Improvements to Virtual Reality System for Advanced Manufacturing Robots

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Manufacturing robots often operate in environments that are unsafe for humans, which limits the ability to reprogram them easily and safely. Our goal is to allow for natural interaction with remote systems or systems that are unsafe for physical interaction with a human.

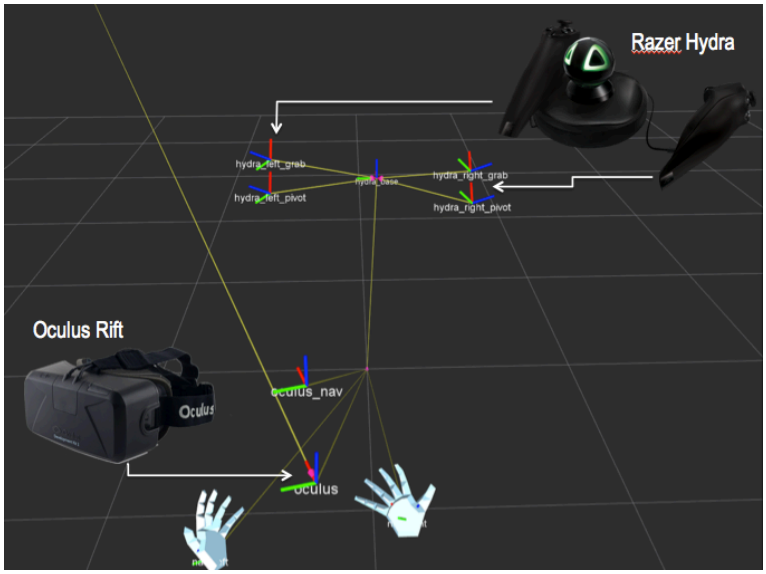

Fig. 1: Overview of virtual system within RVIZ

Immersive Virtual Robotics Environment, or IVRE, is a natural immersive virtual environment that allows users to interact with a robotic system either in simulation or in real-time via a virtual proxy. Users have access to a variety of virtual tools that allow them to manipulate the robot, display information, or otherwise interact with the environment. IVRE uses the Oculus Rift virtual reality head-mounted display and Razer Hydra motion controllers to provide interaction with the environment.

IVRE has two primary components: motion and information centric interaction, both of which have to be adequately intuitive to allow for a natural virtual experience for the user. The goal for this summer was to make two major upgrades to the system, one in each of these two primary components.

The first was to upgrade the virtual headset from the Oculus Rift Development Kit 1 (DK1) to the Development Kit 2 (DK2)- necessary for improving the natural feel of the system due to the added capability of positional tracking. By retrieving the position of the Oculus DK2 relative to the infrared camera that comes with it, we could map this into the visualization tool and have changes in position reflected in the virtual space.

The second goal was to be able to import arbitrary user interfaces that are fully functional on a desktop computer into the virtual world, and with some simple modifications, have them fully functional in that 3D space. This was done by loading a user interface file and rendering it into a specified position in the virtual world. After modifying the interaction spaces to fit to the shape of the buttons, only a few changes are needed to convert a desktop UI to a virtual UI, as shown in Figure 2.

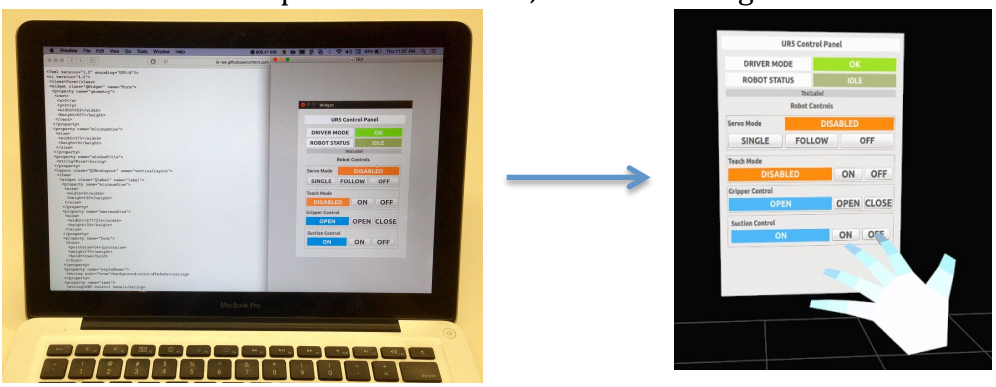

Fig. 2: Conversion from desktop to virtual user interface

By improving these key aspects of the virtual interaction experience, we are closer to providing a natural robotic interaction system that provides the natural physical movement of kinesthetic interaction, but from a safe location.