

Robotics and Virtual Reality to Improve Functional Recovery in Stroke Patients

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Extended Abstract

Stroke is the most frequent disability cause around the world and one of the most common causes of death in the adult people. The interruption in the blood flow results in brain cell death and partial loss of neurological function. Only 6 to 10 percent of people with stroke achieve a full recovery by 6 months. The dose-response relationship in stroke rehabilitation have shown that more intensive therapy is associated with enhanced motor recovery. There are different rehabilitation approaches that had been proven effective to reduce motor impairment due to stroke. Traditional therapies are still not delivered more intensively or frequently, often because of cost and labor limitations. Robot-assisted therapy provide consistent training and to measure performance with high reliability and accuracy, also, robots may allow patients to train more independently and with less supervision from a therapist [1].

Robotic-assisted treatment can contribute to the recovery of disability and motor control in stroke patients; however, other rehabilitation interventions need to be included. [2]. Virtual reality (VR) and robotics combination has resulted in significant improvements in clinical and functional parameters in post-stroke patients; VR is a feasible approach to enrich robot-assisted rehabilitation training. It resulted in high acceptability and motivation in stroke patients, and in a reduced drop-out rate and an extended training time compared to standard treatment [3].

In this work a video game system based on virtual reality, synchronized with a Stewart-type robotic platform that simulates exercise in a canoe and that allows stimulating human motor recovery in hemiplegic patients was developed. The video game system is developed on free UNITY program, where the patient drives a canoe on river using a rowing avoiding obstacles, the patient visualized the virtual environment by an OCULUS QUEST virtual reality dispositive, the game increases the difficulty according to the patient improvement. Stewart-type robotic platform emulates the canoe's movement based in rehabilitation therapy when the patient is sitting on a Bobath ball, which were captured and recording by ten VICON cameras, laying markers around the patient's pelvis. The Stewart- platform consist in six linear motors which are controlled with classical PID controls, the posture and orientation of the canoe from the video game are used as tracking reference for the mobile base Stewart- platform using the inverse Kinematic, the desired position of linear actuators are obtained. [4] The communication between video game computer and Stewart- platform computer control was implanted by Bluetooth protocol.

Rehabilitation technology, like robotic or virtual reality, allow us to have another option that makes the rehabilitation treatment interesting and easy to execute. The use of new technologies in rehabilitation resulted in high acceptability and motivation which may promote neuroplasticity. Even though most studies using VR and/or robotics report and increase in motor function recovery (e.g. Manual Muscle Test, Fugl-Meyer upper motor scale, hand grip) compared with standard rehabilitation therapy, efficacy of some intervention may be under debate. [5]

References

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