Welcome to
CSE P590a Robotics

Instructor Dieter Fox

Teaching Assistants
Zoey Chen
Aaron Walsman

Organization

- Lectures: Wed 6:00 – 9:00
  (will also put Zoom recordings on Canvas)

- Office hours
  - Dieter: Tue 12-1pm
  - Aaron: tbd
  - Zoey: tbd

- Tasks
  - 3 homeworks w/ Python programming, covering Gaussians, particle filters, RRT planning, and deep learning

- Readings: Papers and chapters from *Probabilistic Robotics*

Organization

- Late policy

  You are allowed to use 6 late days throughout the quarter. After this, assignments turned in late will incur a penalty of 10%, for each day. Please plan ahead and don't expect more.

- Academic Honesty Policy

  While we encourage students to discuss homeworks, each student must write up their own solution. It's fine to use a source for generic algorithms (with attribution), but it is not allowed to copy solutions to the problems. Additionally, students may not post their code online. If we determine that a student posted their code online, they will get an automatic 50% reduction on the entire assignment (math + code) and if they copy code for the problems from another student or from online, they will get an automatic 0% for the entire assignment (and possibly reported to the college). While we can't check for the use of tools such as ChatGPT, we stronlgy encourage you to develop your own solution and be honest about how you used such a tool in case you did.

