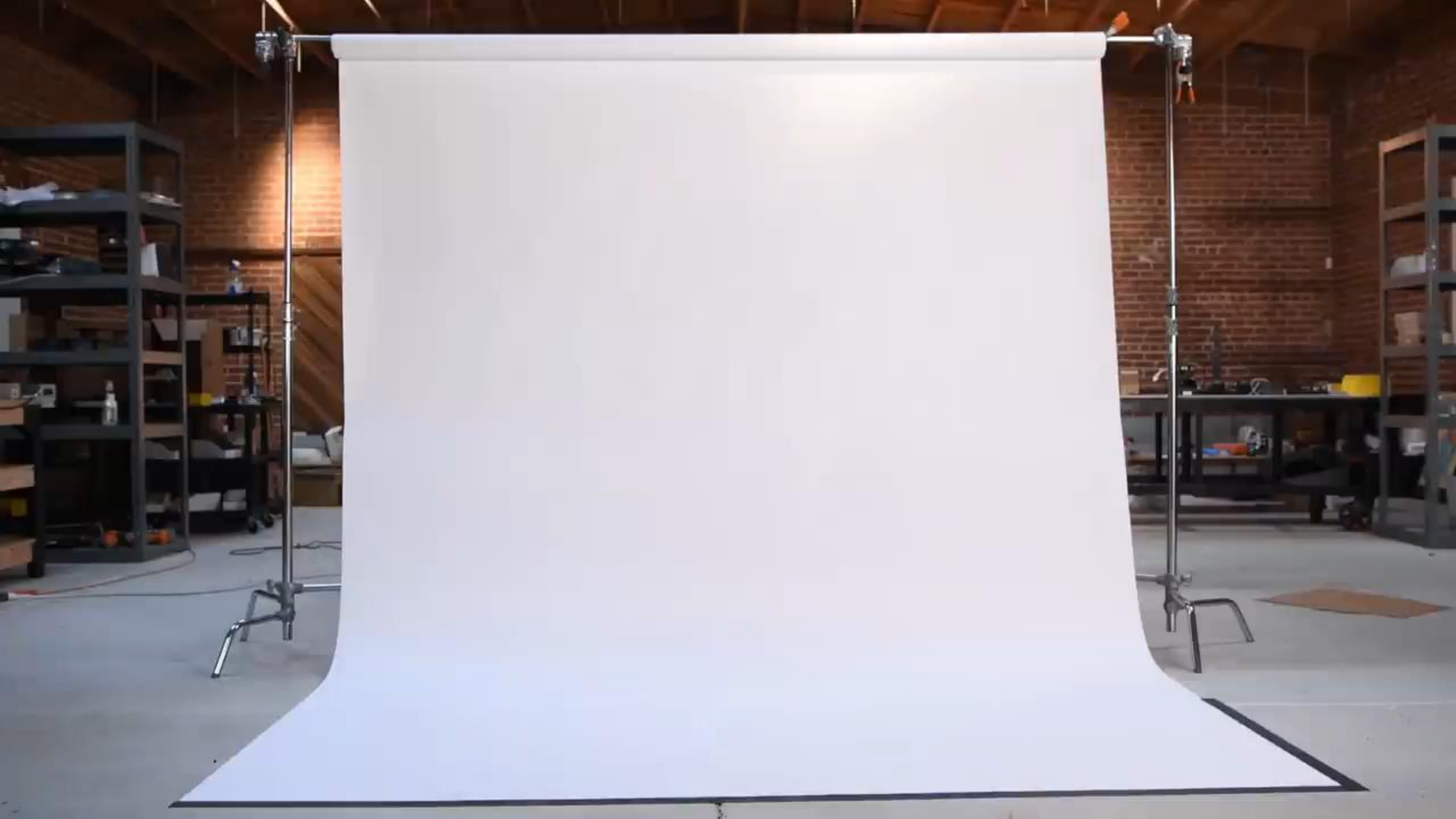
Robot Arms

Reading: Modern Robotics 1



This Lecture

- What are the parts of a robot arm?
- What is a serial robot arm?
- What is a parallel robot arm?
- What are some common sensors for robots?

