



UNIVERSITY OF
SOUTH CAROLINA

CSCE 574 ROBOTICS

Introduction

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



Present Everywhere

- **At home**
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- Education
- In Factories
- In Warehouses
- In Space



Present Everywhere

- At home
- **On the road**
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- Education
- In Factories
- In Warehouses
- In Space



Present Everywhere

- At home
- On the road
- **In the sky (drones)**
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- Education
- In Factories
- In Warehouses
- In Space



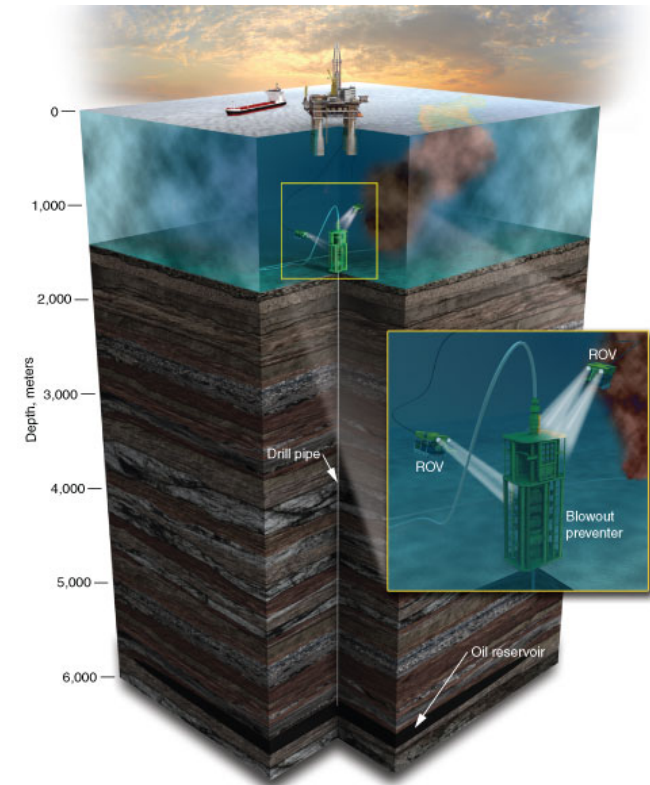
Present Everywhere

- At home
- On the road
- In the sky (drones)
- **In the fields
(agricultural robotics)**
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- Education
- In Factories
- In Warehouses
- In Space



Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- **In resource utilization
(ROV in the oil industry)**
- Along power lines
- In Hospitals
- Education
- In Factories
- In Warehouses
- In Space



Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- **Along power lines**
- In Hospitals
- Education
- In Factories
- In Warehouses
- In Space



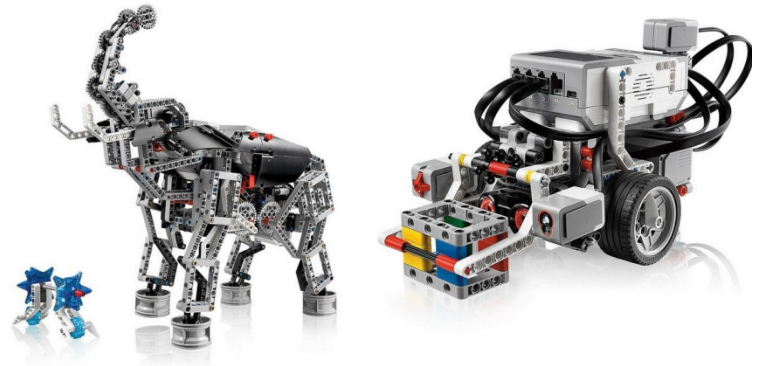
Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- **In Hospitals/Care facilities**
- Education
- In Factories
- In Warehouses
- In Space



