

Development of a VR based Game Environment for Wrist and Finger Rehabilitation

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Abstract

Finger and joint injuries are common among children. This may come from a strain, fracture or just overuse of the different joints. These types of injuries may occur in the three joints of the hand: the metacarpophalangeal joint (MCP), interphalangeal joint (PIP), or the distal interphalangeal joint (DIP). However, a child with these types of injuries may find the normal rehabilitation methods boring and uninteresting, which may affect the speed of the rehabilitation process. In this project, the Unity game development engine (*Unity*) was used to design a game for children with these types of joint injuries to speed up the process of rehabilitation. Additionally, the Oculus Rift (*Oculus VR*) was used as the VR headset and the Leap Motion Controller (*Leap Motion*) was used to measure the hand movements and angles of the patient throughout the experiment. This type of game may speed up the recovery process of a child with a DIP, PIP, or MCP injury. The child may find the game more interesting than the normal set of exercises and therefore may be keener on winning the game which will speed up the rehabilitation process.

Biographies

Aditya Pillai is a high school student in the ninth grade attending the University School of Milwaukee. He is currently working in the BioRobotics lab under the help of Dr. Rahman and Mr. Swapnil. He brings expertise in game design and computer programming and have been working with industry leading game development platforms. His research interests include robotics, biology, video game rehabilitation, mechanical engineering.

Asif Al Zubayer Swapnil is a graduate student in the Mechanical Engineering Department of University of Wisconsin-Milwaukee. Currently he is working for his MS the BioRobotics lab under supervision of Dr. Rahman. He received his BSc. Engineering (mechanical) degree from Khulna University of Engineering & Technology, Bangladesh in 2014. He worked as an industrial and mechatronic system designer in product design industries for 4 years. His research interests include mechatronic and robotic systems for rehabilitation and assistance persons with physical disabilities.

Mohammad Habib Rahman is with the Mechanical and Biomedical Engineering Department, University of Wisconsin-Milwaukee, WI, USA. As Director of the BioRobotics Lab at the University of Wisconsin-Milwaukee, he brings the resources and expertise of an interdisciplinary R&D team. For more than 15 years he has been researching bio-mechatronics/bio-robotics with emphasis on the design, development and control of wearable robots to rehabilitate and assist elderly and physically disabled individuals who have lost their upper-limb function or motion due to stroke,

cardiovascular disease, trauma, sports injuries, occupational injuries, and spinal cord injuries. He received a BSc Engineering (mechanical) degree from Khulna University of Engineering & Technology, Bangladesh in 2001, a Master of Engineering (bio-robotics) degree from Saga University, Japan in 2005 and a PhD in Engineering (bio-robotics) from École de technologie supérieure (ETS), Université du Québec, Canada in 2012. He worked as a postdoctoral research fellow in the School of Physical & Occupational Therapy, McGill University (2012-2014). His research interests are in bio-robotics, exoskeleton robot, intelligent system and control, mobile robotics, nonlinear control, control using biological signal such as electromyogram signals.