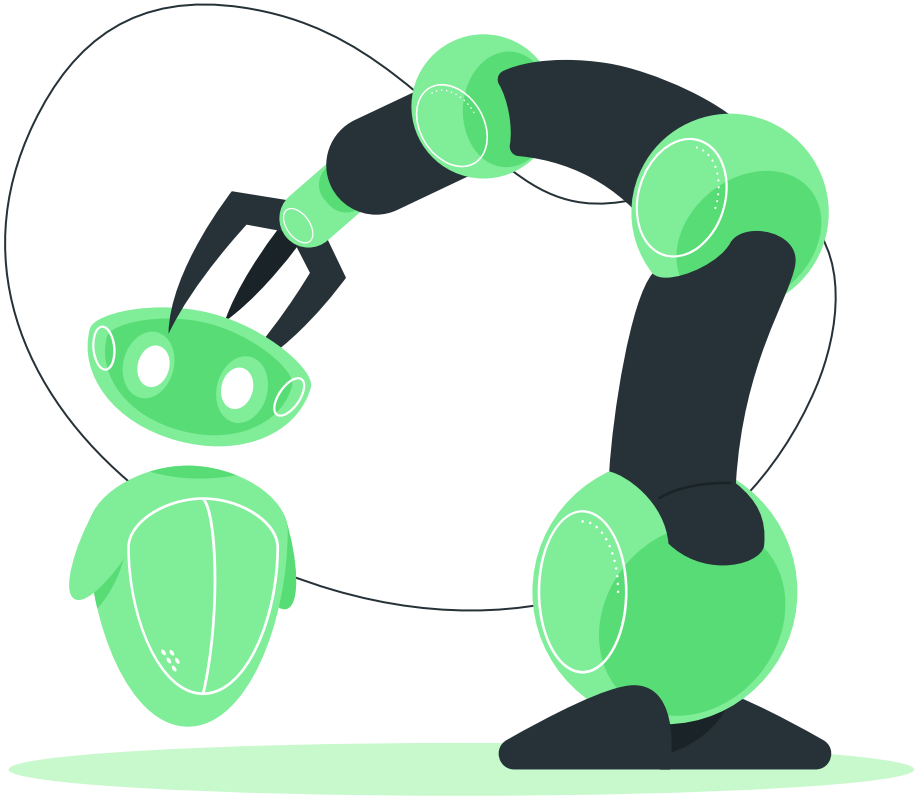
EECS C106B
Week 1 Lab

First lab section woooooo!!!



Agenda

1. **Introduction**
   Meet your classmates! (and potential project-mates)
2. **Lab Section Logistics**
   Info about paper presentation assignment
3. **Project 0 Intro**
   Some relevant info for Project 0
4. **Project 1A Intro**
   Some relevant info for Project 1A
5. **Free Time**
   Meet your classmates! (and potential project-mates)

1 Introduction

Teaching Team

Tarun Amarnath
Head TA - Admin
Content & Lab TA

Massimiliano de Sa
Head TA - Content

Han Nguyen
Head TA - Lab

Fangyu Wu
Lab TA

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Lab Section Logistics

Welcome to Lab Section!

Lab sections are for:

- Paper presentations
- Project introductions

Lab section etiquette:

- Show up (sections are **synchronous** and **not recorded**)
- Come prepared to discuss the papers for the week
- Be respectful

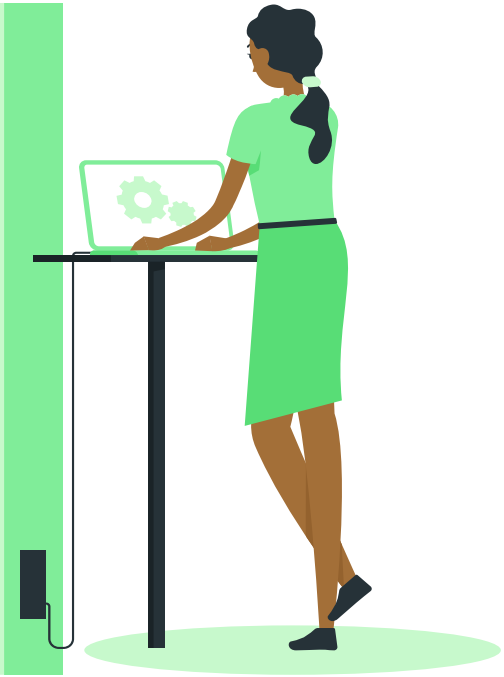
Paper Presentations

- 1-2 paper presentations per week in lab section
- Explain your chosen paper in as simple terms as possible so others can understand it
- Sign-up sheet will open next week
  - Papers will complement ongoing lecture
  - 1 paper **before** Spring Break
  - 1 paper **after** Spring Break
- Grade breakdown (5% total)
  - 4% for paper presentations (2% each)
  - 1% for participation in discussions

