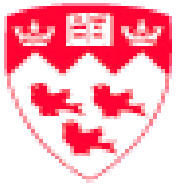


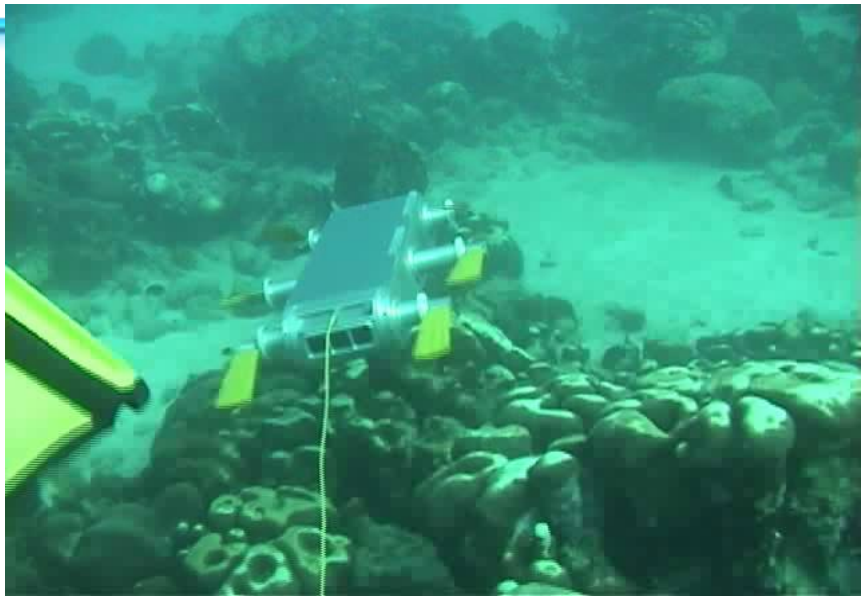
CS-417 INTRODUCTION TO ROBOTICS AND INTELLIGENT SYSTEMS

Introduction

Ioannis Rekleitis

Why Robotics

Mars **E**xploration **R**over animation



Underwater exploration, Barbados

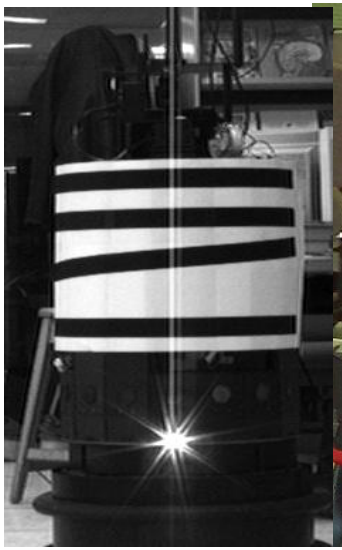
Roomba vacuuming robot in action.
More than 5M sold!

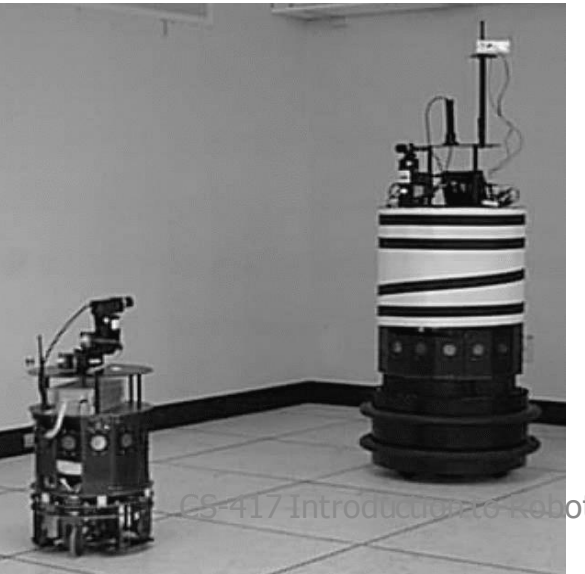
Planetary exploration experiment at CSA

Why Robotics?

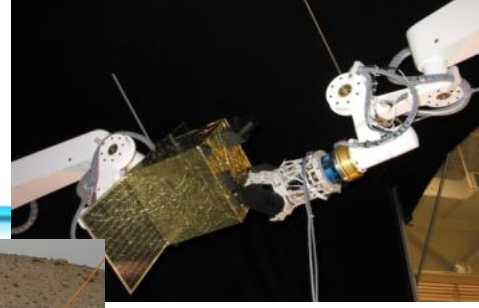
- Manufacturing
- Labor shortage (agriculture, mining)
- Point where computers fast/cheap
- Automation of cars→more cars on highways
- To reach areas where no human can go

Past Projects





Past/Current Projects



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 6: Generalized Voronoi Graphs, Atlas.
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

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

Walter's *Tortoise 1950's*

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