

Welcome to

CSE 571 Robotics

Instructor: Dieter Fox

Teaching Assistant: Arunkumar Byravan

9/28/16

Organization

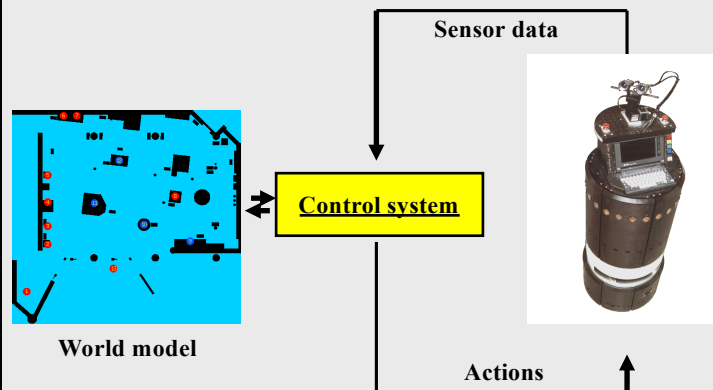
- M/W 1:30 – 2:50
- Grading
 - Homeworks (individual programming, questions): 45%
 - Team project: 45%
 - Participation: 10%
- Office hours
 - Dieter: Wed 3pm or just ask
 - Arunkumar:
- Readings:
 - Papers
 - Chapters from *Probabilistic Robotics*
- Web page: <http://www.cs.washington.edu/571>

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High-level View on Robot Systems

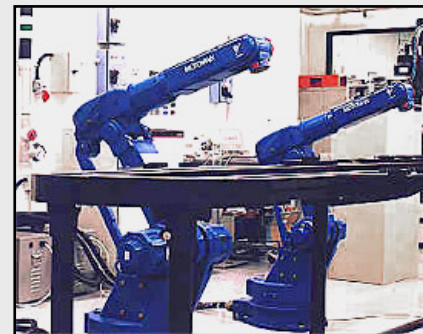


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Robotics Yesterday



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Minerva (CMU + Univ. Bonn, 1998)

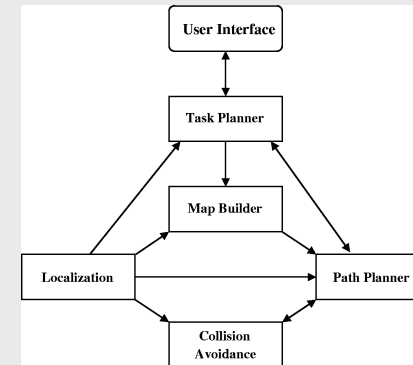


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Architecture of the Control System



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RoboCup: Integrated System Research

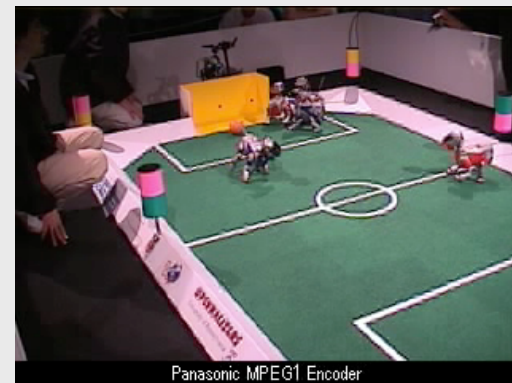
- Focus on addressing all problems at once
 - Hardware development
 - Perception
 - Low level control
 - High level planning and decision making
 - Multi robot systems

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RoboCup-99, Stockholm, Sweden



Panasonic MPEG1 Encoder

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RoboCup Small Humanoid League



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RoboCup: Midsize League



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DARPA Urban Challenge 2007



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Self-Driving Cars



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Robots in Warehouses (Kiva@Amazon)



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Amazon Prime Air



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DARPA Robotics Challenge 2015