Presentation Logistics

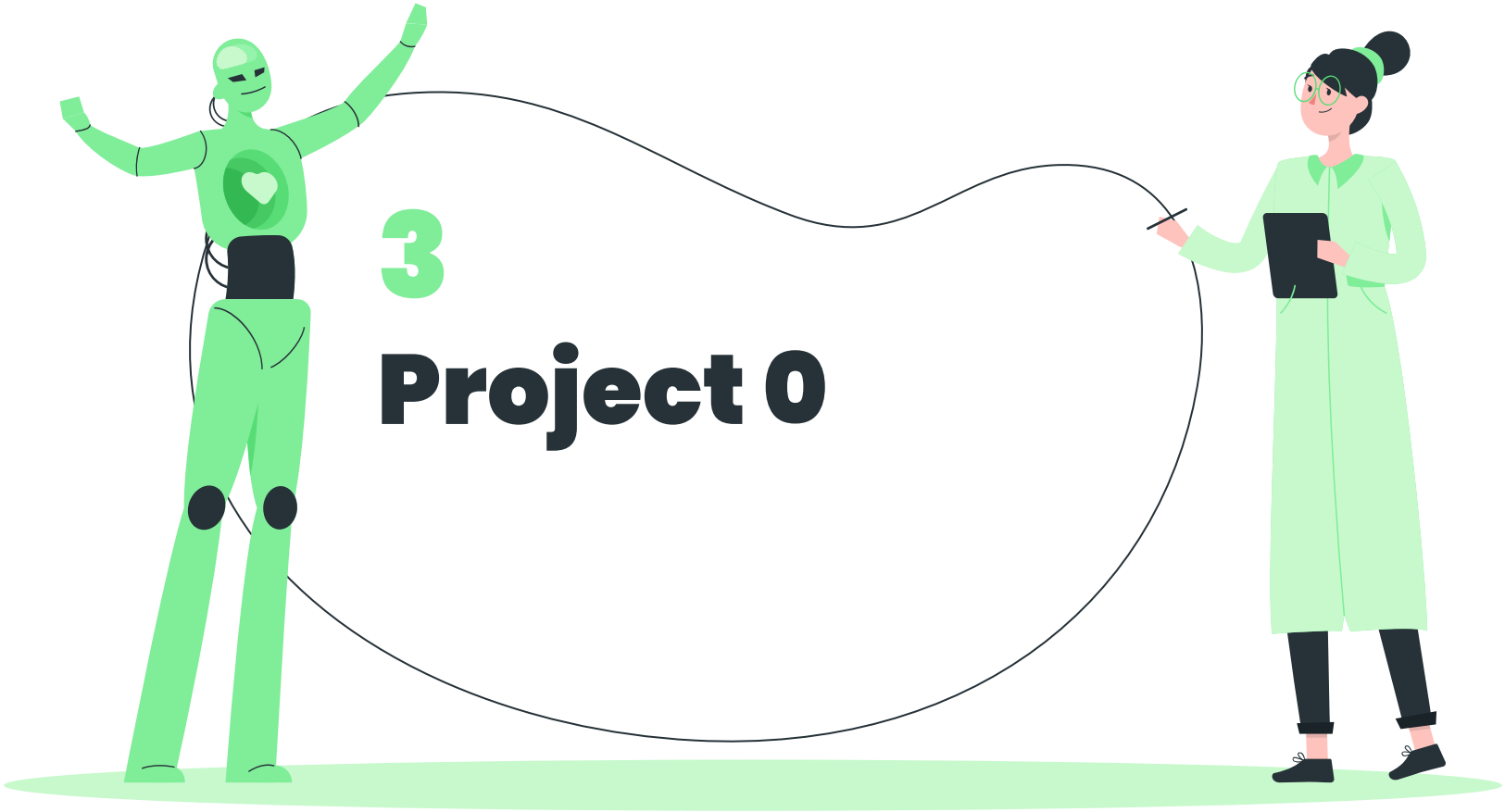
- Present as group of 2* in the same lab section
  - Meet people who have the same interests as you
  - Doesn't have to be same partner for both presentations
- 10-15 mins for presentation
- 5-10 mins for questions/leading a discussion

* Depending on the circumstances groups of 1 or 3 are ok but should be rare and approved by your TA first. Max 1 group of 3 per lab section.



