Lecture 1 - 2

What's in a Robot?

Robot Components
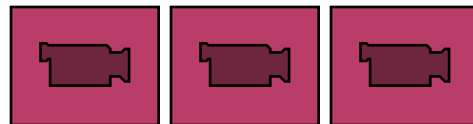
The Robotics Primer (Ch. 3)

Quote of the Week

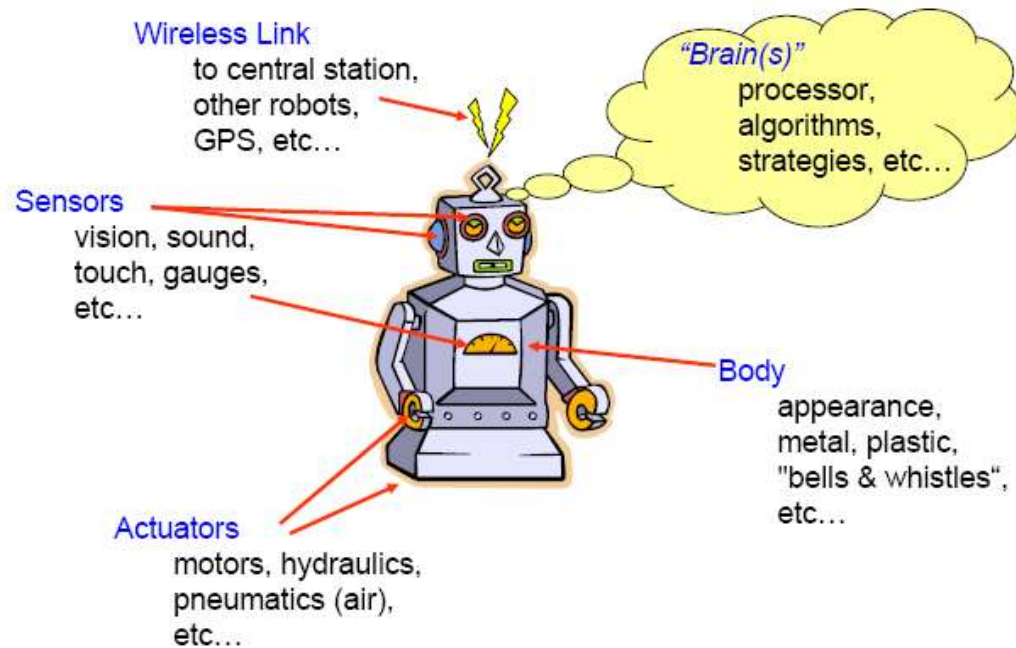*"Don't tell people how to do things. Tell them what to do and let them surprise you with their results."*

George Patton

Robot Components

- Body
- Sensors
- Effectors and Actuators
- Controller

Wireless Link
to central station, other robots, GPS, etc…

"Brain(s)"
processor, algorithms, strategies, etc…

Sensors
vision, sound, touch, gauges, etc…

Body
appearance, metal, plastic, "bells & whistles", etc…

Actuators
motors, hydraulics, pneumatics (air), etc…

Bring your Laptop on Thursday!

Embodiment

the robot has a physical body in the real world

- It must obey the same physical laws that all creatures obey

- It must not run into other things in the environment or itself

- It will have limitations based upon shape

- It limits how fast the robot can move

Sensing

- **Sensors** are physical devices that enable a robot to perceive its physical environment in order to get information

- Sensing allows a robot to know its **state** or description of itself at any point in time

- A robot's state may be visible, partially hidden, or hidden

- A state may be discrete or continuous

- A state space consists of all of the possible states a system can be in

Sensing cont.

- **External state** is the robot's perception of the world

- **Internal state** is the robot's perception of itself

- **Representation** or **internal model** is created when a robot uses its internal state to remember information about the world.

- A robot's **sensor space** or **perceptual space** is the space of all possible sensory readings based upon all of the robot's sensors
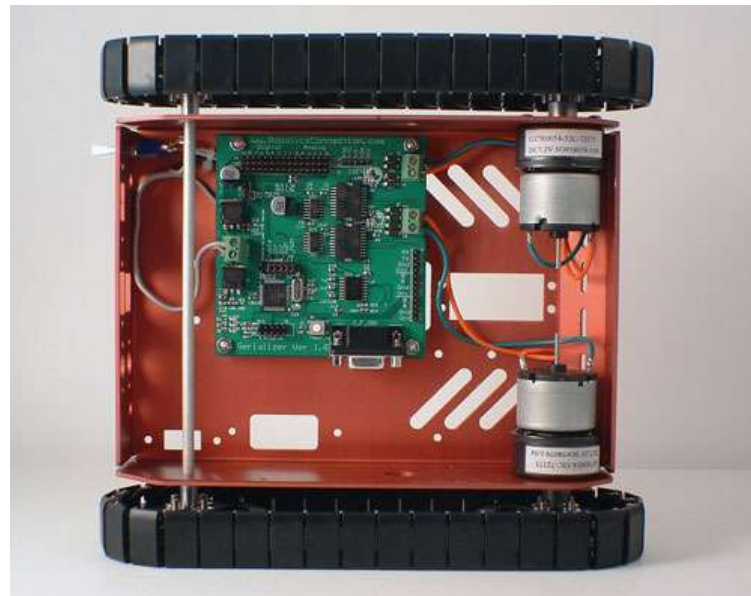
Robot Action

- ◉ Effectors

  - ▪ Devices that have impact on the environment

  - ▪ Effectors must match a robot's task

  - ▪ Controllers command the effectors to achieve the desired task

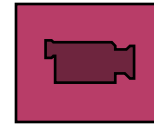 - ▪ Wheels, tracks, legs, grippers

- ◉ Actuators

  - ▪ Mechanisms that allow the effectors to execute an action

  - ▪ Pneumatics, electric motors, hydraulics

Effectors are used for

- Locomotion
  - Moving a robot around, going places
- Manipulation
  - Moving objects around, handling objects
- Effectors for locomotion
  - Legs: walking/crawling/climbing/jumping/hopping
  - Wheels: rolling
  - Arms: swinging/crawling/climbing
  - Flippers: swimming
- Most robots use wheels or tracks for locomotion
- The dimensions in which a manipulator can move are called its degrees of freedom

Mobile Robotics

- Mobile robotics studies robots that move around on the ground but also in the air or water (i.e. Mars rover)

- Manipulator robotics is concerned with robot arms (i.e. industrial robots)

Various mobile robots

Honda Walking

NASA Nomad

Sony AIBO

ROV Tiburon Underwater

Pioneer

BR700 Cleaning Robot

Autonomy

- **Controller** provide hardware and/or software that makes the robot autonomous by using the sensor inputs to decide what to do and control the effectors to execute that action.

- Controllers play the role of the brain and the nervous system

- **Autonomy** is the ability to make one's own decision and act on them