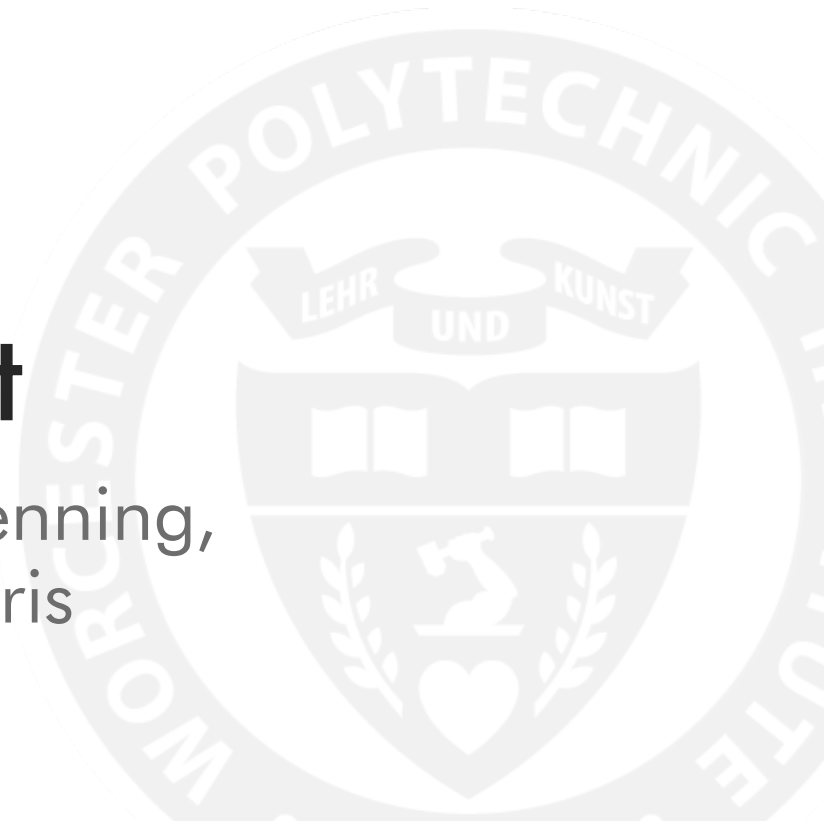




WPI in collaboration with **iRobot®**

Enabling Semi-Autonomous Manipulation on iRobot's PackBot

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Motivation

- PackBot is the most successful defense and security robot in the world
- Using PackBot's arm and gripper can compromise its operator's safety
- Semi-autonomous manipulation reduces operator workload

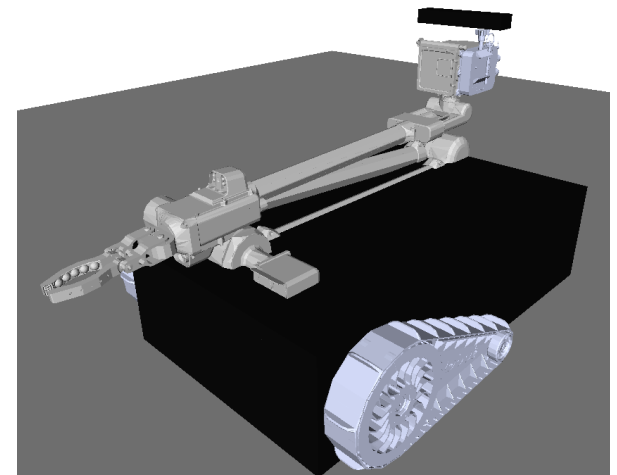
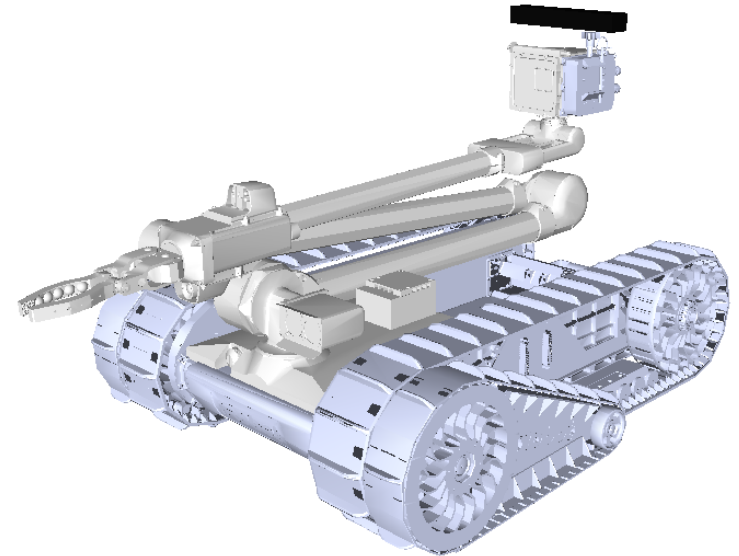


