

The Virtual Tablet

Virtual Reality as a Control System

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Abstract

In the field of human-computer interaction, Augmented Reality (AR) and Virtual Reality (VR) have been rapidly growing areas of interest and concerted development effort thanks to both private and public research. At NASA, a number of groups have explored the possibilities afforded by AR and VR technology, among which is the IT Advanced Concepts Lab (ITACL). Within ITACL, the AVR (Augmented/Virtual Reality) Lab focuses on VR technology specifically for its use in command and control. Previous work in the AVR lab includes the Natural User Interface (NUI) project and the Virtual Control Panel (VCP) project, which created virtual three-dimensional interfaces that users could interact with while wearing a VR headset thanks to body- and hand-tracking technology. The Virtual Tablet (VT) project attempts to improve on these previous efforts by incorporating a physical surrogate which is mirrored in the virtual environment, mitigating issues with difficulty of visually determining the interface location and lack of tactile feedback discovered in the development of previous efforts. The physical surrogate takes the form of a handheld sheet of acrylic glass with several infrared-range reflective markers and a sensor package attached. Using the sensor package to track orientation and a motion-capture system to track the marker positions, a model of the surrogate is placed in the virtual environment at a position which corresponds with the real-world location relative to the user's VR Head Mounted Display (HMD). A set of control mechanisms is then projected onto the surface of the surrogate such that to the user, immersed in VR, the control interface appears to be attached to the object they are holding. The VT project was taken from an early stage where the sensor package, motion-capture system, and physical surrogate had been constructed or tested individually but not yet combined or incorporated into the virtual environment. My contribution was to combine the pieces of hardware, write software to incorporate each piece of position or orientation data into a coherent description of the object's location in space, place the virtual analogue accordingly, and project the control interface onto it, resulting in a functioning object which has both a physical and a virtual presence. Additionally, the virtual environment was enhanced with two live video feeds from cameras mounted on the robotic device being used as an example target of the virtual interface. The working VT allows users to naturally interact with a control interface with little to no training and without the issues found in previous efforts.