CS 6301 Project - The Dinnerware Distributor

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Background & Motivation

- **Project's task:** set up a dining table with kitchen tableware
- Assistive robots for the elderly and people with disabilities
- Stats according to the CDC:
  - 3.6% of Americans have difficulty dressing/bathing themselves
  - 12.2% have mobility issues
  - 1 in 4 adults w/ disabilities don't have a healthcare provider
- Tasks robots can do:
  - Household chores, opening/closing doors, pet services
- Types of existing assistive robots:
  - Lean Empowering Assistant (LEA)
  - Robot for Interactive Body Assistance (RIBA)
  - Panasonic

Methodology

- Fetch robot in a Gazebo simulation environment
- Three models: dinner plate, bowl, mug
- Datasets: MultiGripperGrasp
  - Used for finding the ideal plate, bowl, and mug grasps
- Task planning:
  - Grap selection
  - Path planning
  - Execution

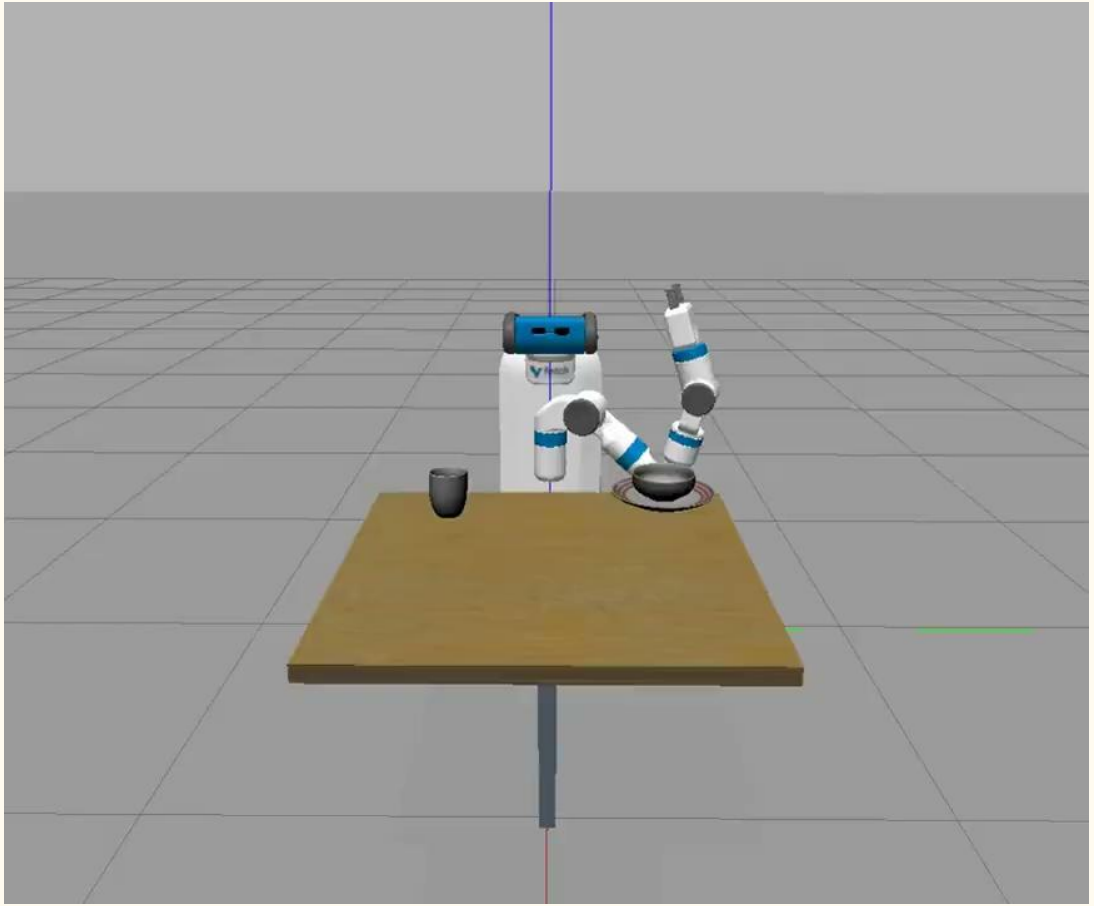
Experiment Breakdown

- Set up scene
  - Add all objects into the scene and identify their positions
- Find the Grasp
  - Cycle through grasp from MultiGripperGrasp for each object
  - Choose the best based on current object position
- Find Gripper path
  - Use the current gripper pose and desired grasp to find a path for the arm
- Execute path
  - Move gripper into position
- Grasp object
- Find path to desired position
  - Use the current gripper pose and desired gripper end position to find a path for the arm
- Release grasp on object

Experiment Results

- Evaluation metrics: placement & orientation, collision avoidance, task completion rate
  - **Mug** -
    - Final placement = [0.95, -0.24, 0.7]
    - Orientation - Correct
    - Collision Avoidance - No Collisions occurred
  - **Bowl** -
    - Final placement = [0.95, 0.2, 0.7]
    - Orientation - Correct
    - Collision Avoidance - No Collisions occurred
  - **Plate** -
    - Final placement = [0.7, 0.013, 0.7]
    - Orientation - Correct
    - Collision Avoidance - No Collisions occurred
  - **Task Completion Rate** - 96%

Demo



Limitations

- Current implementation is limited to the models we used
- Requires pre-defined table dimensions and layout
- Doesn’t handle various textured surfaces
- Doesn’t handle dynamic objects during task execution

References

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