

Programming Assignment 2

Platforming in VR

Virtual Reality
Grade Percentage: 5%
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1 Objective

This programming assignment introduces basic-to-intermediate concepts of Virtual Reality (VR) development. Through the assignment, the student will learn basic tools to program and test VR projects.

2 Background

2.1 Teleportation

Teleportation is a widely implemented virtual locomotion technique that allows users to navigate between two locations immediately. The user, located at point A , first selects the target location, point B . Afterwards, a “jump” happens, in which the user moves from A to B , either instantly or accompanied by an animation or a view distortion effect. Research has shown that teleportation can alleviate motion sickness, but at the cost of a lower presence and an increase in spatial disorientation.

2.2 Controller-based Interaction

In higher-end Virtual Reality devices, the use of controllers can be an intuitive approach to interact with content inside a virtual environment. In this approach, the headset tracks the position in the physical world of controllers, usually linked to the headset by default. The controllers’ position in the physical world is then mirrored inside the virtual world. Afterwards, the controllers can be pointed at or pressed to interact with virtual elements.

2.3 World Space User Interface

There are two main approaches to create User Interfaces (UI) in Virtual Reality: anchored to either World Space (WS) or Screen Space coordinates. In WS, the UI does not move along with the user, but rather remains fixed at a certain (x, y, z) coordinate in the 3D environment. The user can interact with such UI as long as they are close to it. These WSUI are usually represented via floating virtual panels.

3 Problem Specification

In this assignment, students will explore and navigate a 3D environment. This 3D environment should be populated with a series of platforms. These platforms will move between two fixed locations, either vertically or horizontally. Their movement will be controlled via a script. The user will put on the VR headset and visualize this 3D environment from a first-person perspective. Once inside the environment, the user will use the headset’s controllers to point at locations in these platforms. Afterwards, the user will press a button in the controllers and will be teleported from its current location to the targeted location. For this assignment, assume that the user can move through the platforms when teleporting (i.e., teleporting “from below” platforms is allowed).

Additionally, there will be various collectibles located in the 3D environment, representing treasures. The user will traverse the 3D environment’s platforms to collect these treasures. At the minimum, these treasure should be repre-