Objectives

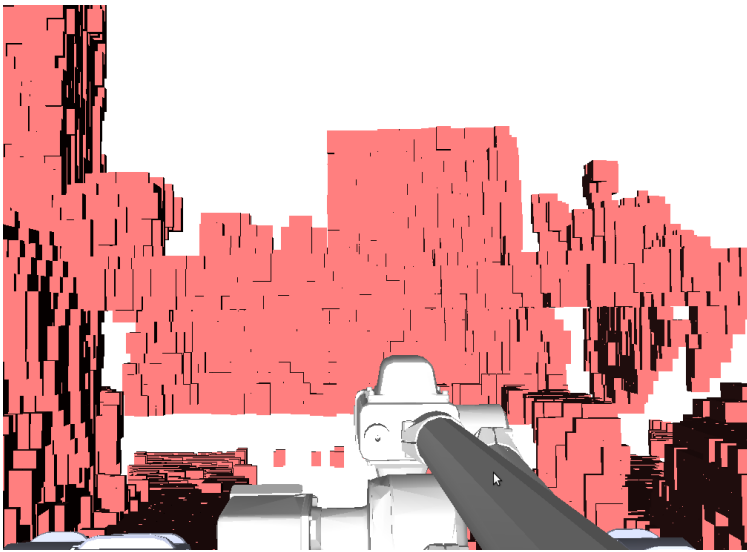
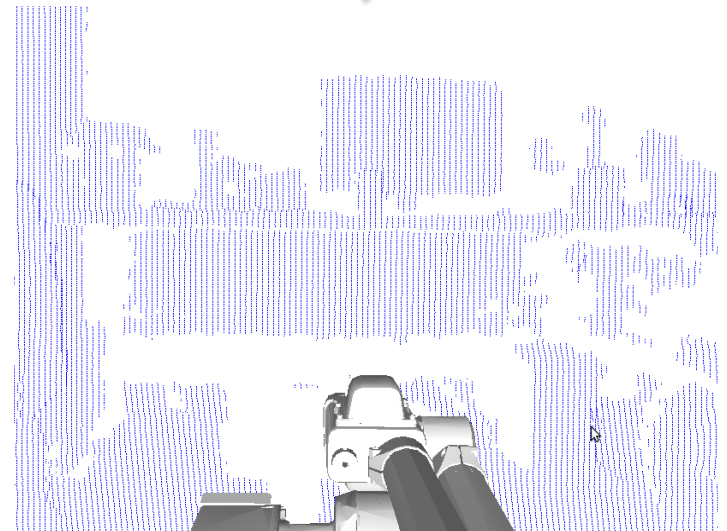
- Simulate PackBot in a motion planner
- Implement trajectory planning and execution
- Use a 3D sensor to recognize obstacles and cylinders
- Enable users to command the robot to grasp recognized objects

