



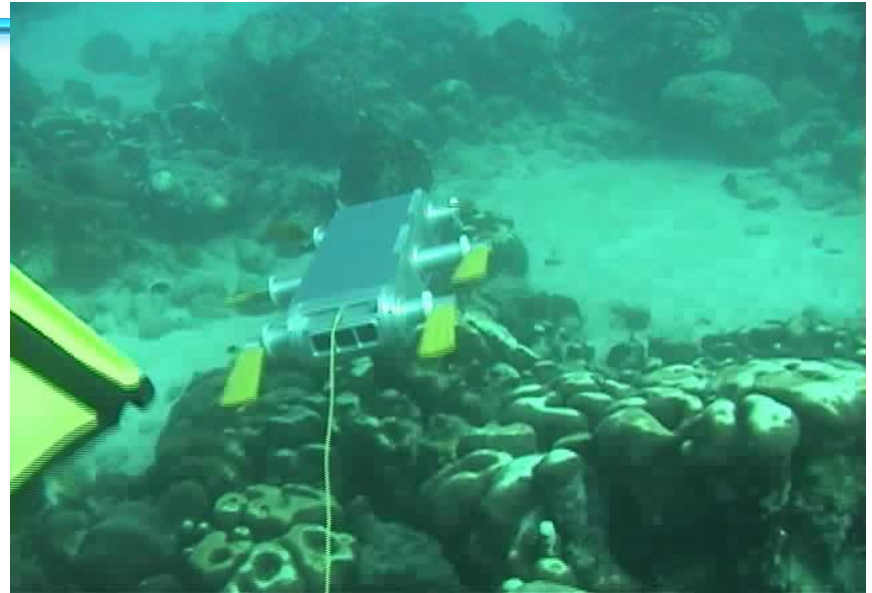
CS-417 INTRODUCTION TO ROBOTICS AND INTELLIGENT SYSTEMS

Introduction

Why Robotics



Mars Exploration Rover animation



Underwater exploration, Barbados



Roomba vacuuming robot in action.

More than 5M sold!



Planetary exploration experiment at CSA

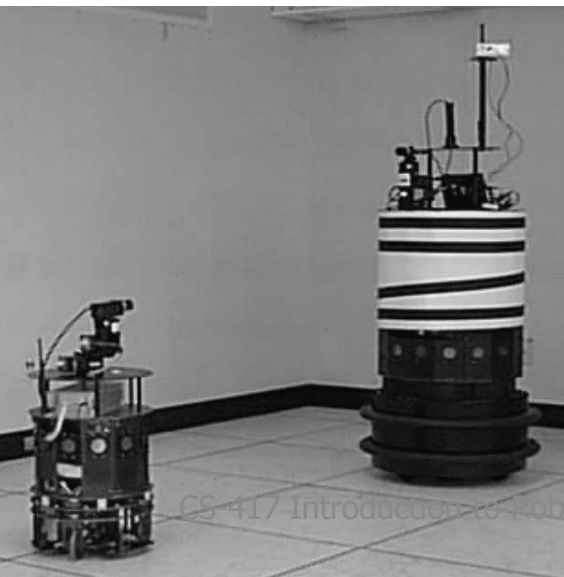
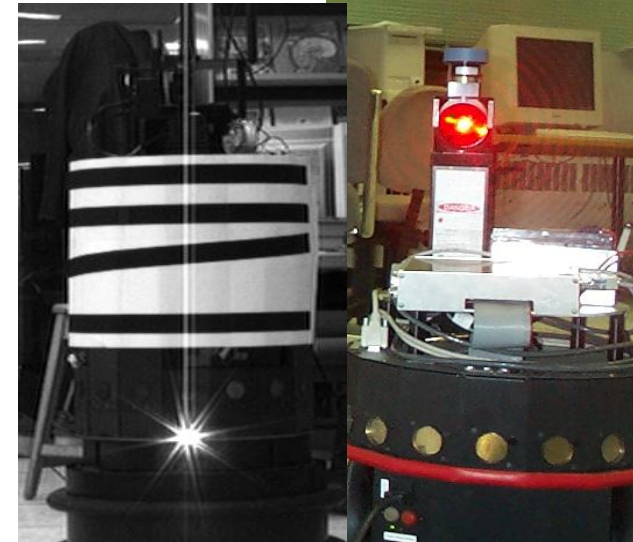


Why Robotics?