Projects

- Prerequisites
  - Python and Linux commands
  - Git/GitHub
  - ROS
- Groups of 2-3
  - At least one person should have completed 106A
- Completed mostly on your group's own time
  - Plan ahead!!!
- Present findings in conference paper format



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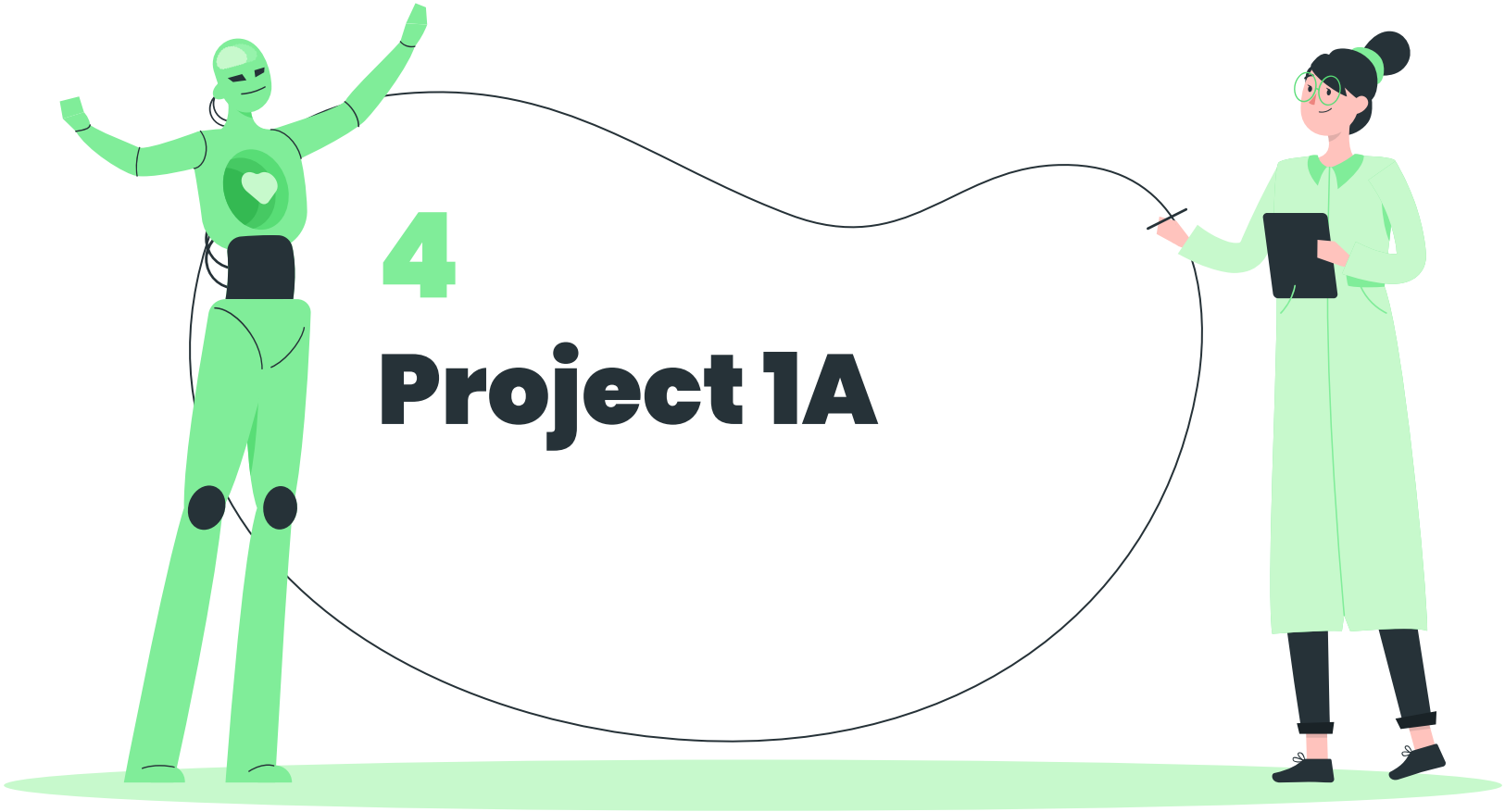
Project 0

