

RoboStage

ロボット化された世界のためのロボット試験環境・シミュレーション環境の対話型生成



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Company:

Asteria ART, LLC.



ARTEFACTS

Service: **ARTEFACTS** (www.artefacts.com)

Continuous Integration & Simulation Platform

Team: various background of members

Specialists of AI, Robotics, Frontend, Backend, Devops...

(France, China, England, Spain, Hungary, Norway, US, India, Japan)

Location: Shinjuku, Tokyo, Japan

Established: June 20th, 2019.

Vision:

Robotized World

to address key problems.
(climate change, workforce shortage...etc.)



Problem

The sales need some demos before the customers will buy their robots.

The sales expect developers to support for demos.

Developers are ALWAYS BUSY and it is difficult to make demos.



“Software engineer is busy” image by RYOYO ELECTRO CORPORATION with NVIDIA Jetson AGX Orin

Solution

RoboStage

a video generator based on your own robot, and using generative AI.



本デモのロボットモデルは、株式会社アールティの“Sciurus17 ROS Packages”を利用しています。

The robot model in the demo is: “Sciurus17 ROS Packages” by RT Corporation.

Solution

RoboStage

a video generator
based on your own
robot, and using
generative AI.

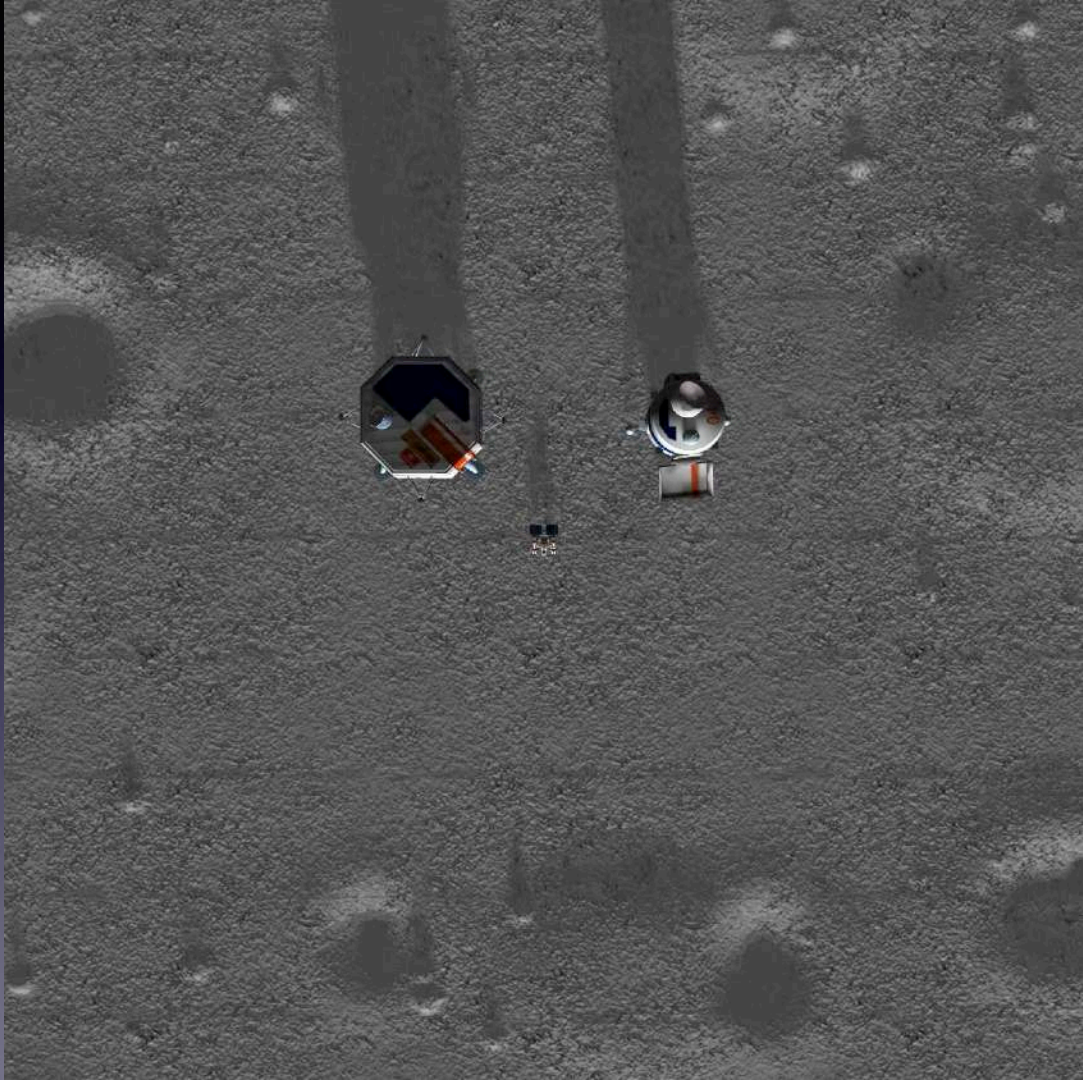


本ロボットには、株式会社CuboRexの
CuGo シリーズを利用しています。
<https://cuborex.com>

Solution

RoboStage

a video generator
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generative AI.



Related works

Robotics planning & control via Generative AI

	Multimodal input	High level planning	Motor control via primitives	Direct motor control	
RoboStage		✓	✓* sim only		
RT-2 (DeepMind)	✓			✓	
RoboCat (DeepMind)	✓			✓	
GenSim (MIT) https://gen-sim.github.io/		✓	✓* sim only		
TidyBot (Princeton)		✓	✓		
InnerMonologue (Robotics at Google)	✓	✓	✓		

Above table made based on our research and it may wrong.

