IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

Stage proposal for M2R - Informatics, 2017-2018

Dynamic Obstacle Avoidance for Indoor Robot Platooning

Among various skills required for mobile service robots to operate alongside human presence, the capacity for coordinating a robot's egomotion with respect to other mobile agents bears utility at several levels. Relatedly, motion coordination is required in optimizing obstacle avoidance, environment mapping, object searching, leader-following [5], patrolling, etc.

In a context of a group of heterogeneous group of agents consisting of robots and humans, a leader agent is tasked with solving a comparatively hard path planning problem whom the remaining agents need to follow. This is termed as vehicle platooning and it involves the resolution of three main problems: (i) path planning in the leader's state-space, (ii) detection, tracking and following of the next immediate leader for each chain link and (iii) reactive obstacle avoidance along the entire vehicle platoon.

While off-the-self solutions are available for treating each problem independently, addressing all three problems robustly in a human-populated environment raises a number of computational as well as practical considerations. Indicatively; how to exploit the platoon sensors to detect the leader and the obstacles? How to handle conflicting agent hypotheses on obstacle presence? What corrective action(s) is applied in the case of heterogeneous agents forming the platoon when avoiding an obstacle?

The objective of this stage proposal is hence to investigate such questions through the application of established algorithms on-board state-of-the-art mobile robot platforms. In detail, indoor robot platooning will be explored using groups of heterogeneous agents composed of TurtleBot2 platforms [1], humans and a contemporary humanoid service robot RB-1 [2]. The basis for all related research and development will be the Robot Operating System (ROS) [3] and associated libraries (OpenCV, Gazebo, PointCloudLibrary (PCL), etc).

Keywords: Multi-robot systems; path-planning; ROS

Hosting team: IHSEV (Interactions Homme Système et Environnements Virtuels), IMT Atlantique Bretagne/Pays de la Loire, Brest

Main supervisor: Ass. prof. Panagiotis PAPADAKIS (panagiotis dot papadakis at imt-atlantique point fr)

References

[1] http://www.turtlebot.com/turtlebot2/
[2] http://www.robotnik.eu/manipulators/rb-one/
[3] http://wiki.ros.org/
[4] P. Kavathekar and Y.Q. Chen, V*ehicle Platooning: A Brief Survey and Categorization*, 2011 ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications.
[5] P. Stein, A. Spalanzani, V. M. F. Santos, C. Laugier, Leader following: A study on classification and selection, Robotics and Autonomous Systems, p. 75: 79-95, 2016.