Simple Sensors

What’s the difference between an active sensor and a passive sensor?
- Passive sensors consist of a detector only.
  - They sense some property of the environment that is already "out there"
- Active sensors include an emitter and a detector.
  - The emitter emits a signal and the detector detects it.

What feature determines whether a sensor is simple or complex?
- The amount of processing needed to turn the data from the sensor into useful information
- Note: Active/passive and simple/complex are independent features

What are some kinds of switches?
- Contact sensors
  - Detect contact with an object
- Limit sensors
  - Detect when a mechanism has moved to the end of its range
- Shaft encoders
  - Detect how many times a motor shaft turns by having a switch change state with each revolution of the shaft

Contact Sensor Switch

How could you build a simple whisker sensor from a switch?

What you could do
- Wire attached to switch (you will build one of these soon)
- Wire in conductive tube.

Rat Whiskers
Light Sensors

Photocell
- A variable resistor
- Resistance is low when illuminated and high in the dark
- Is this a light sensor or a dark sensor?
- Uses:
  - Light intensity
  - Differential intensity (2 units)
  - Break beam (active) sensor

Polarized light
- Waves travel only along a particular plane
  - This is called the “characteristic plane” of the light
  - Polarizing filter only transmits light with a certain characteristic plane
- How could you use this fact to construct polarized light sensors?

Photodiodes

Why use a photodiode rather than a photocell?
- Photodiodes are much faster to respond than photocells

Photodiodes

Sensors made with LEDs and Photodiodes

What can you do with light reflectivity?
- Detect the presence of an object
- Detect the distance to an object
- Detect a surface feature (line on the floor, e.g.)
- Read a bar code
- Measure the rotation of a wheel (position, speed, total rotations = distance

Why does ambient light create a problem for reflectivity sensors?
- Because the sensor must subtract the ambient light from the detector reading in order to “see” the reflected light.
- You would have to know the amount of ambient light. How can you do that?
- Take a reading with the emitter off
  - This is an example of sensor calibration.
Sensor Calibration

- Calibration is the process of adjusting a mechanism so as to maximize its performance (accuracy, range, etc.). Sensors require calibration, some only initially, and others continually, in order to operate effectively. Calibration may be performed by the designer, the user, or the sensor mechanism itself.

Infra Red Light

Shaft Encoders

Resistive Position Sensors

Assignment

- Assignment: Work through Ch 1 of Robotics with the Board of Education Shield for Arduino at http://learn.parallax.com/node/129
  – Answer the challenges. Consult the solutions ONLY AFTER you have worked out the answers on your own. You will be required to do exercises like this on the next quiz.
- Work through Ch 2. Read and understand all of exercises.
  – Do everything you can do without the bot itself. And understand all of it.