Cognitive Interaction with Robots

Safety & Control Improvement in Human-Robot Interaction

Authors:
Alex Pardo
Marc Bolaños
Pablo Pardo

Professors:
Cecilio Angulo
Marta Díaz

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UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

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1 Introduction

This project is comprehended within the teleoperated robots area. A broad topic recently being pulled further given the increasing need of elderly attention.

The robot we were working with was MASHI, which is a teleoperated robot with the purpose of guiding in "La Bóbila" social centre in L'Hospitalet del Llobregat. The root consists in an Arduino board embedded to a wheeled structure that resembles the human figure.

The environment the robot is going to work in the main entrance of the social centre, where some temporary expositions are hold. MASHI is supposed to welcome the visitors and guide them through the exposition being able to communicate with the visitors.

Our project is focused on two different but necessary aspects:

1. **Collisions Avoidance**: We developed a simple but efficient way to avoid collisions using an RGB-D camera attached in the neck of MASHI. Our method tackles the so called *Freezing Robot Problem.*

2. **Gesture Control**: Facilitate the teleoperator control of the robot by allowing him/her to use the hands to move the robot. This feature will allow the teleoperator to manage more complex movements such as control head, arms, hands and so on.

The Section 2 is a brief compilation of related works and common problems in the area. In the Section 3 we explain with all the detail how was carried out the implementation part. The Section 4 contains the experiments with users done in order to test the acceptance and efficiency of out work. In the last section (Section 5) we expose our conclusions of this project and the possible future work.

2 Related Work

2.1 The Freezing Robot Problem

The *Freezing Robot Problem* is a classic problem in robotics and consists of finding a balance between being conservative in terms of movement and safety and being efficient. If the robot is too conservative and the environment too complex could end up freezing because none of the possible movements would be considered to be safe enough.

Peter Trautman and Andreas Krause [1] studied and proposed a non-parametric statistical model based on dependent output Gaussian processes that can estimate crowd interaction from data. Chung-Che Yu and Chieh-Chih Wang [2] proposed a Learning from Demonstration (LfD) approach proving that these kind of methods are efficient to both avoid collisions and freezing fee navigation.

3 Implementation

3.1 Collision Avoidance

3.2 Gesture Control

4 Test with Users

5   Conclusions

References

[1] Peter Trautman and Andreas Krause. Unfreezing the robot: Navigation in dense, interacting crowds. In *IROS*, pages 797–803. IEEE, 2010.

[2] Chung-Che Yu and Chieh-Chih Wang. Collision- and freezing-free navigation in dynamic environments using learning to search. In *Technologies and Applications of Artificial Intelligence (TAAI), 2012 Conference on*, pages 151–156, Nov 2012.