Introduction to Robot Intelligence
[Spring 2023]

Introduction to sensing

April 4, 2023

Lerrel Pinto

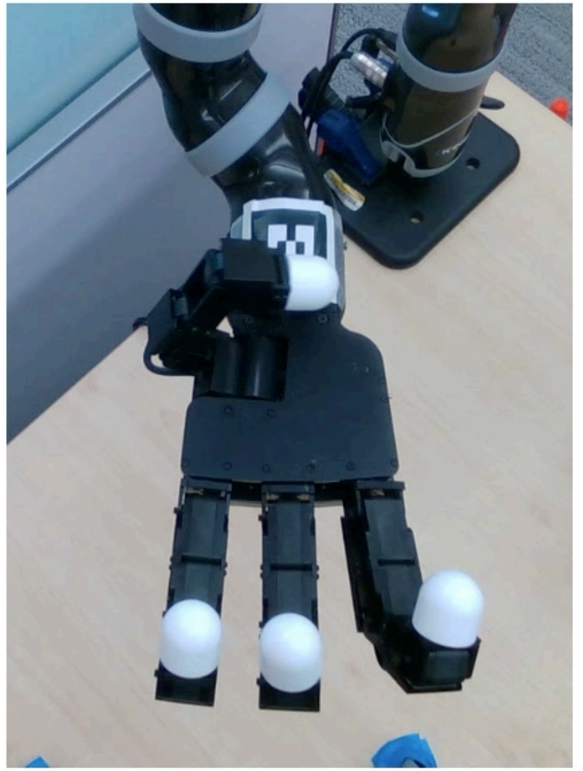
What have we learned so far

- Forward Kinematics and Inverse Kinematics
- Optimal Control – PD, LQR etc.

Example 1:

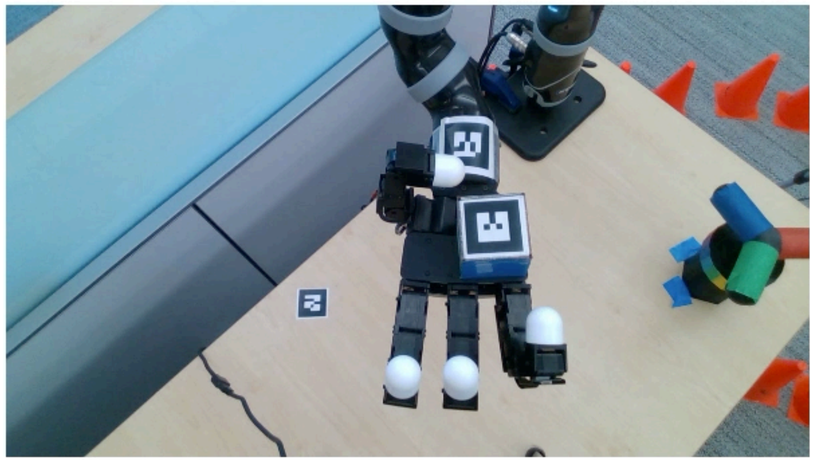
Teleoperation with a Single RGB Camera

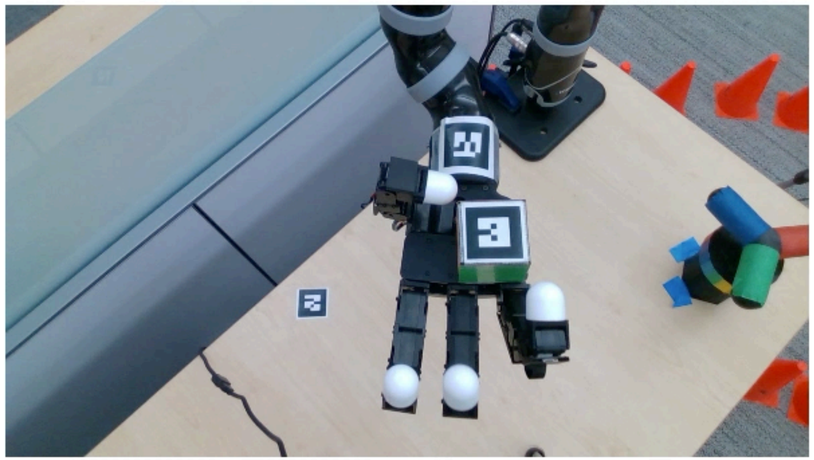
