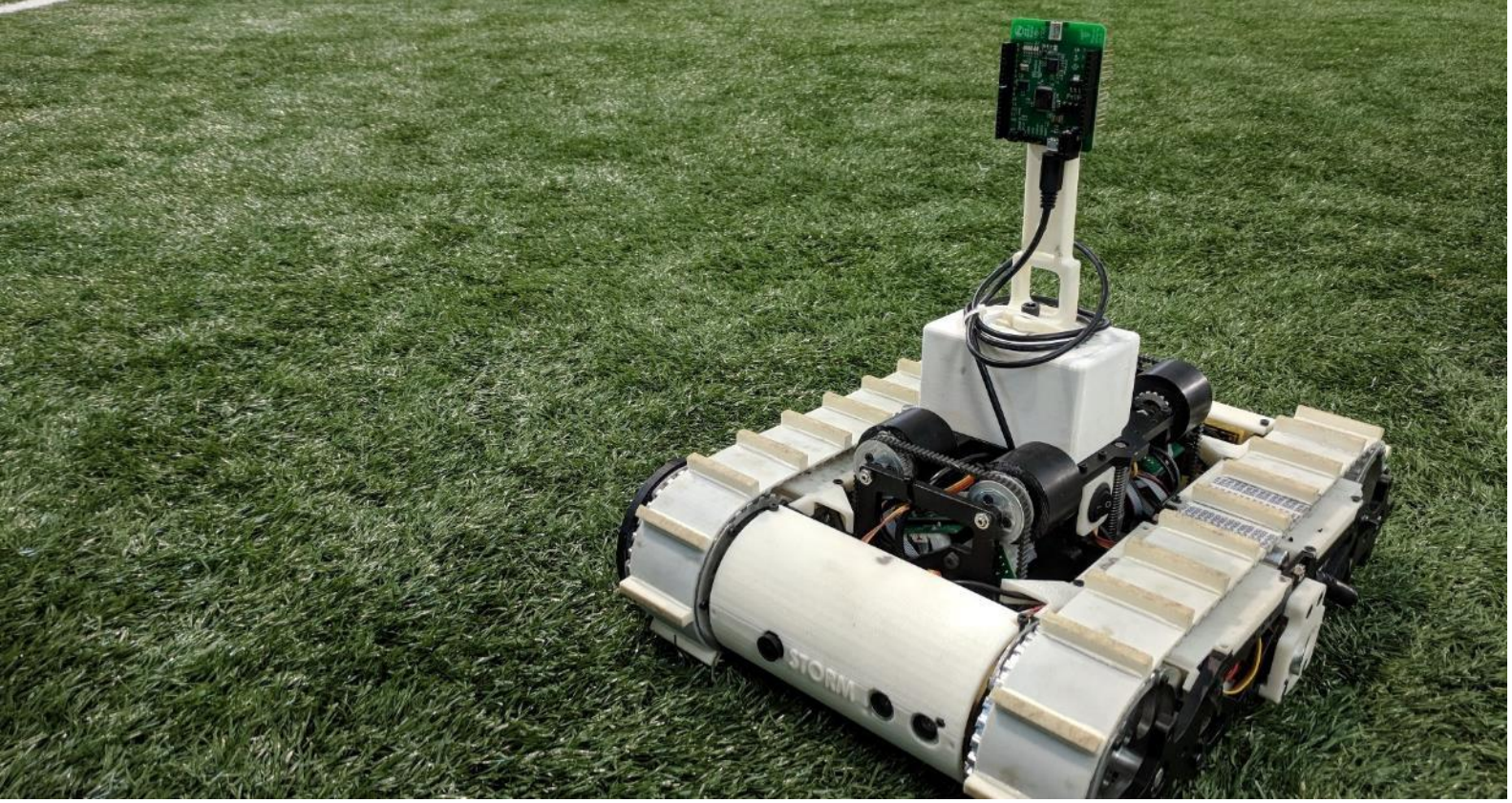


ED 5215
INTRODUCTION TO MOTION PLANNING

Instructors: Bijo Sebastian, Nrav Patel

PROJECTS

Instructions:

- Graduate students can apply planning problems to your research (project should have a major motion planning component)
- Individual or groups of no more than three students
- Multiple teams can choose the same project, access to hardware will be shared
- Finalize your project statement by 17th February
- Proposal presentation on 24th February (Include methodology, project timeline and milestones)
- Mid-Term presentation 24th March (Show progress on timeline from proposal, any major changes in methodology or milestones to be explained)
- Final presentation and demo of project results 14th April onwards

PROJECTS

Task	Deadline
Finalize your project statement and team members	17th February
Proposal presentation(Include methodology, project timeline and milestones)	On 24th February
Mid-Term presentation (Show progress on timeline from proposal, any major changes in methodology or milestones to be explained)	On 24th March
Final presentation and demo of project results	14th April onwards

PROJECT PROPOSAL PRESENTATION

Should include:

- Methodology: How do you plan to solve the problem, what tools/algorithms (ROS, Gazebo, MoveIt, MATALB, OMPL, CoppeliaSim, MuJoCo, RRT, A* etc.) you might use
- Milestones: what are the minimum deliverable tasks that we can evaluate
- Project timeline: deadline for each of the minimum deliverable task
- **Deliverables**
- Minimum deliverables: this is the minimum possible outcome of the project that must be achieved and presented towards the end of the semester. This must be a significant task, not just putting together a bunch or tools/libraries.
- Extended deliverables (if you were able to achieve minimum deliverables before the proposed timeline, what else can you add to the project)