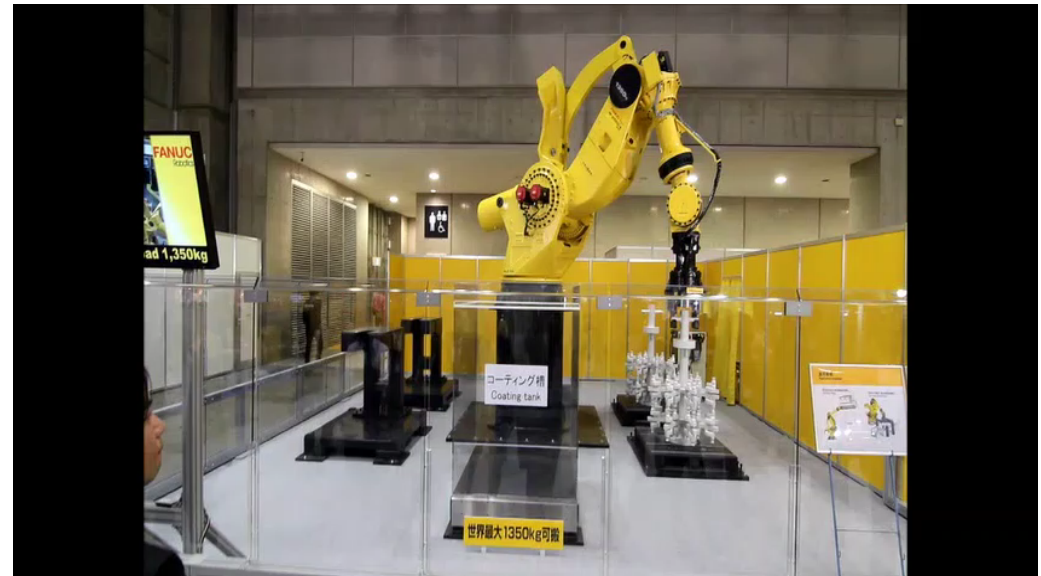
Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- **Education**
- In Factories
- In Warehouses
- In Space



Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- Education
- **In Factories**
- In Warehouses
- In Space



Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- Education
- In Factories
- **In Warehouses**
- In Space

Amazon bought Kiva for \$775M



Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields
(agricultural robotics)
- In resource utilization
(ROV in the oil industry)
- Along power lines
- In Hospitals
- Education
- In Factories
- In Warehouses
- **In Space**



Robotic technology becomes affordable

TurtleBot 2



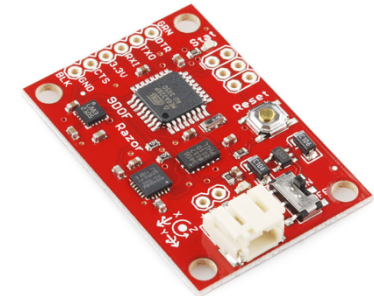
AR.DRONE



Kinect



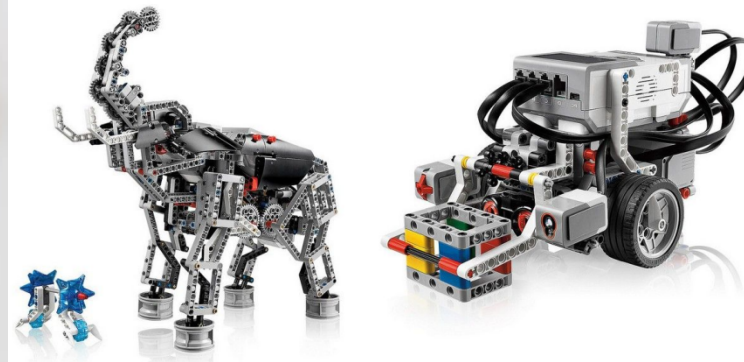
IMU



Raspberry Pi



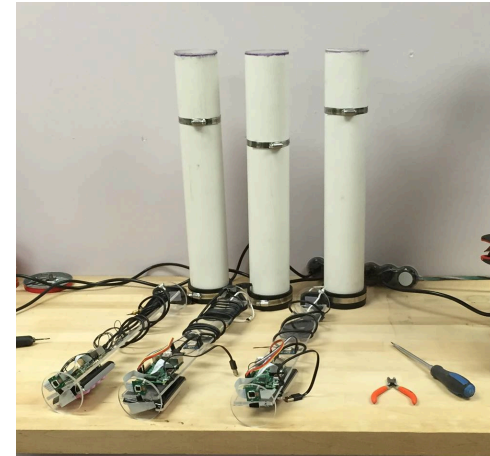
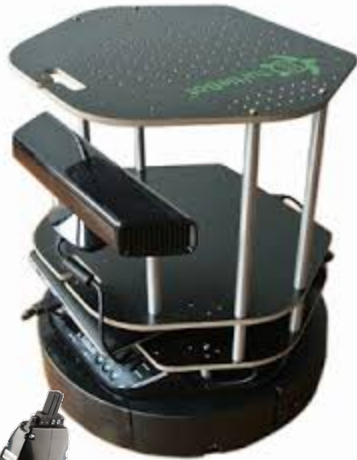
GPS