Observations from a human operator

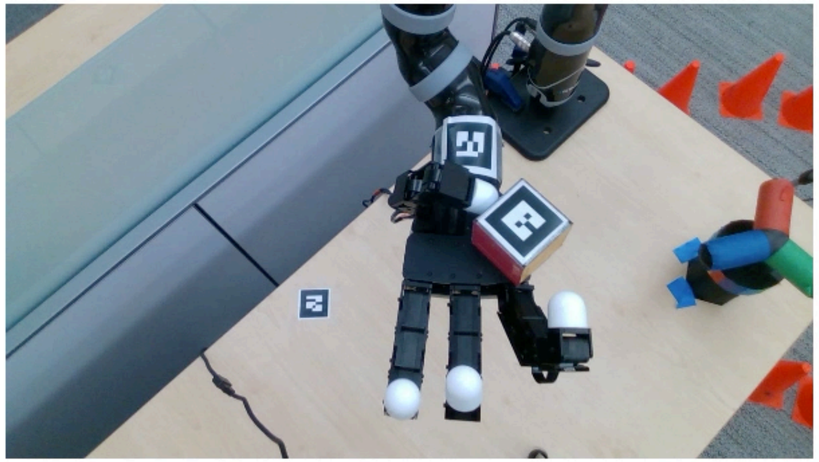


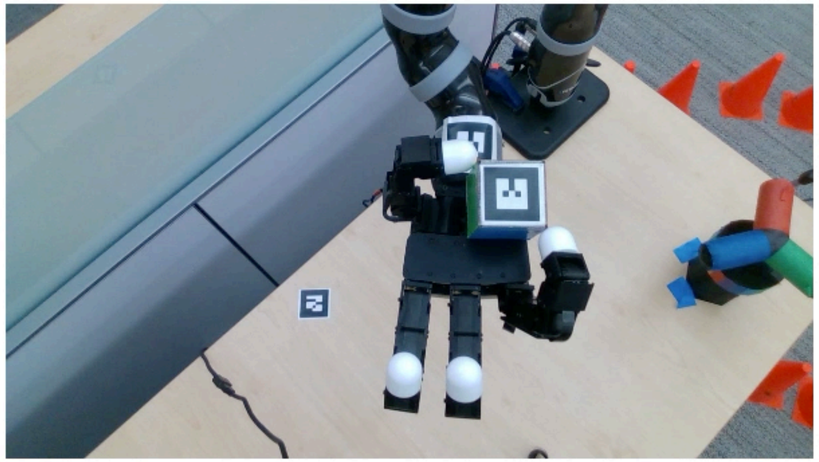
