Subareas of Robotics

Sensing and Perception (perception)

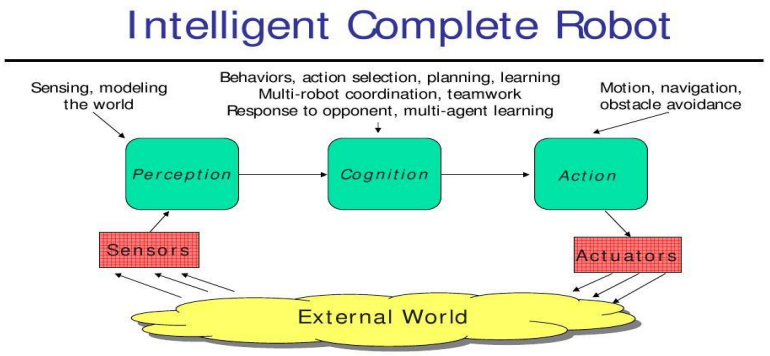
Range sensing, vision, filtering, sensor modeling, …

Motion and Control (action)

PID control, open/closed loop control, action modeling, walking, ...

Decision Making (cognition)

Behavior architectures, planning, AI, developmental psychology, ...



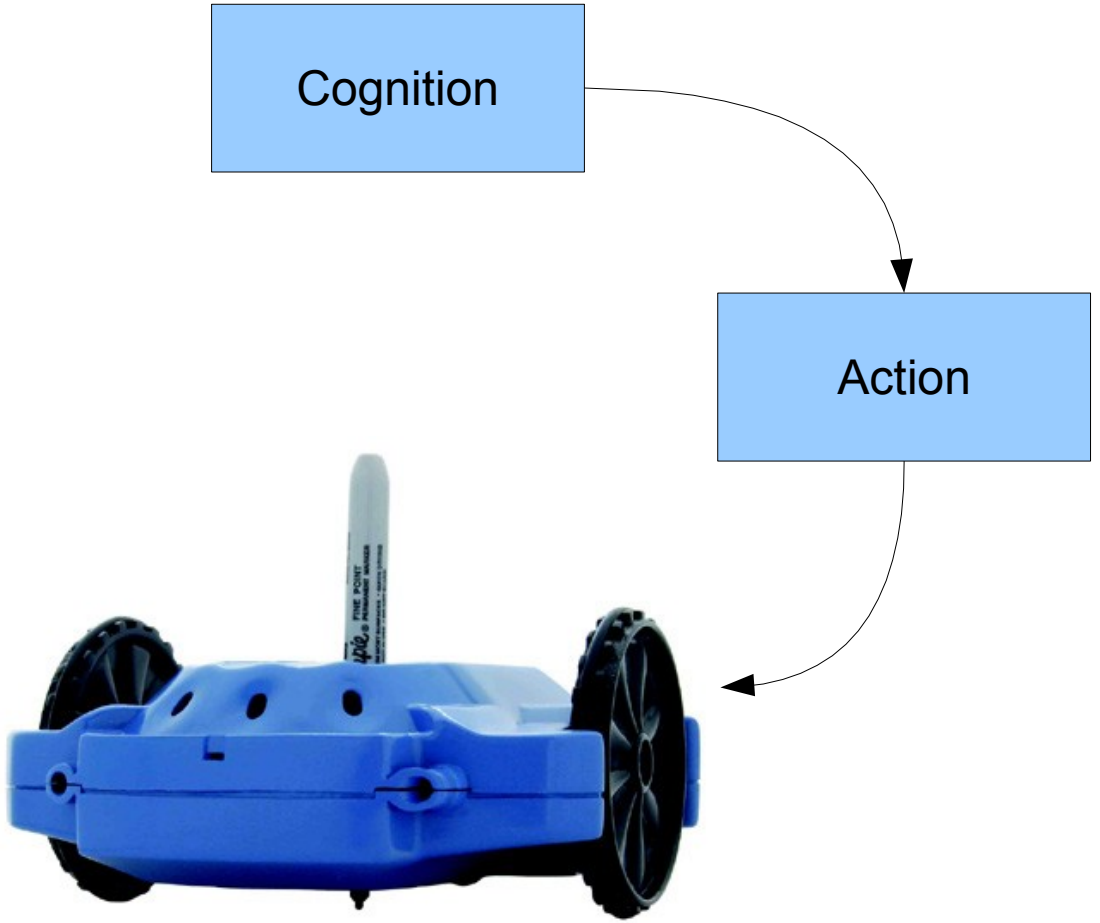
Sensing

Why Sense?

