

# Towards Intelligent Control of Electric Wheelchairs for Physically Challenged People

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**Abstract:** The chapter deals with the use of soft computing techniques in solving the mobility problems of physically handicapped people using available signals such as face directional gesture, voice, brain and electromyogram (EMG) signals. These signals, depending on the type and degree of handicap, are used to classify commands required to drive a wheelchair. The user's intention is transferred to the wheelchair controller through the human-computer interface (HCI), and then the wheelchair is guided to the intended direction. Additionally, the wheelchair can perform safe and reliable motions by detecting and avoiding obstacles autonomously. Several detection methods and commands classification algorithms will be discussed. For smooth and reliable operation, an intelligent controller will be proposed to drive wheelchair motors. An adaptive Neuro-fuzzy inference system (ANFIS) technique will be used in the controller. The chapter introduces a modified method to design multiple-input, multiple-output (MIMO) ANFIS using only MATLAB. This controller relies on real data received from obstacle avoidance sensors and the HCI unit.

The implemented wheelchair will be equipped with path detection sensors, GPS tracking and battery level monitoring to guaranty more safety for the user. It has been tested on 3D simulation software, and the obtained results from the wheelchair prototype and 3D simulation model demonstrated the performance of the proposed real-time controller in dealing with user requirements and working environment constraints. The cost of the proposed smart wheelchair is suitable with user case.

By combining the concepts of soft computing and mechatronics, the implemented wheelchair will be more sophisticated and gives people more mobility. The obtained results show that the proposed intelligent wheelchair is feasible for the disabled and the elderly with severe mobility disabilities.

**Keywords:** Smart wheelchair control, Brain-computer interface, Human-computer interface, Voice recognition, Intelligent control, ANFIS, V-REP Mechatronics.