

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

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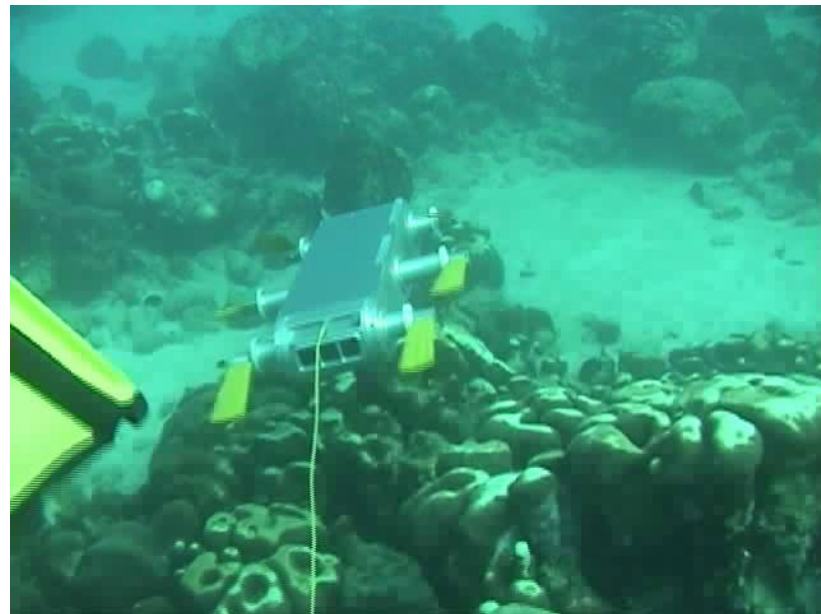
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Why Robotics



Mars Exploration Rover animation



Underwater exploration, Barbados



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

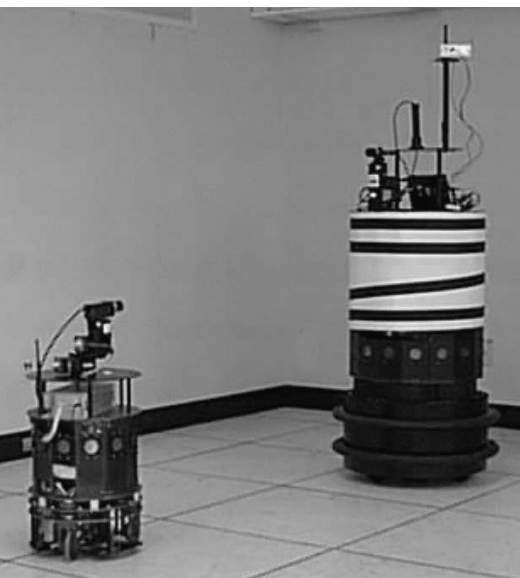
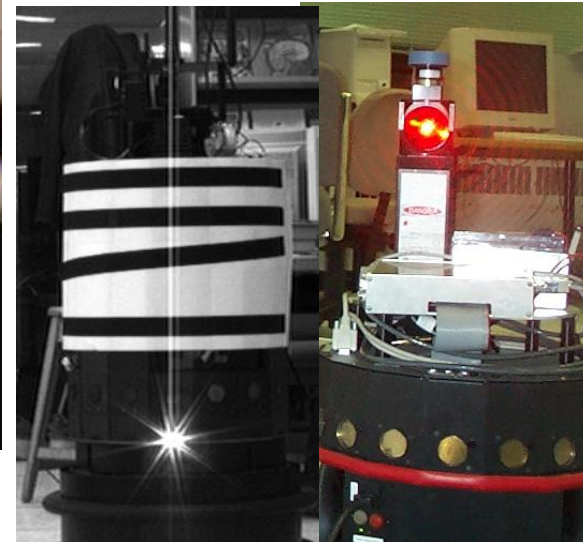
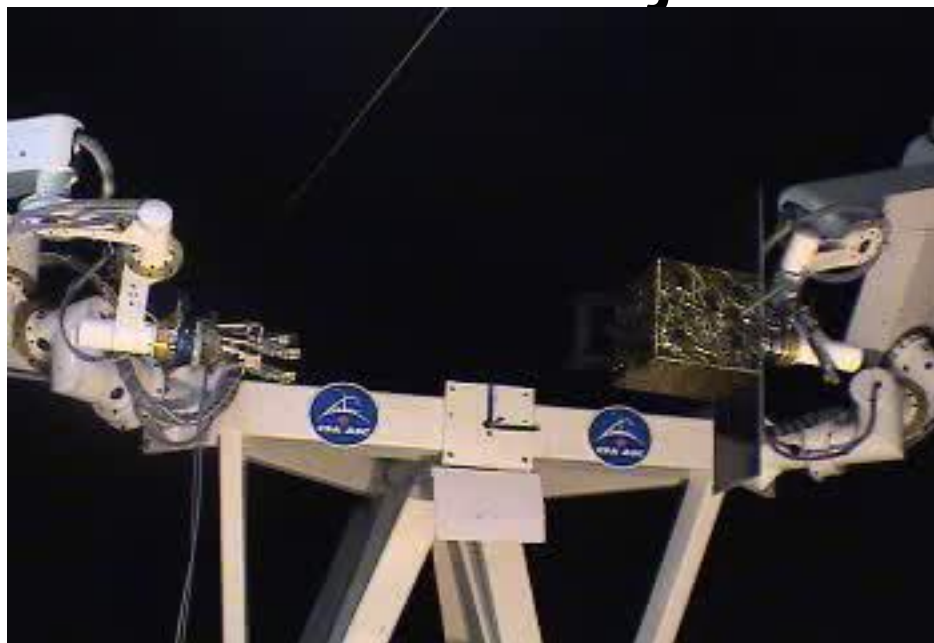


