfort from the user. Whereas in a third person perspective it is less likely that simulator sickness occurs. However in a third person display, the immersiveness of the game is lost.

Our group was put in the dilemma of doing a third person perspective or a first person perspective. We wanted to make an enjoyable game for all users and not worry about motion sickness, but the virtual reality aspect and immersiveness that we were looking for for the project was not going to be there. Since our project is still in development we are still in discussion on what would be the best solution for this problem.

We implemented some environment interactions and objects and Unity techniques to build and run our scenes on Android platform

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Figure 2: A visualization of the forest scene



Figure 3: A visualization of the city scene

from different online tutorials. [1]

### 3 METHODOLOGY

#### Interaction and Input Device

This project started as a basic obstacle course game from an Unity Asset Store package called “Obstacle Course Pack” (AisuKase Studio, 2018). This package contained different elements and a movable player that could jump and move with keyboard controls.

To implement this package and the obstacle concept of the game into Virtual Reality, we had to create our own 3D world and make the Quest 2 headset work with Unity, which caused some problems since our team members had Apple devices and Unity needed to be configured manually to work with macOS systems. After overcoming our own obstacles we proceed to create the different level scenarios, specifically Desert, Forest and City and using different assets from various resources online, we could create an environment that simulated the desired world setting.

To make the game more challenging and make the objective of the game not solely to get to the end, we implemented a timer that



Figure 4: A visualization of the city scene

was attached to the headset view. With this timer the user will have to be focused on going through all the obstacles and get to the end of the level as fast as possible before the time ends and the screen displays a game over scene or try again.

The game will be playable with a Quest 2 VR headset and control joystick will be used to move and turn the character. Control main triggers will be used to make the character jump. We had to ensure that the user played in a safe environment since the user will be immersed in a virtual world and will not have visual contact with the real world. To do that we limited the movement from our controls to interact as little as possible.

On the Desert level, interaction with the environment included grabbing rocks with the secondary triggers. The rocks were inter-actable to be used to throw them at animated chickens (chickens are subject to change due to animal rights) and when the rock made contact with the chicken the user would get more time added to finish the level.

There are some interactions used in desert city scene. Users are able to control their moving direction by VR headset. Players can control their jump by the main trigger of the touch controller. In addition, we have a countdown timer. When the player collides with obstacles, players will be pushed back or bounced into the sky, and it will waste players’ time. When players run out of time, the game will show a game over menu, and players can choose “try again” or “quit game”. When players reach the finish line, there is an event trigger which will take players to the congratulations menu, and they can choose the next level scene.

Throughout the design phase of our VR game, many interaction methods were employed to create a fuller player experience. For interactions, the end goal of our project is to have players complete obstacle challenges in virtual reality through some minimal physical movements. For reference frames, the forest level is intended to use the torso reference frame which moves with both physical and virtual rotation. In terms of user locomotion, we plan to have users stay in place while also having control to character movement through the controller. We aim to minimize user moving range but add as many in-place movements as possible for safety considerations. We decided to use controllers over bare hands because of their features



Figure 5: A visualization of the desert scene



Figure 6: A visualization of the desert scene

of reliability and capability of adding haptics.

## 4 USER EVALUATION AND RESULTS

### 4.1 Peer Evaluation

The obstacle game starts with the main menu which includes buttons of the three main levels and three eagles flying around with sound effects and game music that made the user of the game feel comfortable and prepared them to start the game. Once it chooses the level desired to play, the user is immediately put into the start of the level chosen to play and timer starts running, this makes the user of the game change its focus immediately to look at the world created by us and start looking for a way to reach the end point of the level.

We notice that users that are not familiar with the usage of VR systems will tend to feel motion sickness when the game is played for a long time so we decided to make the timer be less than 2 minutes and be able to be personalized in Unity.

### 4.2 End Results

As an added interaction with the obstacles we made the player bounce against some of the movable obstacles and in some levels play a sound that seemed enjoyable by the users. Although not all the interactions with objects work efficiently and as desired, like the



Figure 7: Game Over

feeling of going through objects and some objects pushing the user too far, the game still was enjoyable.

At the end menus of the game we added a scene for winning the game and losing. In both of these scenes we included an animated chicken so that the player could also visually enjoy the end of the game even if the outcome was not as desired.

## 5 DISCUSSIONS AND CONCLUSIONS

Using Unity and all its features to create our virtual reality worlds was really challenging and beneficial to us since it put our programming skills and creativity to work. Unity is a really powerful tool for developers like us to be creative and use this program to make more than just games, but real intricate applications compatible with Virtual Reality, Augmented Reality, Mixed Reality and much more.

The decision to change the main character from a third person player to a first person player was the best idea for our project to be more immersive and interactable for the user. It made the controls and movement more natural for a person and the interactions more real.

Our obstacle game resulted in a really enjoyable VR game that challenged the user to interact with different objects and obstacles included on the levels created by us. The user by going through our personalized immersive worlds and drawing players into a reality made by us.

## 6 RELATED LINKS

### Demo Links

Forest Scene: <https://youtu.be/K8-I9dHHc7c>

City Scene: [https://youtu.be/bPJgf\\_1-HgM](https://youtu.be/bPJgf_1-HgM)

Desert Scene: <https://youtu.be/E0mo6stqG4U>

### Github Repository

<https://github.com/Zhipeng-Yang69/VR-obstacle-course-game>

## REFERENCES

- [1] *Oculus Quest Unity Development Crash Course*. YouTube, Mar 2020.
- [2] D. Monteiro, H.-N. Liang, W. Xu, M. Brucker, V. Nanjappan, and Y. Yue. Evaluating enjoyment, presence, and emulator sickness in vr games based on first- and third- person viewing perspectives. *Computer Animation and Virtual Worlds*, 29(3-4), 2018. doi: 10.1002/cav.1830



Figure 8: Congratulations