Retargeted behavior on Allegro Hand

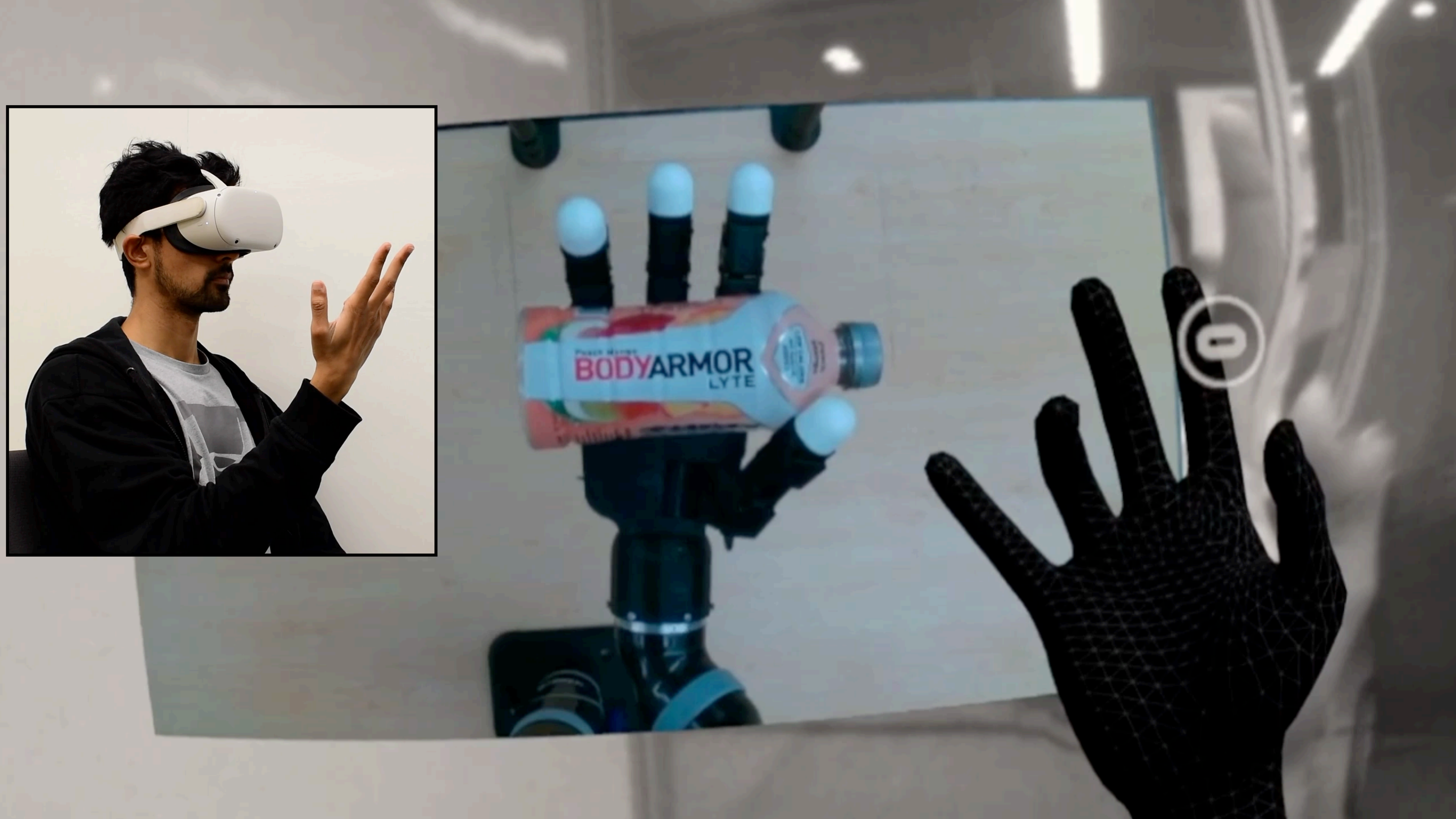
Demonstrations for Cube Rotation

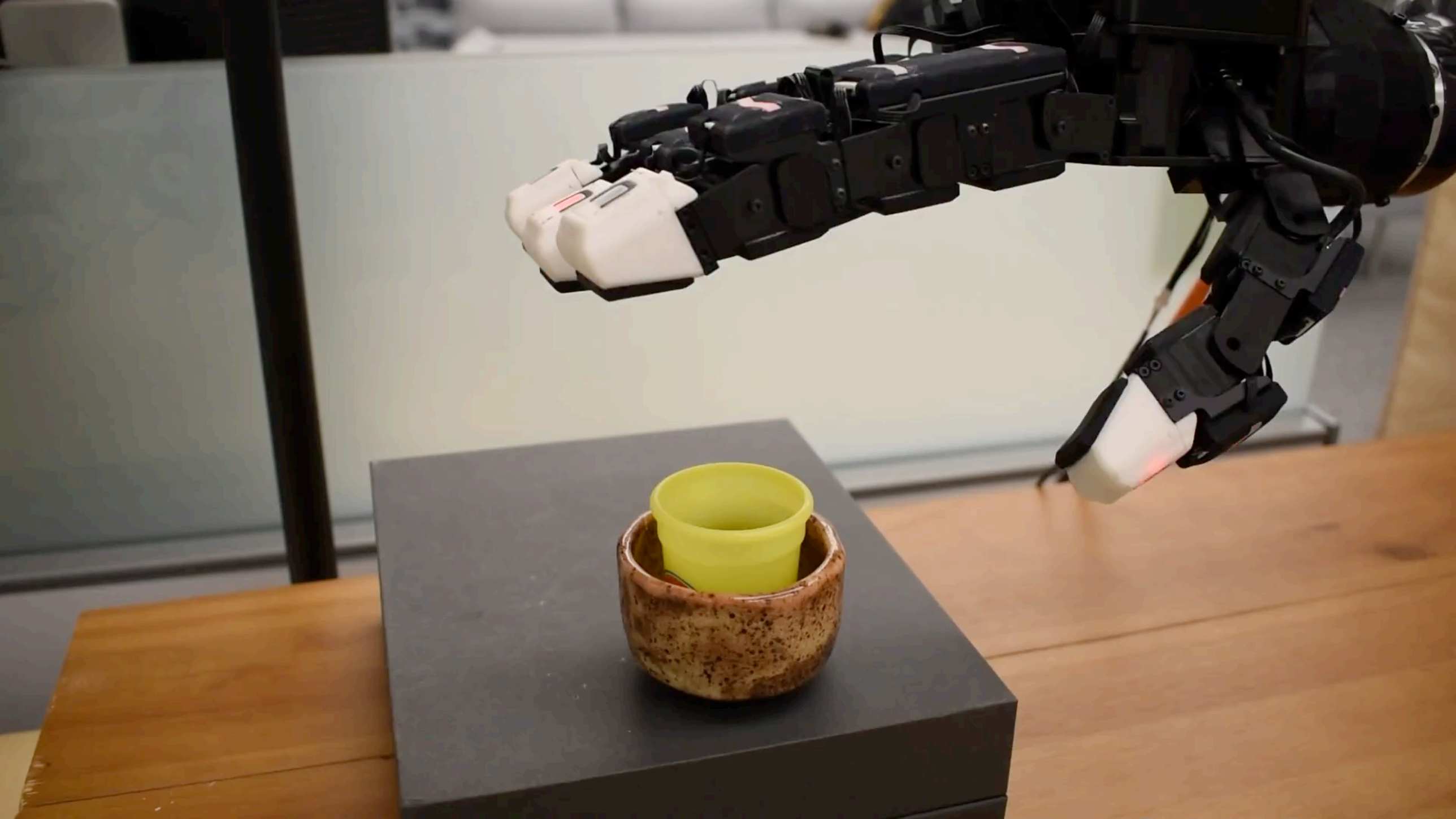