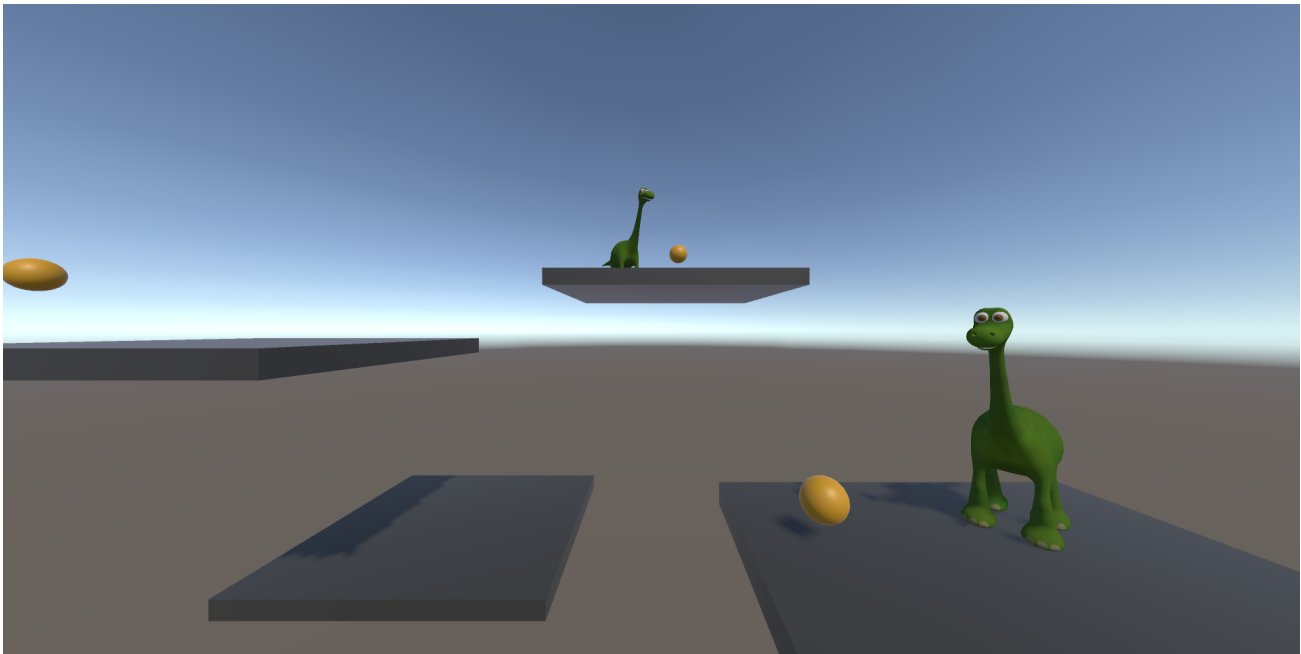


Figure 1: Sample first-person view of user exploring a 3D platforming environment with obstacles and treasures.

sented with 3D gold spheres. The user will use the headset's controllers to collect the treasures. The specific approach to make this interaction is up to the student's choice, as long as the controllers are used during the process. The only exception is using external UI to interact with the treasure, as opposed to directly interacting with it. Once collected, the treasures should disappear from the 3D environment. When all treasures are collected, the experience will end.

The mini-game will also integrate enemies. Create at least 3 enemies, each linked to a specific moving platform. The enemies will move along with the platforms, but will also move independently over the platform via a script. If these enemies touch the user, the user will be teleported to the starting point of the mini-game. The progress, however, will not reset (i.e., treasures that were previously collected do not need to be respawned).

Finally, create various WSUI panels along the 3D environment. These panels can be used to provide the user with instructions on how the mini-game plays, inform about the enemies, col-

lectibles, etc. Given that the platforms will be moving, you might consider having these WSUIs move along with the platforms.

3.1 Extra Credit

You will earn cumulative extra credit by completing any of the following tasks. If the extra credit earned makes the grade of the assignment go over a 100, it can be transferred to future assignments:

- **Seamless Teleporting:** Instead of simply appearing and disappearing as the user teleports, implement a teleporting approach that provides better contextual cues as the teleport happens. For instance, you can do an animation from point A to point B.
- **Interacting via Hands:** Implement the routines for the user to interact with the collectibles via hands. Use Oculus framework for this.
- **Screen Space User Interface:** In addition to the WSUI, implement a Screen Space User Interface (SSUI). SSUI will follow the

user along the entire duration of the experience, as opposed to being fixed to specific 3D position in the virtual space. See Fig. 2 for reference.

- **Set Dressing:** Instead of showing a basic 3D environment with gray boxes and spheres representing treasures, dress the environment in a way that tell a cohesive and interesting story. For instance, you could be in a forest where the obstacles are trees and the treasures are acorns that you are collecting in preparation for the winter.

4 Rubric

The rubric to evaluate the assignment is shown below:

| Component | Percentage |
|------------------------------|-------------|
| Basic environment design | 10% |
| Movement via teleporting | 30% |
| Interactions via controllers | 30% |
| Platform & enemy movement | 15% |
| World Space User Interface | 15% |
| Seamless teleporting | 10% |
| Interacting via Hands | 10% |
| Screen Space User Interface | 10% |
| Set Dressing | 20% |
| TOTAL | 150% |

5 Logistics

- The assignment will be done in pairs.
- Due date: Thursday March 2, 11:59 pm.
- The assignment must to be uploaded as a .zip file. The content of the .zip should be:
 1. A .txt file with a link of a Dropbox/OneDrive (or equivalent) folder containing all the files created by your game engine. The instructor should be able to export and open the folder into the corresponding game engine in his computer.

2. A .mp4 video file of a screen recording of your VR headset while the application is in use. The recording should showcase all the functionalities of the developed application.

3. A 1-page .pdf file describing your application. This can be done using text, diagrams or whatever other means you consider useful or necessary.

- The naming convention for the .zip file should be the first 3 letters of each team member's first name the plus the code PA1. For instance, if Gabriella and Troy team up, their .zip file should be named *GabTroPA1.zip*.

