

Baxter the Builder

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Why?

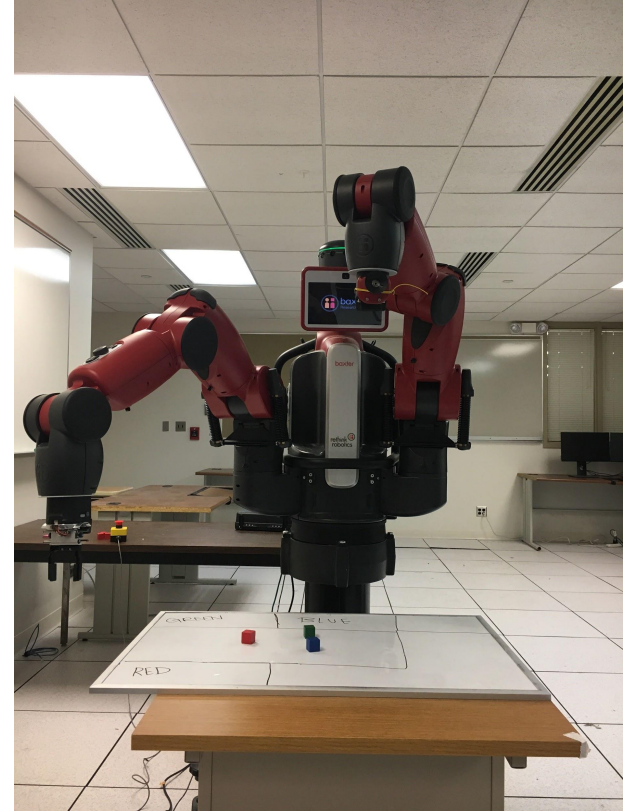
- Sorting and placement used widely in human life (e.g. sorting waste, agricultural harvesting)
- Automation saves time and human effort
- Robots can interact with hazards that humans can't



<https://waste-management-world.com/a/zenrobotics-to-supply-waste-sorting-robot-to-veolia-in-france>

Objective

- Identify objects
- Pick objects based on color
- Place objects in areas that are designated by the human (not hardcoded)





Tie in With Class

- ROS
- Sensing (computer vision)
- Inverse kinematics
- Manipulator usage (spherical wrist)



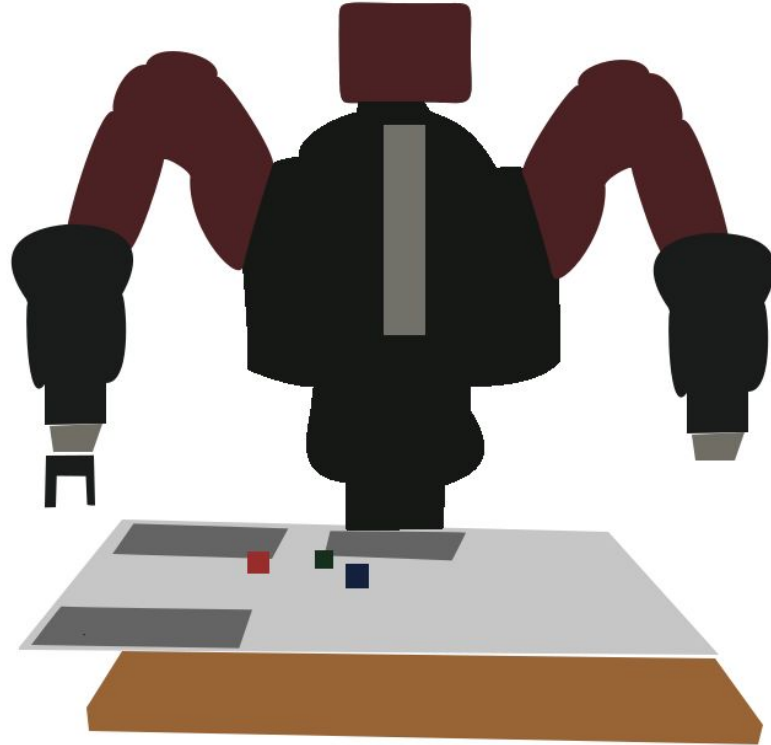


How does it work?