Parts of a Robot Arm

Link
Rigid body

Joint
Connection between two links

Actuator
Control the joint values

End-effector
Gripper for manipulating objects

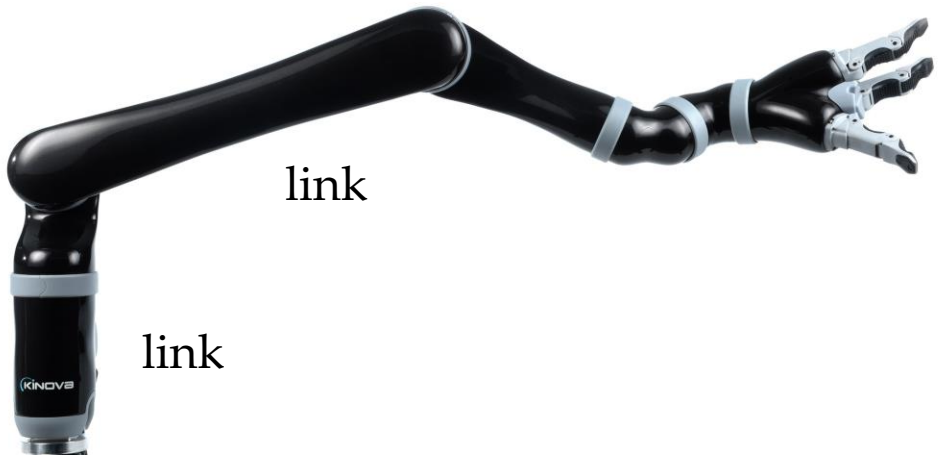
Parts of a Robot Arm

Link
Rigid body

Joint
Connection between two links

Actuator
Control the joint values

End-effector
Gripper for manipulating objects