Planetary exploration experiment at CSA

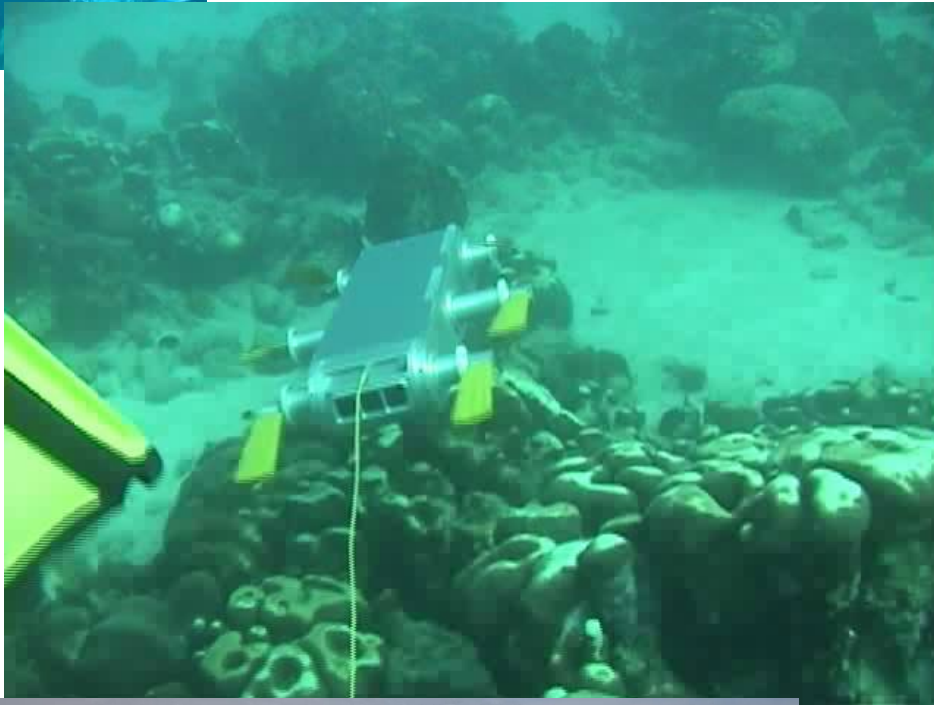
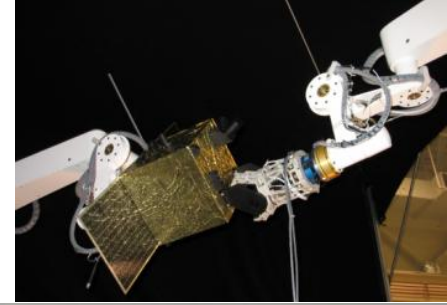
Why Robotics?

- Manufacturing
- Labor shortage (agriculture, mining)
- Point where computers fast/cheap
- Automation of cars → 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

- 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>

