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Sensors and Sensing

Spring 2026

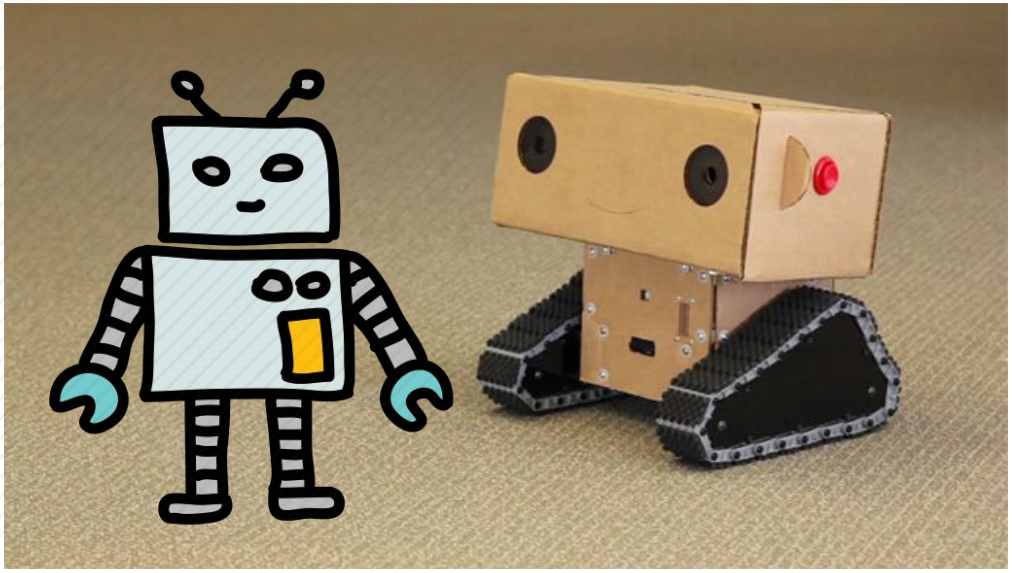
Quick Look at Sensors

Lots of sensor types:

- Proximity/Distance
  - Tactile
  - Ultrasonic
  - Capacitive
  - etc
- Orientation
- Temperature
- Sound Level
- Sensors on your robot

Candy Question!

- What is the difference between a digital and analog sensor?
- Name an example of each!



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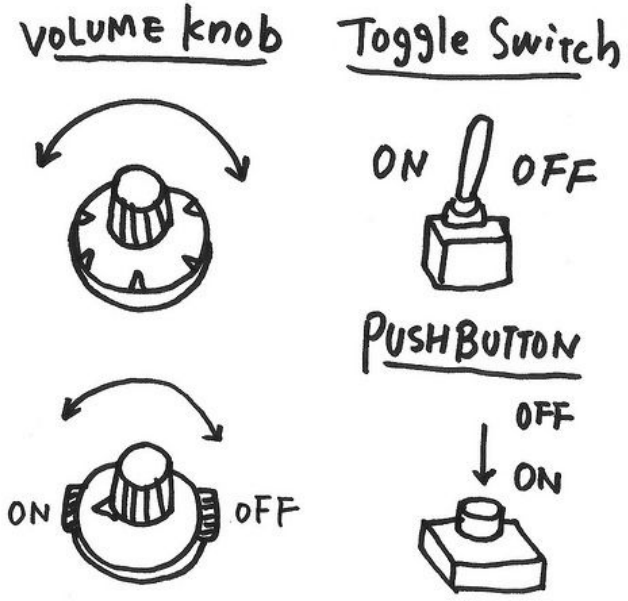
Answer:

- A digital sensor returns a 0 or a 1
  - Example: bump sensor, button
- An analog sensor returns a value from a range based on the voltage level.
  - Examples: photocell, IR rangefinder



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Sensors: Proximity: Reflective

- Camera sensors
  - Computer Vision
- Photoresistors
- Photodiodes
- Vary in price due to range of quality

