Locomotion Project

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**Project Report**

**Project Description:**

This project attempts to solve the problem of virtual locomotion in a limited space. With a head-mounted display, a user can feel as if they are fully immersed in a virtual world. However, moving about in that world is currently tricky since the real world often does not resemble the virtual space that is being experienced. Many applications try to employ tricks to get around this such as redirection of the user, moving platforms, teleportation, or other limitations on movement. Some ventures into omni-directional low friction treadmills have also been proposed to allow users to actually move around naturally as they travel in VR. These treadmills are bulky and still restrict user movement. The tricks are also limiting in that a truly open expanse of world cannot be traveled by walking. In addition, adding movement by means other than having the use physically move can result in conflicts between perception and reality which may cause user discomfort. My project solves these issues by adding a walk/jog in place mechanism using a smartphone as a sensing device. This allows unlimited movement while also maintaining physical motion that is much related to the actual motion. Using a smartphone adds the benefit of having a sensor that most users already own that can be tucked away in a pocket and allows full use of other controllers in hand. The smartphone communicates over WiFi to a PC running the virtual reality application and interfacing with the Oculus Rift.

**Project source files:**

This project has two parts, an android application for the phone (Galaxy S7) and a PC application for the Oculus Rift.

**Android Application:**

The source code from the android was developed entirely on my own and is located in folder “testApp2” in the archive. It was developed on the Android Studio IDE using a standard project template. API references were obtained from <https://developer.android.com/index.html>

The main code files are here:

testApp2\app\src\main\java\com\example\chris\testapp2

The manifest is here:

testApp2\app\src\main

Additional files for layout are here:

testApp2\app\src\main\res

**Oculus Rift PC Applicaton:**

The code for the Rift was based off of the Oculus sample framework asset package.

<https://developer.oculus.com/downloads/package/oculus-sample-framework-for-unity-5-project/>

The following files are my own contribution (in the “Locomotion Project” folder):

Assets\MyNetwork\NetworkServer.cs

The following code files were modified by me:

Assets\SampleScenes\Common\Scripts\SamplePlayerController.cs

Additional work was done in the unity editor to link public variables for the transfer of data from the network to the player controller script.

**User Manual**

1. **Initialization**

To run the project, the Oculus rift needs to be set up on a Windows PC which meets the minimum requirements. This requires a powerful graphics card. Full requirements and installation instructions can be found on <https://www.oculus.com/setup/>

After installation of the oculus software, you will need to follow the onscreen instructions to set up the sensors. Two sensors are required for room scale movement and this project.

After installing Oculus software, the project can be run from “Locomotion Project\Builds\locomotionproject.exe”

The Android application is already installed on the Galaxy S7 under the “apps” icon. It is called “PhoneSensor”. The application can be developed and debugged using AndroidStudio and installation and of the IDE and opening of the project will automatically prompt to download additional required packages. <https://developer.android.com/studio/index.html>

1. **Use**

First, run the Oculus application on the PC (location detailed in “Initialization”). This will start the application and launch the Oculus software. Then, use the PhoneSensor Application and enter the IP address of the PC and click “Send”. Then, lock the screen so that the phone can be placed in your front pocket. The sensor works better if it is located in a central pocket. Now, when you walk or jog in place, the phone will send data to the PC and you will move in virtual reality in the direction you are facing. Looking around with the headset will change the direction. In addition, swinging the Oculus touch sensors will also translate into movement.

Note: It is required to have UDP port 51000 open to allow the messages from the phone to reach the Oculus application. If necessary, this can be done by:

Typing “firewall” into the windows 10 search plane. Click “Advanced Settings” then “Inbound Rules”. Look for the rule for “Unity Editor” if running the project in the editor, and disable the UDP inbound rule which blocks all UDP traffic. When running the “exe” version, this should not be a problem.