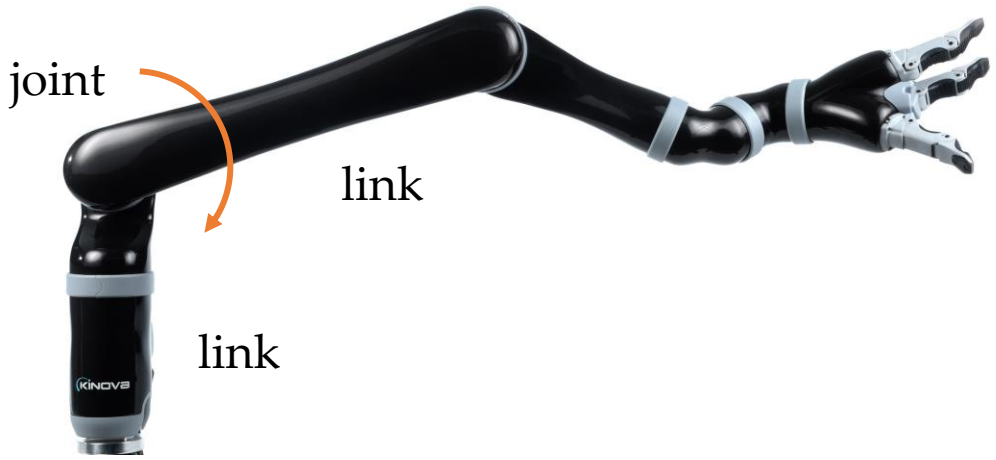
Parts of a Robot Arm

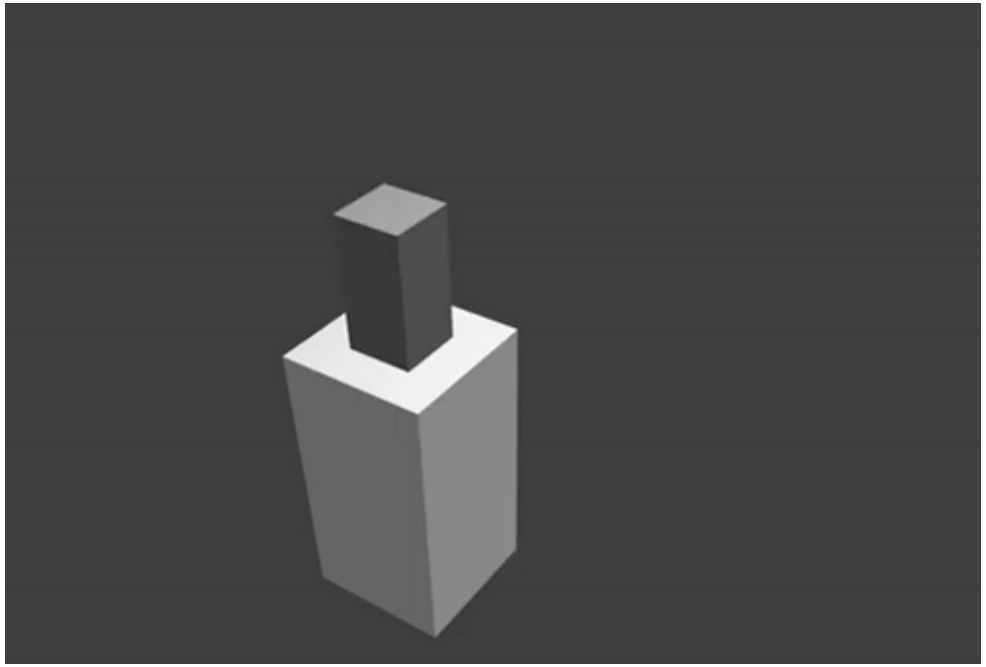
Link
Rigid body

Joint
Connection between two links

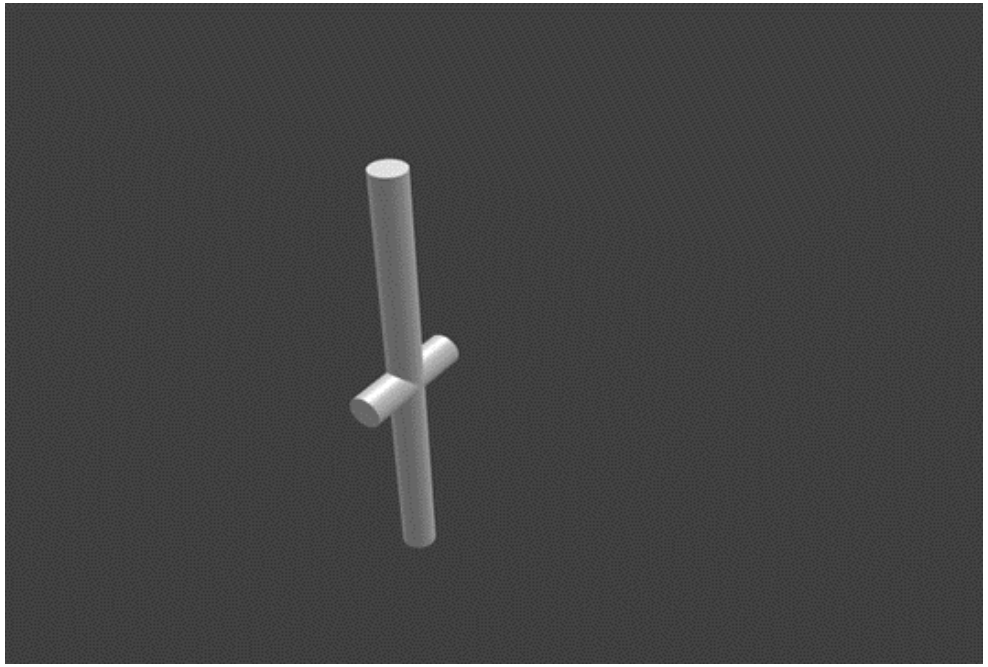
Actuator
Control the joint values

End-effector
Gripper for manipulating objects





Prismatic Joint



Revolute Joint

