

DOCTORAL DISSERTATION ABSTRACT

Mechatronic driving system for people with disabilities

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Electric wheelchairs make it easier for disabled and elderly people to live, move, interact and participate in society. Driving a wheelchair in open spaces is relatively easy, but in closed and small spaces, maneuvering can be difficult for handicapped people.

Solutions to such problems are addressed to a relatively small group of disabled recipients and are highly customized. The considerable costs are a significant barrier to accessibility. New technologies can provide an opportunity to improve the quality of life of people with disabilities. Using selected modules from complex automation and control systems, cost-effective solutions can be created. This can facilitate the functioning of people with disabilities.

The dissertation provides an overview of hazards and problems when maneuvering a wheelchair in narrow passageways, as well as the methods of the authors to solve this problem. In this work, the construction of a mechatronic anticollision system based on 2D LiDAR laser scanners was presented.

Modules of the driving system were also described. The designed and manufactured prototype of the rotary scanning module makes it possible to generate a three-dimensional scene based on a series of 2D scans of the environment.

The developed method for avoiding collisions with the surrounding objects was described. The method defines the required safety zone, which is a function of time and instantaneous speed of the vehicle.

The mathematical model of unfolding body of the trolley was described, as well as the method of assessing the risk of collision of the wheelchair with elements of the environment. The paper also presents a description of numerical simulations, experimental investigations, that were carried out. Directions for further research were also pointed out.