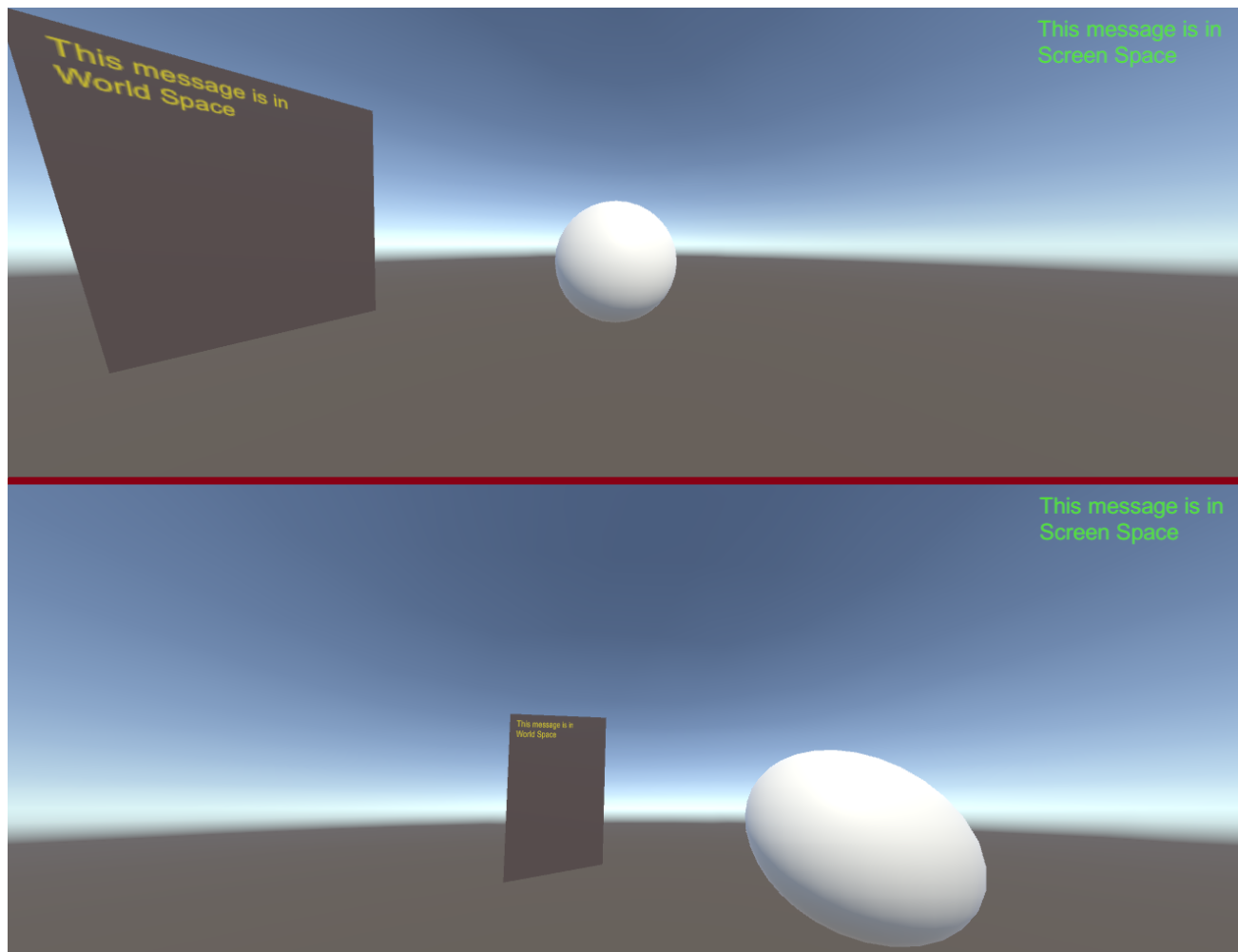


Figure 2: Simple example of differences between WS and SS UIs. In this example, the user just finished rotating its head. SSUI remained fixed to its screen position, while the WSUI is now at a different angle with respect to the user.