NUS Graduate School for Integrative Sciences and Engineering
Research Project Write-up

Title of Project : Intelligent Robotic Walker for Neurorehabilitation

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Short Description

Cerebrovascular Disease including stroke is the leading cause of adult disability, such as loss or impairment of motor control function. Rehabilitation through physical therapy is the main treatment for such patients to regain maximum function. Motor network reorganization happens with motor training after stroke, which is known as neuroplasticity. However, physical therapy is labor intensive and costly, causing many stroke patients discharged from hospital still living with the motor impairment without proper rehabilitation

Robotic assisted gait rehabilitation has the potentials to reduce labor intensity for therapists, provide stimulating biofeedback to patients, provide quantitative measures to clinicians, and ultimately better functional outcome than conventional therapies.

We are developing a novel robotic platform with pelvic motion and trunk support for over-ground gait rehabilitation. We believe that the most effective gait training can only be achieved in the most natural setting which elicit proper sensory input and feedback closest to actual walking: the over-ground, which will best facilitate brain plasticity and motor learning and motor skill retention. We also believe that applying the motor learning principles such as error augmentation and motion adaptation will enhance the functional outcome.

The research focus of this project will be a) Development of intelligent control system to determine the level assistance based on the patient characteristics measured by onboard sensors; b) to develop and clinically validate rehabilitation protocols for this system based on biomechanics and principles of motor learning and neuroplasticity to improve motor learning and motor skill retention; c) To collaborate with industrial partner to translate the system developed in this project into a commercially viable portable and affordable device.

This project will result in better understanding of biomechanics and neuroscience aspect of stroke rehabilitation, provide better rehabilitation techniques with improved functional outcomes, and reduce manpower and improved productivity in healthcare. With rapid aging population, this technology has tremendous market potential. Students with biomechanics, control system, and clinical background are welcome to work on this research.

Keywords:
Neurorehabilitation, Neuroplasticity, Human Sensorimotor Control, Robotics, Intelligent Control, Human Robot Interaction.