Project Title: *Home-Based, Telerehabilitation System for Improving Functional Hand and Arm Movement Recovery*

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The goal of this project is to develop a means for individuals with stroke to practice arm movement therapy at home with remote monitoring. We previously developed a web-based system for repetitive movement training (Java Therapy). We have developed a new input device for the system that measures and assists in naturalistic arm movement, as well as software enhancements. The new input device is an instrumented, adult-sized version of Wilmington Robotic Exoskeleton (WREX), which is a five degrees-of-freedom orthosis that counterbalances the weight of the arm using elastic bands. We instrumented WREX with high precision potentiometers at each joint. To test the ability of the new device (Training-WREX or “T-WREX”) to measure and assist in functional arm movements, we measured five chronic stroke subjects’ movement ability while wearing the orthosis without gravity balance compared to wearing the orthosis with gravity balance. T-WREX’s gravity balance function improved a clinical measure of arm movement (Fugl-Meyer Score), range of motion of reaching movements, and accuracy of drawing movements. Coupled with an enhanced version of Java Therapy, T-WREX will thus provide a means to assist functional arm movement training at home, either over the Web in real-time, or stand-alone with periodic communication with a remote site. This enhanced version of Java Therapy focuses on functionally oriented games, such as reaching for objects on a shelf, eating, and cooking.

Figure: Left: T-WREX. Right: Effect of gravity balance on tracing movement for one chronic stroke subject using T-WREX. This subject attempted to trace a circle 30 times, without gravity balance (top four panels) and with gravity balance (bottom four panels), with her arm in the device. The panels show example trials throughout the 30 trials.