Project 0

- Refresher on ROS
  - Basic commands and data structures
  - Turtlesim! Write your own controller!
- Publisher/Subscribers
- Find AR tags with a Camera
- Run basic scripts on Sawyer
- Don’t worry about the Robot Usage Quiz for now



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Project 1A

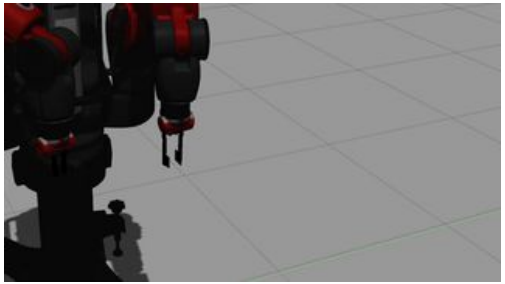
Project Goal

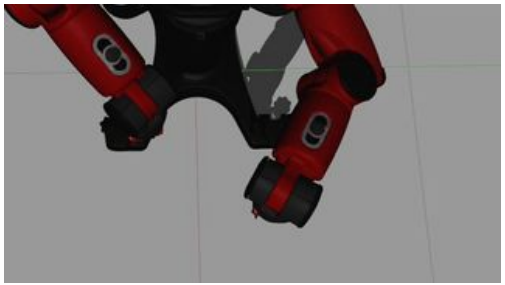
Implement closed-loop PD control on Sawyer and compare with the default MoveIt! controller

*This is Baxter. We will be using Sawyer this semester!

Part A Tasks: Trajectories

- Define 3 trajectories
  - Linear
  - Circular
  - Polygonal
- For a given time **t**, return a
  - target SE(3) pose
  - target se(3) body velocity

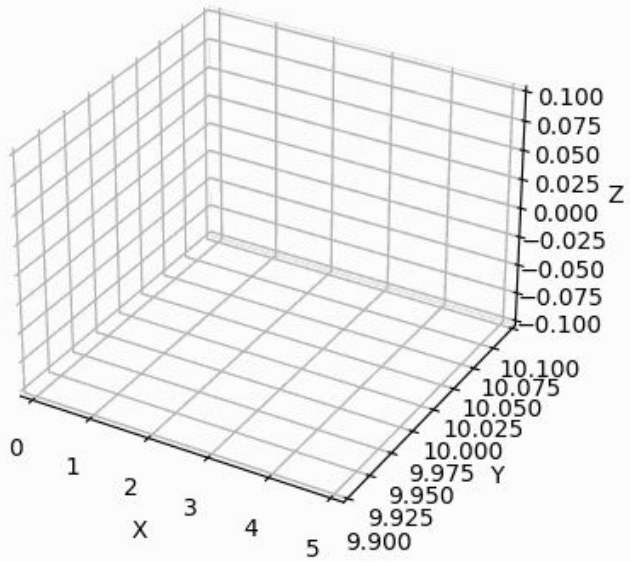




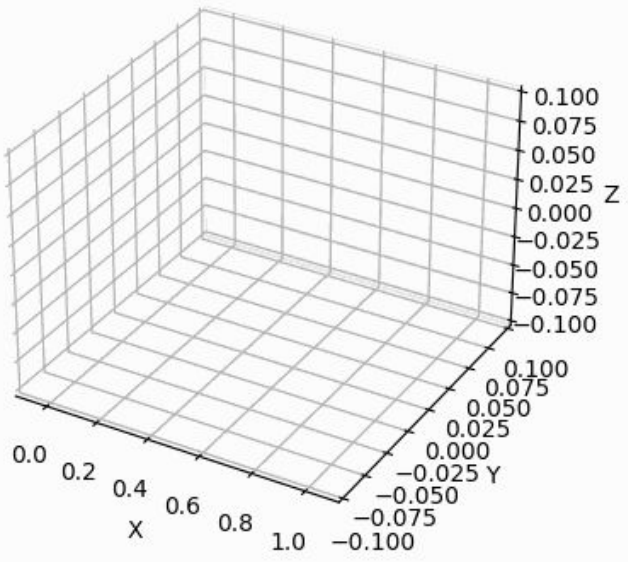
- Analytically solve for smooth trajectories that start and end with 0 velocity
  - Finite difference approximates are not your friend

LinearTrajectory

LinearTrajectory evolution of
end-effector's position.