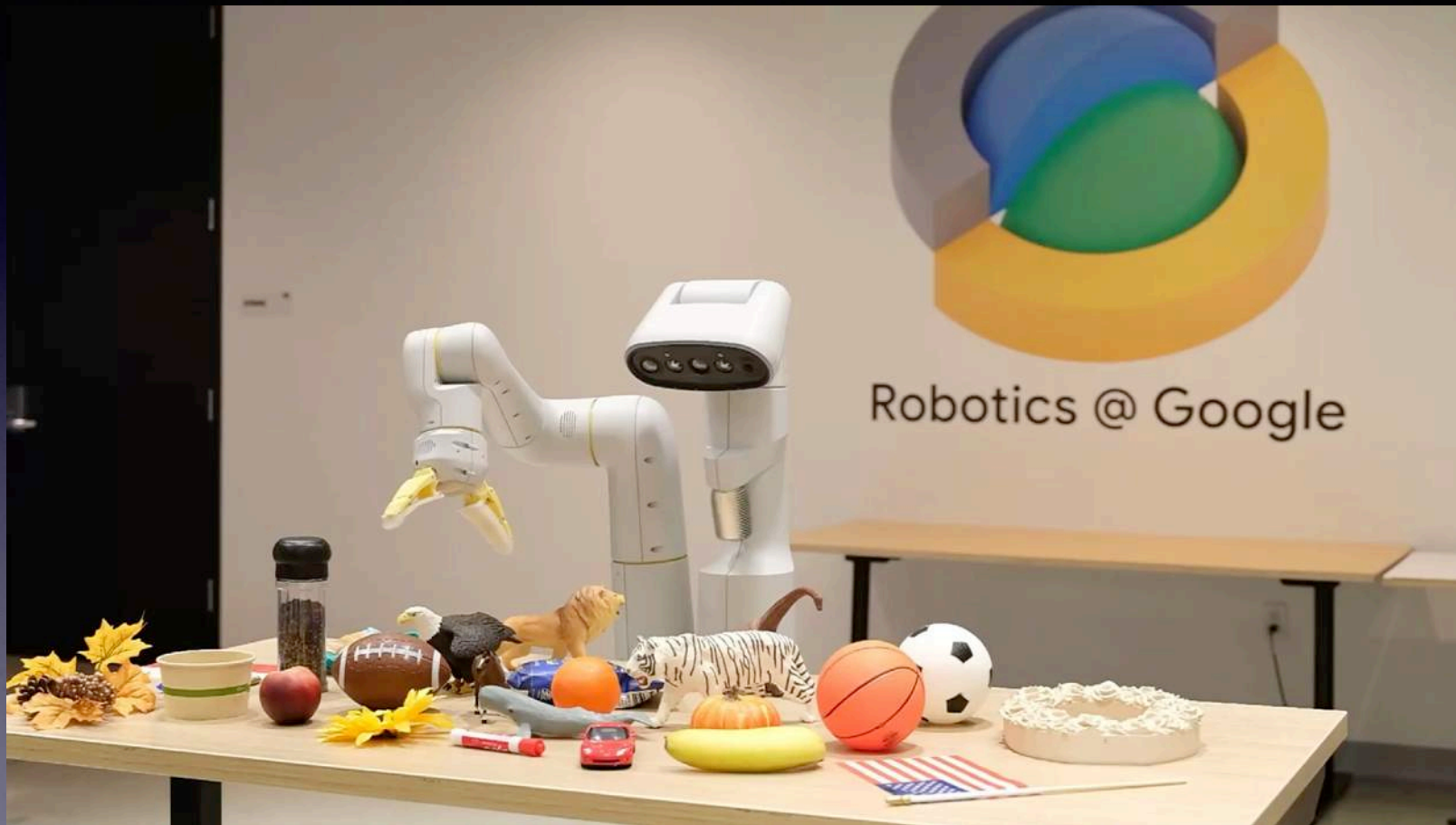
Related works

Robotics Simulation Environment via Generative AI

	Asset generation	Layout generation	Layout scale	Task variety	
RoboStage	✓*planned	✓ ✓	Large Spaces	Large	
Gen-Sim (MIT) https://gen-sim.github.io/	✓	✓	tabletop	limited	
Gen2Sim (CMU) https://gen2sim.github.io/	✓	✓	Tabletop, small room	Large	
Text2NerF	✓* (limited viewpoints)	✓* (limited viewpoints)	Large spaces	None (not a simulation)	

Above table made based on our research and it may wrong.

Related works



Environment Form

