



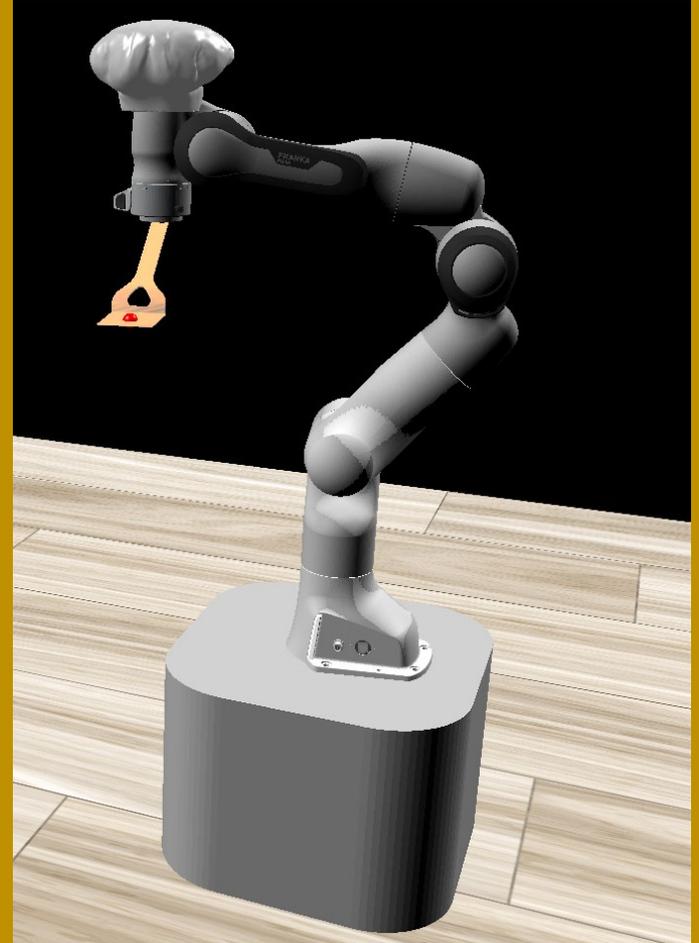
Gordon the Robot makes a Grilled Cheese

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- **Abstract/Introduction.** Introduce your project at a high level. What was your motivation for choosing this project? Explain the challenges of your task, and summarize the design of your final implementation. This is similar to the milestone and in-class presentations. (~0.5 page)
- **Final implementation.** Provide a detailed description of how you implemented your project. Give the equations, show figures/photos, and write about anything that makes it easier to understand how you implemented your solution. Talk about the different subsystems and how they integrate with each other. When you discuss the robot controller in detail, do not mention the specific functions that you used. Instead, explain what controller you used (e.g., we do not want to see "we used a posori task" -- instead, say "we used an operational space controller for the end effector position/orientation control with/without dynamic decoupling ...") and give your control equations. This part should be written in a way such that someone with a robotics background who reads it could re-implement your idea. (~3 pages)
- **Challenges.** Discuss the major problems you ran into, and your solutions for solving them. For each problem, tell us about what you did to resolve it, and what other options you considered. If you had to reimplement your project from scratch, would you do anything differently? (~1 page)
- **Results/Conclusion.** Give us your final thoughts about the project. What were the most important lessons/skills that you learned? Include at least one link to a video of your demonstration. (~0.5 page)

Introduction

- Implement a collaborative kitchen robot
- Goal: make a grilled cheese

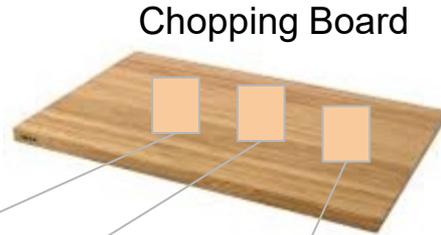


Environment



Objects to be modeled

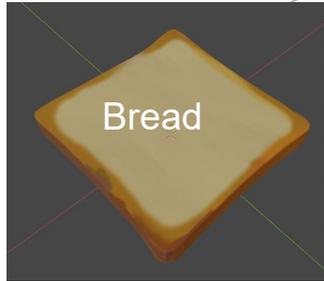
- Spatula
- Chopping board
- Flat Grill plate
- Plate to serve
- Bread & cheese



