CS 4758/6758: Robot Learning

Spring 2010: Lecture 5

Ashutosh Saxena

Sensors on a Human

Sight: image from a camera

Sound: microphone on a robot

Touch

Taste/Smell

Inertial?

Range sensor?

Sensors and Algorithms

- *Choice of sensors* is as much important as *choice of algorithms*.

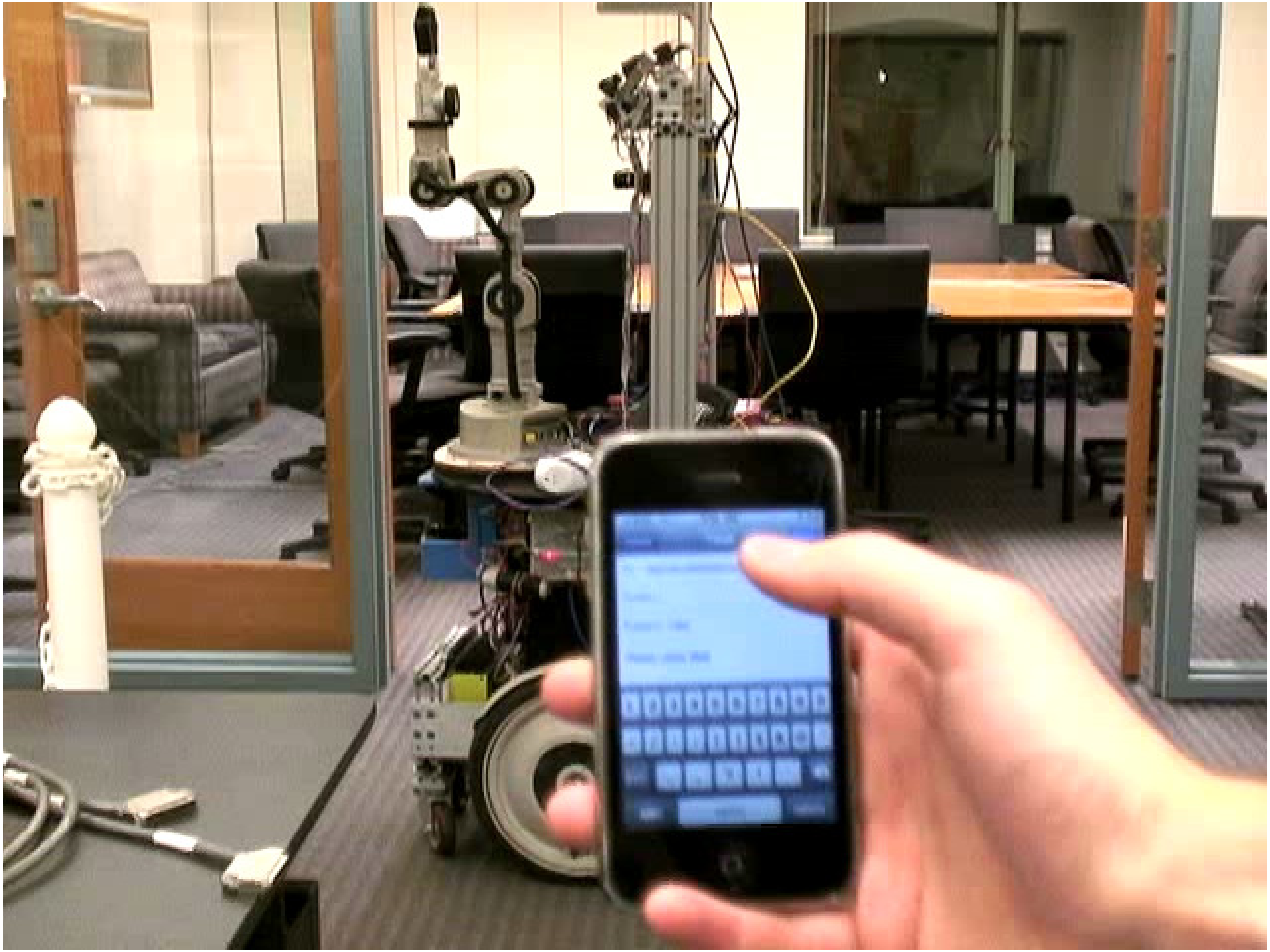
- Often people forget about one of them.