Simulate PackBot

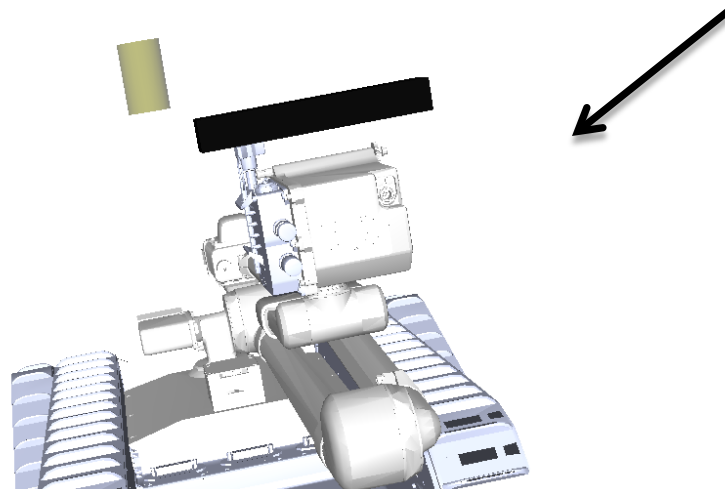
- Converted from SolidWorks to VRML
- Made an OpenRAVE XML file
- Added Xtion Sensor
- Made simplified collision model