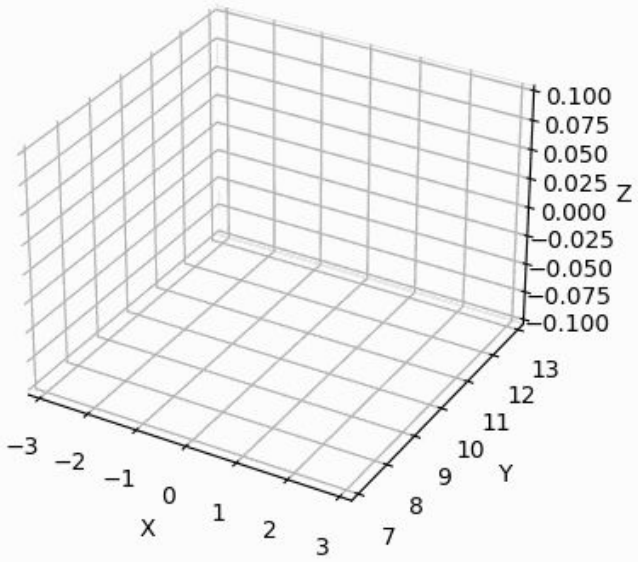


LinearTrajectory evolution of
end-effector's translational body-frame velocity.

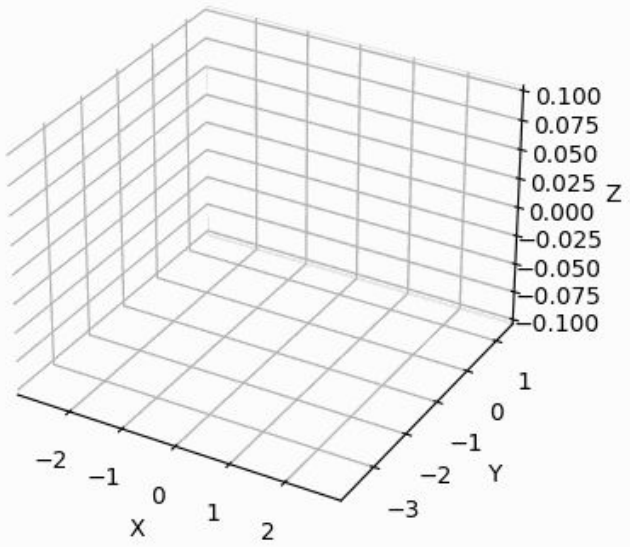


CircularTrajectory

CircularTrajectory evolution of
end-effector's position.

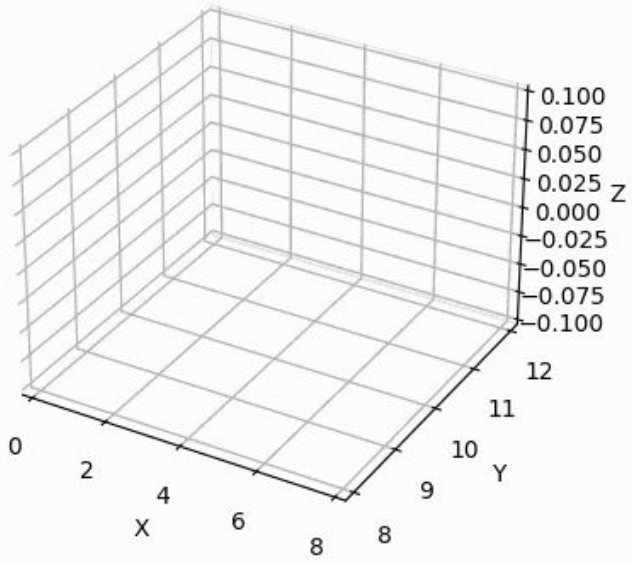


CircularTrajectory evolution of
end-effector's translational body-frame velocity.