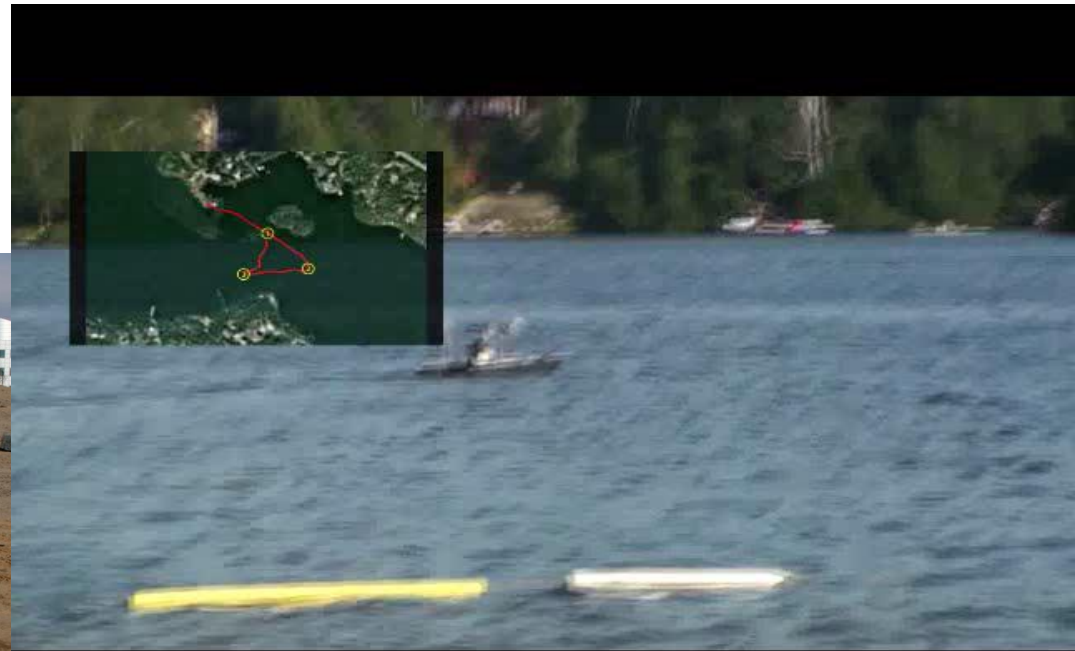
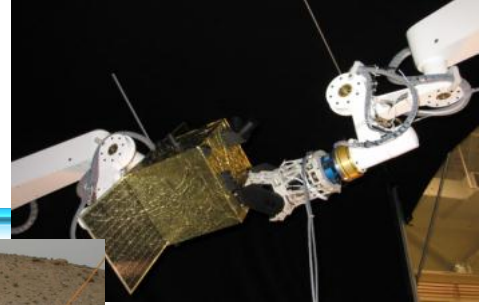
- Manufacturing
- Labor shortage (agriculture, mining)
- Point where computers fast/cheap
- Automation of cars → more cars on highways
- To reach areas where no human can go



Past Projects



Past/Current Projects



Current work in U/W Robotics



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: Actuators. Locomotion. Manipulators.

Week 3: ROS, Control

Week 4: Sensor (Tactile, Range Finders, GPS, IMU, Position Encoders).

Week 5: Mapping: Metric Maps, Topological Maps, hybrids

Week 6: Sensor (Vision).

Week 7: Visibility Graphs, Bug Algorithm, Potential Fields.

Week 8: Generalized Voronoi Graphs, Atlas.

Week 9: Mid-Term. Semantic hierarchy of spatial representations. Configuration Space, PRMs

Week 8: Architectures. HRI

Week 9: Coverage, Multi-Robot Coverage

Week 10: State Estimation, Dead reckoning, Landmarks, Bayesian Filtering

Week 11: Particle Filters, Kalman Filters, SLAM

Week 12: SLAM, BoeBots tutorial

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

Week 14: In class demo, Review of Material

Week 15: Final



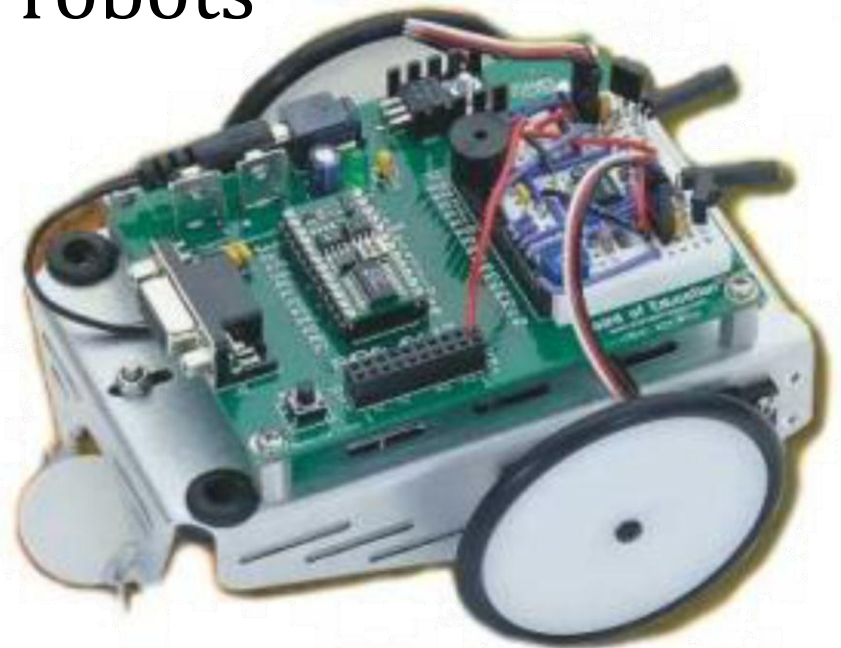
Evaluation

- 4 Assignments, 12.5% each: 50%
- Midterm Examination: 10%
- Final Examination: 35%
- In class participation 5%



Assignments

- Using ROS
- Using Simulations
- Using sensor data from real robots
- Using real robots (BoeBots)



Contacts

- <http://www.cim.mcgill.ca/~yiannis/>
- Email: yiannis@cim.mcgill.ca
- <http://moodle.cs.mcgill.ca/moodle/>
- Office hours: M/W 10:30-11:00, T/Th 16:15-16:30
and by appointment.
- TA: Anqi Xu



Walter's *Tortoise* 1950's

<http://www.youtube.com/watch?v=1LULRlmXkKo>

