

Cozmo's Containers

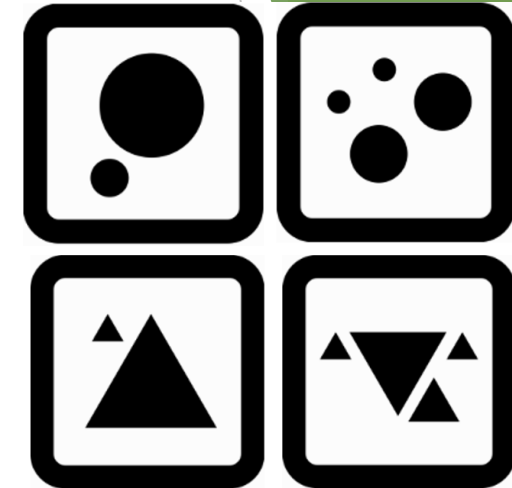
15-494 Cognitive Robotics

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Set Up

- ▶ Container ==
 - ▶ Cardboard box cut down to 45 mm
 - ▶ 1 Custom Marker Tag placed on each side of the box
 - ▶ Place directly in the center
 - ▶ Use a different tag for each side
 - ▶ Cubes visible

CONTAINER 1



CONTAINER 2



Objective

- ▶ Locate and define (position & dimensions) of a container after seeing 2 or more custom markers
 - ▶ Requires a Container Object representation
 - ▶ Container appears on world map
 - ▶ Container added to rrt path planner as an obstacle
 - ▶ Up to 4 containers in the world map
 - ▶ If only 1 marker seen, search for an adjacent side
- ▶ When instructed, Cozmo should be able to pick up the desired cube and place it in the desired box