- Left arm positions camera
- Write 'RED', 'GREEN', or 'BLUE' on the whiteboard
- Identify block for given color
- Move block with right arm
- Repeat for each block

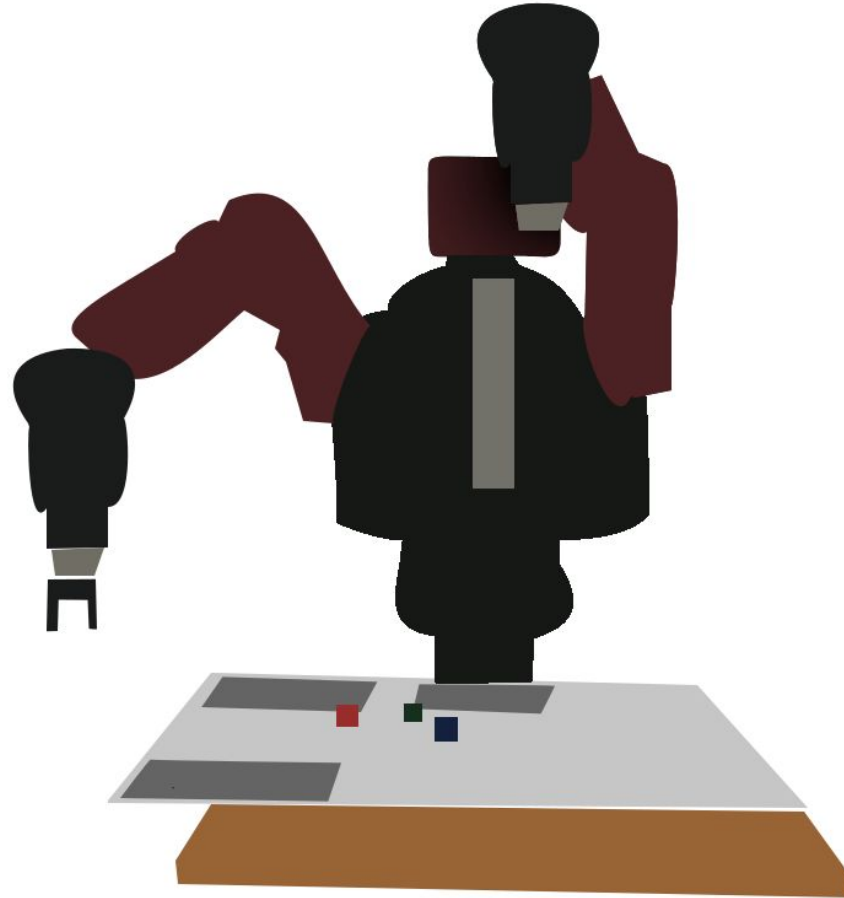


