Robot hardware

Sensors

Types of sensors

- **Encoders** measure the amount of rotation in a joint or wheel, often using an **encoder wheel** and an **emitter-detector pair**.
- **Infrared sensors** measure distance by emitting IR light and measuring the intensity of the signal reflected back into the sensor.
- **Ultrasonic (sonar)** sensors measure distance by emitting a pulse of sound and measuring its time-of-flight.
- **Lidar** measures distance using phase shifts in highly coherent light.

Types of sensors

- **Cameras** record the color and intensity of visible light, possibly aided by mirrors of various shapes.
- **RGBD (red-green-blue-depth)** sensors provide images with an additional channel representing the distance to the nearest object in that direction, usually by projecting a pattern of infrared dots onto the scene and measuring the distortion in how the dots appear.

Types of sensors

- **Compasses** measure orientation with respect to Earth's magnetic field.
- **GPS (Global Positioning System) receivers** use satellite signals to determine a device's position on the Earth.
- **Inclinometers** measure the relative direction of gravity.
- **Inertial measurement units** (IMUs) combine 3 accelerometers and 3 gyroscopes to measure linear and angular acceleration.