BODYARMOR
LYTE



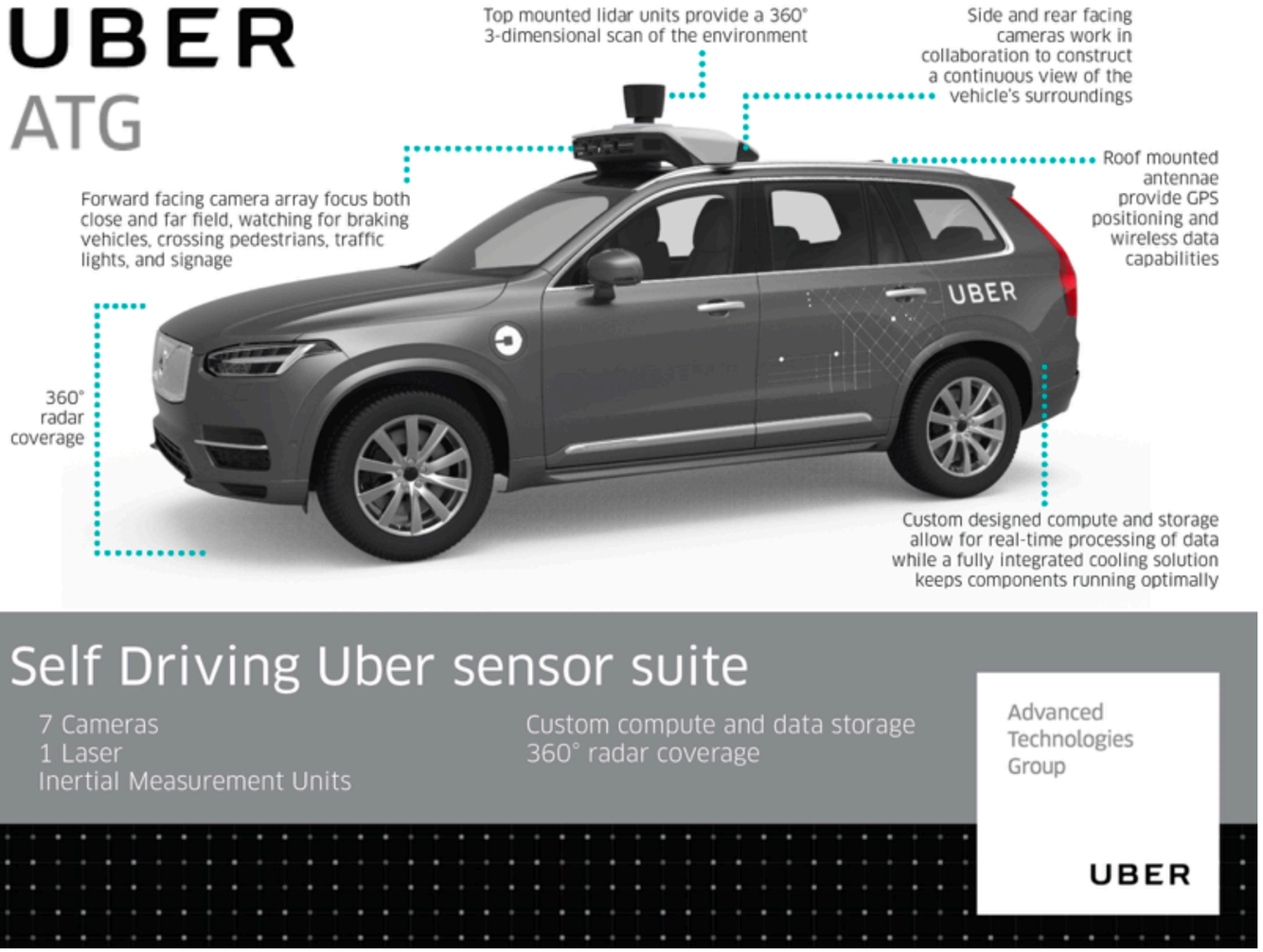
But how does a robot know what is around it?