Seed
0

Floor Size
5 5

Counter Models
 Bar IslandBarCounter

Table Count
3

Table Models
 BellaCoffeeTable PaleOakCoffeeTable

Seat Count
8

Seat Models
 Chair

Counter Position
0 -2.6

Counter Rotation
0

Regenerate

Request for the assistant:

Ask assistant

Relax collisions

Save Project

Environment Tree

- Counter
 - x: 0 y: -2.60 rot: 0
 - Crane X7
 - x: 0 y: -0.20 rot: 0
- Table 0
 - x: -1.2249 y: -1.2425 rot: 311.88
 - Serving 000

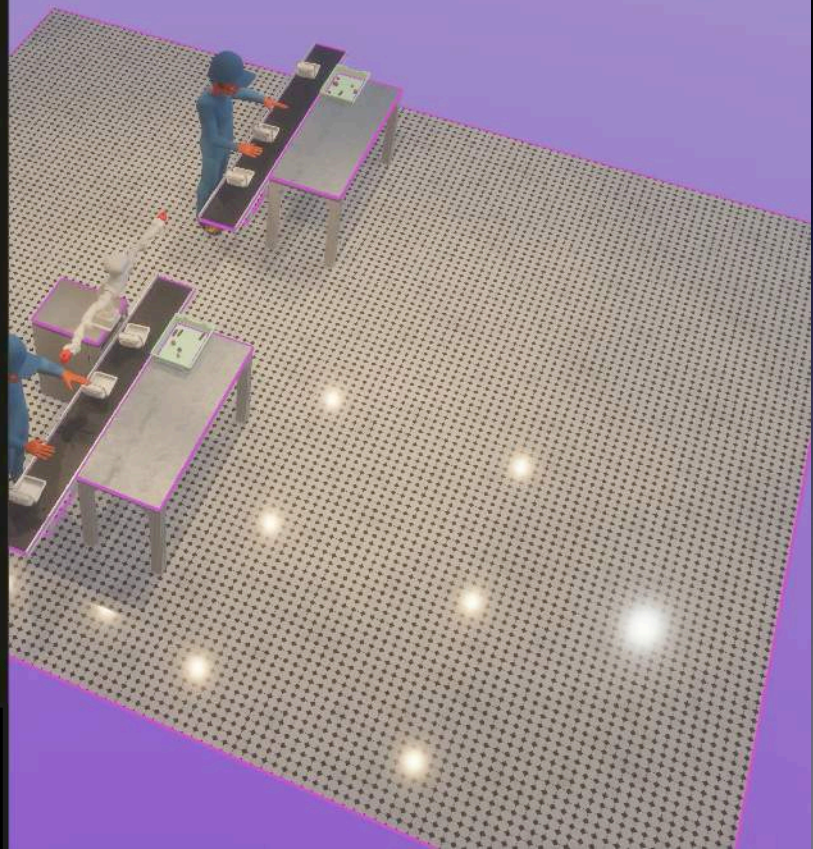
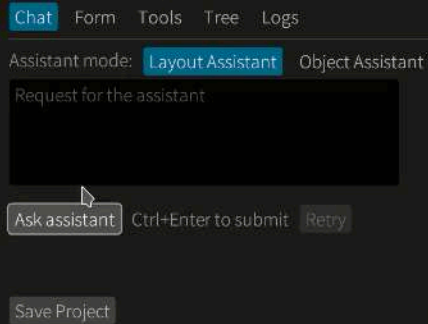