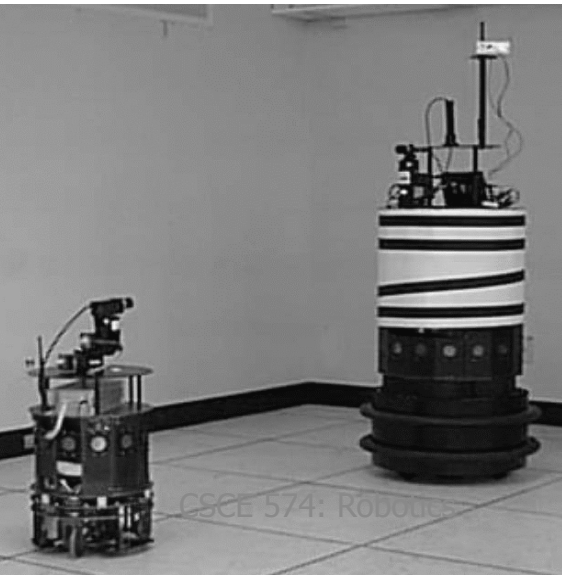
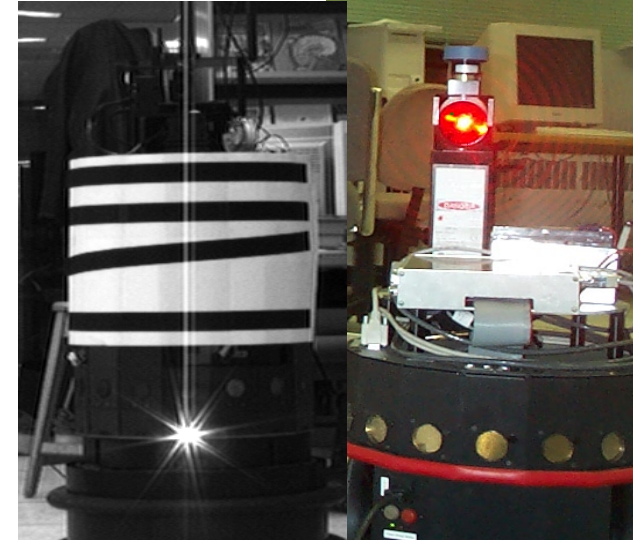
Lego Mindstorm

Robotics at USC

Courses	Professors
CSCE 274	Dr. O’Kane
CSCE 574	Dr. Beer
CSCE 774	Dr. Rekleitis

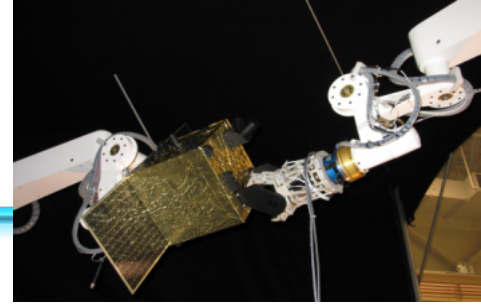


Past Projects





Past/Current Projects



**Complete Optimal Terrain Coverage
using an Unmanned Aerial Vehicle**

Anqi Xu
Chatavut Viriyasuthee
Ioannis Rekleitis



Current work in U/W Robotics



Current work in indoor Robotics



Syllabus

- Week 01:** Syllabus presentation, Round Table, Introduction, History of Robotics. ROS
- Week 02:** Actuators. Locomotion. Sensor (Tactile, Range Finders, GPS, IMU, Position Encoders).
- Week 03:** Reactive Path Planning. Potential Fields. State Estimation, Bayesian Filtering
- Week 04:** Particle and Kalman Filters
- Week 05:** Exploration, HRI
- Week 06:** Mapping: Metric Maps, Topological Maps, hybrids
- Week 07:** Visibility Graphs, Bug Algorithm, Generalized Voronoi Graphs, Atlas.
- Week 08:** Break
- Week 09:** Semantic hierarchy of spatial representations. Configuration Space, PRMs
- Week 08:** Architectures.
- Week 09:** Coverage, Multi-Robot Coverage
- Week 10:** Presentations
- Week 11:** Presentations
- Week 12:** Sensor (Vision).
- Week 13:** Presentations
- Week 14:** Review of Material
- Week 15:** Final



Evaluation

- 5 Homeworks, 10% each: 50%
- Final Examination: 30%
- Midterm: 20%
- Presentation (grad, honors):



Homeworks/Projects

- Using ROS
- Using Simulations
- Using sensor data from real robots
- Using real robots (TurtleBot, Parrot AirDrone2)



Contact

- <http://www.cse.sc.edu/~yiannisr/>
- <http://www.cse.sc.edu/~yiannisr/574/2015>
- **Email:** yiannisr@cse.sc.edu
- **Office hours:** 3A54 -- Tue/Th 14:30-15:30
and by appointment