Process



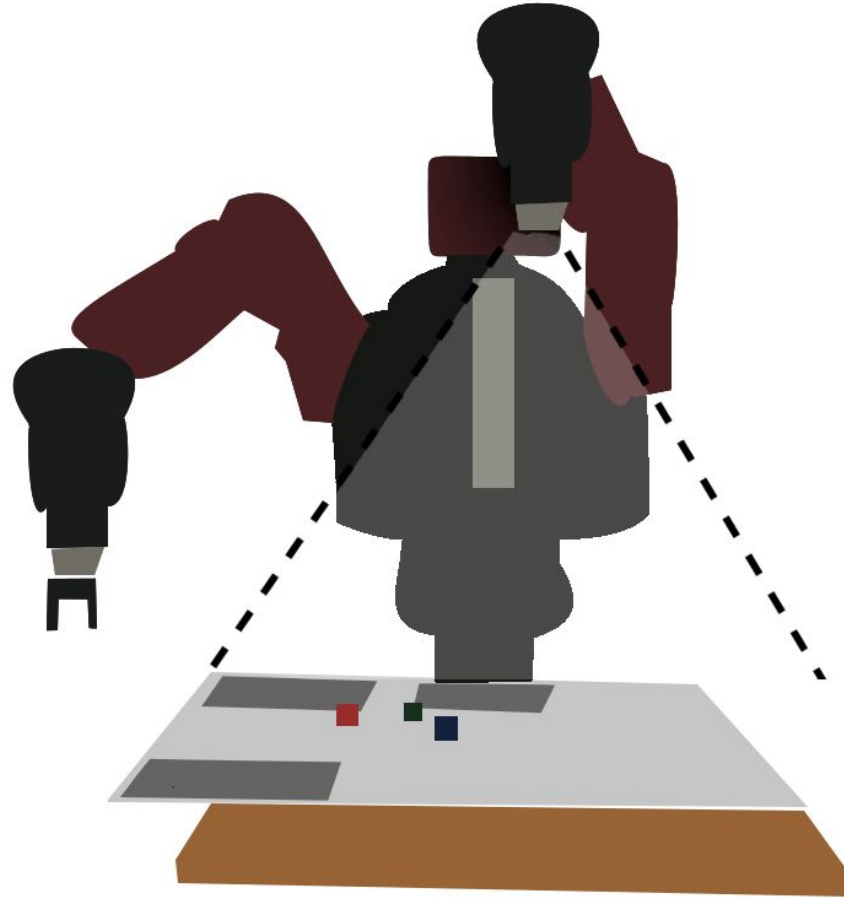


Process



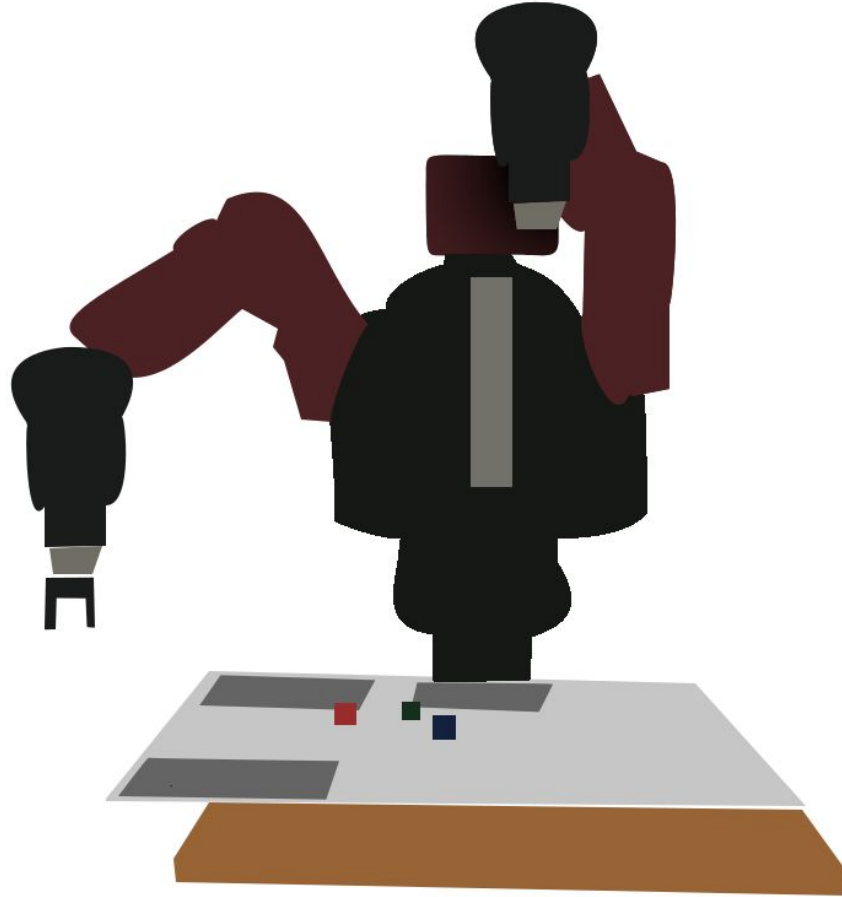


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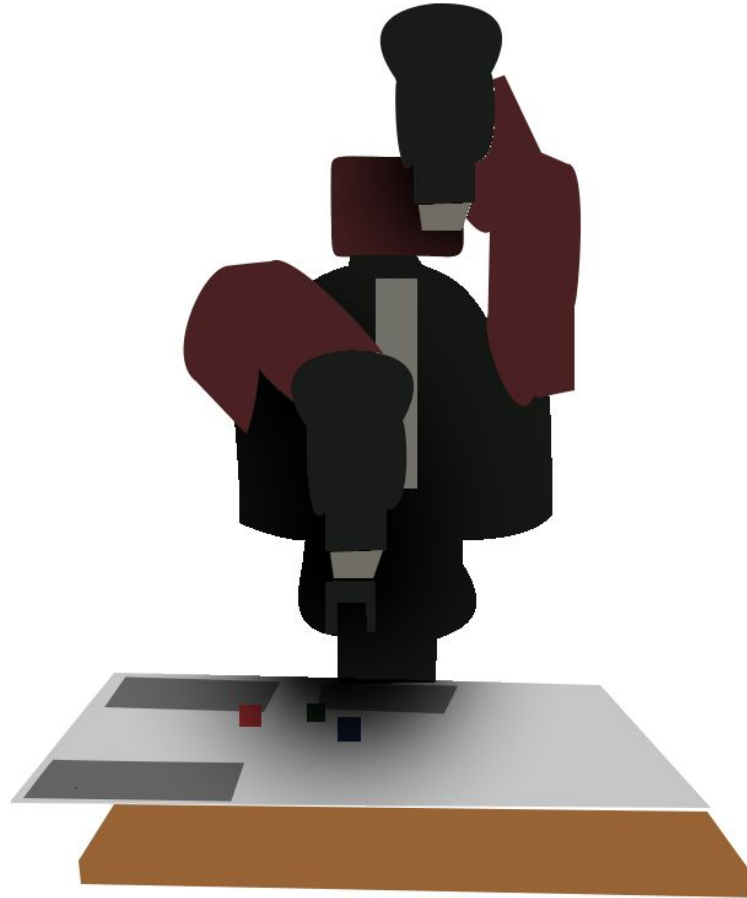