High-level View on Robot Systems

Sensor data

Control system

Actions

World model
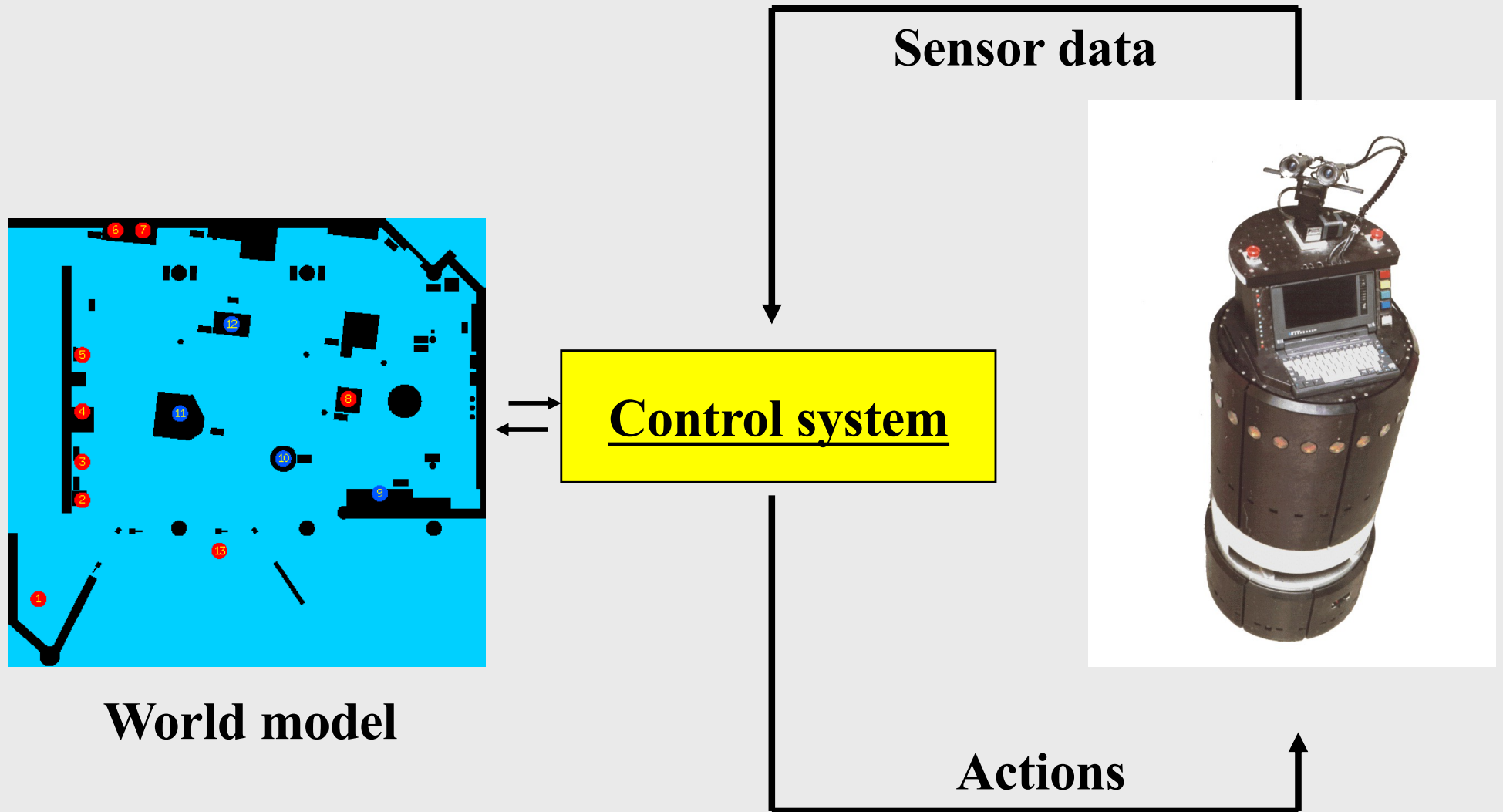
Industrial Robotics Today

Minerva (CMU + Univ. Bonn, 1998)