PROJECT:1

Motion planning for pick and place task using UR5

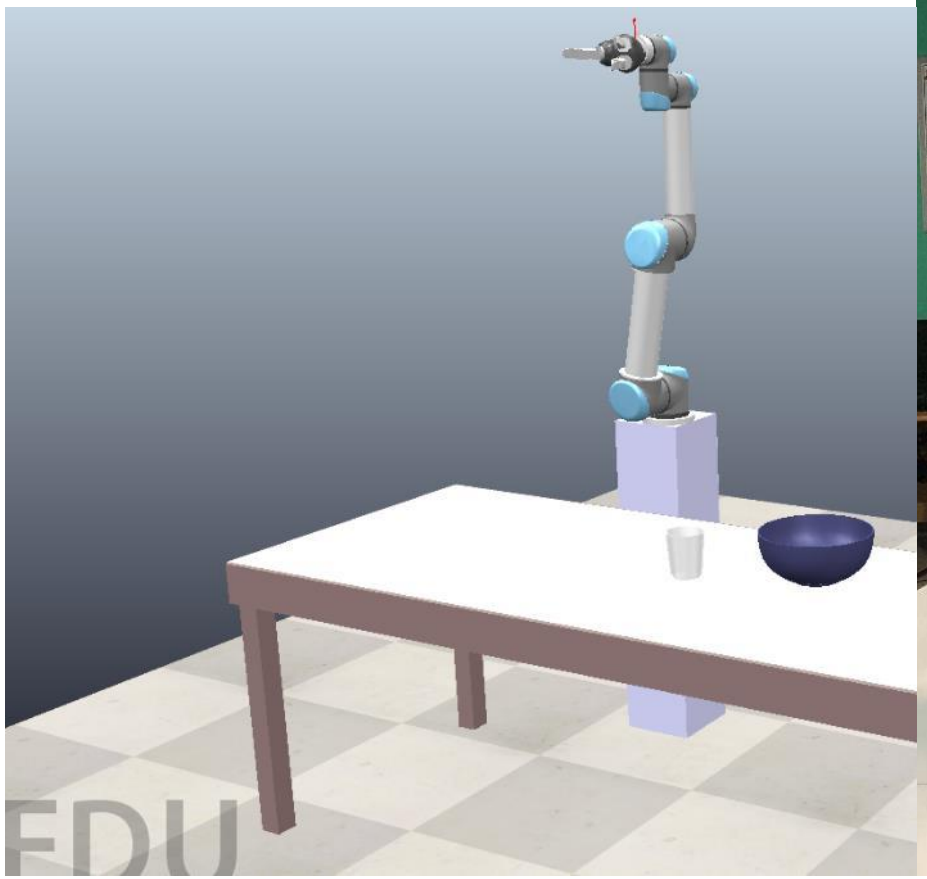
- Static obstacles
- Rigid objects

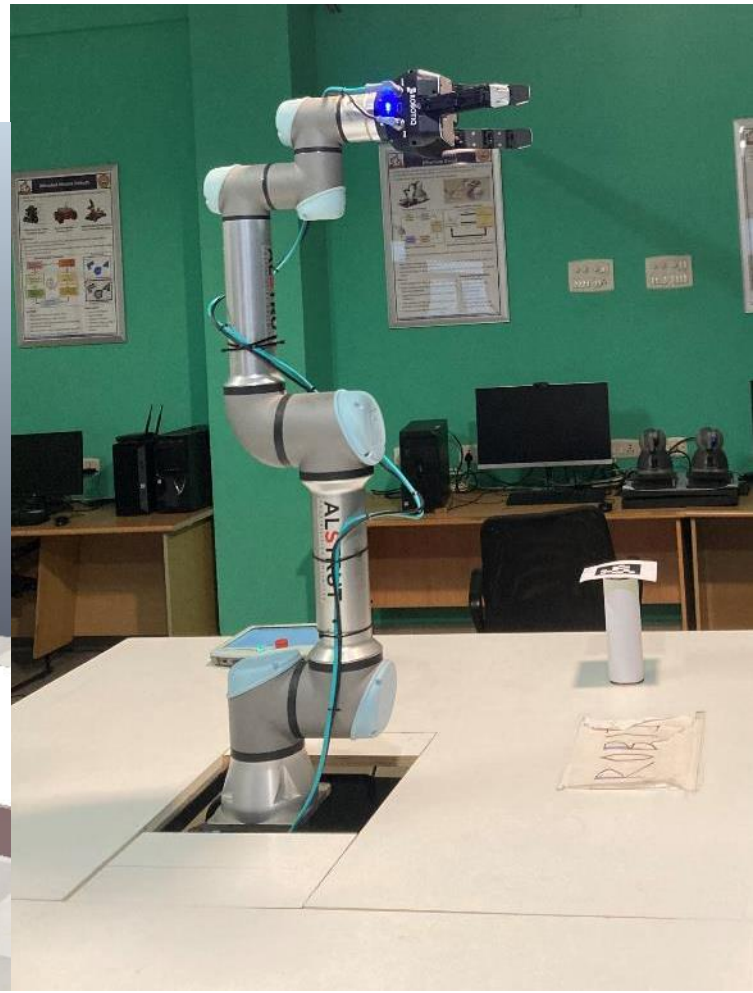
Phase 1: Simulation