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Getting out of Car

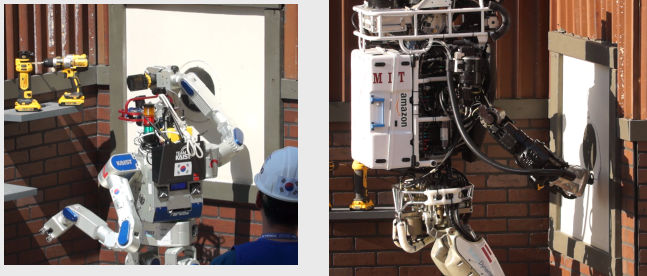


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Drilling Hole

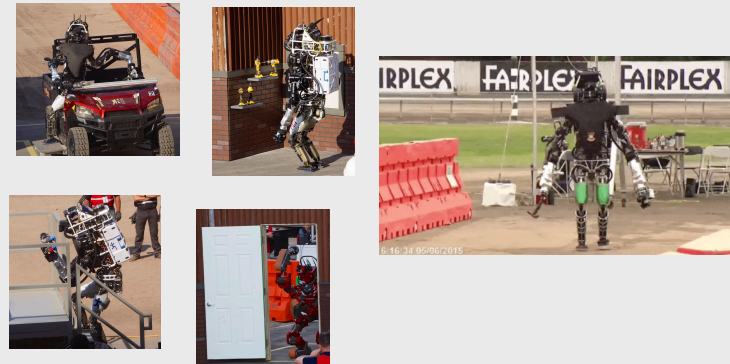


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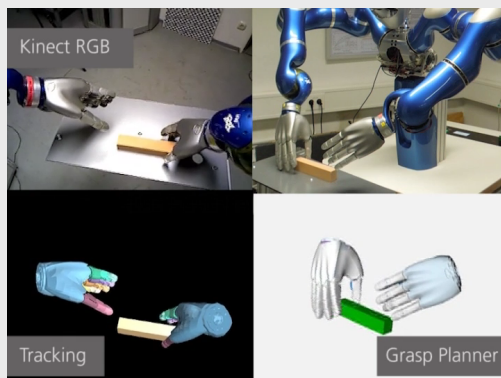
Humanoid robots



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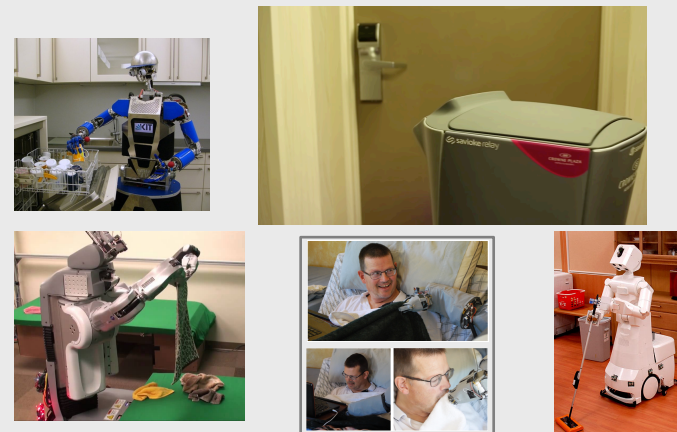
Manipulation



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Service Robots



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Control: BigDog



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Autonomous Running Jumps Over Obstacles in the MIT Cheetah 2

Hae-Won Park, Patrick Wensing, and Sangbae Kim



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Boston Dynamics Cheetah



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Current Research Trends / Topics

- Self-driving cars, drones
- Manipulation of everyday objects
- Complex household tasks (cooking, cleaning, ...)
- (Depth) cameras for object detection, 3D mapping, tracking, interaction
- Human robot interaction, co-robots
- Machine learning for control, imitation learning, recognition
- Deep learning

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Goal of this course

- Provide an overview of problems / techniques in robotics
- Understanding of estimation and decision making in dynamical systems
 - Probabilistic modeling, filtering, MAP inference
 - Deterministic and non-deterministic planning
- Hands-on experience

Course Outline

Week	Content	HW / Project
#1	Introduction / Probabilities	
Probabilistic Models / State Estimation		
#2	Bayesian state estimation / filtering	
#2	Gaussian processes, Motion and sensor models	HW 1: GP modeling
Filtering (localization, tracking, mapping)		
#3 / 4	Robot localization: grid, particle filters, EKF, UKF	HW2: Filtering
#5 / 6	Map building: EKF-SLAM, Fast-SLAM, RGBD	
Planning / Control		
#6 / 7 / 8	Path planning, manipulation, exploration	Project
#9	Reinforcement learning, inverse RL	HW3: RRT planning
Other Topics		
#10	Deep learning	