DARPA Urban Challenge 2007

Self-Driving Cars

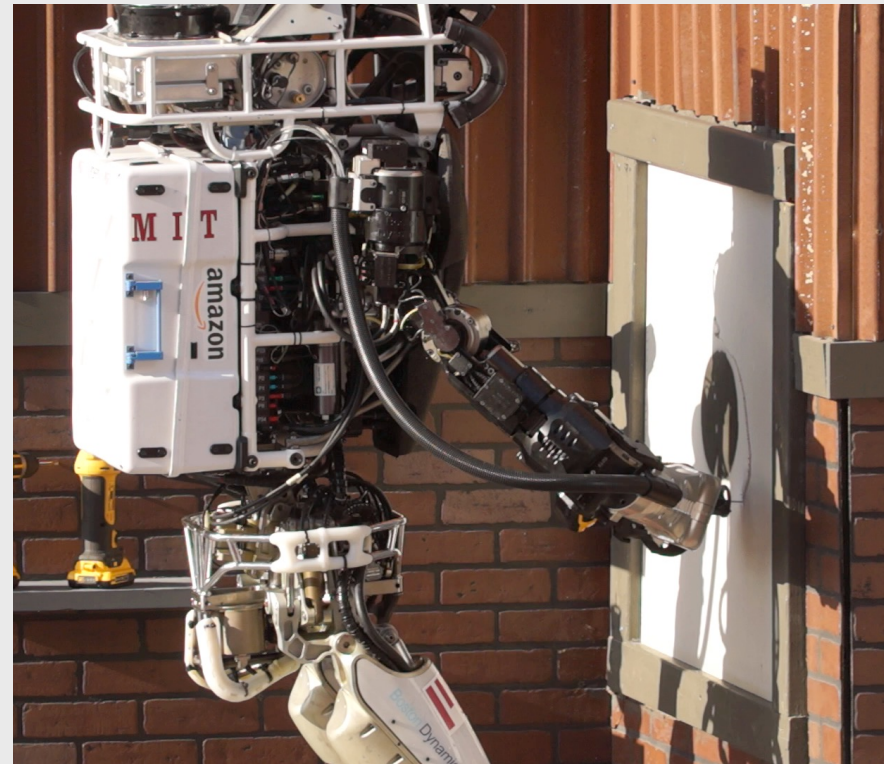# Robots in Warehouses
(Kiva@Amazon)
