8803 - Mobile Manipulation

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Welcome

- Welcome to this graduate course on Mobile Manipulation
- 2^{th} generation of course
- The emphasis is on design of a functional system
- The course is centered on group work and design

Video from 2007

Objectives

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Motivation

- Mobility is a "mature" field
  - Without manipulation the interaction is very limited
- Manipulation is a "mature" technology
  - Without mobility the flexibility is limited
- The next big problem domain is mobile manipulation

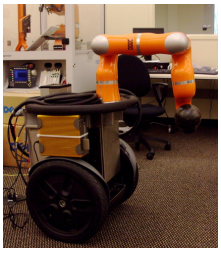
Objectives

- Acquire knowledge about all the key aspects of mobile manipulation
- Mobility, Manipulation, Systems Integration
- Mobility
  - Control, Localization and Navigation
- Manipulation
  - Detection, Servoing, Grasping, Handling
- Integration
  - Utilization of the redundancy of the system

Real Objective

- Design of a system for demonstration of mobile manipulation
- Fetch-and-Carry type system
- Design is a key aspect
- Fielding of systems for demonstration at Automatica 2008
  - The biggest automation show in the world (Jun 10-13, 2008)

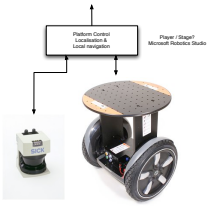
The System



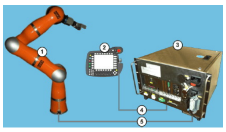
- Segway RMP200
- KUKA LWR Robot
- Schunk Gripper
- SICK LMS291
- FireWire Camera

Platform System

- Segway RMP200 (USB)
- Sick LMS291 Scanner
- EATON Industry PC
- WXP SP2 w MSRS



Arm System



- KUKA LWR System
- Prototype System
- KRC2lw controller
- Schunck Parallel Gripper (RS232)
- FireWire Camera (color)

Software Structure

- Based on Microsoft Robotics Studio
- C#, Python, VPL, (C++)
- Basic Drivers Available for all parts

Structure

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Style of course

- Mixture of
  - lectures / discussions
  - design discussions on system components
- Lectures
  - Provide background information and example methods
- Design discussions
  - Design discussion and review of progress

Startup lectures / discussions

- System outline / scenario
- Robot kinematics
- MSRS discussion / tutorial
- KUKA Robot Systems
- KUKA Robot Programming
- Localization and Navigation
- Vision for Recognition and Servoing
- Systems Integration

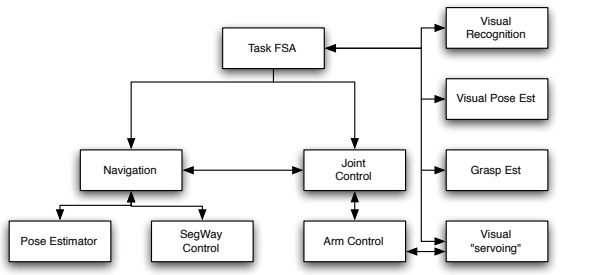
KUKA Training

- After KUKA Lectures
- Training on basic programming
- KRL
- RSI Basics
- Manipulate API

Tasks to be achieved

- Basic Platform Control
- Localization using Laser Data
- Navigation and trajectory following
- Arm Control incl compliance
- Object Recognition and Servoing
- Grasp Planning
- Task / Systems Integration

System Outline



Administrative Details

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Organization

- Work will be performed in groups of 4-5
- Once plan in place progress will be discussed weekly
- The groups should be self-organized
- Groups must be formed by January 25.

Rough Time Table

Jan Background / organization
Feb Planning / Early Design
Mar Part Prototyping
Apr Integration / Testing

Expected Results

- Design document with associated time table (March 1)
- A mid-term report that details the progress (April 1)
- A functional system that executes the task (May 1)
- A conference paper that details the design (May 6)

Other Things

- KUKA will offer 4-5 students a scholarship to goto Germany for June
  - Early June - Preparation of a Demo System
  - Jun 10-13: Presentation of system at Automatica 2008
  - Jun 15-25: De-brief with KUKA R&D Staff
- Great exposure of research and networking
- Selection model is open for discussion

Material

- Course web page
  `http://www.cc.gatech.edu/~hic/8803-Mobile-08`
- Lecture notes and associated material will be published on page
- Blog will report on updates. Check frequently

Questions?

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