Sensors: Proximity: Tactile

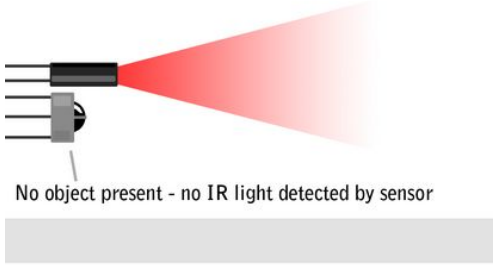
- Limit Switches
- On-Off Switch

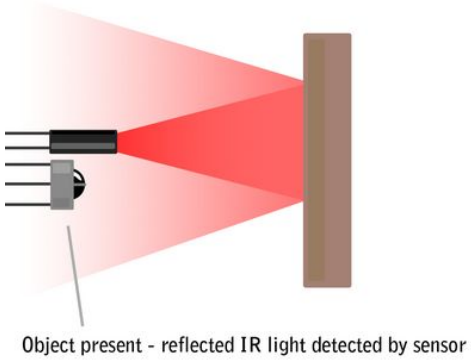
Input changes once the Switch is pressed.

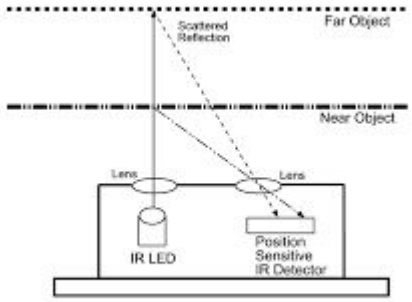
Extremely easy to read/ either On or Off

Sensors: Proximity: Infrared

- Bounces IR beam off target
- Cheap, reliable
- Analog, returns distance
- Range: 5 – 150 cm
- Some similar sensors use ultrasonic instead

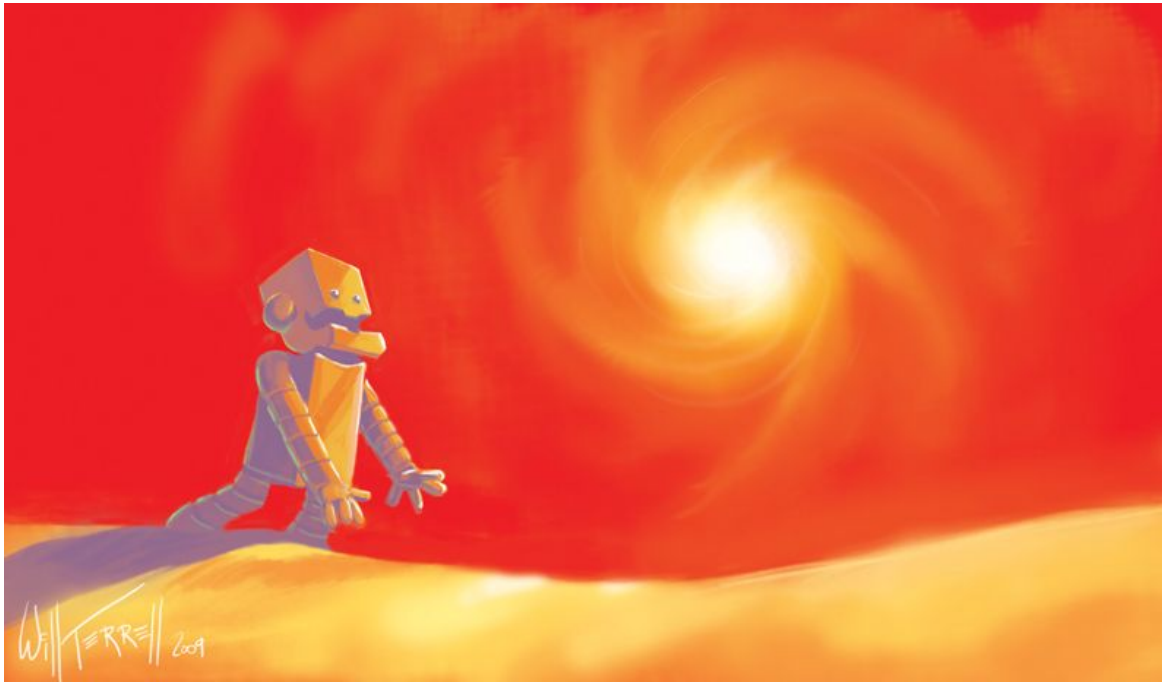






Candy Question!

- Do IR sensors work well in direct sunlight?
- Why don't we always use ultrasonic sensors?