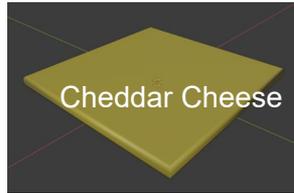
Spatula



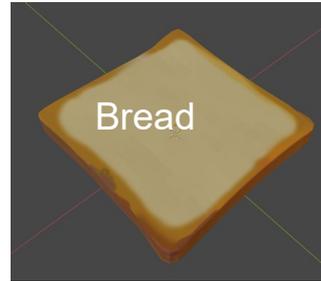
Griddle Grill



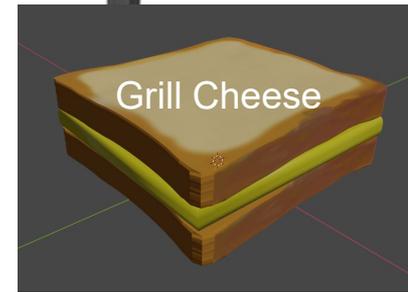
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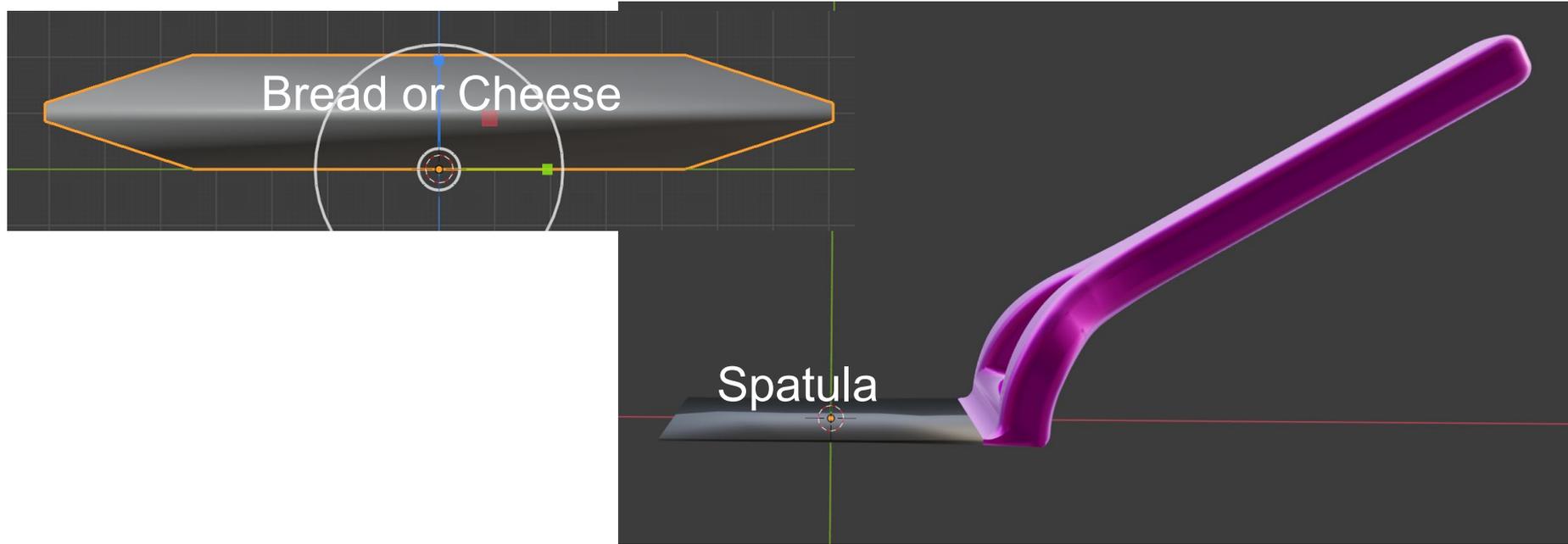
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Plate

