Engineering, Robotics

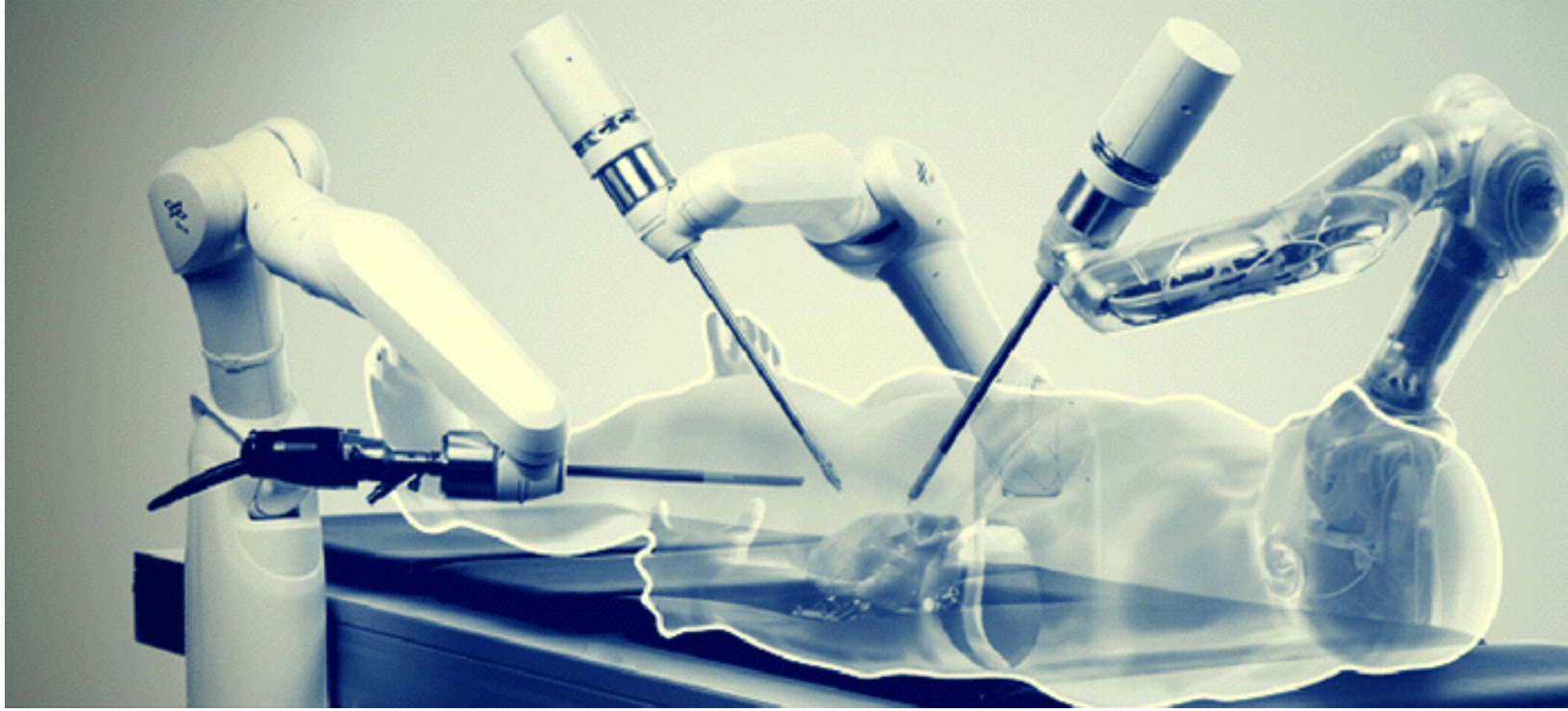
Introduction, Tasks

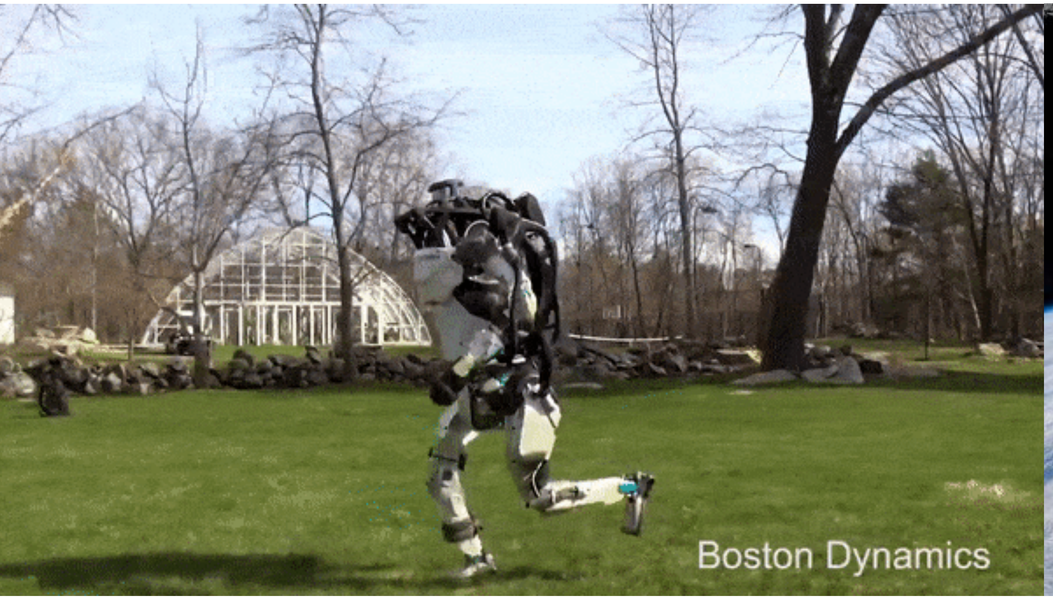
What is the most recent engineering marvel that you remember?

What do engineers do?

Robots and Engineering

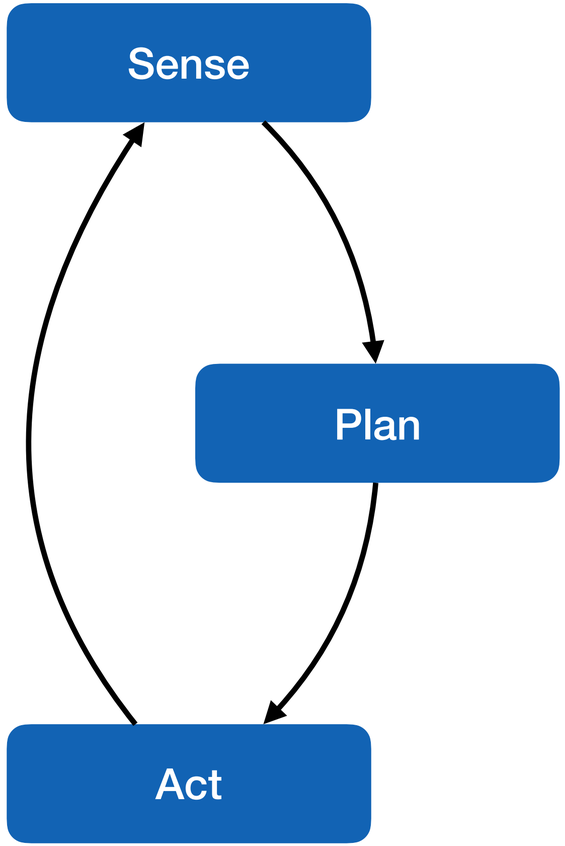
- What is a robot?
- How do they ‘fit in’ engineering problem solving?




Boston Dynamics

Robotics - Science

- To develop engineering solutions involving robots, a number of core robotics problems need to be solved (approximately)
  - Perception/Sensing — Observe and interpret the environment
  - Plan — Think and decide about what to do next.
  - Act — Perform the chosen action



Robotics - Engineering

- Robotics tasks
  - Manipulation — techniques for ‘modifying’ the environment
  - Navigation — techniques for ‘moving’ around in an environment
- The engineer’s view of robotics
  - Automate, automate, automate
  - Examples:
    - Agriculture, transportation, software, manufacturing

MISE Robotics Project

Project 1: Navigational Aid

- Develop:
  - Navigational aid system for the visually impaired, using only cameras, laptop and microphones.
    - Step 1: via Stereo
    - Step 2: via Optical flow
  - In both steps, develop an automatic way ‘communicating' occupancy information to the subject.

Tools for MISE Tasks

- Solution design
  - Engineering design process
- Math fundamentals
  - Frames, transformations, linear algebra
- Multi-view geometry in computer vision
- Audio synthesis
- Integration — software and hardware, communicating result.

Final Results

- Solution demo
  - Live demo of the navigational aid.
- Report
  - Details of the design
  - Components, methods

Reading/Reference Material

- Math fundamentals
  - https://www.khanacademy.org/math/linear-algebra
- Engineering design
  - https://en.wikipedia.org/wiki/Engineering_design_process
- Computer vision
  - https://en.wikipedia.org/wiki/Visual_perception
  - https://en.wikipedia.org/wiki/Depth_perception
- https://docs.scipy.org/doc/numpy/user/quickstart.html