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Robotic Agent to Support Navigation and Communication for Autonomous Wheelchair

Rekha Kumari   Hisato Fukuda   Yoshinori Kobayashi   Yoshinori Kuno

Graduate School of Science and Engineering, Saitama University

1. Introduction

In recent years there has been an increasing demand for elderly care in Japan due to a declined birthrate and an aging population. Demand for more robotic assistive systems is expected to increase. One of the more researched areas in assistive technology is the development of assistant robots like robotic wheelchairs can perform effective and valuable work in our daily lives. Navigating through a large and complicated area can be difficult for a robotic wheelchair. To deal with this problem, we have developed a wheelchair robot system that moves alongside companions, collaboratively and autonomously. In addition we advance communications technology by adding on a robot agent to promote friendly conversation between the wheelchair user and his/her human companion. The add-on robot achieves this by providing information details about the surrounding environment.

2. Autonomous Wheelchair

We propose a robotic wheelchair able to move alongside a companion and facilitate easy communication between the companion and the wheelchair user. Cooperative face-to-face communication is known to be effective to ameliorate elderly mental health. We added three laser range sensors and omni directional camera to observe the visual environment around wheelchair and track the companion's position. The laser range sensor and the omni-directional camera work together to observe distances and 270 degree directions respectively.

3. Proposed System

We are developing an add-on agent robot system (Fig.1) for autonomous wheelchairs to support in navigation and communication. Through friendly conversation with the wheelchair user and companion, we reduce the physical load and time consumption on caregivers (Fig.2). Communication agent mentally support to elderly wheelchair user.

Fig 1. Robotic wheelchair with agent robot

Specifically we have implemented the proposed prototype to determine optimal paths for navigation and locations accurately. As for the type of things the add-on robot says, it conveys information relevant to location of the robotic wheelchair and the destination it will navigate to. Robotic wheelchairs equipped with agent robots performing such tasks requires information about the environment where the wheelchair robot is situated. The robot used in our project is developed using a minimal set of sensors such as a camera and sensors. The camera and leaser sensors capture the surrounding environment and nearby objects to avoid collision.

Fig 2. Conversation among wheelchair user, companion and agent robot

4. Conclusion and Future Work

In the near future, we aim at improving the navigation and communications capabilities of the autonomous wheelchair by an embedded robotic agent. We call an interaction that increases familiarity and makes communication smoother a social interaction. Our hope is to achieve better symbiotic interaction between human and robots. In this work, we contribute a robot agent capable of being in a symbiotic relationship with humans.

Reference

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