Haptic Applications for Multi-Modal Environments Research (HAMMER) Laboratory

Overview:

The Institute for Simulation & Training (IST) at the University of Central Florida (UCF) has been investigating the benefit of incorporating haptic technologies into immersive virtual simulations. Current virtual simulations primarily immerse the participant visually while engaging the other senses in a limited fashion. For these simulations to become more effective, they must become more realistic. Fully realistic simulations require live participants to *feel* the virtual environment as well as see it and hear it.

Accomplishments:

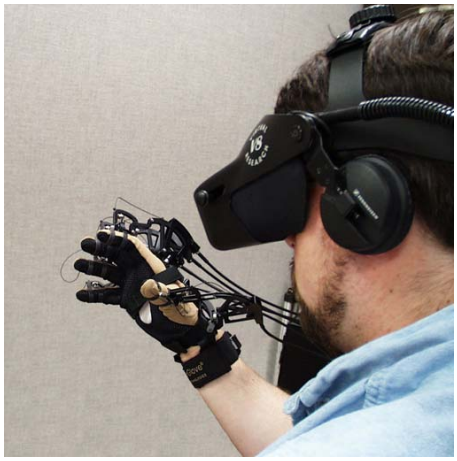
We have created a prototype Virtual Environment Stimulus Tool (VEST), which gives the user a sense of being touched or wounded. We selected small vibrator motors (often used in cell phones) because they are inexpensive and readily available. A sleeveless drysuit was used for mounting the vibrator motors. It is lightweight, durable, comfortable, form-fitting and able to muffle vibrator noises.

The prototype VEST uses 32 vibrators installed in eight zones of four vibrators each. The VEST has two sets of four zones on the front and back of the user with an upper level in the shoulder area and lower level around the waist. The vibrator motor is powered at a constant voltage and is pulsed via a Basic Stamp II, which controls the durations of the duty cycle.

The duration of time "on" versus time "off" with this vibrator motor yields an impressive range of sensations. Remarks made by several participants after using the VEST were that the stimulation was a significant enhancement to the VR environment.

We have integrated the Immersion CyberGrasp force feedback glove into our virtual environment. The CyberGrasp is a haptic device geared toward providing realistic manipulation of virtual objects. It is both an input device, providing 22 degrees of freedom covering most of the joints of the hand, and a force feedback device, providing up to 12 Newtons of resistance to each finger and the thumb.

The software required to integrate this versatile device into a virtual environment application is complex.



The CyberGrasp and VEST were integrated into the IST Virtual Environment Software Sandbox (VESS) and Virtual Reality (VR) testbed. These devices give participants in an immersive virtual simulation the capability to interact with the

environment more fully and to communicate more effectively with team members.

We are also working with Engineering Acoustics, Inc (EAI), which developed the C2 tactor for the Tactile Situation Awareness System (TSAS) project. We are currently developing a full-body haptics suit, including arms and legs with 12 C2 Tactors, for the Navy Virtual Environments and Technologies (VIRTE) project. For this project we are conducting an experiment to demonstrate how haptics can improve performance in certain tasks.

Overall, a significant amount of haptics research has been completed by the HAMMER laboratory at IST. In the near future we hope to demonstrate how the CyberGrasp and VEST could be used in Military Operations in Urban Terrain (MOUT) simulation through improving the user's sense of presence. We plan to continue exploring the use of haptics in VR and Augmented Reality (AR) environments. We will accomplish this through continued software and hardware development plus further experimentation.

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