An Interactive Design of an Upper Limb Motor Relearning Method for Neurological Injuries with Tangible Robotic Companionship and Emotion Assessment

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Every year, over 600,000 people suffer from stroke and spinal cord injuries in the U.S. alone, and about 80% of acute stroke survivors lose motor skills of the arm and the hand. It may considerably limit the people's ability to achieve daily living activities. Research shows that methodical repetition of movements promotes recovery following a neurological injury. However, traditional physical therapy tasks may frustrate the patient due to their repetitive nature and may result in lack of motivation and poor rehabilitation. The goal of this research is to develop an effective and accurate motor-relearning method with a therapy tool and a tangible robotic platform that includes task-specific exercises as a novel solution to these issues. The system design includes electromyography (EMG) sensors and other sensors to measure subjects' muscle strength and improvement in real-time. Subjects move the developed therapy tool to control the robot in a horizontal plane from the central target to the eight outer targets. Thirty different limb positions were considered in this research to discover the pattern recognition to trigger the precise muscles for each subject. As a part of the subjects experience pleasure to trigger positive emotions by integrating an interactive robot in many shapes. With over two years of observation and data collection the data shows a coloration between the high repetition, improvement, and emotion; subjects show an increase in the measurement of the limb mobility. Pre and post therapy test scale showed a significant improvement over time. These findings indicate that the motor relearning method significantly improved. The developed low-cost interactive design is fun to provide a novel, objective approach to the motor relearning method.

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