Process



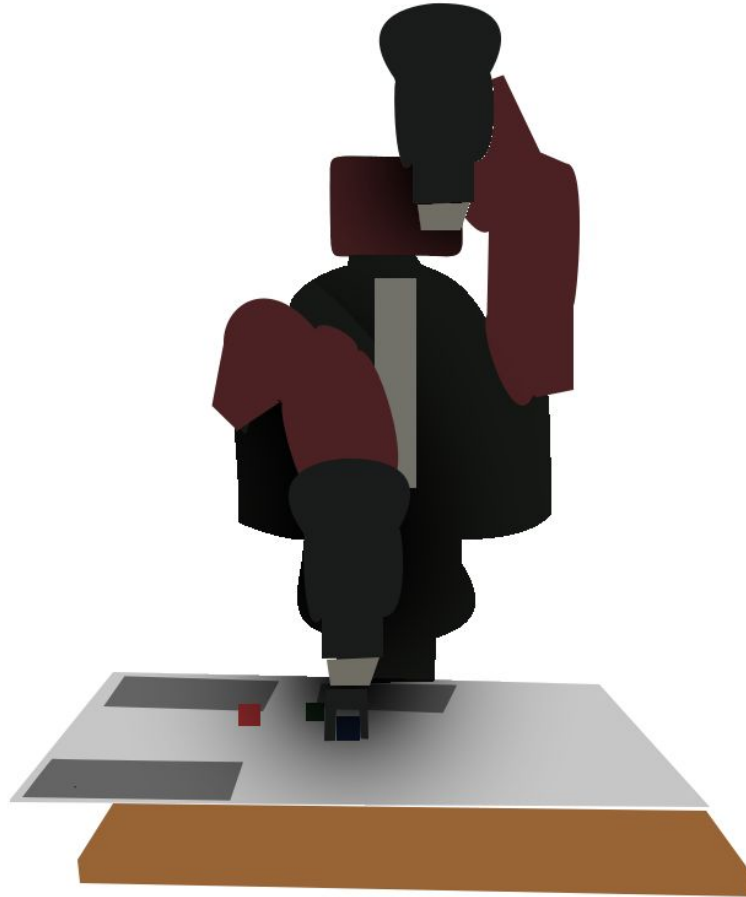


Process



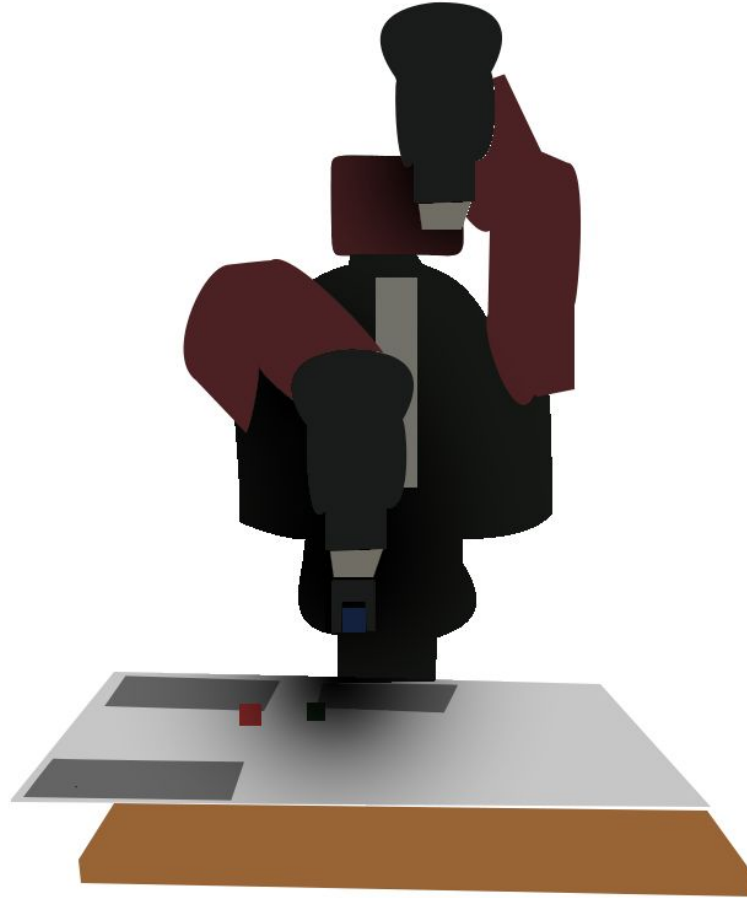