Robostage

Food factory

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Robostage

Construction

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<https://cuborex.com>

Chat Form Tools Tree Logs

Assistant mode: Layout Assistant **Object Assistant**

Please add some yellow construction warning signs

Asking... Ctrl+Enter to submit Retry

Project



Simulation & CI Workflow

<Simulation>

- Asset management (RoboProp)
- Robot behavior and environment generation (Robostage)

<CI>

- Testing (Artefacts)

Simulation Workflow

1. Asset management

3D models preparation:

image-to-3D (ex. One-2-3-45)



Image



3D model

Simulation Workflow

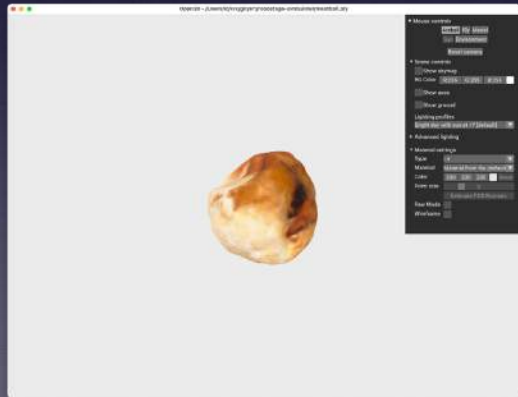
1. Asset management

Image-to-3D seems to worked nicely for organic objects, not for geometric objects (in our experiments).

Image



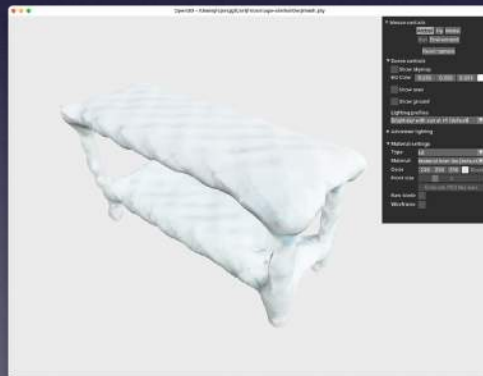
3D model



Image



3D model



Simulation Workflow

1. Asset management

text-to-3D (ex. lumalab.ai)

Empty Bento Box:

Prompt: "Empty bento box" (Worked better than large prompts, always getting food inside, had to ask for a lot of variations)