Cameras

Several Types of Cameras

- Usual digital cameras
- Pan-Tilt-Zoom

Journey
Genius



Sensors

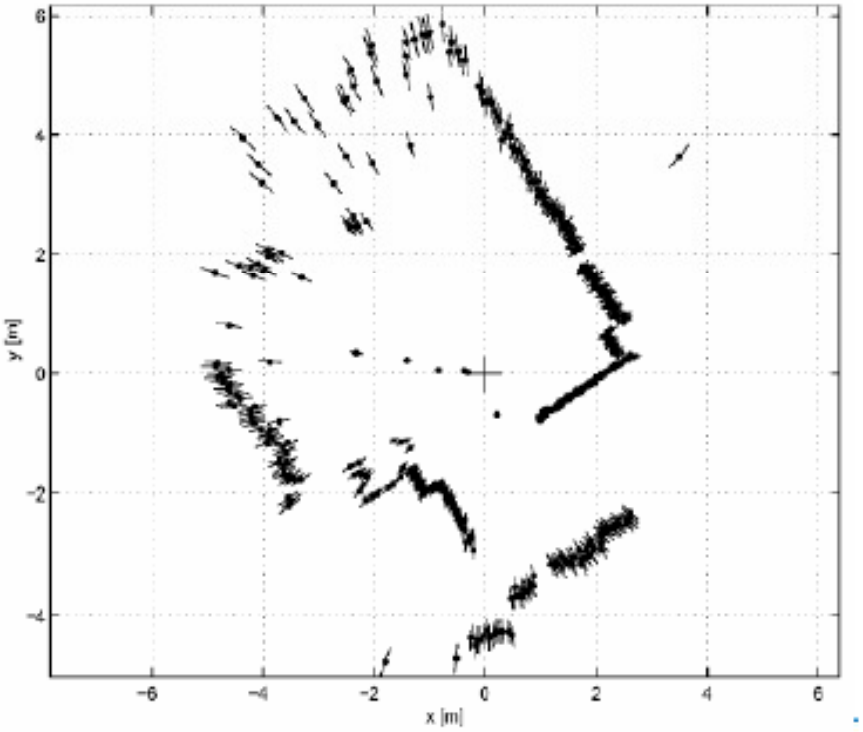
Inertial sensors

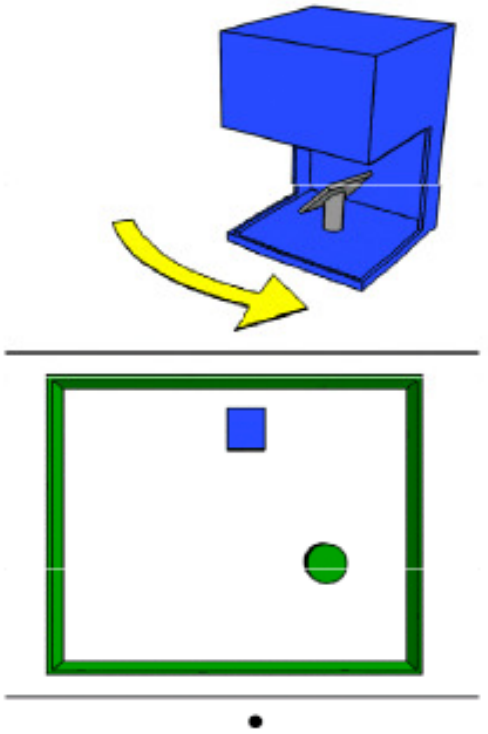
Gyros, accelerometers, compass.

Sensors

- Ranging sensors
  - Ultrasonic, laser rangefinder (time of flight)
  - Structured light, stereo (triangulation)
  - Infra-red (reflective intensity)