Phase 2: Real robot

Driver code for

(In progress, please contact Bijo)





PROJECT:2

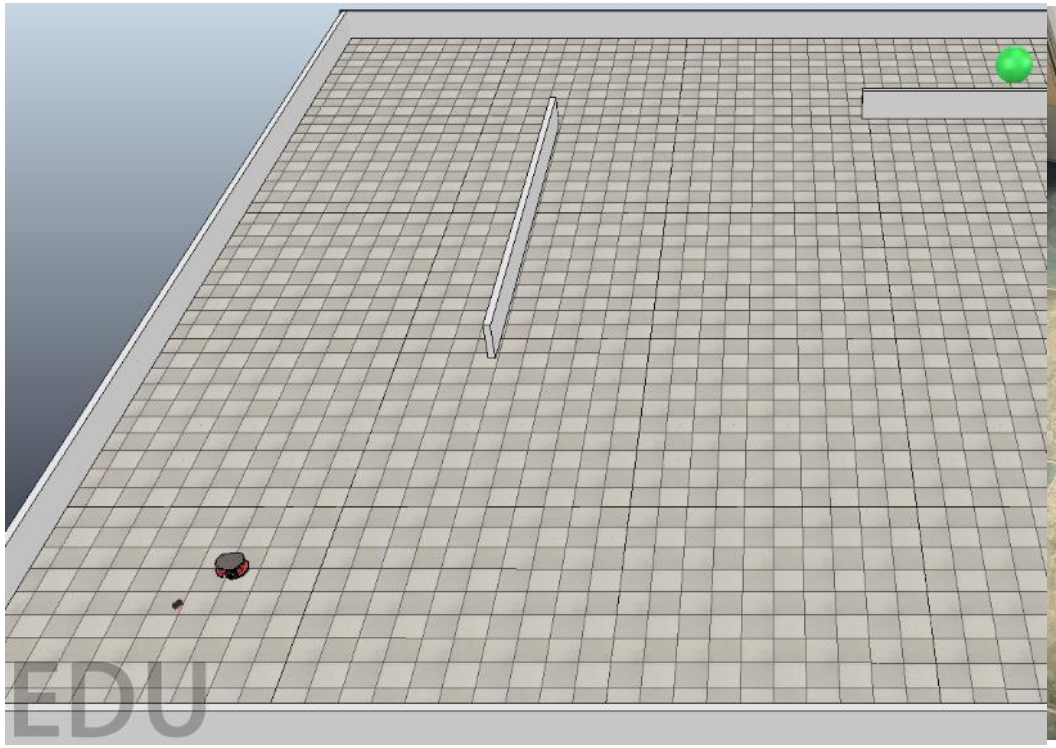
Path planning in dynamic environment for Pioneer P3-AT