Actually, how does a robot even know where it is?

A taxonomy of sensors

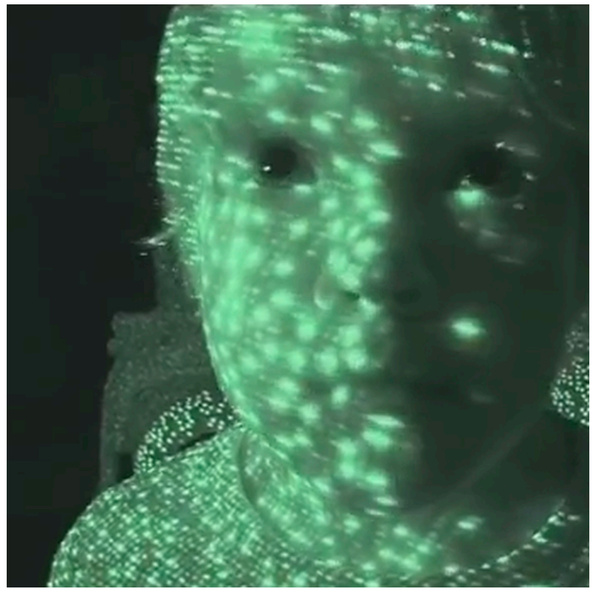
Spot the sensors

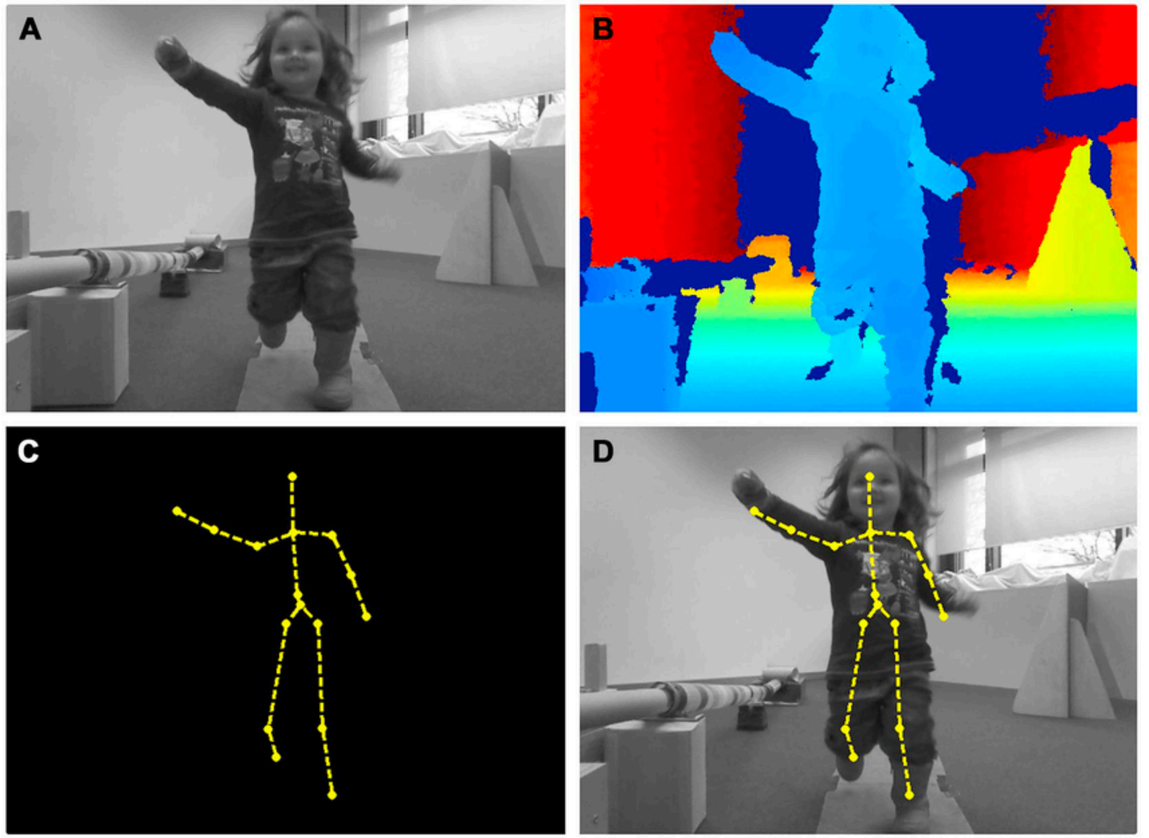
Spot the sensors



Challenges with sensing

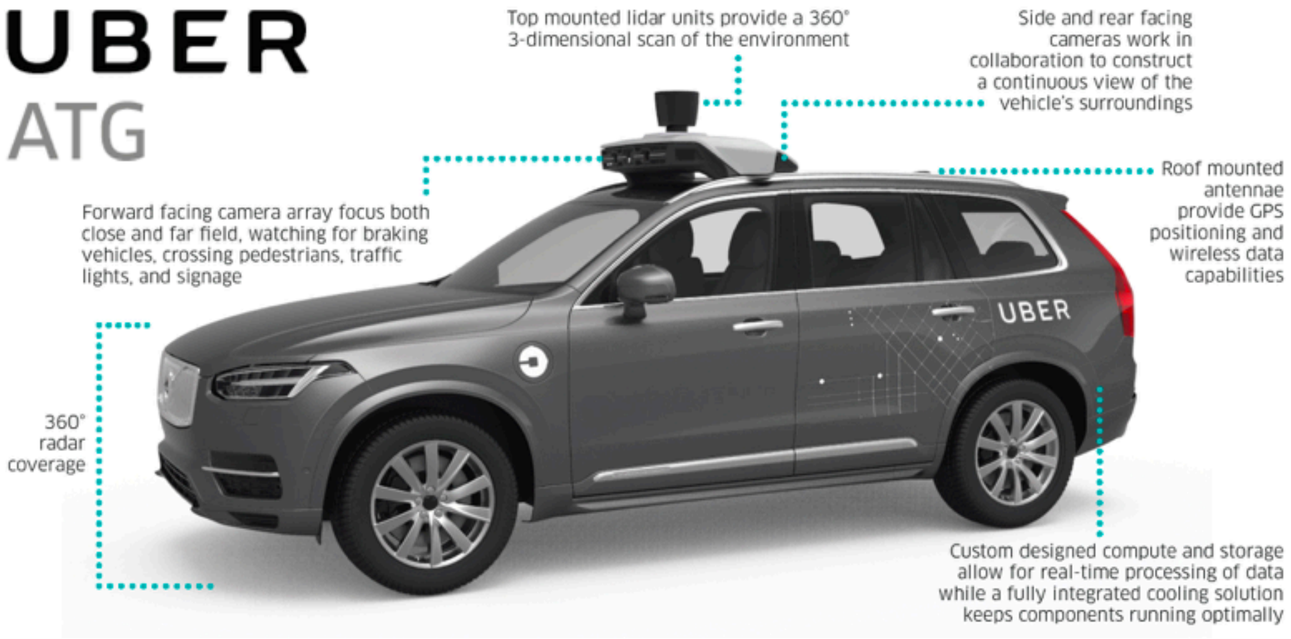
- Dealing with inaccuracies/ noise in the sensor