Integrate 3D Sensor

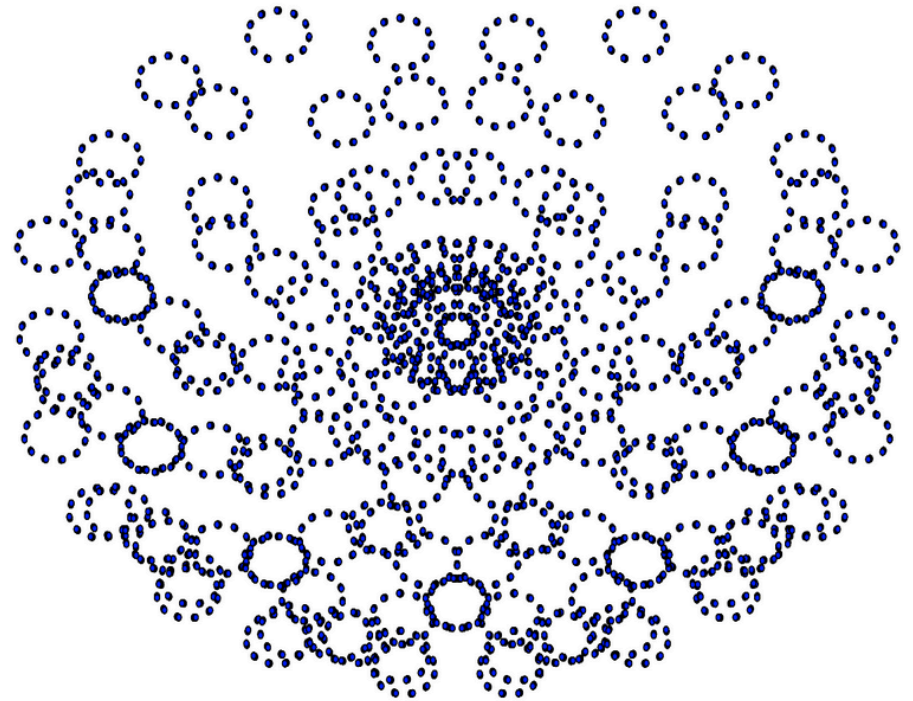


Detect Cylinders



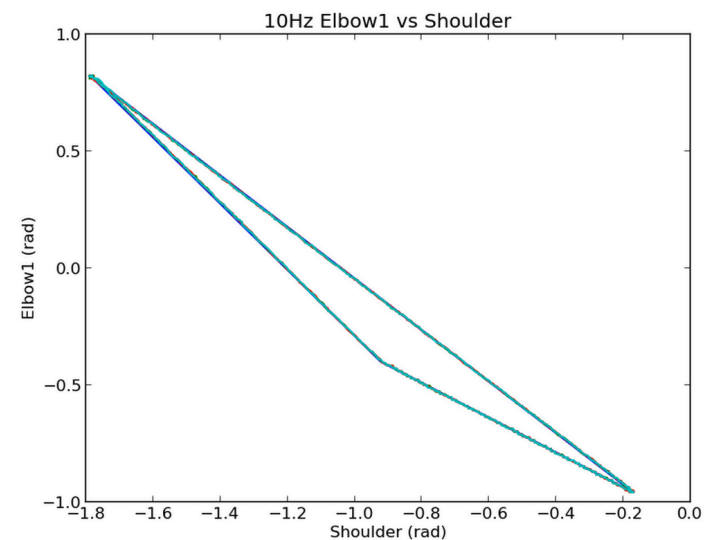
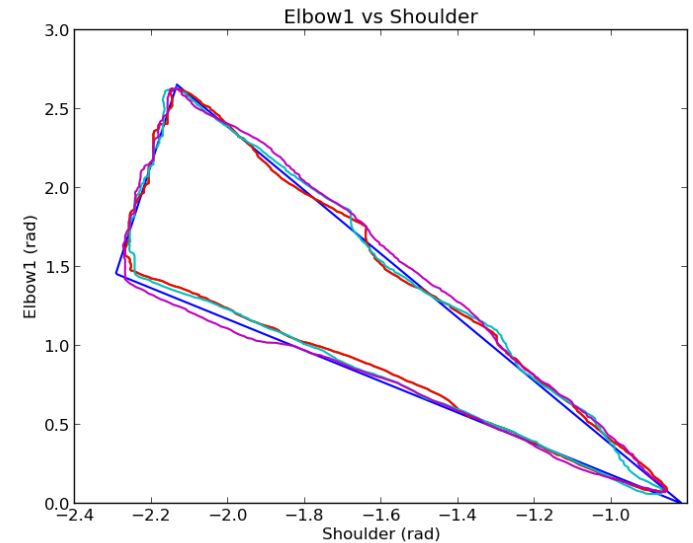
Plan Trajectories

- Pre-generated database of 3 million configurations and poses
- Search the database for the nearest neighbor to the desired end-effector pose
- Run Iterative Jacobian IK solver to get from nearest neighbor to target