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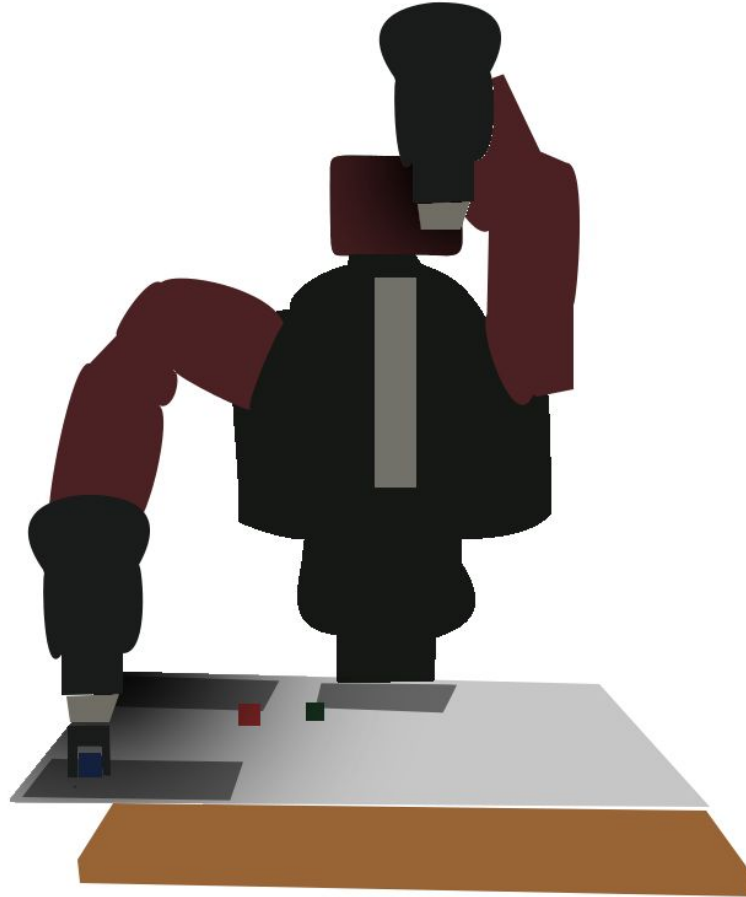