- To acquire information about the environment and oneself
- Open loop control suffers from
  - Uncertainty, changes in the world
  - Error detection and correction

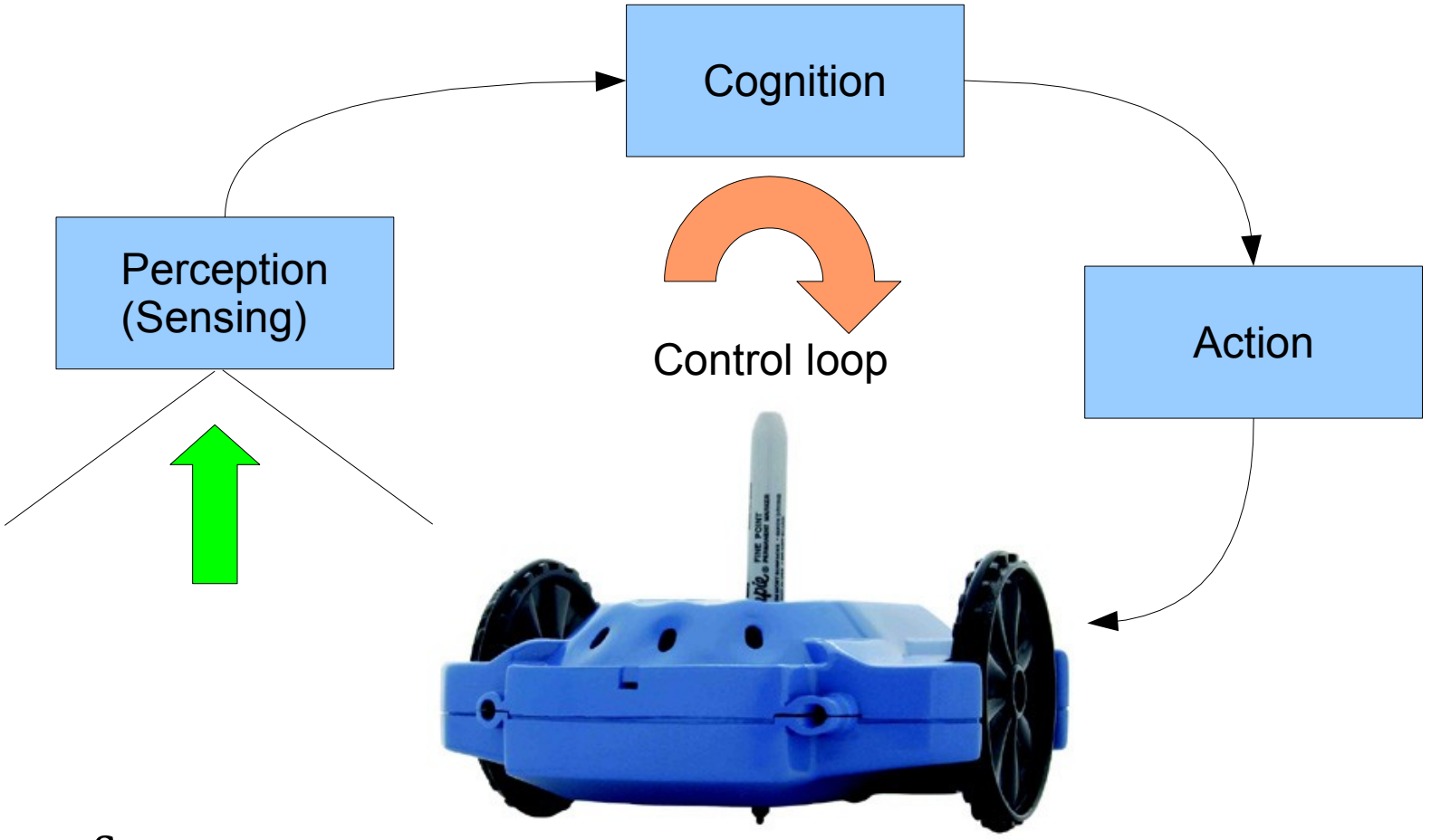
Open Loop Control

- No sensing input



The Sensing Loop

- "Feedback" control



Issues to Address

- What sensors to use?
- How to model the sensor?
- How to calibrate intrinsic/extrinsic models?
- What low-level processing?
- What high-level processing (perception)?