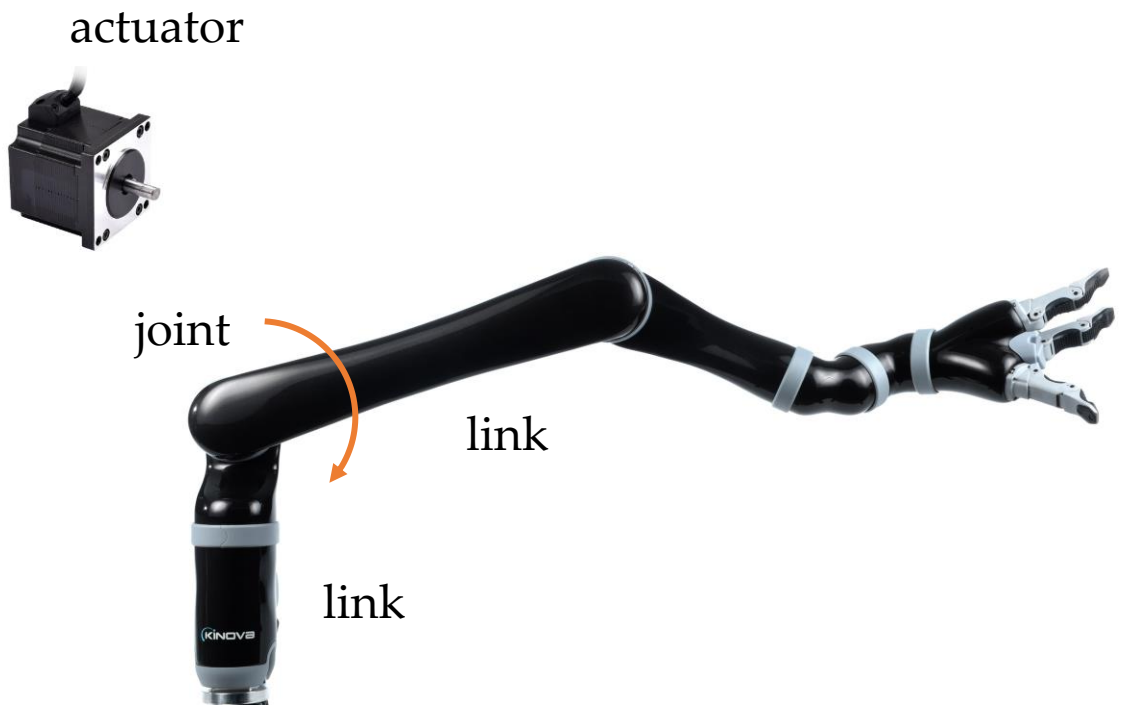
Parts of a Robot Arm

Link
Rigid body

Joint
Connection between two links

Actuator
Control the joint values

End-effector
Gripper for manipulating objects



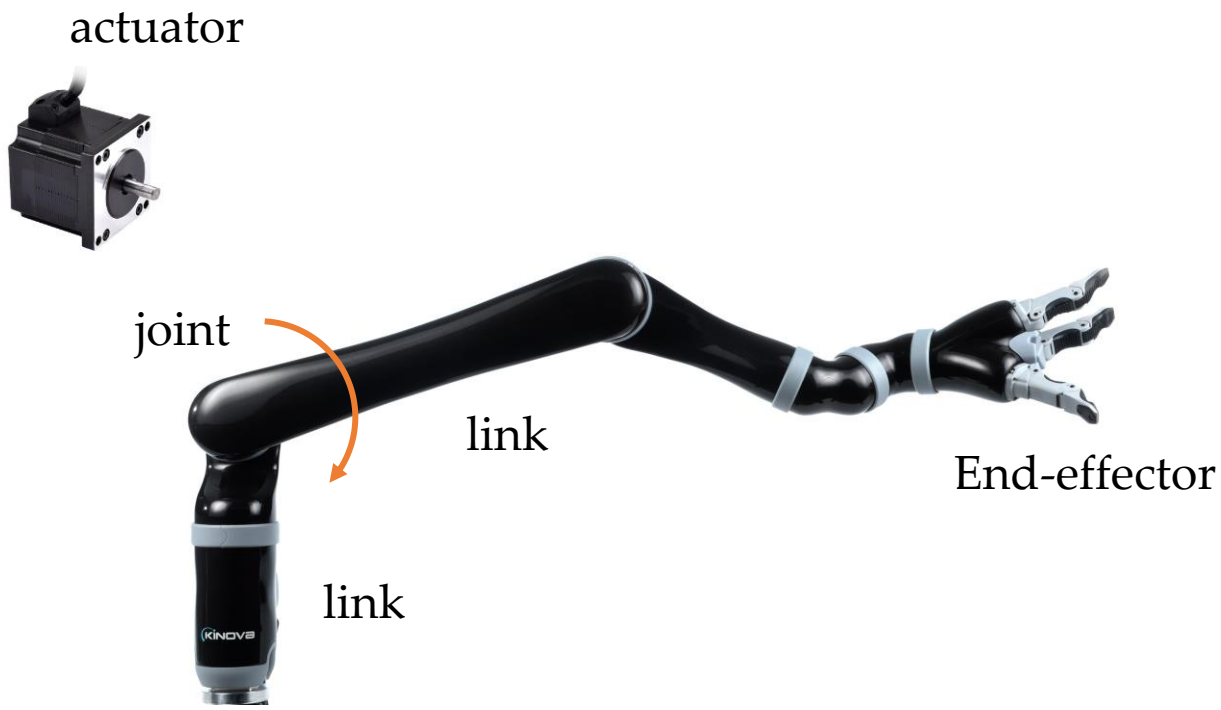
Parts of a Robot Arm

Link
Rigid body

Joint
Connection between two links

Actuator
Control the joint values

