Donovan Arrington

UID 104-174-500

CS 199 Using VR to Create a Robot Control System

After taking a virtual reality course I was fascinated by the subject and wanted to combine it with the robotics research I was doing in the lab I work in. The idea came to me with power of VR, I could truly make an interactive control system where a robot wasn’t controlled by a remote or by a laptop but instead by an Oculus rift; where actions in the virtual world affected the real world.

The research project I created for my 199 is an interactive virtual reality controller for the robot DARwin- OP. Robots are slowly becoming an integral part of our society so the goal of my project was to create an interactive virtual reality control system that would allow a person to maneuver and control a robot just like their own body. In this way, the robot would look in the same direction as the user would mimicking their movements almost perfectly. In the early stages of my project I was using Unreal Engine 4 and its plugins for the oculus rift as a base for my application. The idea for the first phase was to stream real time footage from DARwin-OP’s webcam to Oculus. After a month and a half of trying I was unable to figure out how to stream real time video onto a texture inside Unreal Engine 4. Afterward, I decided to try using an Oculus integrated with Unity 5 which went much smoother. I was able to figure out a way to stream real time footage from DARwin-OP using Unity 5 [www.textures](http://www.textures) to turn images from online sources into textures. I then pasted the online texture onto a cube that I stretched into a wall inside of my development environment in Unity 5. Subsequently, phase 2 was to send the head orientation information; the x and y rotation from the Oculus back to DARwin-OP. However, a big problem arose when trying to send information Unity 5 back to DARwin-OP. My idea at first was to attempt to use a socket connection but Unity 5 and DARwin-OP in which Unity and the Oculus functioned as the client and DARwin-OP functioned as a server taking information in. The problem was that Unity has domain restriction policies about communication with devices which proved a very difficult obstacle to overcome. I eventually got over this hurdle by creating an intermediary program that functioned as a server and a client. I would then send the head tracking information in the form of a string from Unity to the server part of my program via a local host computer, and then using the client portion of the program I send information back to DARwin upon which it moves its head to the location received. Overall the project was difficult but is was still exciting to be using VR not to play a game but to make an application that world let you control a robot in real time.

The application is meant to give the user a more interactive approach to controlling a robot, instead of simply typing and sending commands through a controller or a keyboard. The user can use the application to make a robot to do some tasks such as maintenance at a power plant, open a door, or use tools like a wrench or screw driver. I want the user to feel more engrossed in their activity as if the robot is an extension of themselves rather than a simple tool. I want the user to feel like they’re actually doing these tasks; that the robot isn’t a simple avatar and instead more like an exoskeleton. Overall, my application presents a brand new way for humans to interact with robots, allowing people to have greater control over robots than they ever have before by actually making the robot move as they do.