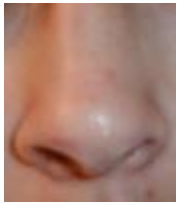
Comparison: Human Sensors

Sense:

- Vision
- Audition
- Gustation
- Olfaction
- Tactition

Sensor:

- Eyes
- Ears
- Tongue
- Nose
- Skin



Robot Sensors

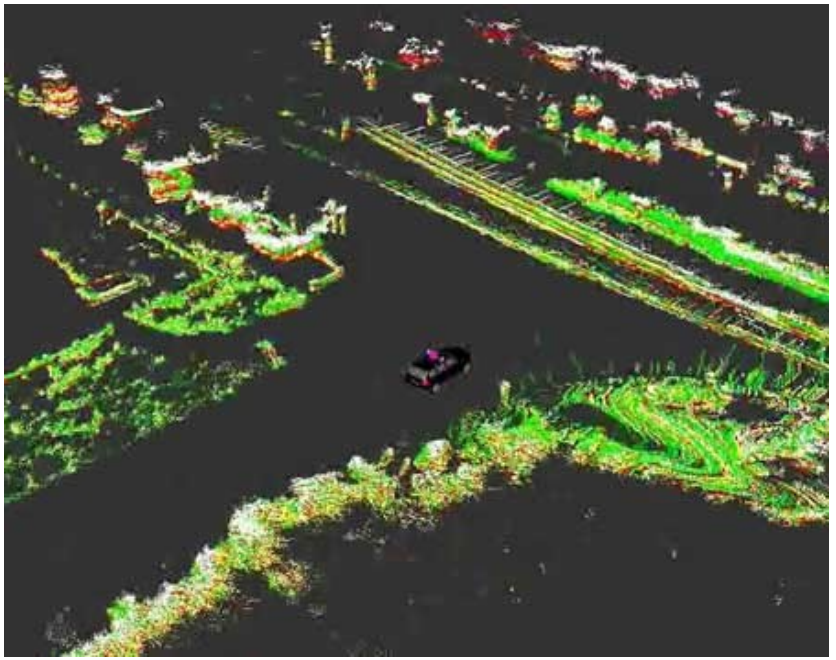
Sense:

- Equilibrioception
- Proprioception
- Magnetoception
- Electroception
- Echolocation
- Pressure gradient

Sensor:

- Accelerometer
- Encoders
- Magnetometer
- Voltage sensor
- Sonar
- Array of pressure sensors

LiDar Sensing



Popular Sensors in Robotics

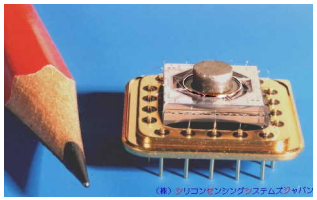
- LiDar
- Infrared
- Radar
- Sonar
- Cameras
- GPS
- Accelerometers
- Gyros, encoders
- Contact switch








