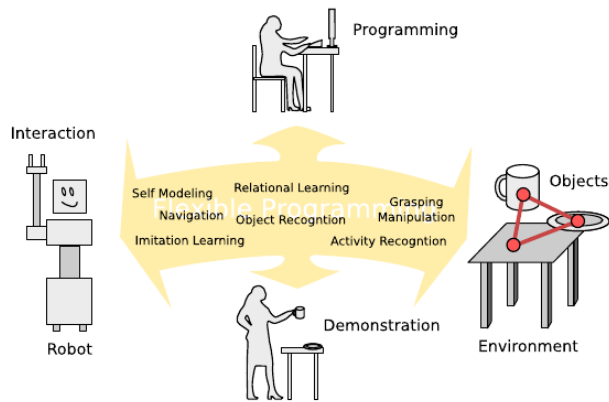


## Goals

The overall objective of First-MM is to build the **basis for a new generation of autonomous mobile manipulation robots** that can flexibly be instructed to perform complex manipulation and transportation tasks.



The project will build upon and extend recent results in

- **Robot Programming**
- **Navigation**
- **Manipulation**
- **Perception**
- **Learning by Demonstration and**
- **Statistical Relational Learning**

to develop advanced technology for mobile manipulation robots that can flexibly be instructed even by non-expert users to perform **challenging manipulation tasks** in real-world environments.

## Consortium

Albert Ludwigs University of Freiburg - Autonomous Intelligent Systems Lab

Foundation for Research and Technology - Hellas - Computational Vision and Robotics Laboratory

Katholieke Universiteit Leuven - Machine Learning Research Group

Instituto Superior Técnico - Computer Vision Laboratory

Fraunhofer Institute for Intelligent Analysis and Information Systems

Ecole Polytechnique Fédérale de Lausanne - Learning Algorithms and Systems Laboratory

Technische Universität Berlin - Robotics and Biology Laboratory

KUKA Roboter GmbH



The First-MM project is funded by the European Community's Seventh Framework Programme (FP7/2007-2013), project FP7-ICT-248258  
© First-MM 2010

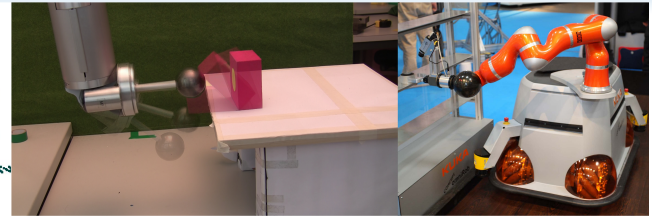
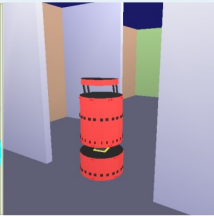
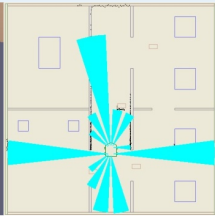
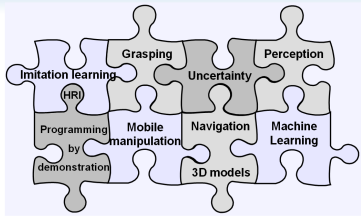


Project Coordinator:  
Prof. Dr. Wolfram Burgard  
Albert-Ludwigs-University Freiburg  
Institute of Computer Science  
Autonomous Intelligent Systems  
Georges-Köhler-Allee 079  
79110 Freiburg, Germany  
Phone: +49 - 761 - 203 - 8006  
Fax: +49 - 761 - 203 - 8007  
Email: burgard@informatik.uni-freiburg.de



**Flexible Skill Acquisition and Intuitive Robot Tasking for Mobile Manipulation in the Real World**





# First-MM

Can a robot **pick up, manipulate and transport** objects flexibly in real-world environments?

The answer to this question involves compliance with **various abilities** of the robot such as learning manipulation activities, navigating reliably in complex and dynamic environments (e.g. industrial settings or households), and transferring skills from one scenario to the other.

To this end the project will develop a novel robot programming environment that allows even non-expert users to specify complex manipulation tasks in **real-world environments**. In addition to a task specification language, the environment includes concepts for probabilistic inference and for learning manipulation skills from demonstration and from experience.

Designed to autonomously navigate in urban environments such as factory floors, supermarkets or department stores to provide various services to users including transportation, and guidance.

## Contributions

One important limitation of current mobile manipulation robots is the difficulty to program them such that they can **flexibly react** to changing situations.

FIRST-MM will develop a programming paradigm that allows the robot to augment programs with manipulation skills learned from demonstration by users or by interaction with the objects.

It will include techniques for **transferring the learned knowledge** to other, similar tasks.

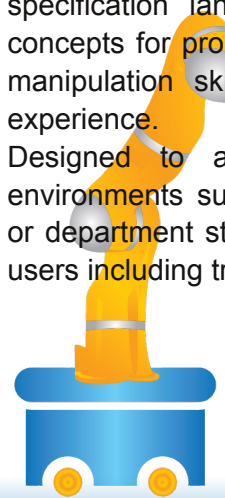
## Research Fields

FIRST-MM focuses on **tightly integrating** robot programming and the involved research areas:

- Relational Learning
- Imitation Learning
- Manipulation and Grasping
- Navigation and Planning
- Visual Perception.

Within the FIRST-MM project, a prototype robot will be developed that is able to complete its programs using skills perceived from demonstrated tasks and to transfer the learned strategy to other, similar tasks. Hence, the FIRST-MM platform will demonstrate its advance related to several challenging problems in the context of autonomous mobile manipulation.

The results of FIRST-MM will help to **close the gap** between special-purpose robots that robustly execute manipulation tasks in the real world and advanced approaches to robot navigation, statistical learning, task specification, and probabilistic reasoning.



# FIRST-MM