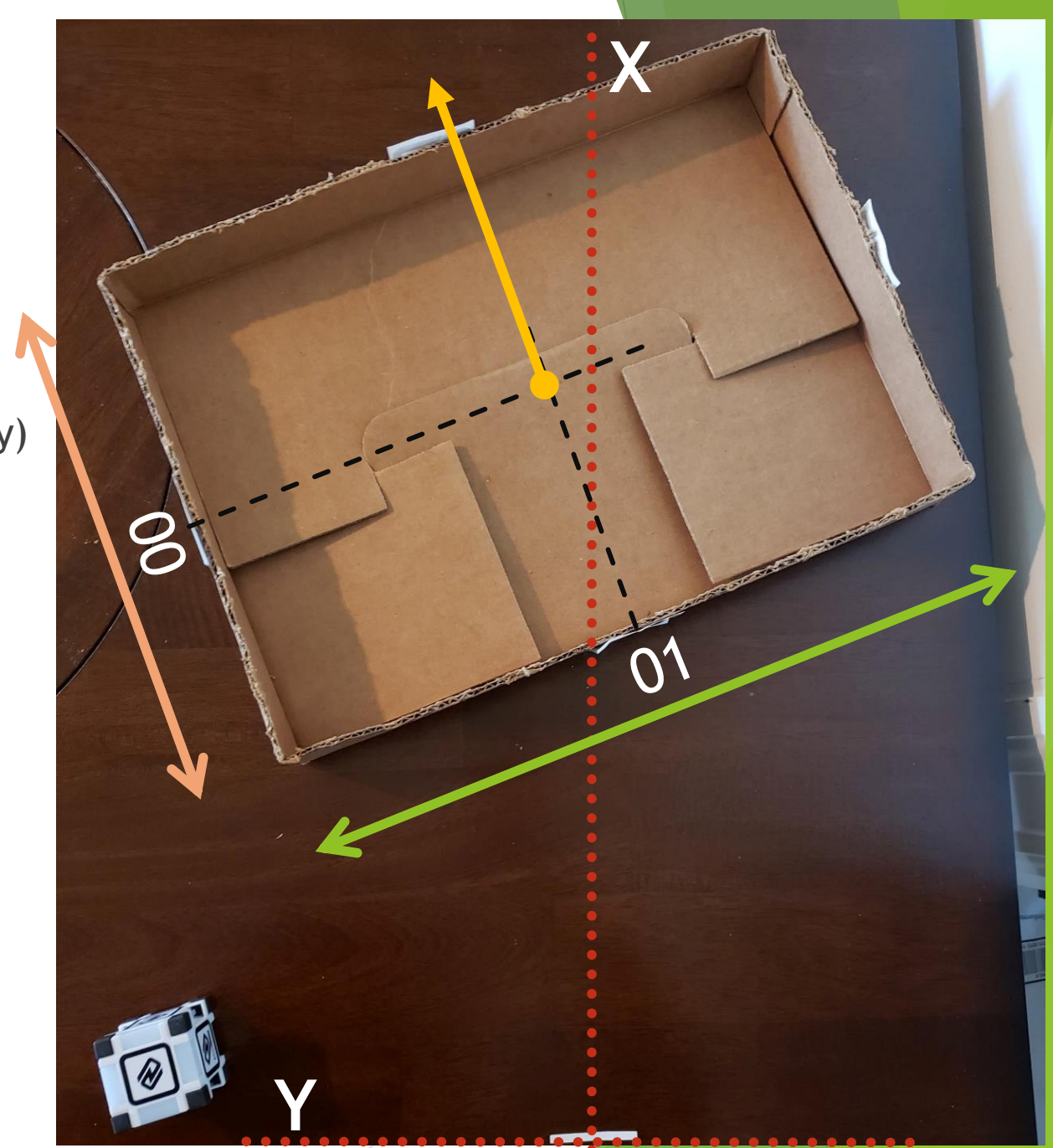
Container Obj Class

▶ Container Representation:

- ▶ container id
- ▶ location of the center of the container (x,y)
- ▶ angle of the container (theta)
- ▶ dimensions of the container (width,depth)
- ▶ Update position and size estimate every time marker is seen

▶ Example:

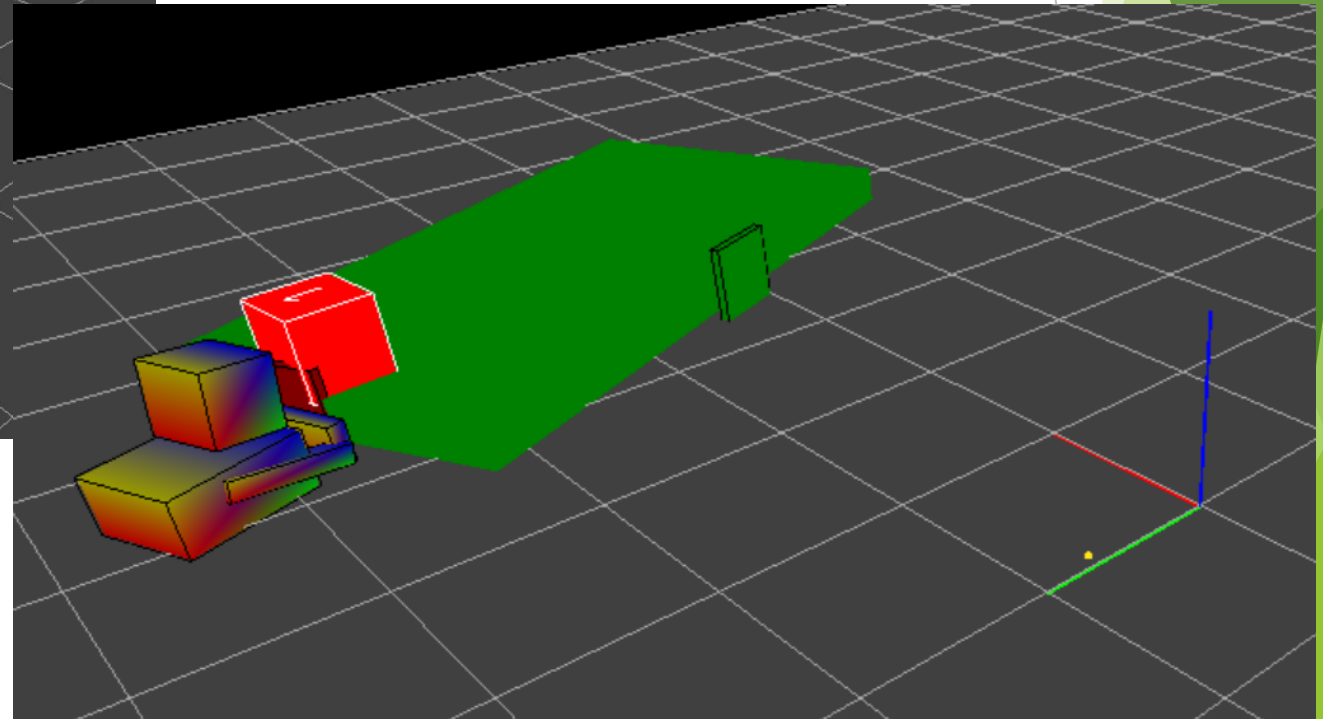
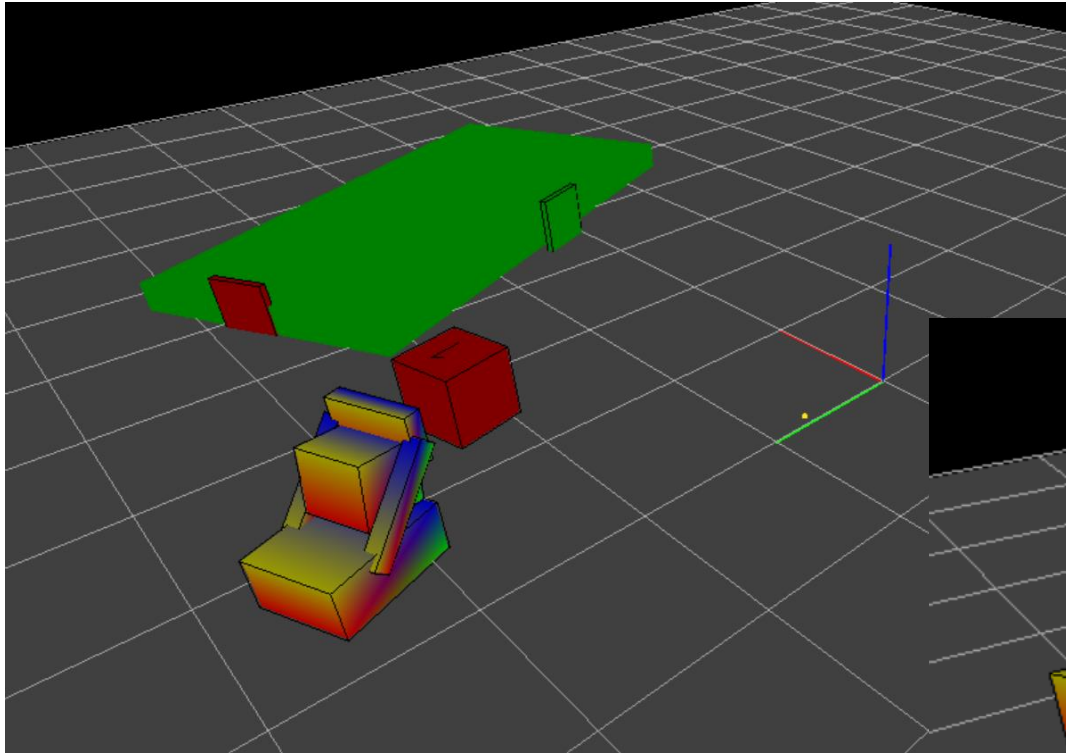
- ▶ Assuming marker 01 seen first
- ▶ (x,y) = ●
- ▶ Theta = →
- ▶ Width = ↔
- ▶ Depth = ↔



ContainerTest.fsm

- ▶ Cozmo prompts the user with speech
- ▶ User can input desired cube and container through text messages
- ▶ StartExplore() + PilotToPose() + search loop:
 - ▶ If only one side of container seen:
 - ▶ Travel perpendicularly to container from marker seen
 - ▶ Turns back towards container every 100 mm
 - ▶ Assume containers smaller than 1000 x 1000 mm
- ▶ GetDocLocation() + PilotToPose()
 - ▶ Uses RRT Path finder to test multiple docking locations until one works
 - ▶ Starts with side closes to cozmo, then orients around the box CCW
 - ▶ Tests left and right of each marker before checking the next side
- ▶ Lower lift to drop cube into container

A Demonstration



Future Work

- ▶ Add recognition for remaining custom markers so that containers 3 and 4 work
- ▶ Improve search method for adjacent side
 - ▶ Could maybe use contours or edge detection to approximate edge of the container and make more decisive turns to find adjacent edge
- ▶ Add door for Cozmo to retrieve cubes from container