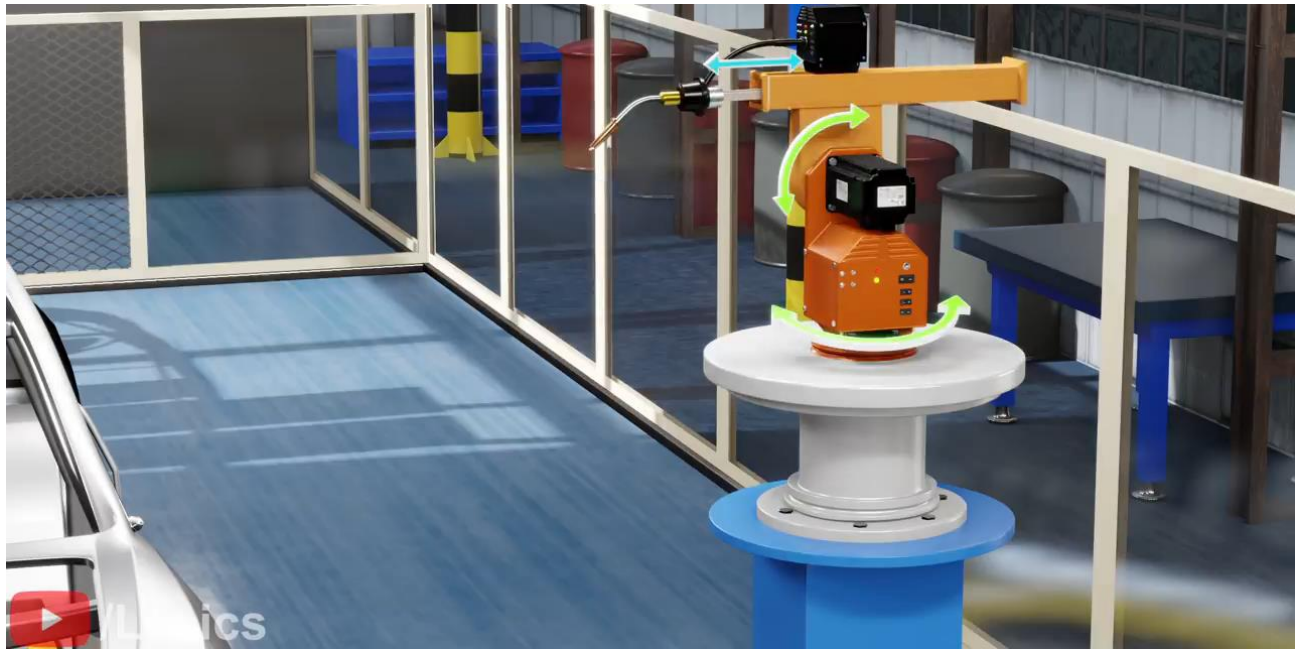
End-effector
Gripper for manipulating objects



Workspace

All positions and rotations the end-effector can reach

Joint space is all the possible joint values



Serial Robot

Open-chain with one connection to the ground.

Example: your arm

Parallel Robot

Closed-chain with one or more kinematic loops.

