The NJIT Robot Assisted Virtual Rehabilitation System

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Cerebral palsy is a non progressive motor condition which causes physical disabilities in human development. Cerebral palsy is caused by damage to the motor control center during pregnancy, childbirth or after birth up to age 3. On average, 3 out of every 1000 newborns are diagnosed with cerebral palsy. Additionally, hemiplegia, paralysis of half the body, occurs in 1 of every 3 cerebral palsy patients.

A team of researchers at The New Jersey Institute of Technology has developed a rehabilitation system for the upper extremity impairments and function of children with hemiparetic cerebral palsy. The NJIT-RAVR (NJIT-Robot Assisted Virtual Reality) system integrates virtual reality with robot assisted rehabilitation thereby creating an interactive, motivating environment in which the therapists can manipulate the practice intensity and feedback to individualize the treatments. Incorporating virtual reality into the system enables age appropriate play in addition to a sense of self-efficiency which results in the desire of the children to participate in the program more.

The hapitic master and ring gimbal is a 6 degree of freedom force-controlled robot used in studying the upper limb rehabilitation of adults with strokes. Adding the ring gimbal as the end effector adds the possibility of forearm rotation and records 3 more angles of freedom. The movement arm acts as an interface between the participant and the virtual environment and forearm hand based volar splints connect the subject's impaired hand to the ring gimbal.

The system consists of 5 different simulation activities which aim to improve speed and accuracy of certain movements in addition to strengthening the upper extremities. Then, the external force, end-point position and velocity are measured in 3D in real time to generate the reactive motion.
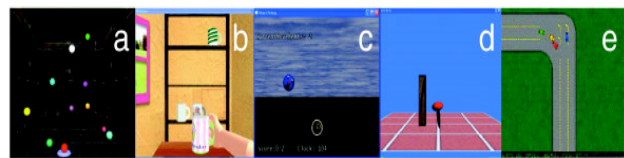
This particular study followed two participants, one male and one female, and tracked their progress over a three week, nine session, period. The 7 year old female showed significant improvement over the course of the trial. Her MAUULG percentage score increased from 59.8 to 67.2. The 10 year old male had a less significant percentage increase of .9, but improved none-the-less. Additionally, both subjects increased nearly 100% on their strength tests.

Sources:

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