Assignment 5

Advanced Graphics, Augmented Reality, and Virtual Reality

September 2020

1 Problem Statement

In this assignment, we will build a simple virtual reality scene. In doing so, we aim to get started with building basic VR applications. We will also aim to gather an understanding of what makes a virtual reality application truly engaging, and how we can combat some physical limitations in order to take the experience to the next level.

2 Problem Statement

We will build a virtual reality version of the world from the game "Portal". A portal is a doorway or a gate across space.

Figure 1: A starting point to give you an idea of the world

1. World : Create a navigable world comprised of rooms with walls, in which you can move based on both 'gaze' based motions, or physical motion in the real world. This world can be imported as well from pre-existing sources. It need not be a complicated world, but make sure you have enough space to explore, and enough surfaces on which to create portals.
2. Gun : Your player must be holding a gun, shooting which creates a portal on the walls. As you may not have access to hand tracking devices, you may explore a gaze-based method of interaction.
3. Portals : Enable the creation of 'portals'. You should be able to see what lies across portals, as well as travel through them. For your convenience, you can limit yourself to two active portals

at a time. Portals may be created on any surface - including walls, ceilings, and floors. Note that you should be able to go partially through a portal as well.

A problem for a full VR experience at home has to do with spatial limitations. Go through different ways to bypass this problem, and attempt to implement a method of spatial "enlargement" of the virtual world. You can find an example of this here.

You can find a very detailed demo on building a clone the Portal game - in Unity - from Harvard University's Department of Continuing Education here.

3 Marking Scheme

You may make a report to aid in documentation and evaluation, but you need not spend too much time on it. Keep in mind that overall VR experience will affect your grades though not explicitly mentioned in the marking scheme.

- World : 10 points
- Portal See Through : 30 points
- Portal Traversal : 30 points
- Virtual Reality Tracking + Spatial Expansion: 30 points

4 Submission Guidelines

Build the scene in Unity, using an appropriate tracking toolkit - you can use Unity's XR framework or Google Cardboard for Unity. We strongly recommend building the project for your mobile device, and experiencing what you've built firsthand - even if you do not currently have access to a mobile VR headset.

Please submit all your files (APKs, EXEs, Unity Scenes) in a roll numbered zip on Moodle on or before **11.55 PM October 30, 2020**. If your files are too large for the Moodle file limit, upload your work on a Git repo, and submit a PDF write up on Moodle with a link to your repo. Keep in mind the late day policy, and use them wisely.

We understand that the semester is now ending soon and there is quite a bit of workload - so this assignment is quite short, yet aims to cover some basics of VR in addition to tackling a persistent real world issue.

Best of luck, hope you enjoy!