- Map will be given but can change during over time
- Should use algorithms that can adapt to change (e.g. D*-Lite) rather than replan from scratch

Phase 1: Simulation

Phase 2: Real robot

Driver code for [simulation]



PROJECT:3

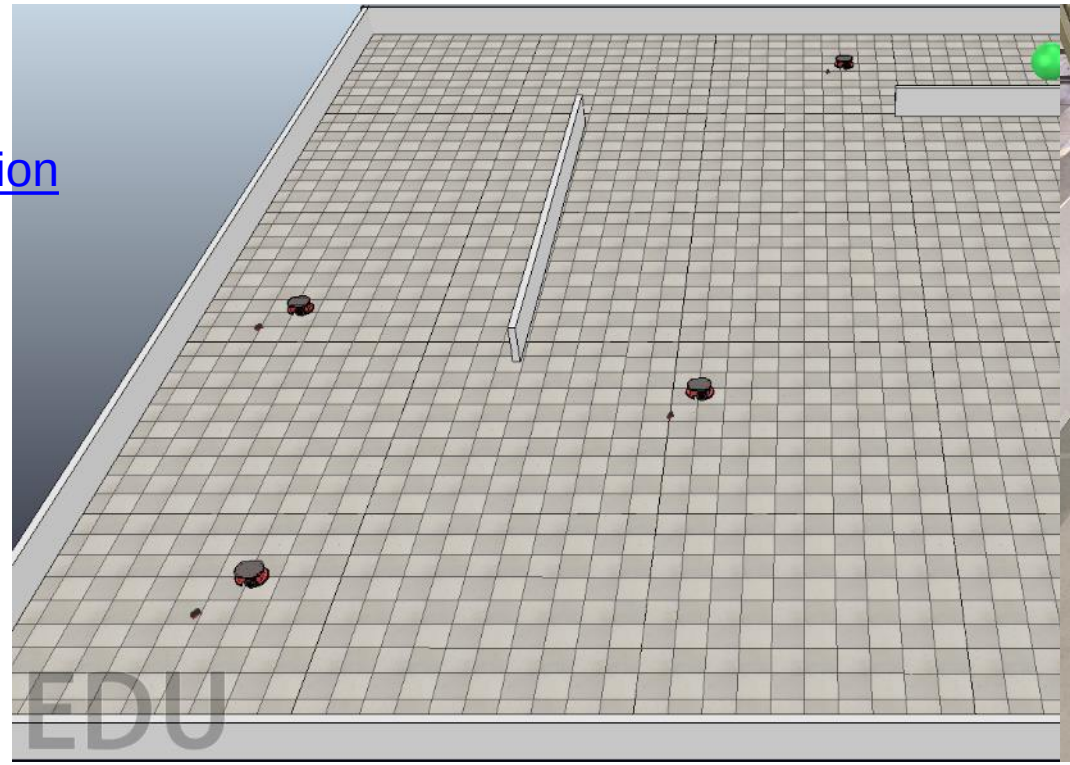
Path planning in multiple mobile robots

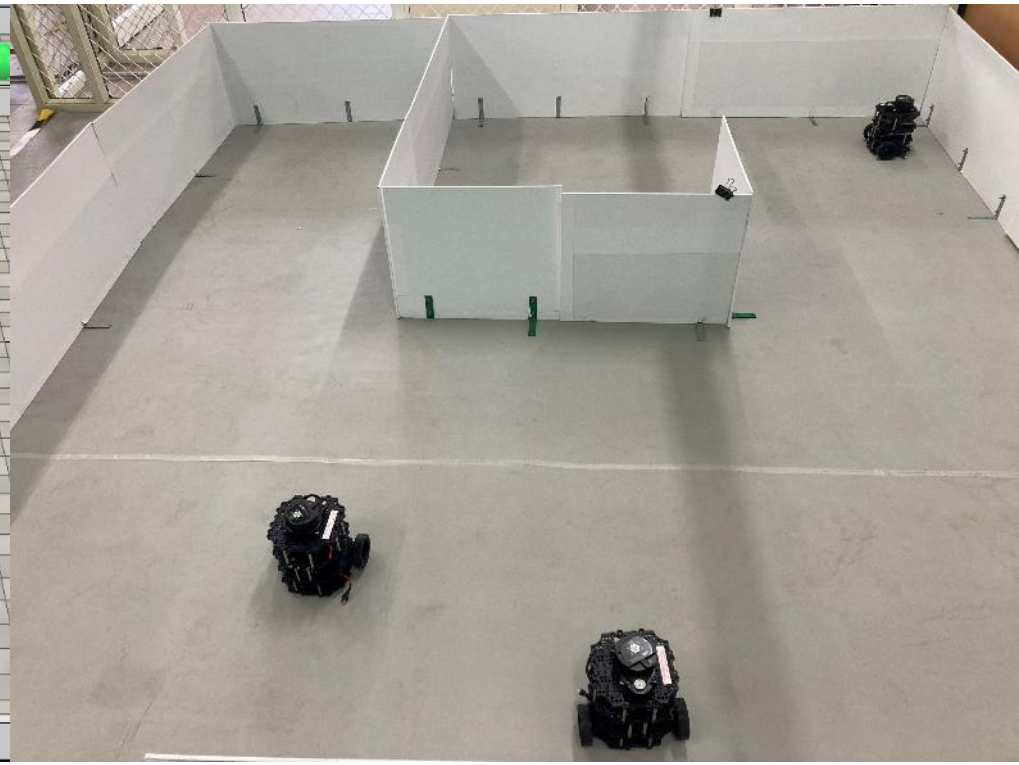
- Static map with different goal point for each robot
- Need to consider states of multiple robots while planning

Phase 1: Simulation

Phase 2: Real robot

Driver code for [simulation]





PROJECT: 4

Longitudinal and Lateral planning for a Car in a city environment

- Static map with moving objects
- Both steering and speed control to be implemented