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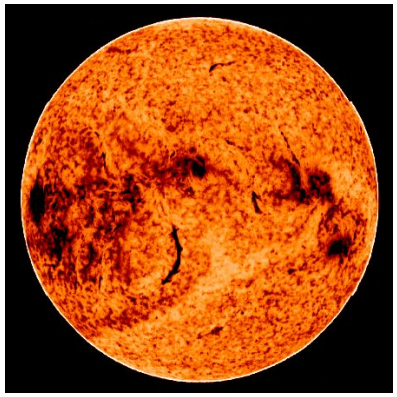
Answer:



- IR sensors do not work well in direct sunlight because the light and heat from the sun interferes with the sensor readings. In other words, the sun emits IR radiation as well, interfering with the sensor.

- Multiple robots running ultrasonic sensors interfere with each other, since one robot may pick up another robot's soundwaves.

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Sensors: Proximity: Capacitive

- Detects changes in capacitance
- (Like a touch screen)
- Requires target to be of somewhat conductive material
- Analog output
- Range: 2 – 40 mm

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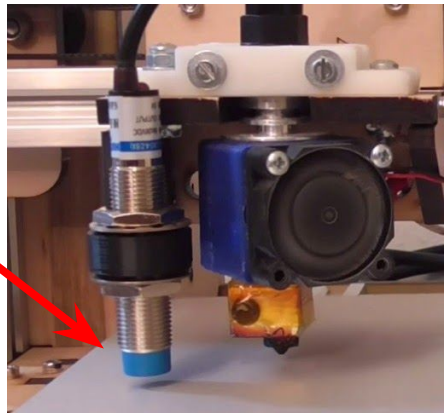
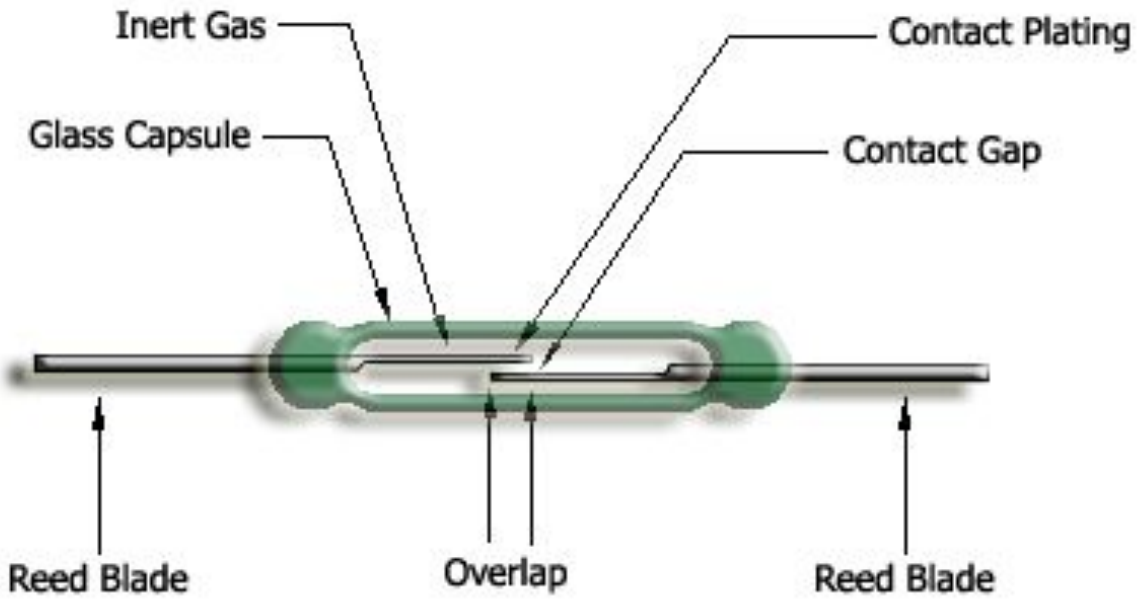
Sensors: Proximity: Inductive

- Similar to Capacitive but requires metallic target
- Either analog or binary output
- Range: 1 – 60 mm
- You might have seen them in 3d printers



Sensors: Proximity: Magnetic

- Hall Effect Sensor
- Reed Switch
- Binary output
- Range: 1 – 5 mm
- Used in some types of motors



Sensors: Proximity: LIDAR

- Basically a spinning laser sensor (which is similar to infrared)
- Useful for environment mapping
- And for speed traps
- Range: 5 cm – 100 m

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