Project No.	Project Title	
2022-01-046	Transparency based action model implemented in robotic trainer system	
Academic Advisor		**Co-Advisor**
Prof. Yael Edan		
Team Members		
Naama Aharony		
naamaah@post.bgu.ac.il		

Abstract

The older adult population is growing. Studies have shown that physical activity improves the quality of life, reduces health problems, and maintains independence in older adults. Due to lack of trainers and the need for social distancing which were both enhanced along Covid-19 there is a need for technological replacements.

A simulator version of a previously developed personal robotic trainer for older adults was developed in Python with CoppeliaSim software. The robot demonstrates exercises and provides visual and audio feedback, including counting repetitions and encouraging the user. The robotic system includes a humanoid robot (PoppyTorso) and a depth camera (Realsense) that uses Nuitrack software to monitor the performance of users and provide feedback to them.

We developed a new model called Transparency-based action (TBA) and implemented it into the robotic trainer system. The model aims to create bidirectional transparency between the robot and the user leading to a more user-centered design of the interaction of the robot and fit it to the user training level. The model has three TBA levels (low, medium, and high), each level contains the information from the previous level, and as the levels increase, transparency and adaption of the physical training program to the user increases. To examine and evaluate the model and the robotic system an experiment with 51 students (ages 23-28, 16 men 35 women) was conducted. Each participant experienced three sessions for each TBA level, in a different order. Results revealed that most participants preferred the High TBA. However, they noted that the robot's ability to monitor and count the repetitions should be improved since errors decreased enjoyment and motivation.

Another part of the project focused on the validation of cameras and algorithms for Human activity recognition. This was conducted to determine a suitable camera to replace the Realsense camera which is going out of production. A comparative experiment was conducted between different cameras (Realsense, two Zed2i: 2 and 4 mm lenses) and algorithms (Nuitrack, Mediapipe, and Pyzed) for identifying the human body skeleton. The experiment included 25 students who performed five sessions of walking with hand movements, each session was documented and recorded by different cameras and algorithms in comparison to a Vicon system which was used as the ground truth. Results will be presented**.**

A future study with older adults will link the different research parts: new camera, TBA and compare the simulator to the robotic trainer.

Keywords: Human-Robot Interaction, Transparency, Physical training , Older adults, Human Body skeleton Algorithm.