Phase 1: Simulation

Driver code for simulation

PROJECT:5

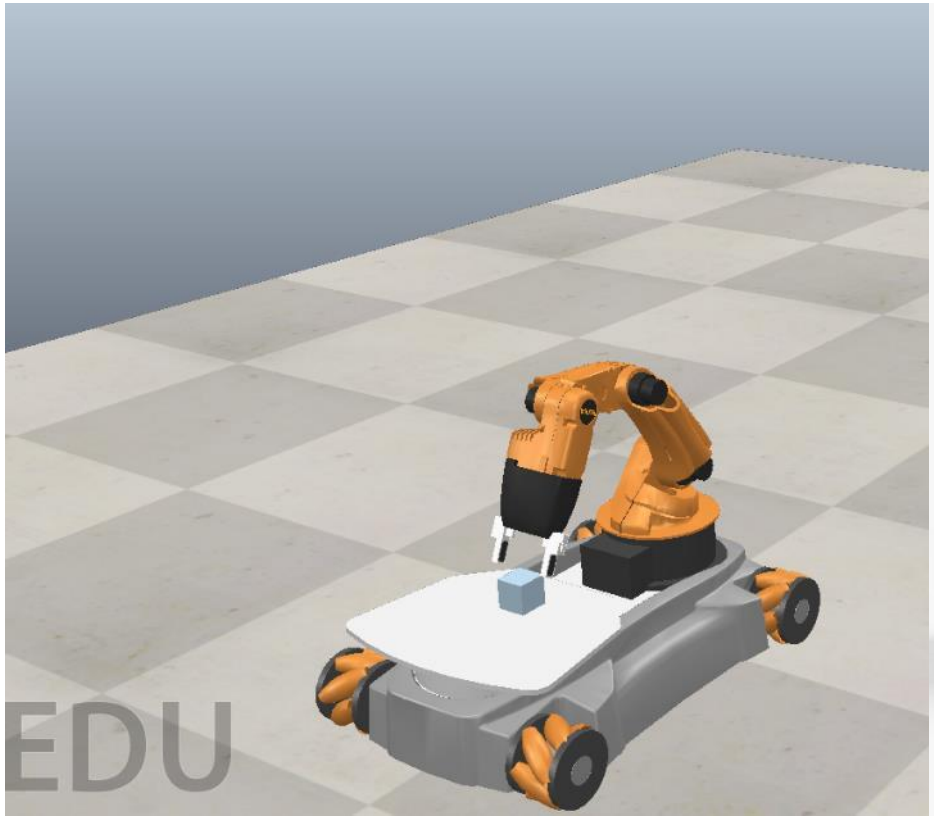
Planning for a mobile manipulator

- Static map already given
- Planning for both mobile platform and arm is needed

Phase 1: Simulation

Phase 2: Real robot (tentative)

Driver code for [simulation]