Karaage

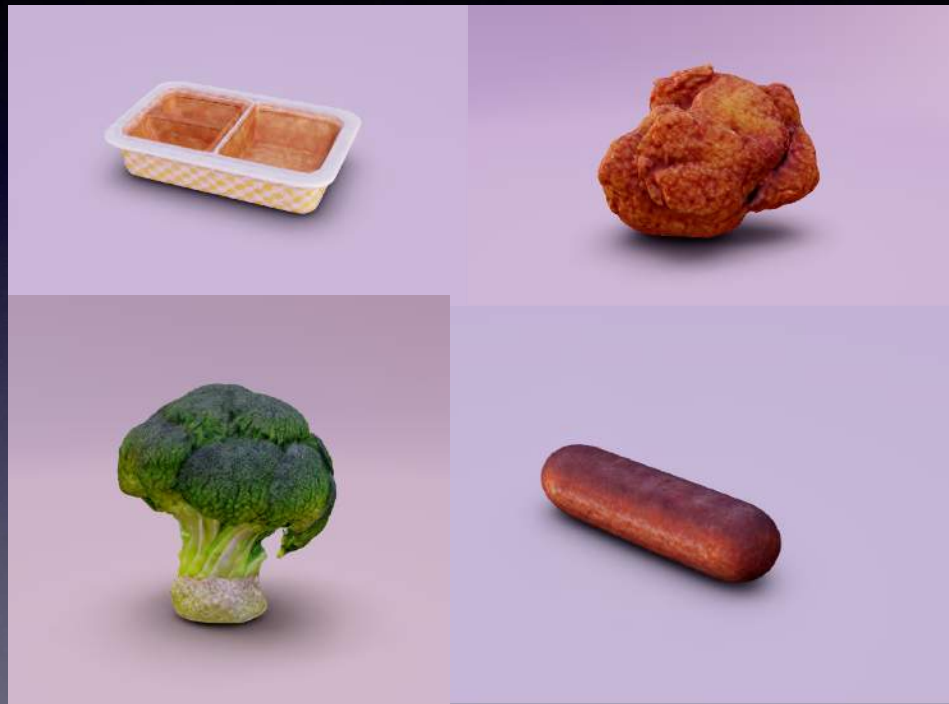
Prompt: "karaage, Japanese fried chicken, HD"

Broccoli:

Prompt: "small broccoli, HD texture"

Sausage:

Prompt: "brown, small, short sausage, short, no stains, real" (For some reasons the sausages had a lot of stains)

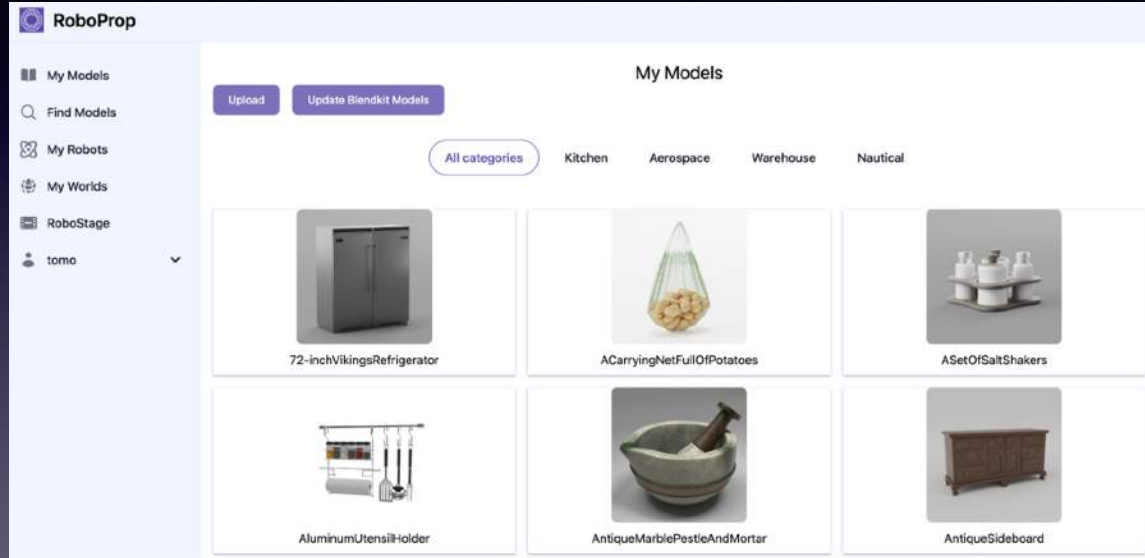


Simulation Workflow

1. Asset management (RoboProp)



karaage



- File server
- Search for Fuel Blenderkit models
- Convert Blender models to SDF
- Open Source

URL: <https://github.com/art-e-fact/roboprop>

Simulation Workflow

2. Robot behavior and environment generation (RoboStage)

Make the floor more industrial looking.

