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Title : Development of Human-Robot Interaction (HRI) Methodology for Autism Rehabilitation using Humanoid Robot with a Telerehabilitation Platform

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Advances in technologies and improvements in diagnostic procedures have contributed to the rising number of autism detection worldwide. Autism is a brain disorder that affects behaviour, communication and social interaction. The use of intelligent robots to rehabilitate children with autism hosts great untapped potential. Robots offer rehabilitation applications that are accurate, motivating and repetitive. However, validity and access to such intervention are still scarce. This research investigates the potential use of a humanoid robot as an adjunct rehabilitation tool to assist children with autism. The focus is also on developing a single, web-based platform that enables stakeholders in autism rehabilitation to gain access to robotic applications. A robot in human shape has great potential to generalize the skills learnt during human-robot interaction to human-human interaction scenarios. The humanoid robot used in this study is NAO. It has moderate degree of likeness to human. Children with autism prefer robots with simplified features. NAO is also the most widely used humanoid platform by engineering and clinical researchers in autism research. The first objective analyses the behaviour response of children with autism when exposed to a humanoid robot for the first time. The pilot experiment took place at NASOM Titiwangsa, a special school for children with autism. A 24-items behaviour score sheet was developed as an observation instrument to measure the children's responses. Qualitative results from video evaluations showed that for the subscale of stereotyped behaviour and communication, 10 children responded positively with reduced autistic behaviour when the robot was present. For social interaction subscale, 7 children showed encouraging responses. In addition, children with higher IQs (more than 80) responded better to robotic interaction. Next is the assessment study of the quality of the behaviour score sheet. Based on the expert opinion method, the instrument was found to have good validity. More than 67% of all experts scored at least 3 on the 5-point Likert scale. In reliability; high internal consistency was seen with a Cronbach's alpha of 0.872 for the whole tool. As a continuation from the pilot study, more interaction contents involving child and robot are in need. New robot scenarios that are socially engaging based on the pre-school curriculum for children with special needs by the Ministry of Education Malaysia and the Applied Behavioural Analysis (ABA) technique were developed. This resulted with six new programs choreographed with body movements and interaction dialogues to fit the purpose of the robot as a learning tool. The interaction scenarios were co-developed with experts from the special education and medical fields. In the final stage, a telerehabilitation platform was developed and tested for its usability by therapists. The RoBIn website enables access of robotic technology to a larger population regardless of location. Survey results show that RoBIn provides an acceptable usability level based on System Usability Scale (SUS) scores. In addition, 80% therapists agree that their overall first-time experience in using RoBIn's website was good. This study was the first of its kind in Malaysia to develop a rehabilitation system involving robots to aid the autism population via the telecommunications technology.