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DEVELOPMENT OF VIRTUAL SIMULATION FOR EVALUATION OF ROBOTIC ASSISTIVE ENVIRONMENT

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Abstract

In this research, Webots, an opensource physics-based simulation and visualization software is evaluated and then used to study and evaluate the performance of two robotic systems for a robotic assistive environment for persons with upper limb disabilities. This includes a wheelchair, a table with objects and two robotic arms attached on the wheelchair. The two arms are a custom developed 4-degrees of freedom arm and a UR5e arm from Universal Robotics. This assistive environment also includes three cameras to identify objects to be manipulated with object geometry and grasping specific information defined and extracted from a metadata file. The motion controller code is written in MATLAB using the Robotics Systems Toolbox. An algorithm that accepts keyboard input to execute a desired motion has been developed. The environment allowed us to successfully study multiple scenarios for interaction and object grasping and provided the tools for visualization as well as detailed information and characteristics of the motion including occurrence of collisions. After verifying the performance in simulation, the inverse-kinematics solution was stored for later analysis. The goal of using these virtual tools is to reduce the testing and analysis time for robotics projects and fine-tune before implementation. The success of this research provides the confidence to implement the environment in the research lab.