UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF AUTISM TELEREHABILITATION SYSTEM USING AUTONOMOUS HUMANOID ROBOT AND MOTION SENSING DEVICES

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Autism is a neurodevelopmental disorder which cause abnormal social behaviour. Researches have been done to assist children with including Human-Robot Interaction (HRI) using NAO robot that enables the humanoid robot to interact with autistic children as part of therapy. However, NAO robot has several highlighted limitations which restrict the personalization behaviours that can be implemented. In this study, a new telerehabilitation system is proposed which consists of a humanoid robot NAO, a system that is based on MATLAB, and a Microsoft Kinect Sensor which is able to follow human joint trajectories. The purpose of this project is to provide an easier and more efficient way of providing a rehabilitation process for children with disabilities, especially for autistic children. The number of autistic patients needing rehabilitation is increasing rapidly and with the problem of shortage of professional therapist, this can be an alternative solution to assist the therapist during rehabilitation period. This interactive platform enables autistic children and Humanoid Robot NAO to imitate each other in real time aided by Microsoft Kinect Sensor for skeletal tracking movement. The imitation program is conducted by sets of instructions given to the patients to imitate certain pose done by humanoid robot NAO. Microsoft Kinect Sensor is used to determine whether the imitation follows the required criteria or not. MATLAB interacts with both humanoid robot NAO and Microsoft Kinect Sensor to perform the rehabilitation program. The number of trials needed to achieve the required imitation are translated into points and these points are uploaded into online database for record and evaluation process. Those stored data can be accessed via monitoring website by the acknowledged therapists and psychologists. They can view the rehabilitation results and do the analysis without making an appointment as the rehabilitation session can be done anytime without therapists and psychologists supervision. The session has been tested with normal healthy children where they imitate Humanoid Robot NAO movement with reference to several different upper body posture. For pilot experiment, we measure the accuracy of the system in determining gait parameters. The system can provide a good measurement of right hip angle and right knee angle of gait parameters. The graphs patterns for right hip and knee angles are similar compared to ViCON motion analysis system though the graph curves were not very smooth. Correlation coefficient values for both graphs indicated that the curve fits are good. It can be concluded that the system can be used to measure the joint trajectories and angles for the right knee and hip. Results of this study suggested this system is valid to be used as an alternative method in determining the gait parameters, depending on the required accuracy level.

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