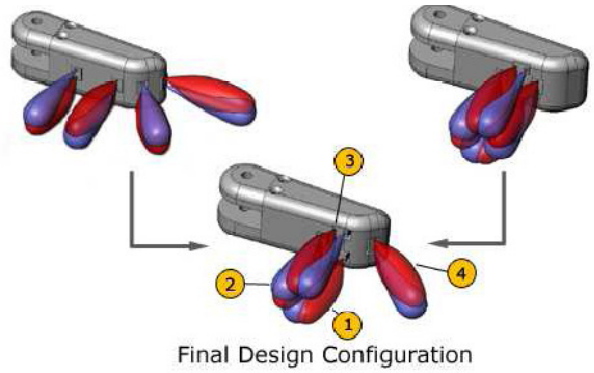
Laser Range Finders





Sensors

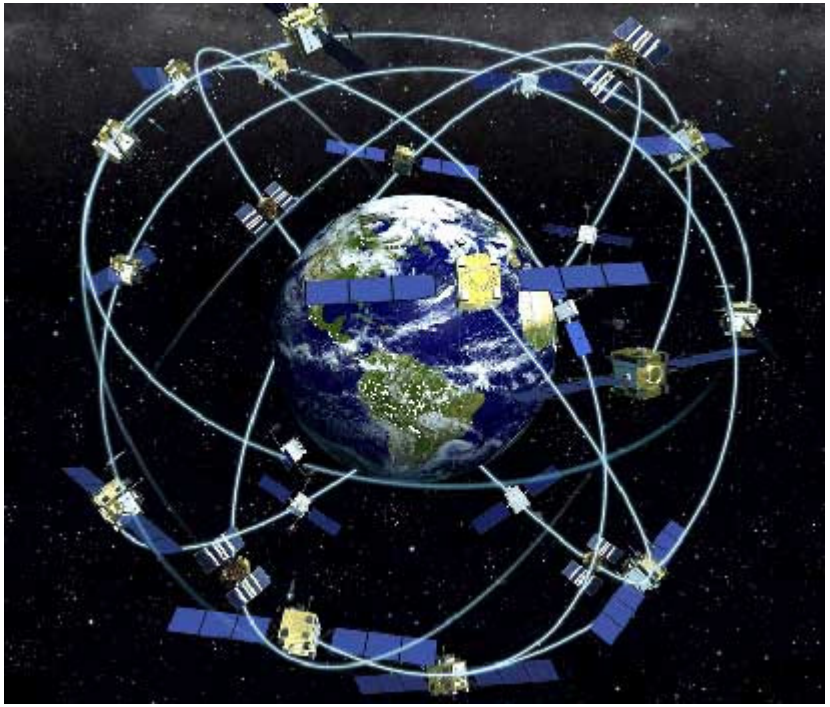
- Touch / Haptic sensors
  - Motor Torques
  - Capacitive / resistive touch (think iPhone)
  - Optical



Final Design Configuration

Sensors

- Localization
  - GPS
  - Indoor GPS (Vikon)
  - RFID



Sensor: Statistical Modeling

Additive error:

$$y = x + \text{error}$$

Multiplicative error;

$$y = x * \text{error}$$

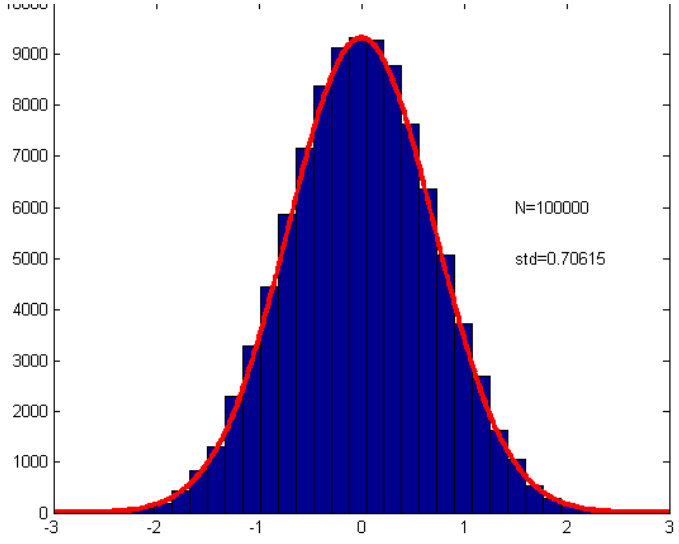
Other types of errors?

Additive Errors

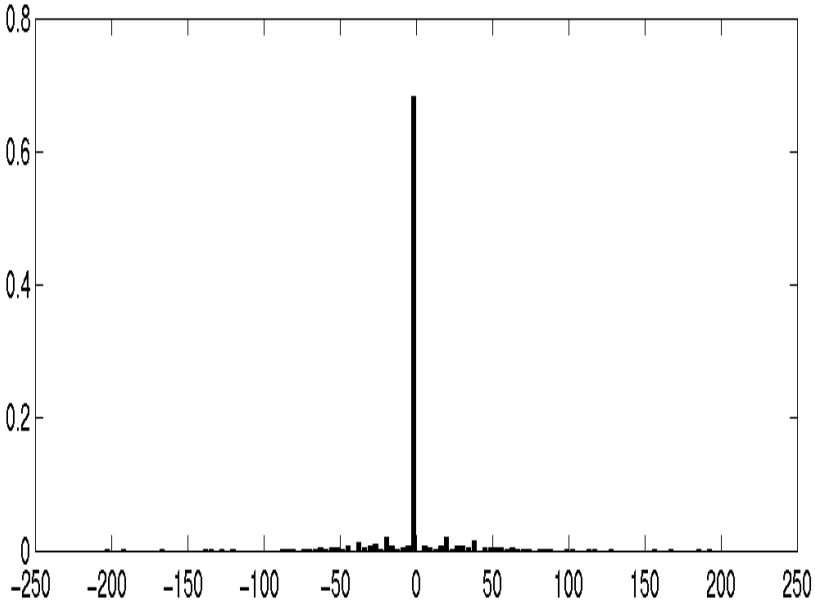
- Characterizing the error of the sensor
  - Helps us in combining data from different sensors.

- Represent error as a random variable.
  - Interested in modeling P(error) as statistical distributions.

Statistical modeling



P(error) for Sensor 1



P(error) for Sensor 2

Which sensor is better?

Modeling the measurement

y = x + error

error (= y-x) is modeled with a statistical distribution.

P(y|x) notation saying we model the observation y given the real value x.

Go to blackboard.