COMP-417A
Introduction to Robotics and Intelligent Systems
Fall 2009

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Why Robotics

Mars Exploration Rover animation

Underwater exploration, Barbados

Roomba vacuuming robot in action. More than 2M sold!

Planetary exploration experiment at CSA
Why Robotics?

- Manufacturing
- Labor shortage (agriculture, mining)
- Point where computers fast/cheap
- Automation of cars $\rightarrow$ more cars on highways
- To reach areas where no human can go
Past Projects
Past/Current Projects
Three Main Challenges in Robotics

1. Where am I? (Localization)
2. What the world looks like? (Mapping)
   - Together 1 and 2 form the problem of *Simultaneous Localization and Mapping* (SLAM)
3. How do I go from A to B? (Path Planning)
   - More general: Which action should I pick next?
• What should I do next? (Planning)
Syllabus

Week 1: Syllabus presentation, Round Table, Introduction, History of Robotics.

Week 2: Sensor (Tactile, Range Finders, GPS, IMU, Position Encoders).

Week 3: Mapping: Metric Maps, Topological Maps, hybrids

Week 4: Sensor (Vision).

Week 5: Visibility Graphs, Bug Algorithm, Potential Fields.


Week 7: Actuators. Locomotion. Manipulators.

Week 8: Mid-Term. Semantic hierarchy of spatial representations. Configuration Space, PRMs

Week 9: Subsumption (reactive) architecture. Control Theory. Plant and Sensor Model

Week 10: Coverage, Multi-Robot Coverage

Week 11: State Estimation, Dead reckoning, Landmarks, Bayesian Filtering

Week 12: Particle Filters, Kalman Filters, SLAM

Week 13: Planetary Exploration, On-Orbit Servicing of Satellites, Underwater Robots

Week 14: Review of Material

Week 15: Final
Evaluation

- 3 Assignments, 15% each: 45%
- Midterm Examination: 15%
- Final Examination: 40%
- In class participation (bonus) 5%
Walter’s Tortoise
1950’s

http://www.youtube.com/watch?v=ILULRImXkKo