Other Robot Sensors


Gyroscope


Lever Switch

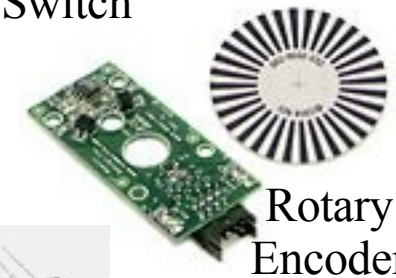

Linear Encoder


GPS


PIR


Accelerometer


Piezo Bend


Rotary Encoder

Resistive Bend


Pendulum Resistive Tilt


Pyroelectric Detector

Gas


Radiation


Pressure


UV Detector


IR Modulator Receiver


Metal Detector

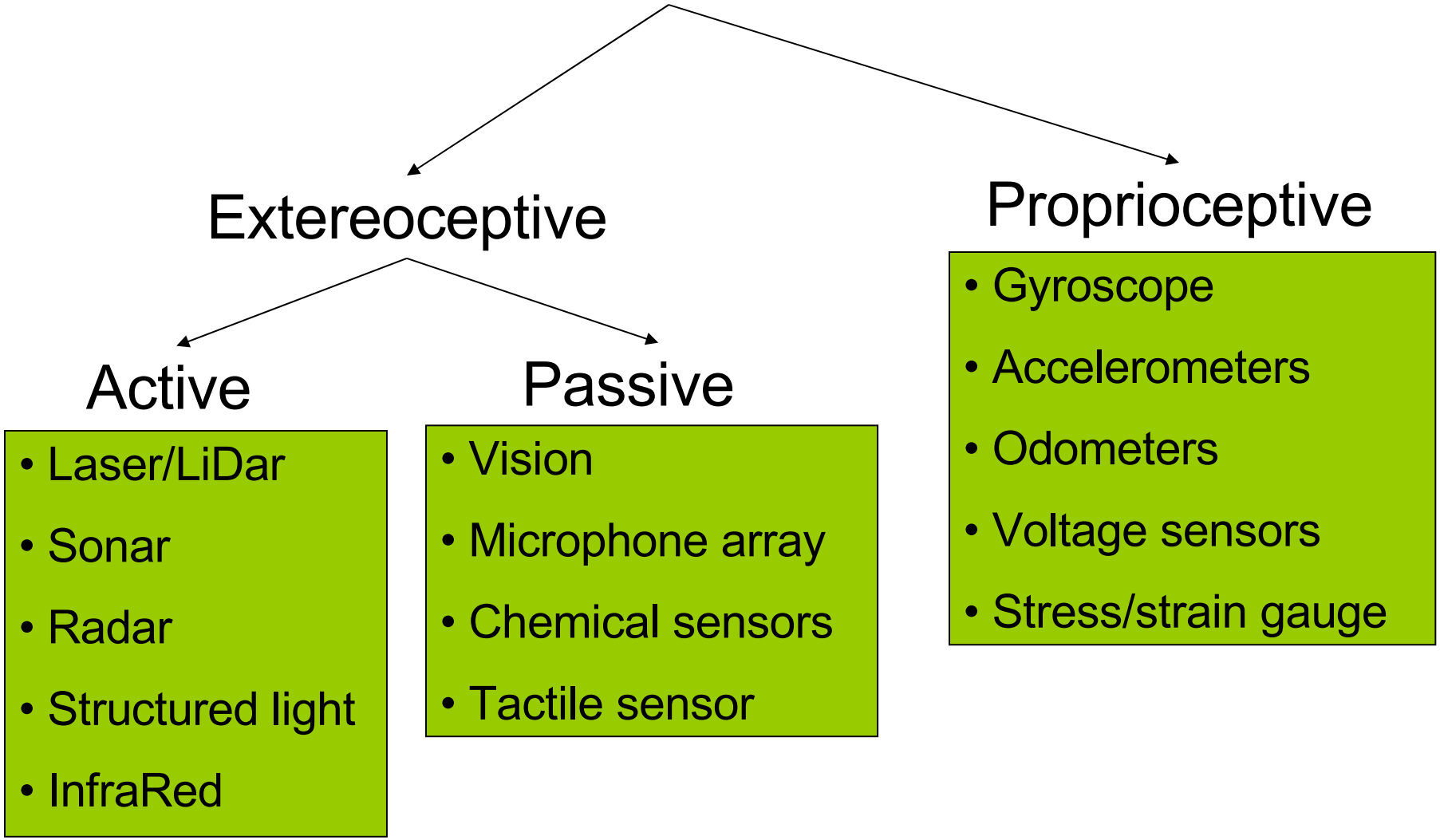

CDS Cell


Compass


Magnetometer


Magnetic Reed Switch

Sensing Classification



Observers

Sensors don’t sense the world directly.

- They just respond to its stimulation.

By gathering lots of sensor input over time, we can estimate what the world is like.

Assumes models of the nature of the world, and of sensor properties, such as error types.