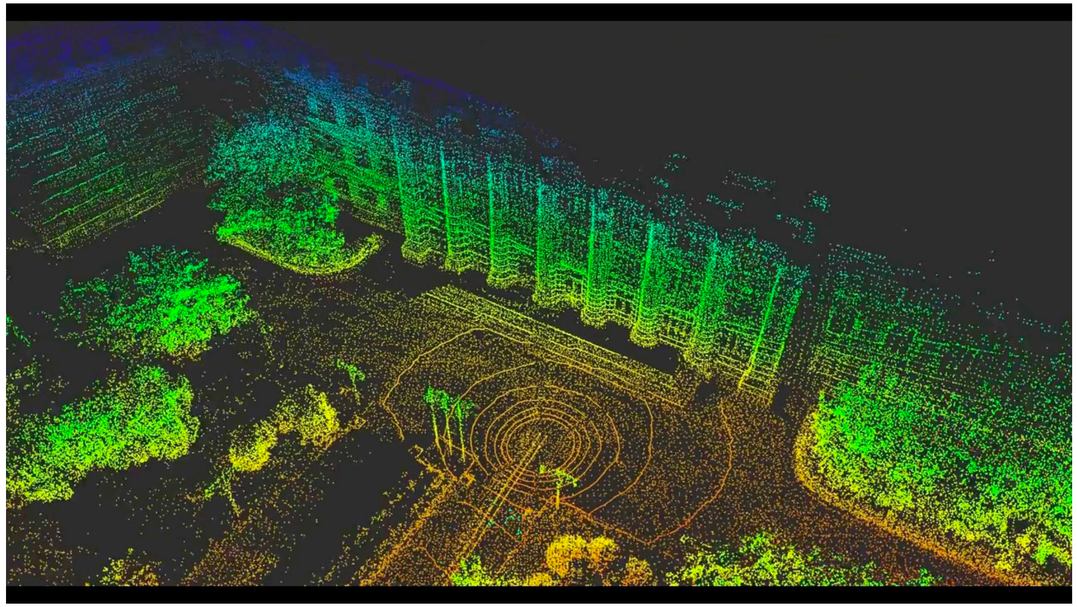
Challenges with sensing

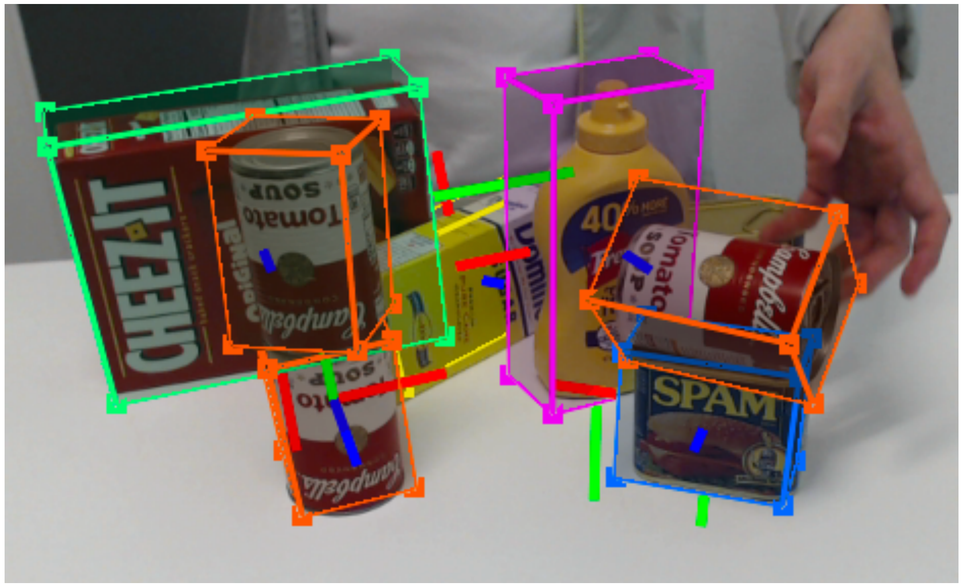
- Dealing with inaccuracies/ noise in the sensor
- Integrating multiple sensors



Challenges with sensing

- Dealing with inaccuracies/ noise in the sensor
- Integrating multiple sensors
- Modeling and mapping the environment





Key difference from previous portions:
Dealing with Stochasticity

Probability

$$P(x|y) = \frac{P(y|x)\ P(x)}{P(y)} = \frac{\text{likelihood} \cdot \text{prior}}{\text{evidence}}$$

http://ais.informatik.uni-freiburg.de/teaching/ss14/robotics/slides/22-summary.pdf