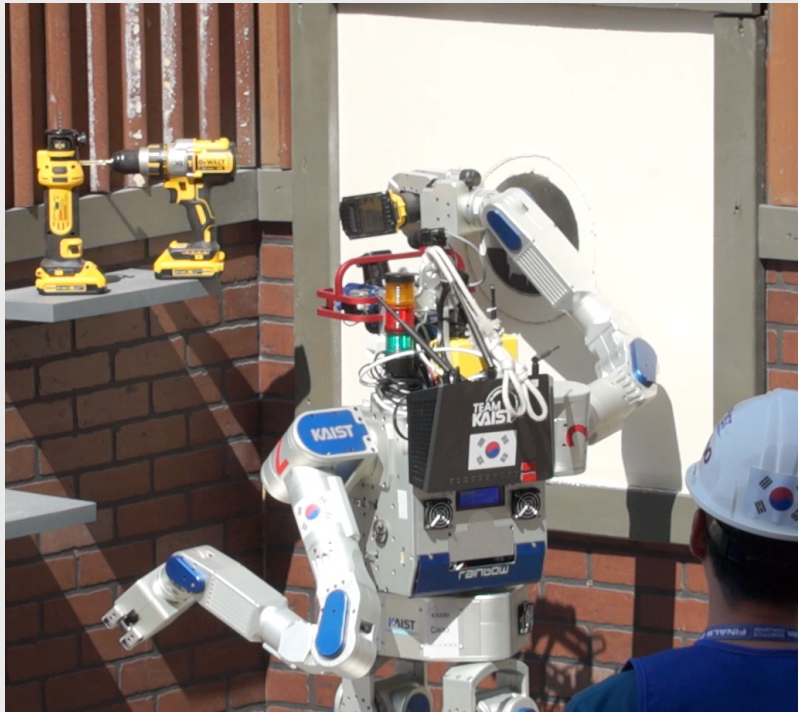
Amazon Prime Air
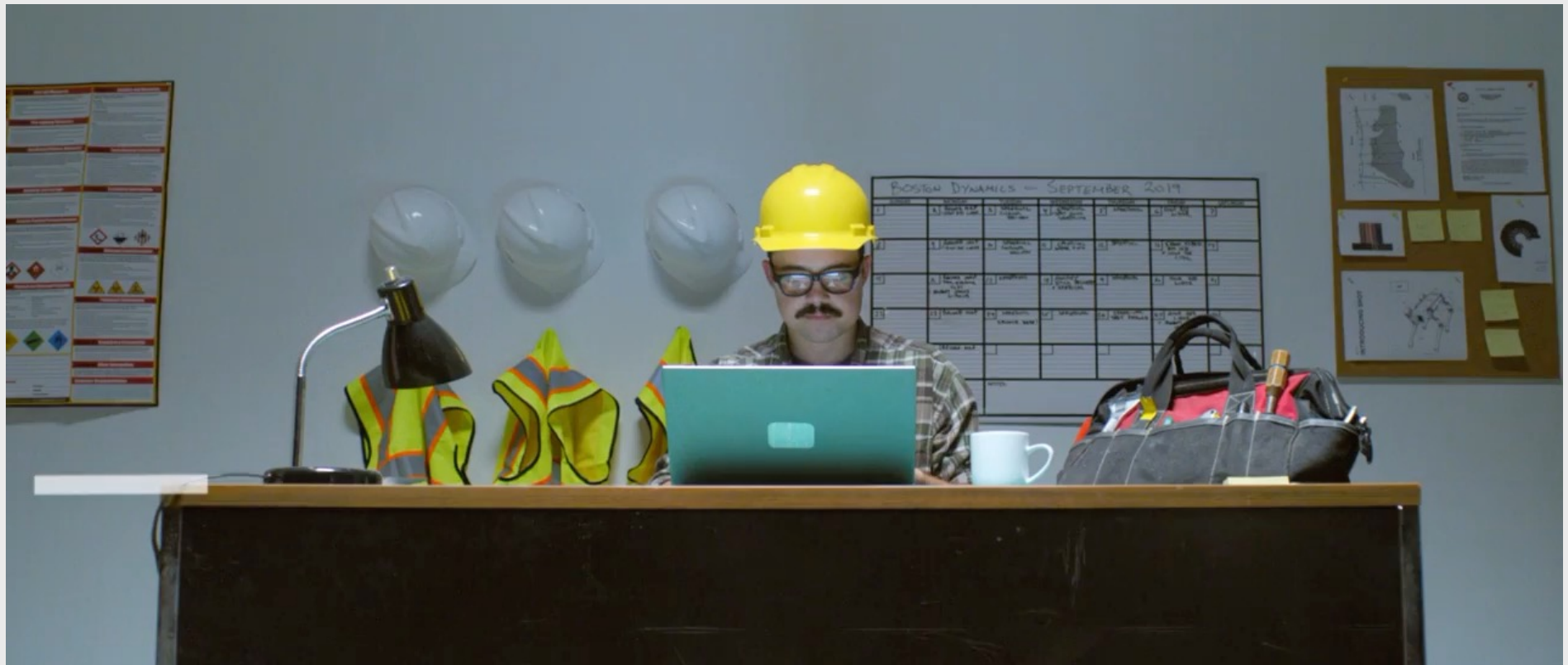
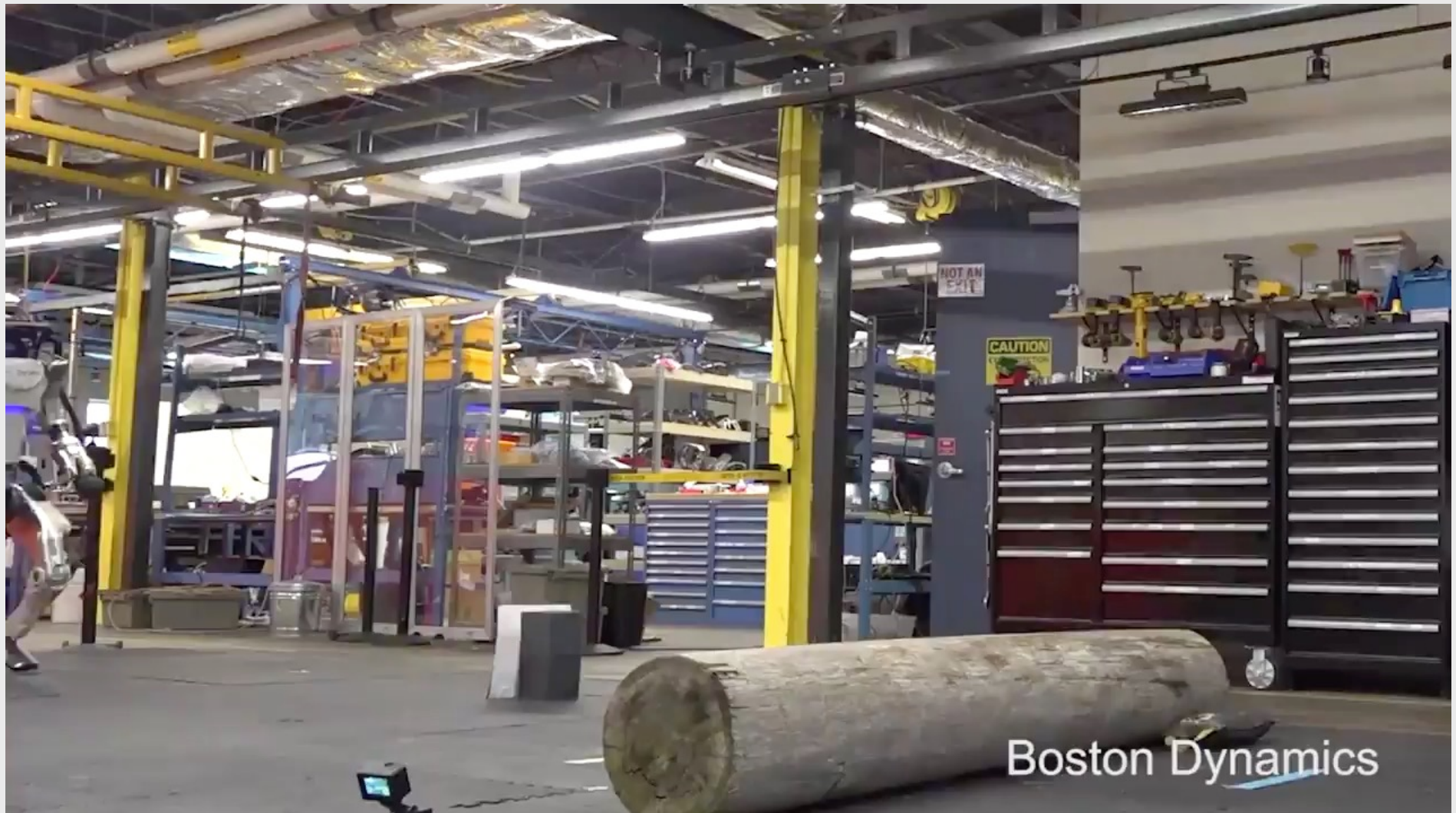# Amazon Prime Air

