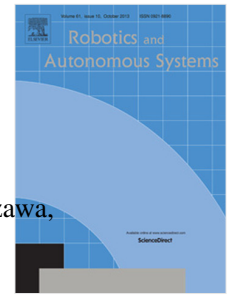
Accepted Manuscript



Passenger discomfort map for autonomous navigation in a robotic wheelchair

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PII: S0921-8890(16)30258-5
DOI: https://doi.org/10.1016/j.robot.2018.02.002
Reference: ROBOT 2980

To appear in: *Robotics and Autonomous Systems*

Please cite this article as: Y. Morales, A. Watanabe, F. Ferreri, J. Even, K. Shinozawa, N. Hagita, Passenger discomfort map for autonomous navigation in a robotic wheelchair, *Robotics and Autonomous Systems* (2018), https://doi.org/10.1016/j.robot.2018.02.002

Passenger Discomfort Map for Autonomous Navigation in a Robotic Wheelchair

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Abstract

This work presents a navigational approach that takes into consideration the perception of comfort by a human passenger. Comfort is the state of being at ease and free from stress; thus, comfortable navigation is a ride that, in addition to being safe, is perceived by the passenger as being free from anxiety and stress. This study considers how to compute passenger comfortable paths. To compute such paths, passenger discomfort is studied in locations with good visibility and those with no visibility. In locations with good visibility, passenger preference to ride in the road is studied. For locations with non-visible areas, the relationship between passenger visibility and discomfort is studied. Autonomous-navigation experiments are performed to build a map of human discomfort that is used to compute global paths. A path planner is proposed that minimizes a three-variable cost function: location discomfort cost, area visibility cost, and path length cost. Planner parameters are calibrated towards a composite trajectory histogram built with data taken from participant self-driving trajectories. Finally, autonomous navigation experiments with 30 participants show that the proposed approach is rated as more comfortable than the state-of-the-art shortest planner approach.

Keywords: HRI, human factors, human comfort, autonomous navigation

This research was supported by the Ministry of Internal Affairs and Communications with a contract entitled "Novel and innovative R&D making use of brain structures."

Part of this work was supported by JSPS KAKENHI Grants Number 16K21719 and JP26118006.

This paper is an extended version of conference paper [1], with integrated technical details, additional discussions and additional experimental results.