I would like 4 work cells.

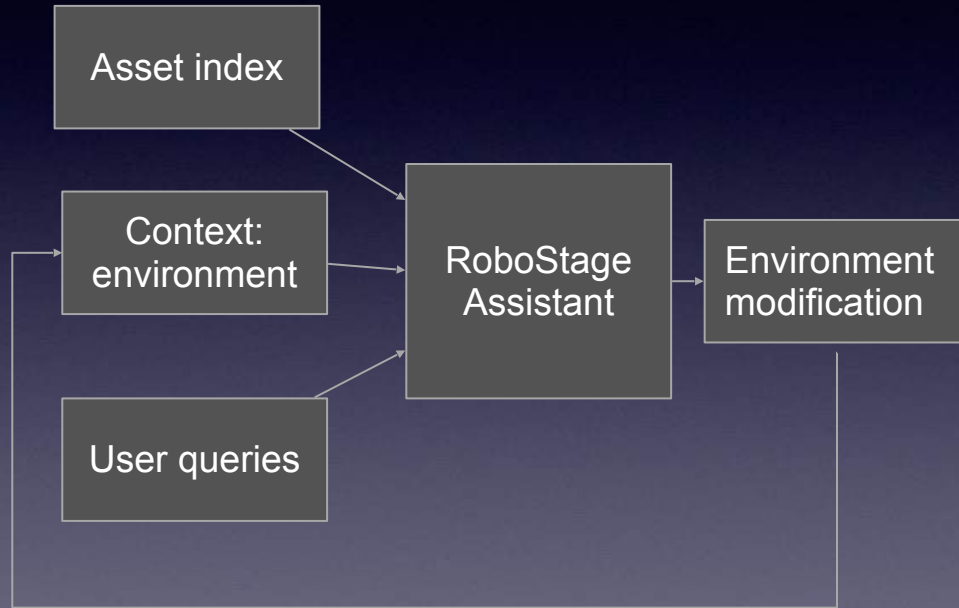


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Simulation Workflow

2. Robot behavior and environment generation (RoboStage)

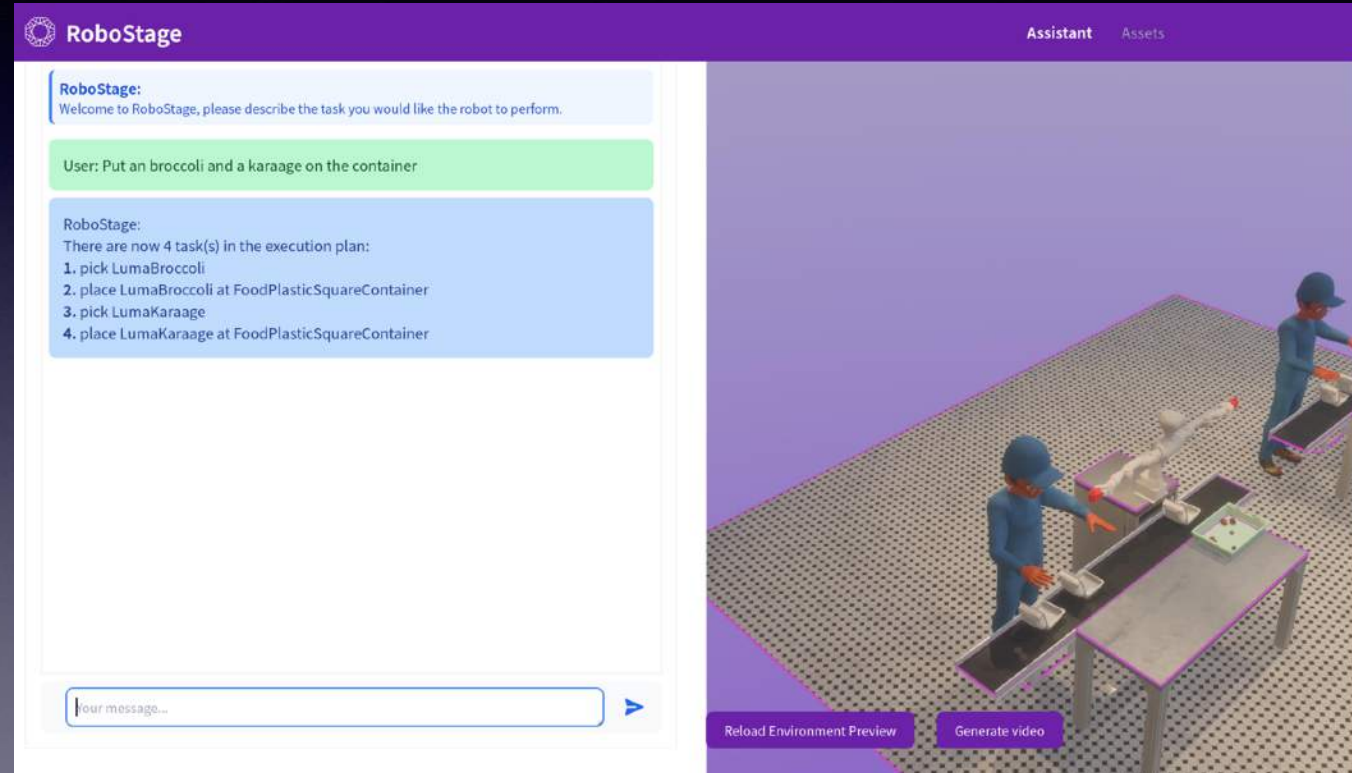
Add a fridge on the floor behind the workers.



