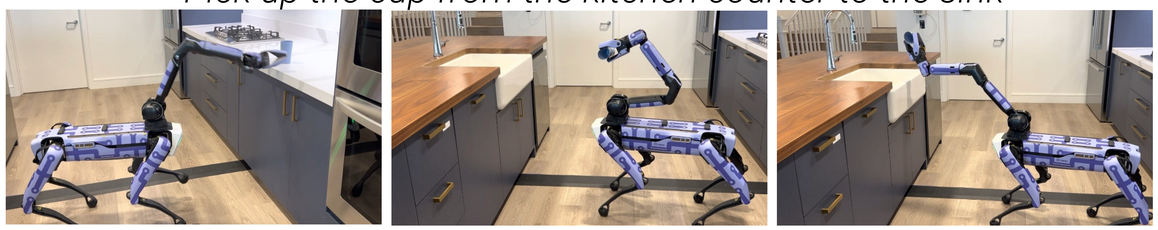
# LSC: Language-guided Skill Coordination

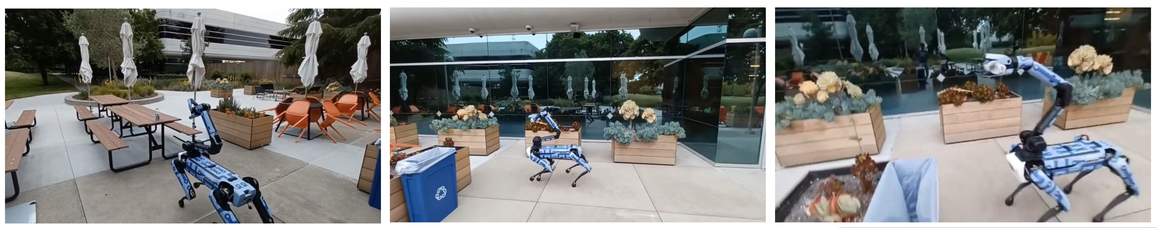
Tsung-Yen Yang[1*], Sergio Arnaud[1*], Kavit Shah[1*], Naoki Yokoyama[2], Alexander William Clegg[1], Joanne Truong, Eric Undersander, Oleksandr Maksymets[1], Sehoon Ha, Mrinal Kalakrishnan[1], Roozbeh Mottaghi[1], Dhruv Batra[1,2], Akshara Rai[1]

[*]Equal Contribution [1]Meta AI, FAIR Team [2]Georgia Tech

*"Pick up the cup from the kitchen counter to the sink"*



*"Take the bottle to the trash"*

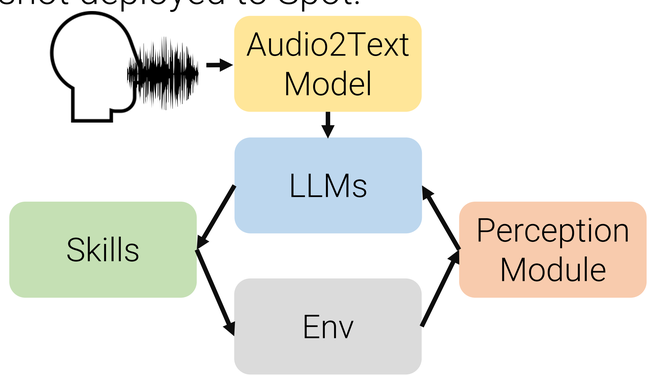


*"Bring me the chocolates, cereal and pills to the room table"*

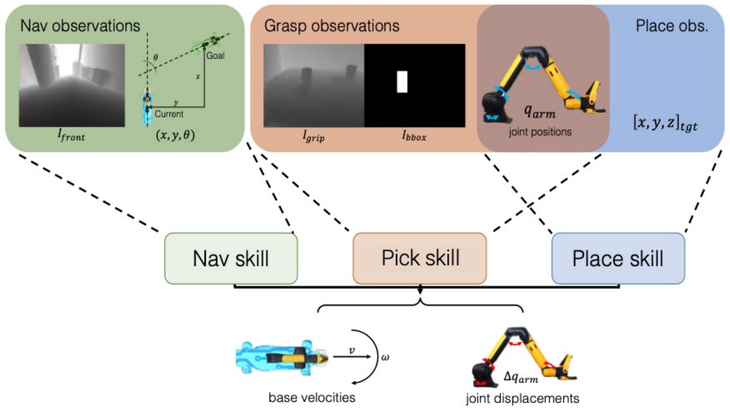
*"Get the mug in the table and place it in the sink"*

## Summary

- Robot receives a free-form natural language instruction for object rearrangement
- Large Language Models (LLMs) make calls to low-level skills (`nav, pick, place`)
- Skills trained in simulation (Habitat) and zero-shot deployed to Spot.




## A Library of Skills [1]




## Training

Habitat-Matterport (HM3D) [2]:

- 1,000 high-resolution 3D scans of real-world residential/commercial/civic spaces

ReplicaCAD [3]:

- Interactive environment with 84 different furniture arrangements


## Chain of Thoughts Prompt [4]

*You will solve a simple rearrangement task that requires you to Navigate to a given object and Pick it up, and then Navigate to a given location and Place it there.*

Instruction: *Go to table and find the mug, and return it to box*

Solution: `Nav(table), Pick(mug), Nav(box), Place()`

Instruction: *Bring the apple from the counter to the table*

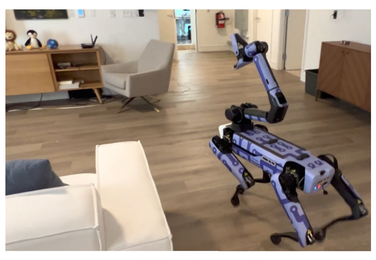
Solution: `Nav(counter), Pick(apple), Nav(table), Place()`

[1] Yokoyama et al., "Adaptive Skill Coordination for Robotic Mobile Manipulation", 2023.
[2] Ramakrishnan et al., "Habitat-matterport 3d dataset (HM3d): 1000 large-scale 3d environments for embodied AI", 2021.
[3] Szot et al., "Habitat 2.0: Training home assistants to rearrange their habitat", 2021.
[4] Wei et al., "Chain of thought prompting elicits reasoning in large language models", 2022.

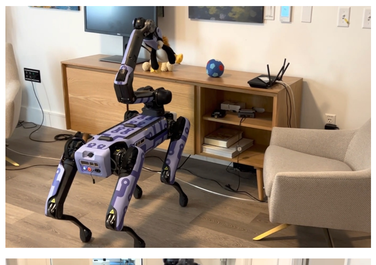
## Real World Deployment

*"Find the plush in the table and place it in the case"*

`Nav(table)`



`Pick(plush)`



`Nav(case)`

`Place()`