

Design, Analysis and Obstacle Avoidance Control of an Electric Wheelchair with Sit-Sleep-Seat Elevation Functions

Authors : Waleed Ahmed, Huang Xiaohua, Wilayat Ali

Abstract : The wheelchair users are generally exposed to physical and psychological health problems, e.g., pressure sores and pain in the hip joint, associated with seating posture or being inactive in a wheelchair for a long time. Reclining Wheelchair with back, thigh, and leg adjustment helps in daily life activities and health preservation. The seat elevating function of an electric wheelchair allows the user (lower limb amputation) to reach different heights. An electric wheelchair is expected to ease the lives of the elderly and disable people by giving them mobility support and decreasing the percentage of accidents caused by users' narrow sight or joystick operation errors. Thus, this paper proposed the design, analysis and obstacle avoidance control of an electric wheelchair with sit-sleep-seat elevation functions. A 3D model of a wheelchair is designed in SolidWorks that was later used for multi-body dynamic (MBD) analysis and to verify driving control system. The control system uses the fuzzy algorithm to avoid the obstacle by getting information in the form of distance from the ultrasonic sensor and user-specified direction from the joystick's operation. The proposed fuzzy driving control system focuses on the direction and velocity of the wheelchair. The wheelchair model has been examined and proven in MSC Adams (Automated Dynamic Analysis of Mechanical Systems). The designed fuzzy control algorithm is implemented on Gazebo robotic 3D simulator using Robotic Operating System (ROS) middleware. The proposed wheelchair design enhanced mobility and quality of life by improving the user's functional capabilities. Simulation results verify the non-accidental behavior of the electric wheelchair.

Keywords : fuzzy logic control, joystick, multi body dynamics, obstacle avoidance, scissor mechanism, sensor

Conference Title : ICCIMSR 2021 : International Conference on Computational Intelligence in Mechatronic Systems and Robotics

Conference Location : Barcelona, Spain

Conference Dates : March 04-05, 2021