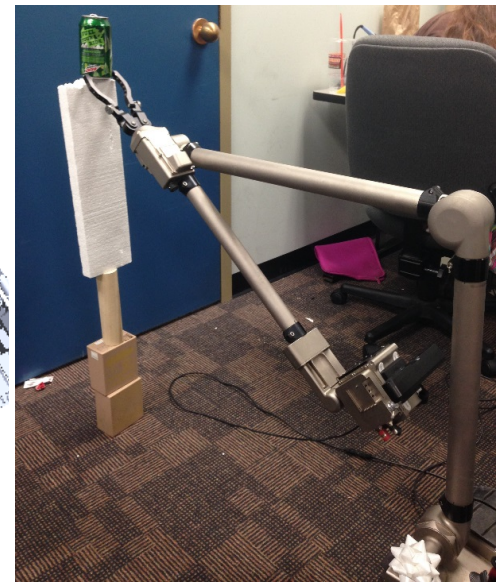
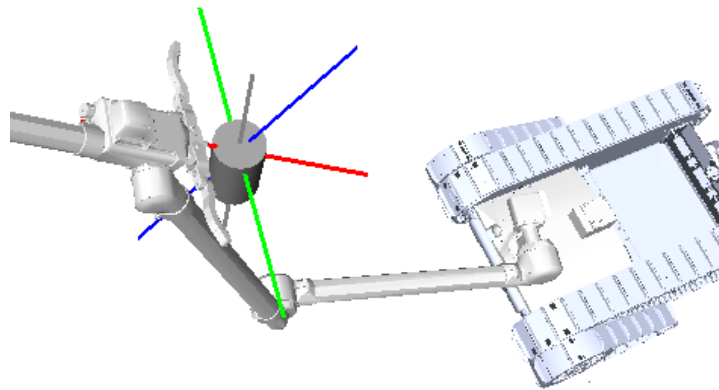
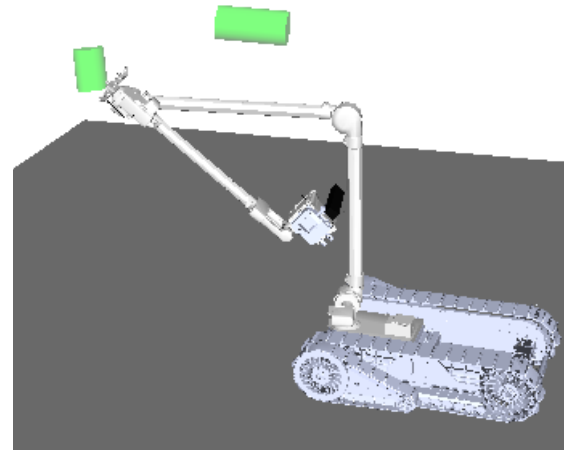
Execute Trajectories

- In openRAVE:
controller plug-in
- On robot:
TrajectoryHandler
script
- Simple proportional
velocity controller

