Tracking Hand Movements using a Handheld VRduino

EE267 - Virtual Reality
Project proposal, May 26th 2017
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Overview

We are trying to render a virtual gun shooting objects in a virtual environment. The input for the gun's position and orientation will be a handheld device that incorporates a VRduino. When the user fires the gun, a haptic cue (vibration) will be rendered on the handheld device.

Previous Work

There are multiple ways to track physical hand movements in the real world. Here we list some products that use different solutions.

Nintento Wii Remote

One early commercial implementation is the Nintendo Wii Remote. The controller has an accelerometer, a gyroscope, as well as infrared sensors that sense infrared light emitted from the console's "Sensor Bar" that is placed on top of the display.

The Nintendo Wii Remote

HTC Vive Controllers

The recent VR headset HTC Vive has motion controllers that the user holds in each hand. They register position and orientation relative to the static light-casters called *Lighthouses*, using methods discussed in the class.


The Oculus camera on the left and the HTC Lighthouse on the right

Oculus Touch Controllers

The Touch controllers to the Oculus Rift headset use a different tracking method compared to the Vive headset and controllers. Instead of emitting light from the base stations and registering it on the headset and controllers themselves, the headset and controllers emit IR light which is registered by one or multiple static IR cameras.

Tactile Haptics developed a handheld controller that can interface with HTC, Oculus, and Steam VR controllers. It uses skin deformation feedback to convey shear forces and torques experienced in a virtual game.
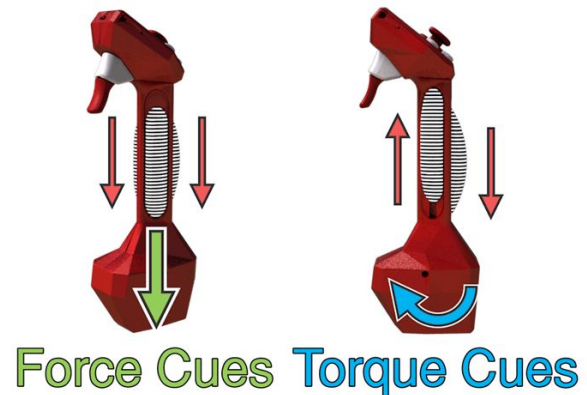
Project contributions

Our new-ish contribution is a optically tracked handheld device that displays haptic vibration feedback. This give the user another level of immersion into the virtual scene by including the sense of touch with the visual stimuli.

The base of the handheld device is the VRduino used in the course labs. One limitation of this is that there are only photodiodes on one side of the board, which means that the device can only be tracked of all photodiodes are in the Lighthouse's view. The result of this is that the user cannot turn their hand to far in any direction since that will cause the device to lose its position and orientation tracking. A way to work around this is to design the game around this limitation, e.g. making the virtual device a gun, where you generally point it forwards i.e. toward the Lighthouse.
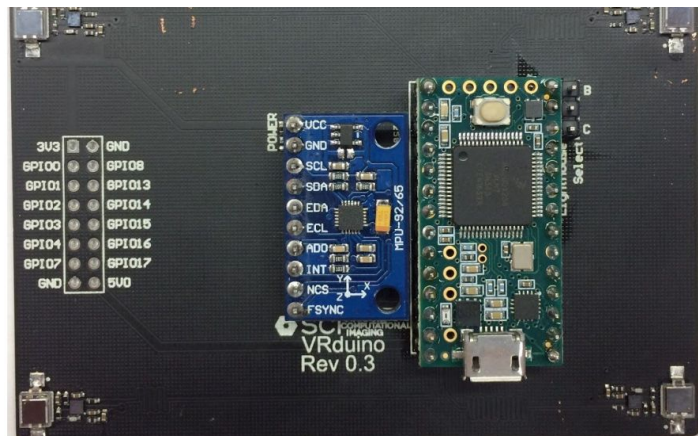
Project timeline

Have a scene in unity: May 30th
Have two VRduinos streaming into unity: May 31st
Have vibration feedback working on the handheld device: May 31st
Deadline: June 1st (Jake leaves June 2nd)