Example: both of your arms when holding hands together

Pros and Cons

Pros and Cons

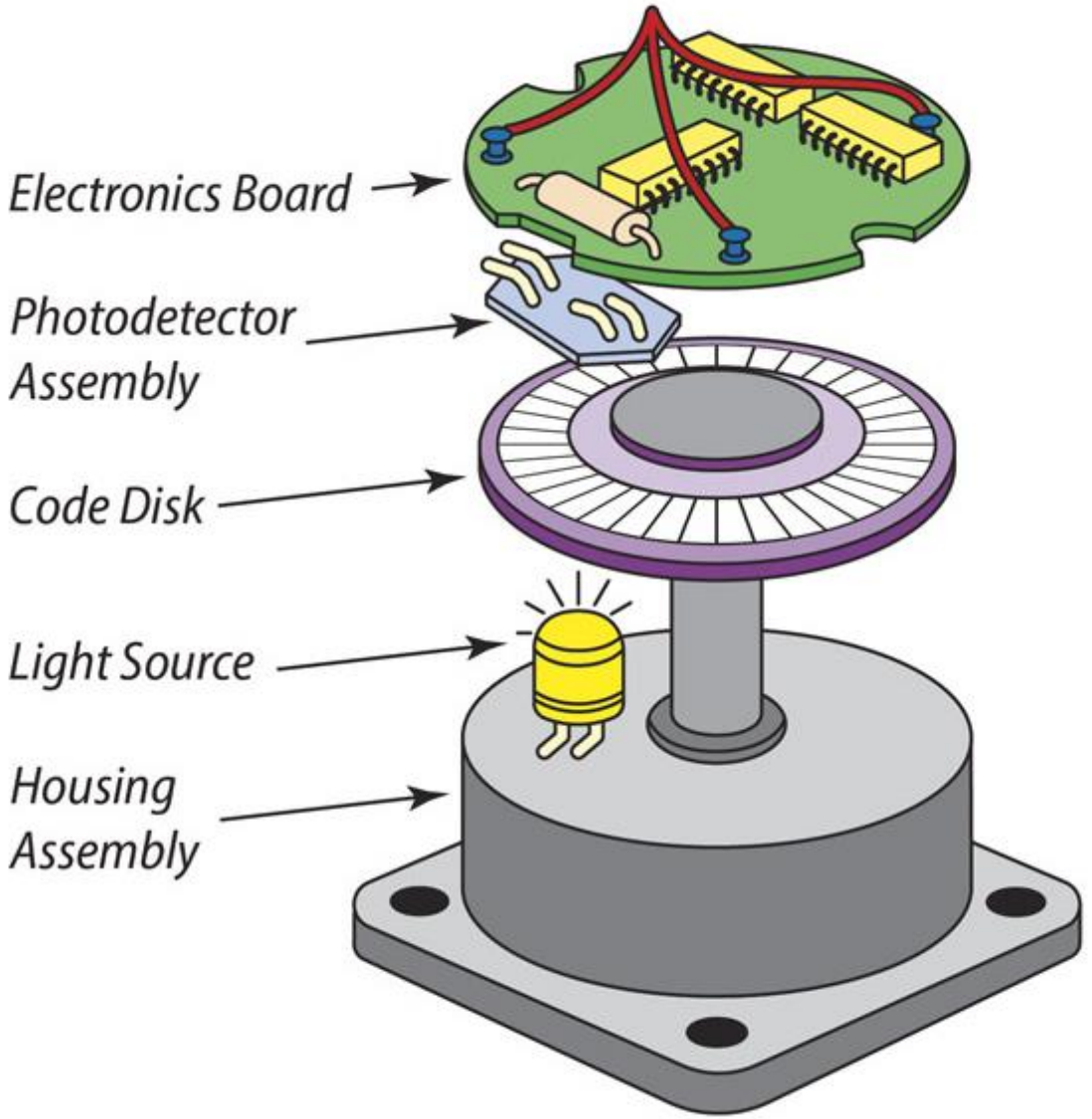
- Larger workspace
- Each new joint gives more mobility

- More precise (each arm helps to balance errors)
- Faster motions

How do robots **sense** the world?