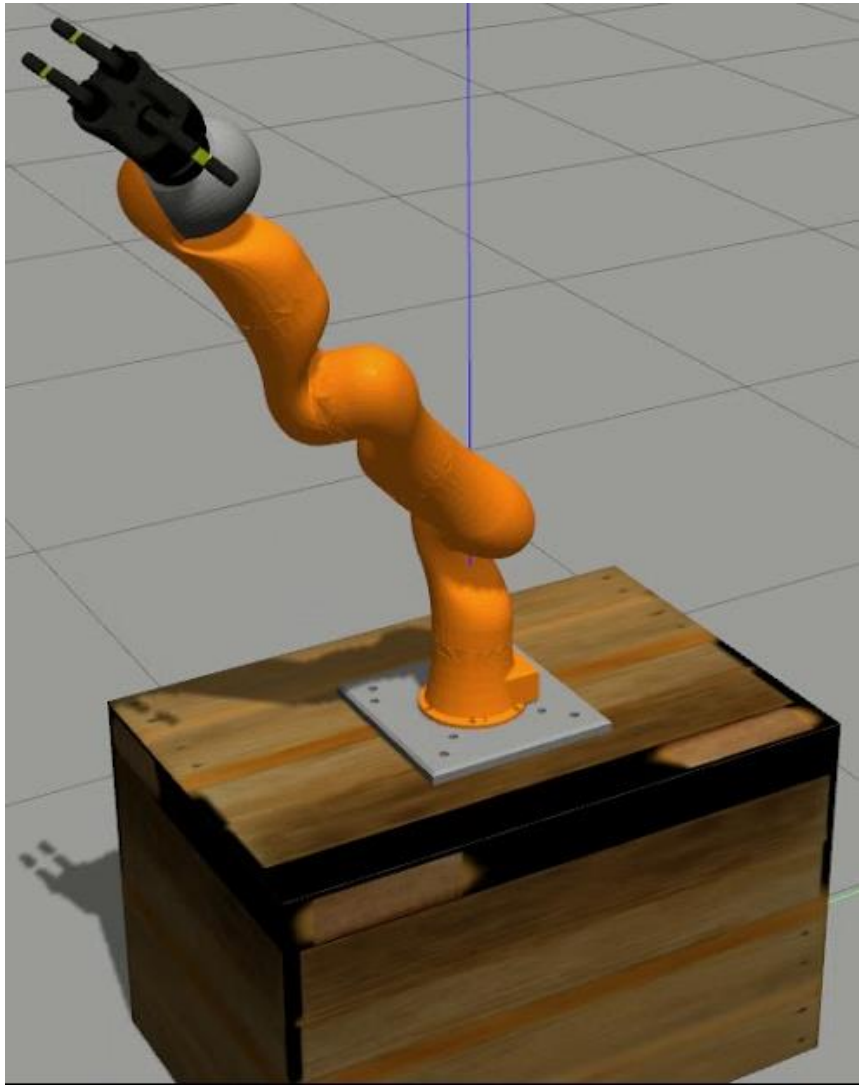
PROJECT:6

Motion planning for pick and place task using Kuka iiwa7

- Static obstacles
- Rigid objects

Phase 1: Simulation

Phase 2: Real robot



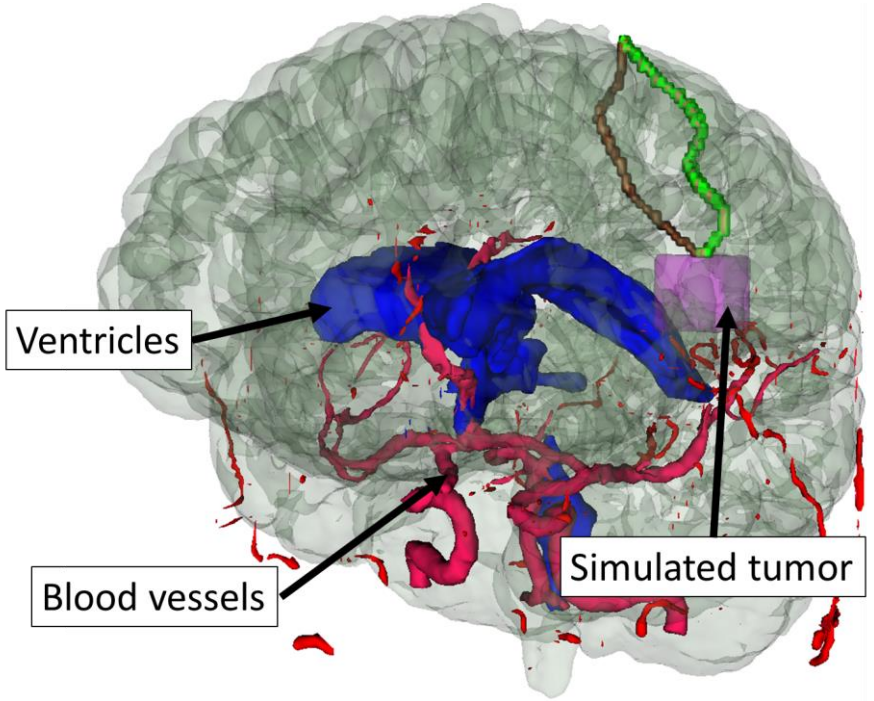
PROJECT:7

Motion planning for needle insertions guided by medical images

- Static obstacles: segmented from MRI/CT data
- Needle model: curvature, insertion depth etc.

Phase 1: Simulation, compare performance of different algorithms

Phase 2: Tentative (phantom studies, we will provide help building a simple robot)



PROJECT:8

Motion planning for surgical robot

- Static obstacles
- Rigid objects

Phase 1: Simulation, compare performance of different algorithms

Phase 2: Implement using kuka iiwa7

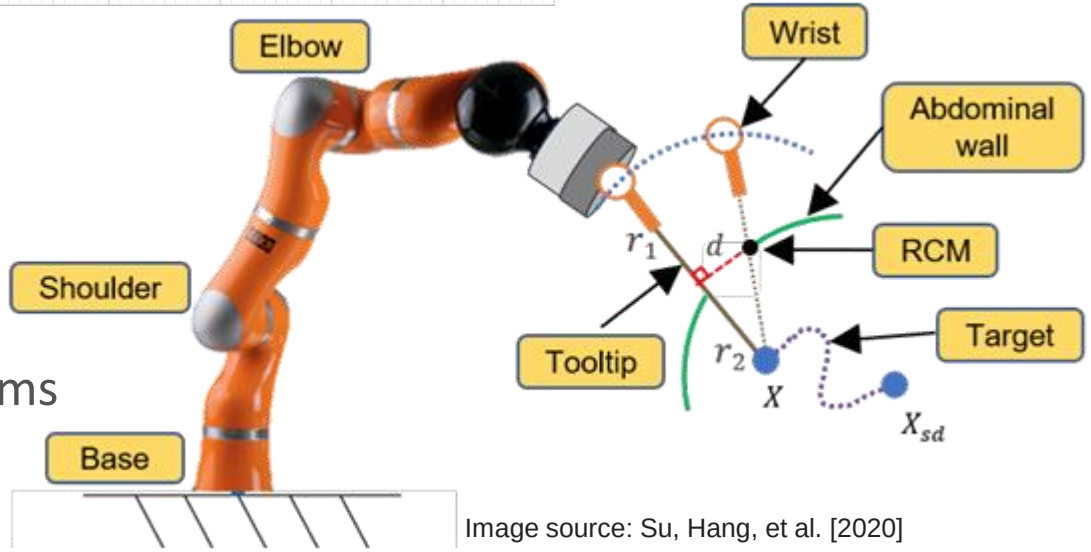


Image source: Su, Hang, et al. [2020]