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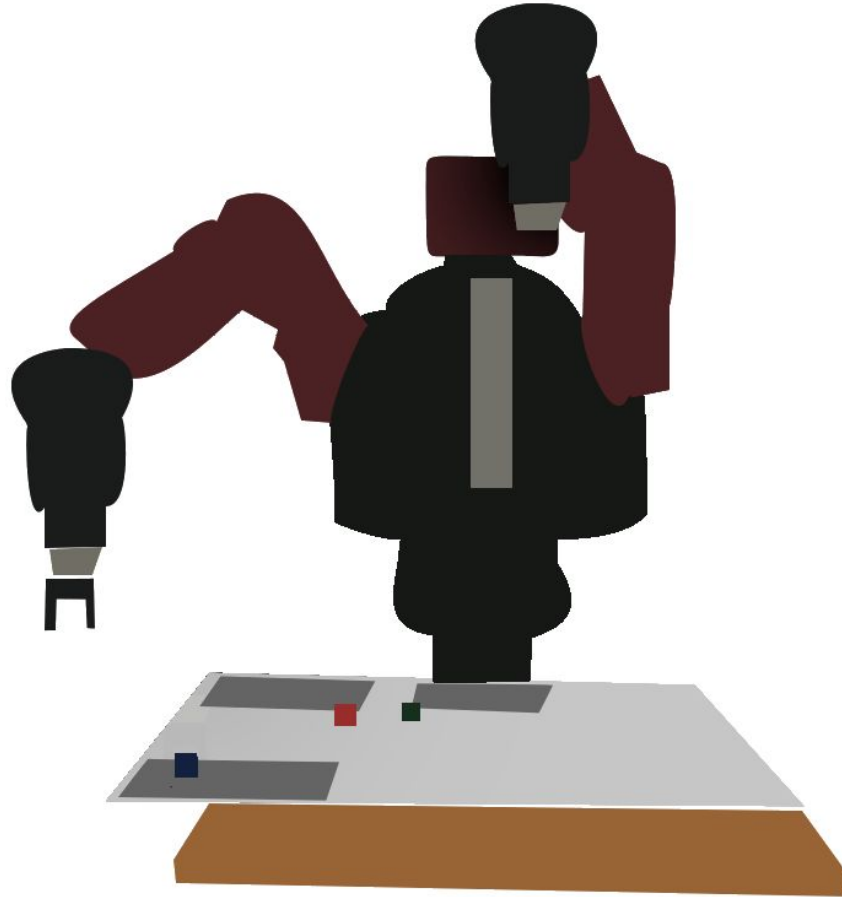


Process





Process



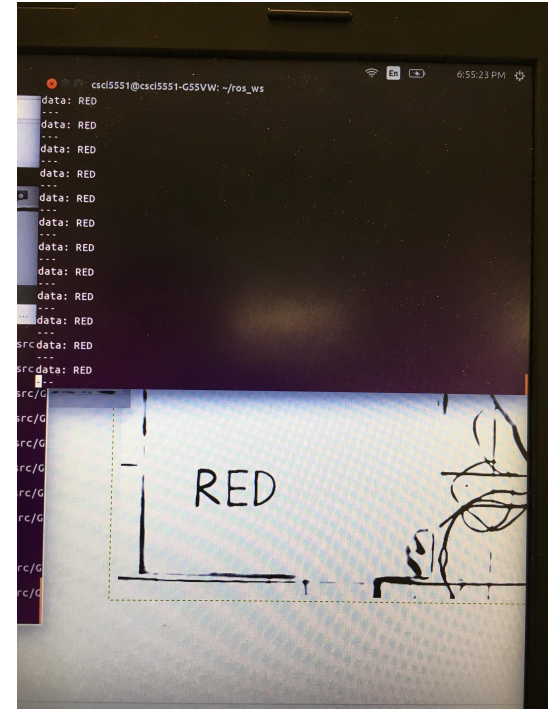


Methodology

- Environment configuration - board in fixed position relative to Baxter
- Block identifier node - identifies blocks, tags colors, calculates centroids (OpenCV)
- Target identifier node - “reads” text and identifies its location (OpenCV)
- Coordinator/pick and place node - prepares Baxter, calls services to get block/target locations, carries out movement and manipulation (baxter_interface, MoveIt!)

Division of Labor

- Claire: identify number/color of blocks
- Avneet: identify target locations
- Ashwad: calculate visual servoing
- Emily: pick and place





Where are we right now?

Baxter can...

- Identify the colors and find the positions of the blocks using the left hand camera
- Translate the image coordinates to coordinates in Baxter's frame
- Open and close its gripper around a block
- Identify the handwritten text on the whiteboard (sometimes)

Still need to...