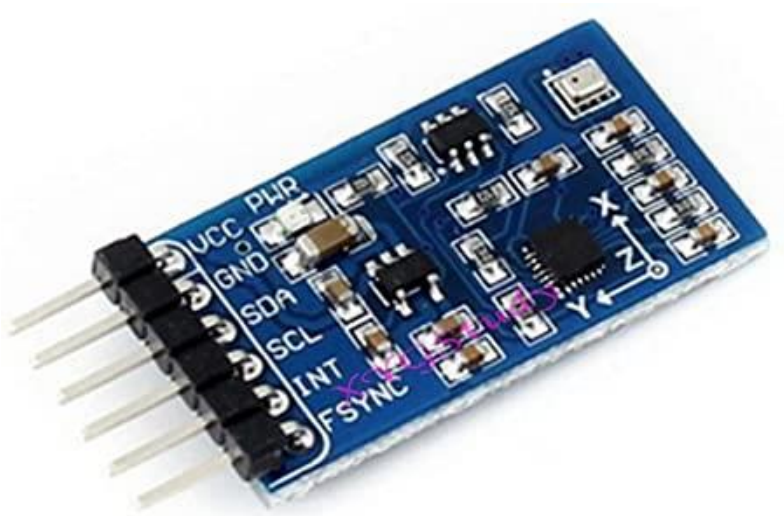
Encoder

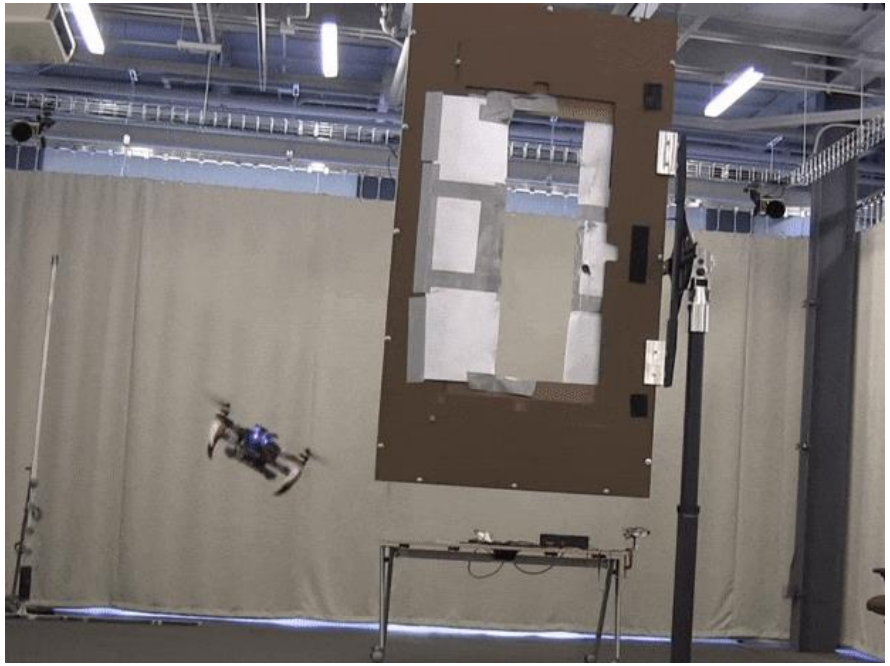
- Used to measure position of revolute or prismatic joints



IMU

- Accelerometers + gyroscopes
- Useful for measuring position and orientation of quadrotors