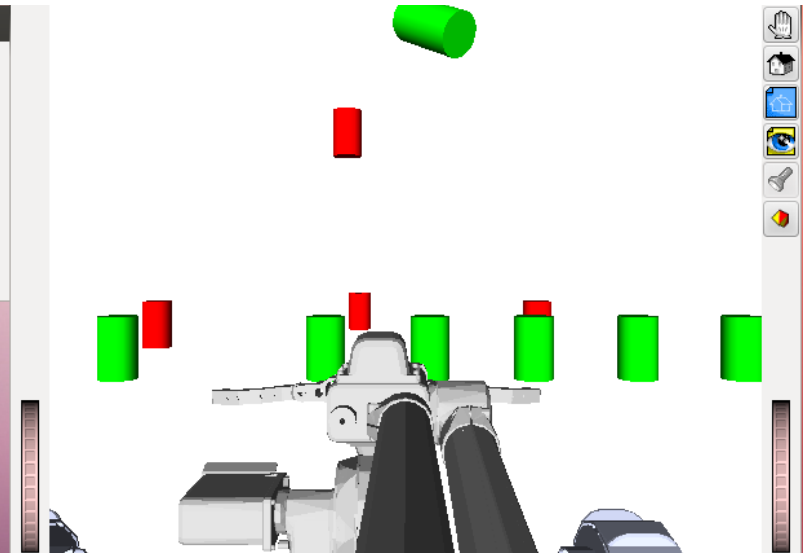
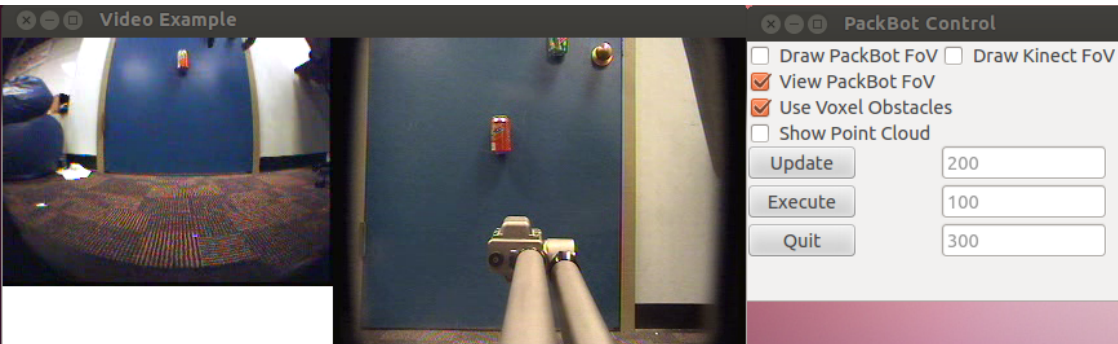
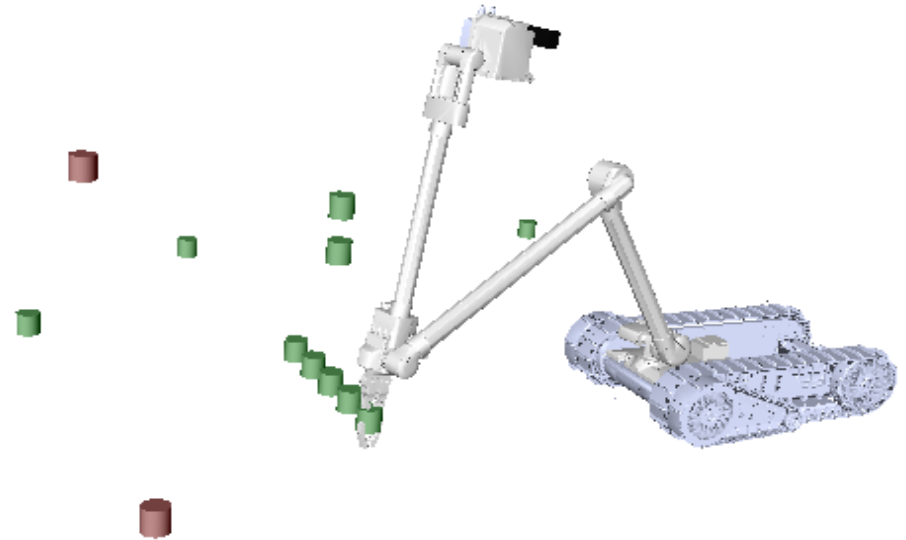
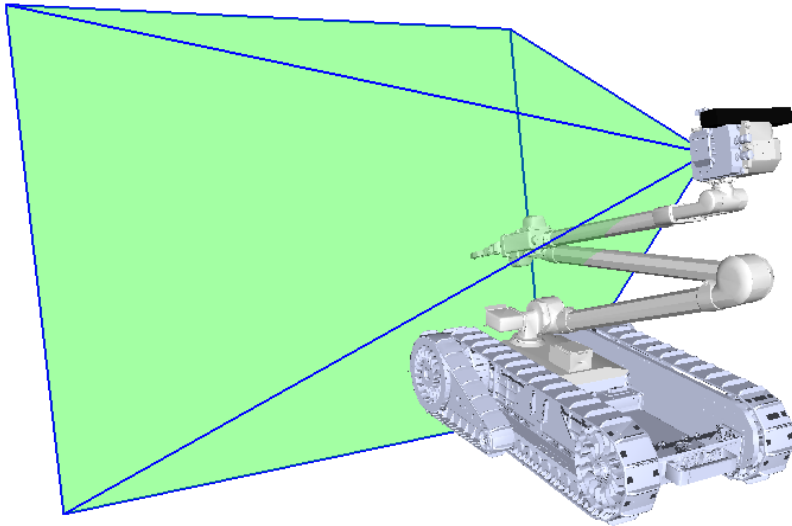


Grasp Cylinders

- Uses IK Solver to find poses approaching the target
- Optimizes based on dot product of gripper and target



Create User Interface



Demo

<https://www.youtube.com/watch?v=OY8pTidjUU0&feature=youtu.be>

Conclusion

- First steps toward semi-autonomous grasping
- Modular, expandable system
- Recommend improving object-recognition, grasp planning, user interface