Project Title: *VROOM: Development of a robotic system with an augmented reality interface for rehabilitation of brain injured individuals*

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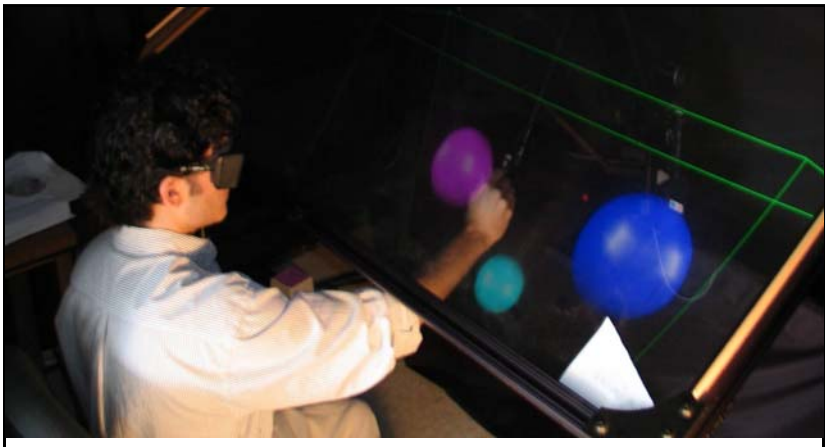
Project Description

The goal of this project is to design, develop, and test a new robotic interface for upper-limb rehabilitation of brain-injured individuals. The novelty of our device is that it safely operates in three dimensions with a large workspace and an appropriately designed visual interface. The first year we proposed to acquire implement the components for the system, in the second year we proposed to interface the robot and develop foundational software. The third year we proposed to will develop an easy-to-use interface for therapist operators. In the fourth year we proposed to develop the various therapeutic programs. In the fifth and final year proposed to test the system and identify technical parameters for the next generation system.



Demonstration using interaction with artificial spheres. VRROOM is a large-workspace, three-dimensional system that incorporates PARIS display (developed at EVL at UIC) that allows the user to see their own limb as well as virtual objects; a Robot that renders programmed forces, and a Flock of Birds motion tracking system.

Progress to Date

The resulting system is the Virtual Reality Robotic Optical Operations Machine (VRROOM). In year 1, we acquired and assembled the PARIS display system combined it with the PHANToM haptic robot, and implemented basic software that demonstrated the system's capabilities. In Year 2 we developed a foundational library for data acquisition, robot control, motion tracking, and viewer-centered display (above). This past year we have broadened our connectivity so that the system can use a choice of several robotic (and other) devices (PHANToM 3.0, Wanda, CyberGlove, HapticMaster, and soon PHANToM Omni and WAM). The system's development and architecture has been recently accepted for publication[1].

Also this year, we have successfully conduced two initial studies on healthy individuals as a precursor to our rehabilitation applications. First, we found that healthy subjects training on VROOM exhibit traits of adaptation that are comparable to those seen our previous robot[2]. Second, we demonstrated that it is more difficult to induce and detect adaptation when subjects train unconstrained in 3 dimensions[3].

Later this month we will begin development of an easy-to-use interface for therapist operators. This process employs focus-groups followed by a formal questionnaire process to determine the programs to develop. We have also begun preliminary reaching tests on individuals with stroke.

Presentations and Publications

1. Patton, J. L., Dawe, G., Scharver, C., Muss-Ivaldi, F. A. & Kenyon, R. Robotics and virtual reality: A perfect marriage for motor control research and rehabilitation. Assistive Technology Accepted, pending revisions (in final review) (2005).
2. Patton, J. L., Dawe, G., Scharver, C., Muss-Ivaldi, F. A. & Kenyon, R. in IEEE Engineering in Medicine and Biology Society Conference (EMBC) (San Francisco, CA, USA, 2004).
3. Scharver, C., Patton, J. L., Kenyon, R. & Kersten, E. in IEEE-International Conference on Rehabilitation Robotics (ICORR) (Chicago, IL, USA, 2005).