Welcome to

CSE 490DF
Mobile Robotics Capstone

Instructor: Dieter Fox

Teaching Assistants:
Griff Hazen and Matt Mohebbi

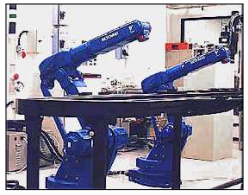
Organization

- T/Th 9:00 – 10:20
  - Tuesdays lectures (MEB 243, Allen 407)
  - Thursdays lab meetings (Allen 407)
- Web page:
  - www.cs.washington.edu/490df

Goal of this course

- Provide an overview of problems / approaches in mobile robotics
- Hands-on programming experience
  - Groups of three students
  - 2 week intro project (same for all)
  - 8 week in-depth project

Robotics Yesterday



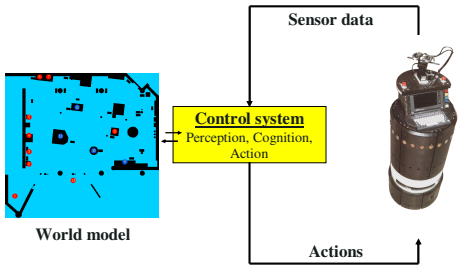
Robotics Today

Current Trends in Robotics

Robots are moving away from factory floors to

- Entertainment, toys
- Personal services
- Medical, surgery
- Industrial automation (mining, harvesting, …)
- Hazardous environments (space, disaster, underwater)

Mobile Robot Control System



Brief History of Mobile Robotics

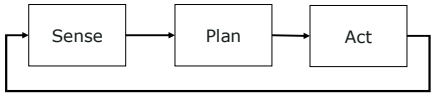
- Autonomous, automaton
  - self-willed (Greek, auto+matos)
- Robot
  - Karel Capek in 1923 play R.U.R. (Rossum's Universal Robots)
    - labor (Czech or Polish, robota)
    - workman (Czech or Polish, robotnik)

Asimov's Three Laws of Robotics

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except when such orders would conflict with the first law.
3. A robot must protect its own existence as long as such protection does not conflict with the first or second law.

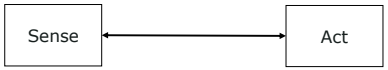
[Runaround, 1942]

Classical / Hierarchical Paradigm



- 70's
- Focus on automated reasoning and knowledge representation
- STRIPS (Stanford Research Institute Problem Solver): Perfect world model, closed world assumption
- Find boxes and move them to designated position

Reactive / Behavior-based Paradigm

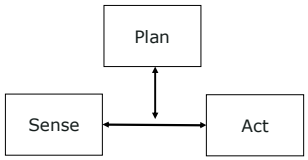


- No models: The world is its own, best model
- Easy successes, but also limitations
- Investigate biological systems

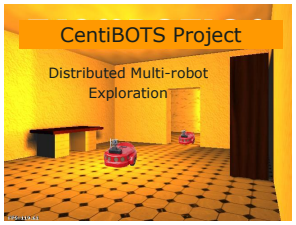
Thing

[Zelinsky et al., Australian National University]

Hybrid Deliberative/reactive Paradigm

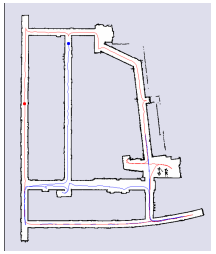


- Combines advantages of previous paradigms
  - World model used for planning
  - Closed loop, reactive control



- Exploration and surveillance of large indoor environments (~100 robots)
- Joint project with SRI International

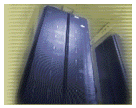
Map of the Allen Center



RoboCup Challenge

Design a team of robots that can play soccer!

Challenges of RoboCup vs. Chess

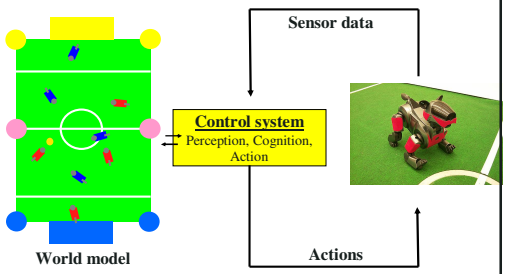


Deep Blue

Robot

Static	Dynamic
Deterministic	Stochastic
Accessible	Inaccessible
Turn-based	Real-time

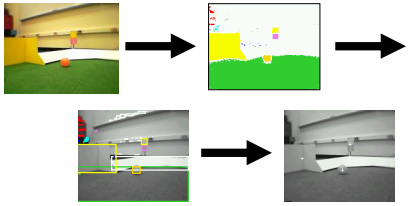
AIBO Control System



Autonomy

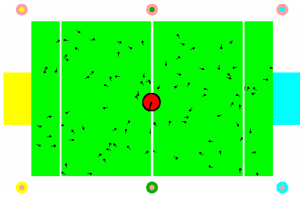
- Perception
  - sensing, modeling of the world
- Cognition
  - behaviors, action selection, planning, learning
  - multi-robot coordination, teamwork
  - response to opponent, multi-agent learning
- Action
  - motion, navigation, obstacle avoidance

Perception: Vision

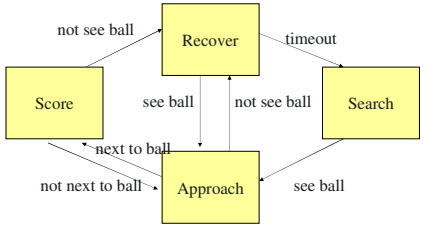


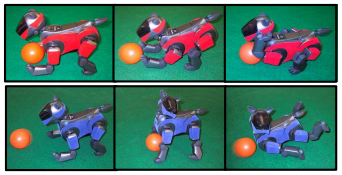
- Real-time and robust
- Effective calibration
- Colored blobs identified as objects

State Estimation: Localization



Cognition: Behaviors



Action: Motion

- Four-legged walking
- Head motion
- Turning, kicking