



Bachelor-, Master- und Doktorandenseminar  
des Instituts für Informatik

## A cooperative multi-robot task planning system

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Mobile Multi-Robot Systems (MRS) are used nowadays in different domains, including manufacturing, mobility, logistics, disaster recovery. The application of MRS in aforementioned domains usually faces challenges such as partially known and dynamically changing environments, necessarily to work in teams without central coordination authority and instable communication.

This work presents an approach to task planning for MRS in partially known dynamically changing environments. As a general approach to the modeling of MRS, Multi-Agent Systems (MAS) are used. The task planning process is divided into four stages: Task cost estimation, Task allocation, Task execution, and Task exchange. For each stage, the corresponding methods are analysed, modified, and interconnected.

A simulation system for analysis and performance evaluation as well as for validation purposes is developed in Java. The simulation allows execution of the developed algorithms for selected validation scenarios and calculation of the efficiency metrics.

This work is closely cooperated with “Robotic firefighters” project, funded by the Lower Saxony University of Technology (Niedersächsische Technische Hochschule, NTH). The goal of this project is to develop a common decentralized information model for a team of mobile robots (referred as DCIM). The developed model is implemented using C++/ROS for real KUKA robots and tested/validated for Industry 4.0<sup>1</sup> scenario in “Kuka Innovation Award<sup>2</sup> 2014” competition. The author also participated in the project, and his role was development and validation of task planning algorithms on the base of DCIM.

The main goal of this research is to develop, validate, and evaluate algorithms for dynamic task planning in MRS. The research questions include review of task planning stages and corresponding algorithms for dynamic task allocation in MRS, selection of scenarios and analysis of specific requirements for them, adoption and modification of methods, analysis of their efficiency, and validation on the base of simulation studies.

1. Industry 4.0, or the fourth industrial revolution, is a collective term embracing a number of contemporary automation, data exchange and manufacturing technologies.
2. [http://www.kuka-robotics.com/germany/en/pressevents/news/NN\\_20140917\\_Innovation\\_Award.htm](http://www.kuka-robotics.com/germany/en/pressevents/news/NN_20140917_Innovation_Award.htm)

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Besprechungsraum 106, IfI, Julius-Albert-Straße 4