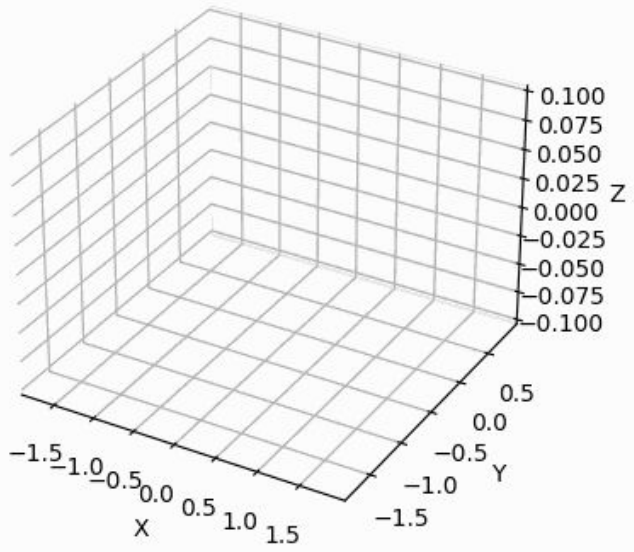


PolygonalTrajectory

PolygonalTrajectory evolution of
end-effector's position.



PolygonalTrajectory evolution of
end-effector's translational body-frame velocity.



Part A Tasks: Controllers

1

Jointspace Velocity (Done)

Given: desired joint positions, velocities, and accelerations
Produce: control input as joint velocities

2

Workspace Velocity

Given: desired workspace positions, velocities, and accelerations
Produce: control input as joint velocities

3

Jointspace Torque

Given: desired joint positions, velocities, and accelerations
Produce: control input as joint torques

Deliverables

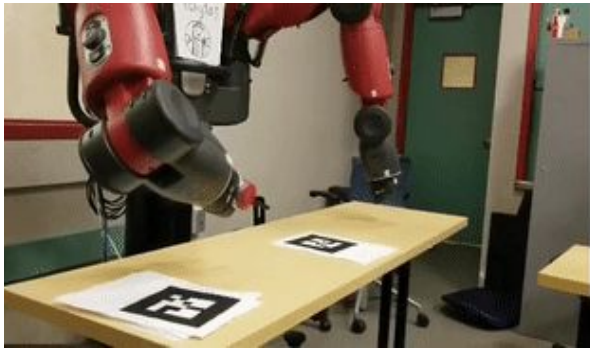
Manipulator simulation videos of:

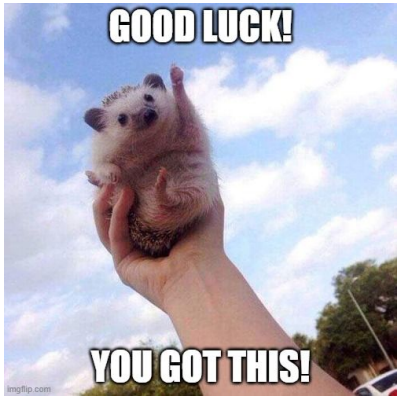
- Workspace Line
- Workspace Circle
- Workspace Polygon
- Torque Line
- Torque Circle
- Torque Polygon

Submit videos as a link to a Google Drive folder

Advice

- Research is very open ended, you may have to try a lot of things and see what works
- Save early, save often
    - Properly using git can save you a lot of time and frustration - ask if you need help!
- You are not alone
    - Use your group effectively (pair program, split up tasks, etc.)
    - Ask and answer questions on Ed, Discord
    - Go to OH, Lab Section for staff help

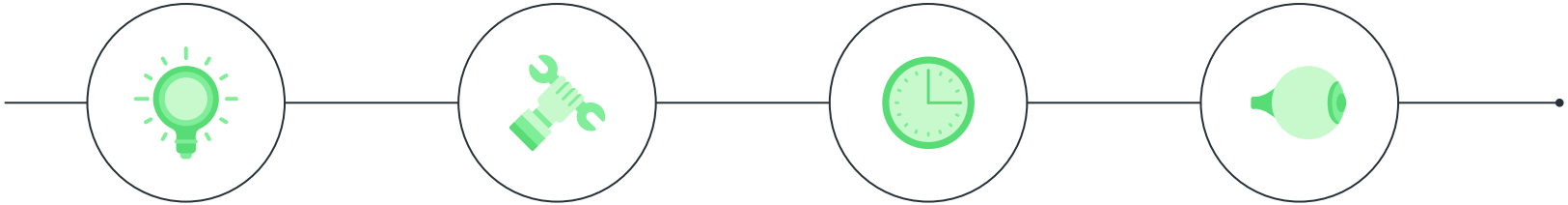




Timeline of the Near Future

Complete Project 0

This will give you a good refresher on ROS. Also, find project partners!



Sign Up for Papers

Next week

Homework 1

Due Tues 1/24

Project 1A

Due Tues 1/31