- Move its arm using MoveIt to that location and open and close the gripper (encountering probs.)
- Identify the handwritten text centroid on whiteboard in image coordinates
- Tie all of these scripts together using a ROS service to pass information back and forth
- Refine the visual servoing

Challenges

- ROS topics → ROS service
- Lighting in Lab
- MoveIt Configuration/IK Solutions Not Found
- Availability of Baxter



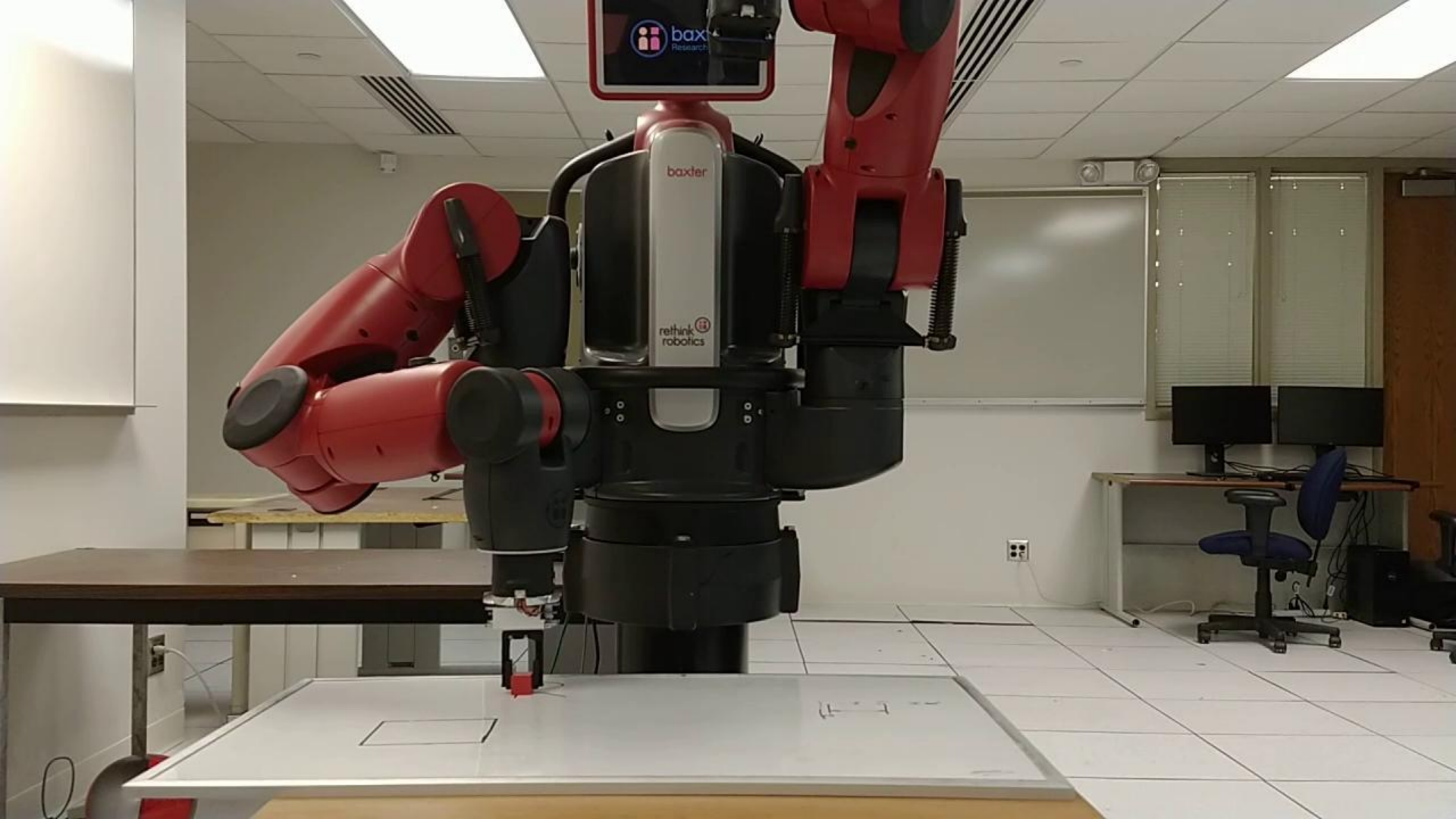


Next steps

- Gesture recognition
- Sort based on other features/combinations of features
- 3D capability - stacks of objects, objects on shelves
- More robust/flexible code with user feedback



A Sneak-Peek of Baxter's Moves



Questions?