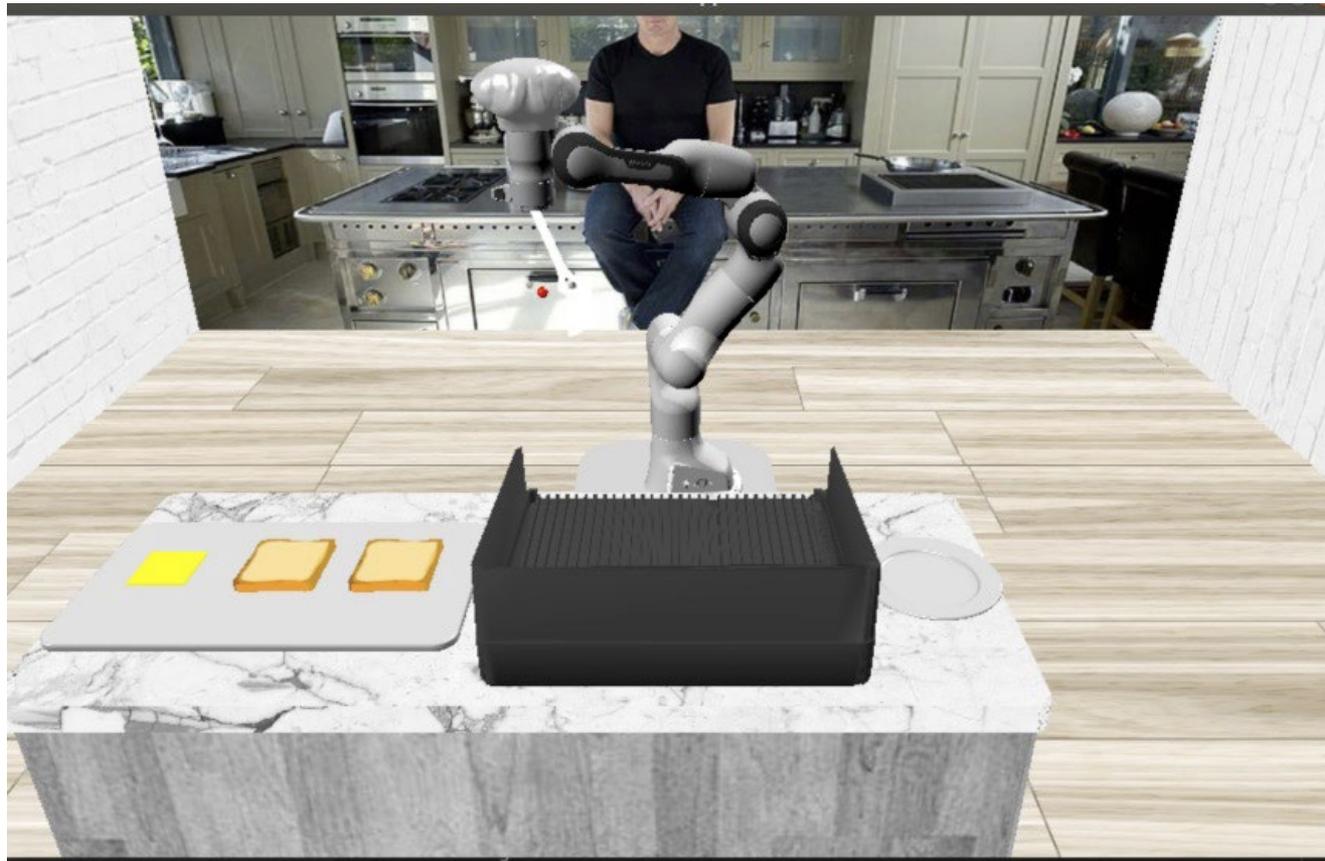


Collision Meshes

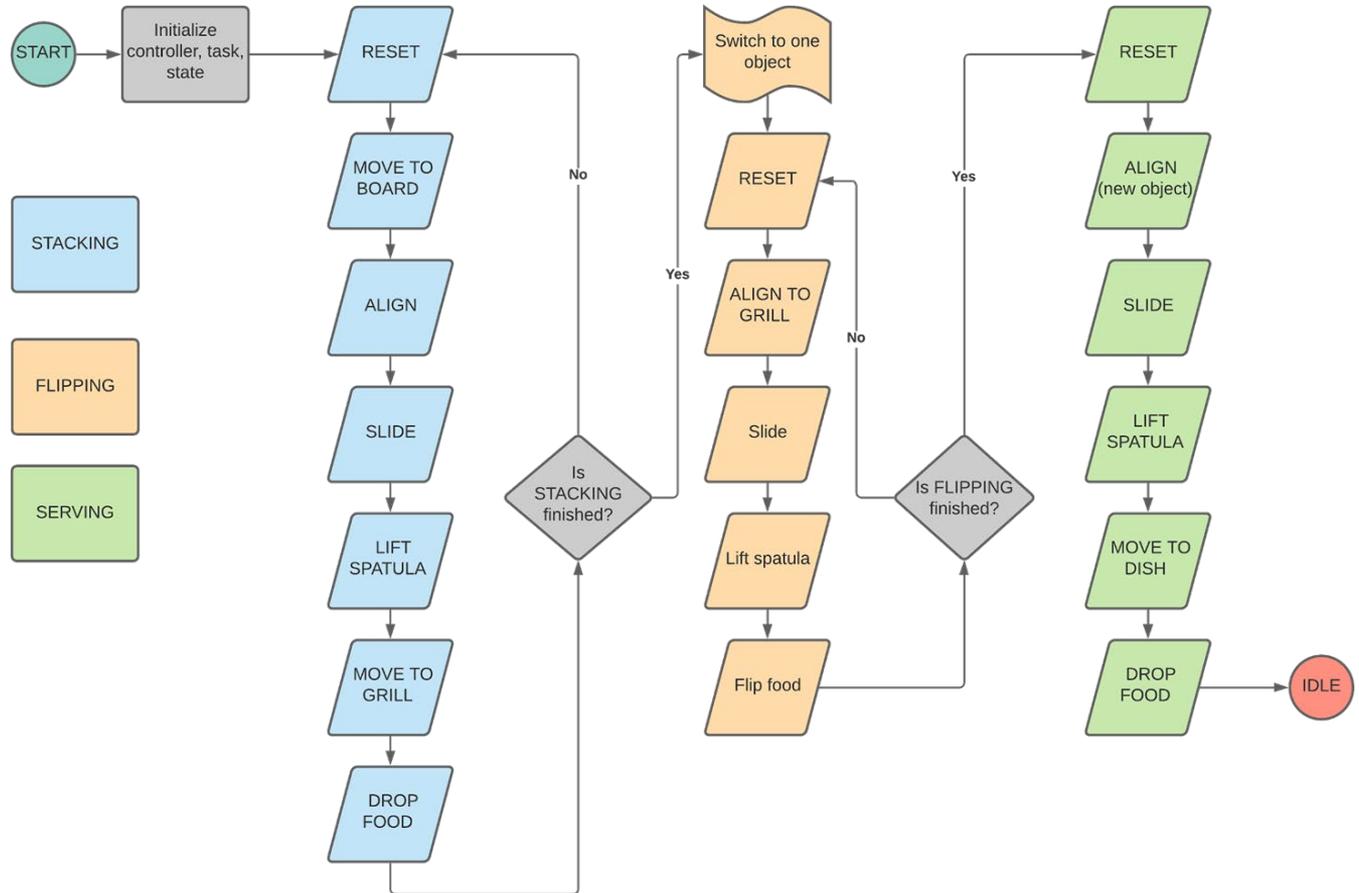




Simulation Environment



State Machine



Control Strategies

- Operational space controller
 - For the end effector (spatula) position/orientation control
 - Use dynamic decoupling
- Joint space controller
 - Move the mobile base

Challenges

- Representation of multiple objects as a single object
 - Switch the visibility for both dynamics and graphics
- Implementation of the flipping task
 - Control the speed and orientation of the spatula
 - Singularity problem depending on the configuration of the robot
- Implementation of the state machine
 - The logic for switching task
 - Reuse code as much as possible
- Sliding under the object
 - Modify the collision mesh of the objects
- Stacking objects into one location
 - Align the objects with the corner of the grill
- Frame Alignment
 - Align the different frames for object, robot and world

Demo

Add video

Conclusion

- Representation of multiple objects as a single object
 - Switch the visibility for both dynamics and graphics