DARPA Robotics Challenge 2015

Drilling Hole

Boston Dynamics BigDog (2008)

Boston Dynamics Spot

Boston Dynamics Atlas
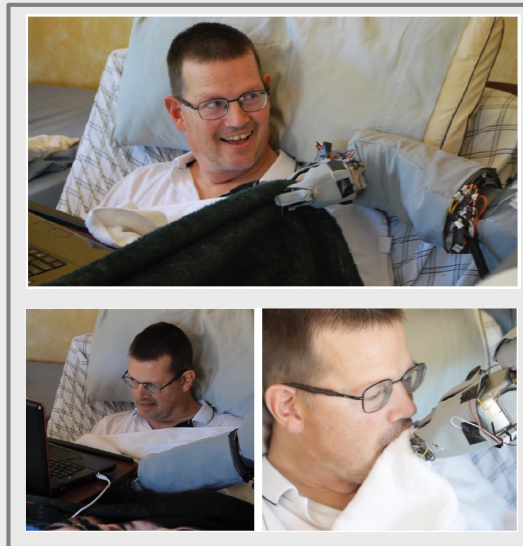
Boston Dynamics Handle

Industrial Pick and Place

Service Robots

Humanoids and Teleop
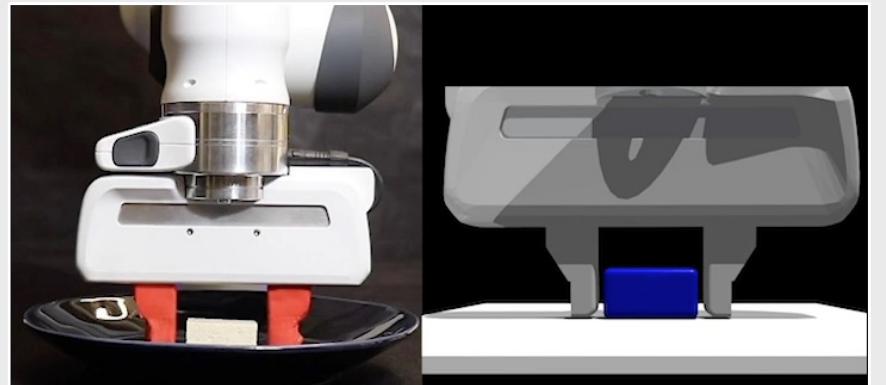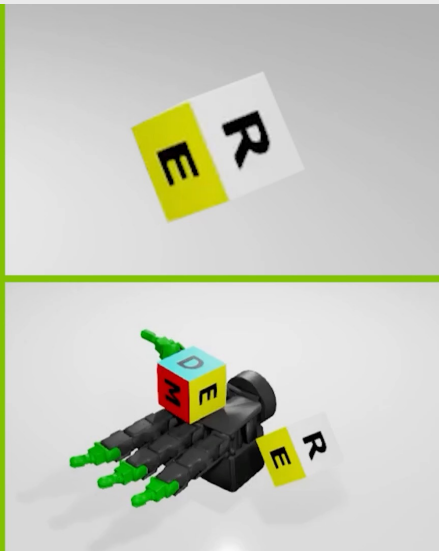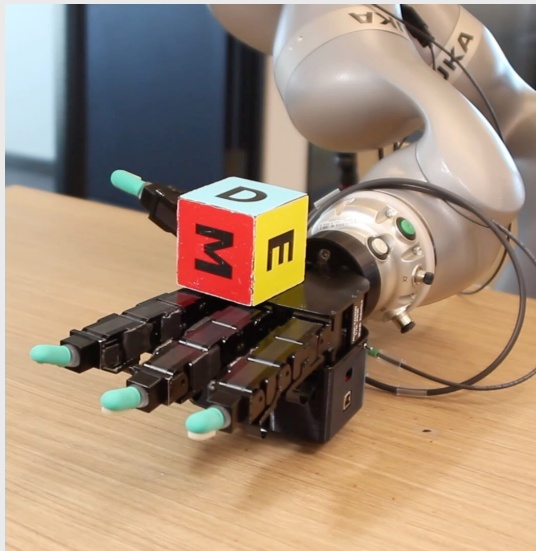
Simulation

CSE-P590a: Robotics

Current Trends / Topics

- Self-driving cars, sidewalk delivery robots, warehouses, manufacturing sites, …
- Drones
- Industrial pick and place
- Manipulation of everyday objects
- Complex household tasks (cooking, cleaning, …)

- Object detection, 3D mapping, tracking
- Cobots, human robot interaction
- Deep learning for perception, control, imitation learning, recognition, LLMs for planning

Goal of this course

- Provide an overview of fundamental problems / techniques in robotics

- Understanding of estimation and decision making in dynamical systems
  - Probabilistic modeling and filtering
  - Deterministic and non-deterministic planning
  - Learning for perception and modeling

Course Outline

Week	Content	HW / Project
#1	Introduction / Bayesian filtering	
#2	Motion and sensor models	
#3	Kalman filters	HW1 due
#4	Particle filters, localization	
#5	Mapping	
#6	Deterministic and sampling-based planning	HW2 due
#7	Exploration	
#8	Manipulation and grasping	
#9	Imitation learning	
#10	Reinforcement learning	HW3 due