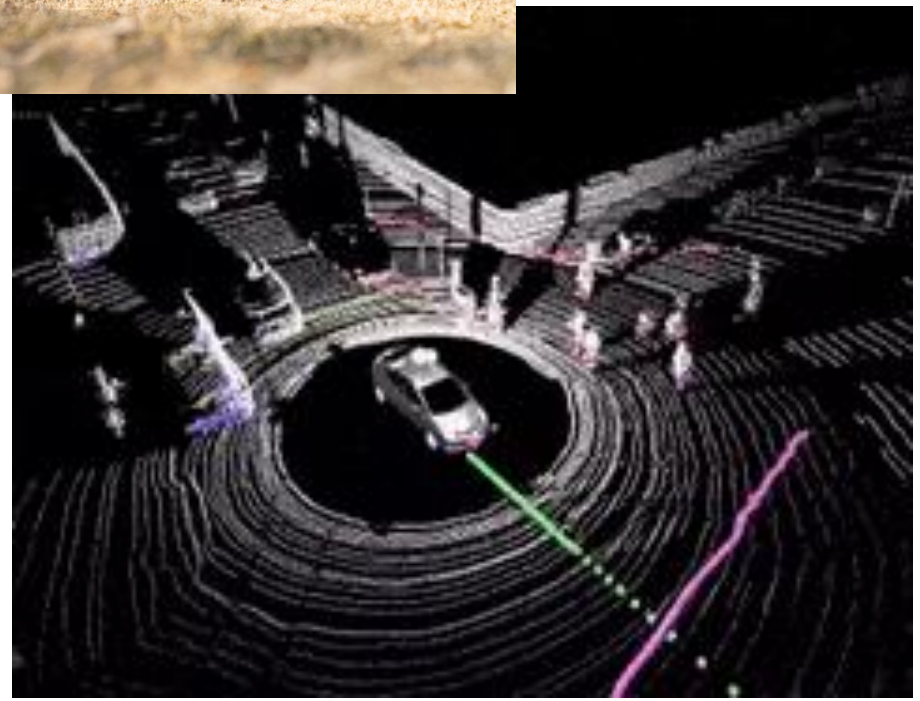


Force / Torque Sensor

- Measures forces and torques along anywhere from 1 – 6 axes
- Can be composed of strain gauges

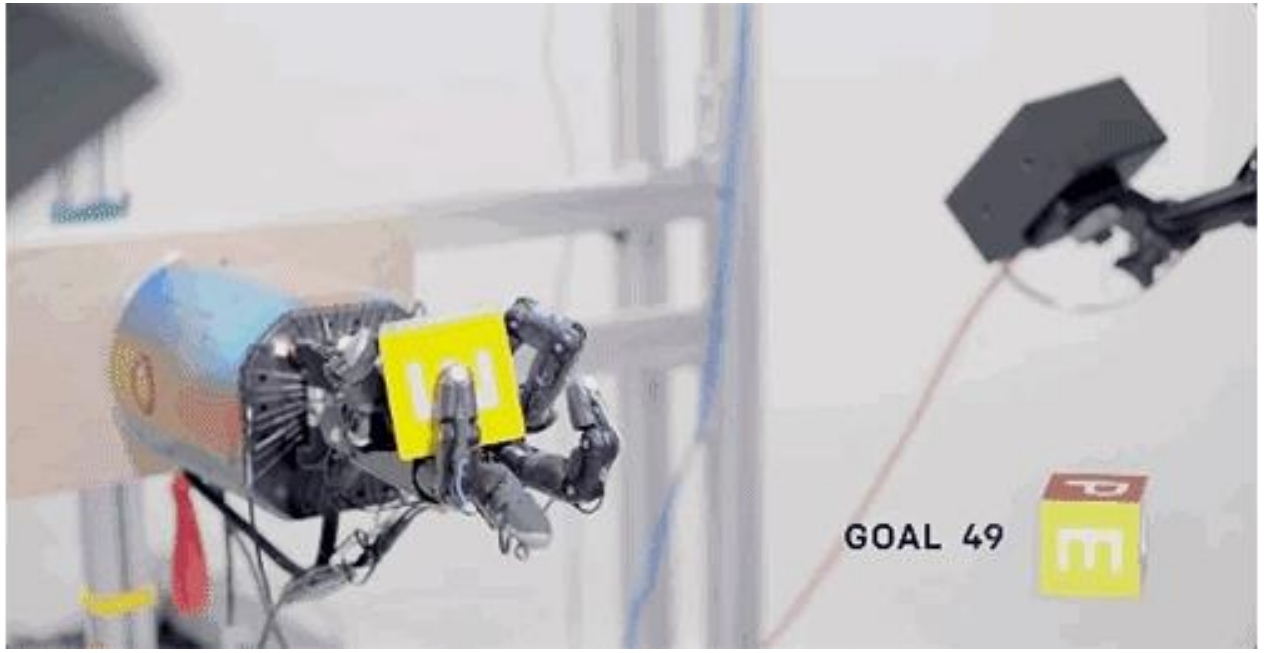
Lidar

- Builds 3D point clouds
- Shoots laser, measures time taken for light to reflect back



Camera

- Used for detecting and classifying objects
- Can also use depth (RGB-D) cameras



This Lecture

- What are the parts of a robot arm?
- What is a serial robot arm?
- What is a parallel robot arm?
- What are some common sensors for robots?

Next Lecture

- How many degrees of freedom does a robot have?