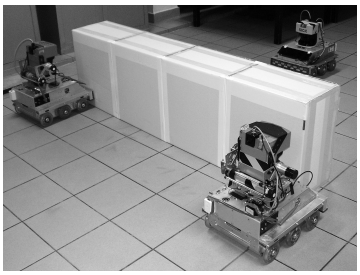
Multirobot Coordination and Cooperation Methods as My Contribution to Monitoring and Coordination Across Networked Autonomous Entities

Piotr Trojanek, Warsaw University of Technology, Poland[◊]

Keywords:
cooperation, coordination, multirobot, MRROC++



The focus of my research is in the cooperation and coordination in multirobot systems, including both manipulators and mobile robots. I have been developing a common benchmarking task – box-pushing, where two mobile robots were cooperating using implicit communication (stigmergy) [1]. This task has been specified using state-transition functions and formal methods of MRROC++ [2]. I am also interested in the methods of integrating robot programming frameworks, expecially MRROC++ and Player, in order to build common environment for both manipulators and mobile robots programming. I am evaluating developed algorithms and control methods using both real robots (our custom Electron mobile platform and IRp6 industrial manipulator) and simulation (Gazebo).
In my current research I investigate methods of multirobot tasks specification using Petri nets, which seems very promising concept for parallel execution of robot behaviours. The motivation of this work is to create tools for programming multirobot systems for elderly care. Such systems have to integrate both human-robot interaction modules (ie. speech and gesture recognition) and effector devices (including servovision and force control). The system composed of multiple robots will be cheaper and more expandable than single, probably very complex, devices. The solution have to integrate as much autonomy as possible in order to guarantee robustness and reliability. At the other hand the formal specification methods are required to assure the system is safe for use by the humans.

References:

[1] P. Trojanek, C. Zieliński, and W. Szynkiewicz. Definition and composition of individual robot behaviours in cooperative box pushing. In *Proceedings of the 13th IEEE IFAC International Conference on Methods and Models in Automation and Robotics (on CD).* Technical University of Szczecin, 29–30 August 2007.

[2] C. Zieliński. Transition-function based approach to structuring robot control software. In K. Kozłowski, editor, *Robot Motion and Control: Recent Developments, Lecture Notes in Control and Information Sciences, Vol.335*, pages 265–286. Springer Verlag, 2006.

[◊] Nowowiejska 15/19, 00-665 Warszawa, Poland; Webpage: `http://robotyka.ia.pw.edu.pl/PiotrTrojanek`; E-mail: `P.Trojanek@elka.pw.edu.pl`