Simulation Workflow

Robot behavior and environment generation (RoboStage)

Behavior generation
(only for simulation)



The screenshot displays the RoboStage interface, which is divided into two main sections. On the left is a chat window, and on the right is a 3D simulation environment.

RoboStage Chat Interface:

- Header:** RoboStage Assistant Assets
- RoboStage:** Welcome to RoboStage, please describe the task you would like the robot to perform.
- User:** Put an broccoli and a karaage on the container
- RoboStage:** There are now 4 task(s) in the execution plan:
 1. pick LumaBroccoli
 2. place LumaBroccoli at FoodPlasticSquareContainer
 3. pick LumaKaraage
 4. place LumaKaraage at FoodPlasticSquareContainer
- Input field:** four message...

3D Simulation Environment:

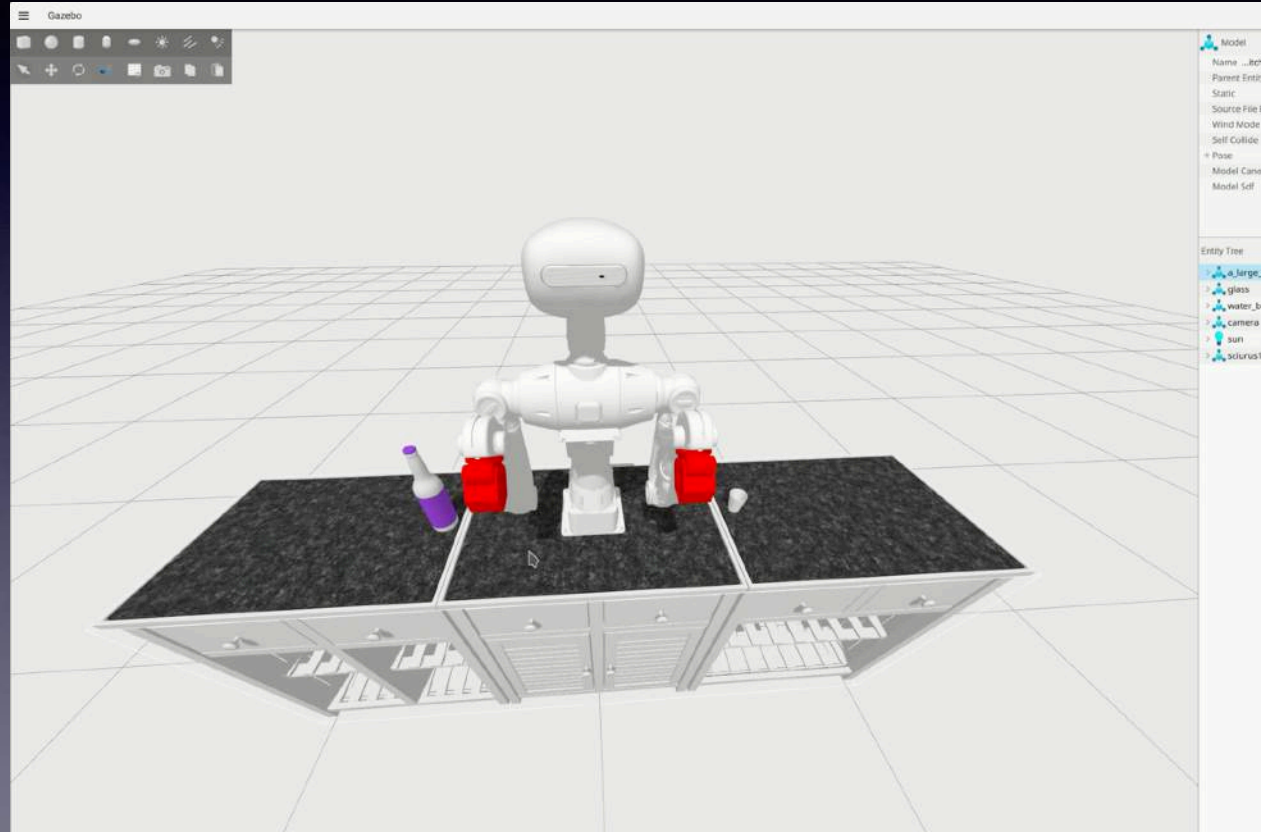
- Shows a robot arm and two human-like figures in a kitchen-like setting.
- Includes a table with various items and a conveyor belt.
- Buttons at the bottom: Reload Environment Preview, Generate video

Simulation Workflow

Robot behavior and environment generation (RoboStage)

Behavior generation
(only for simulation)

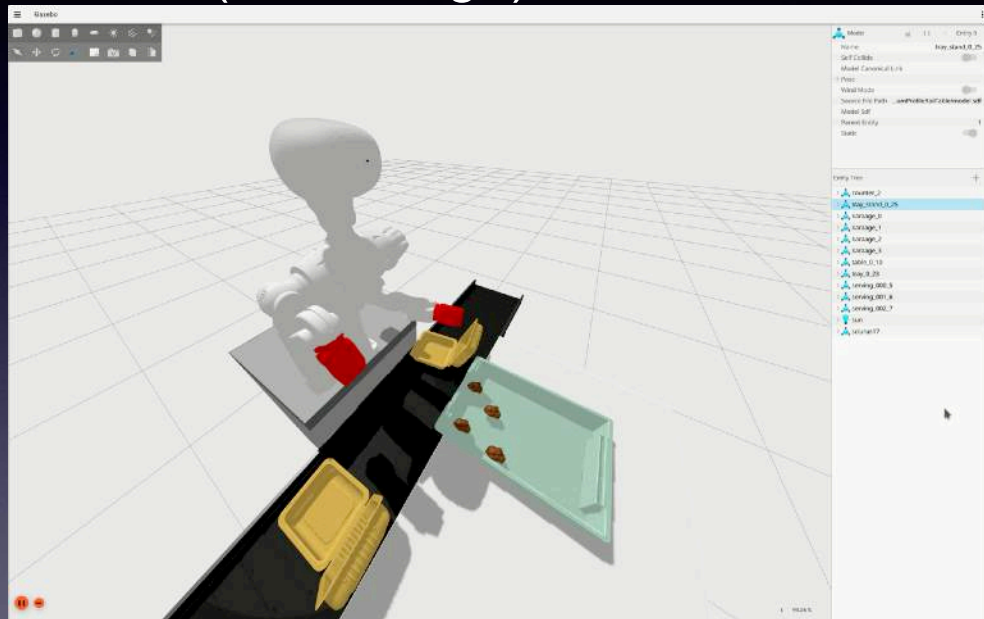
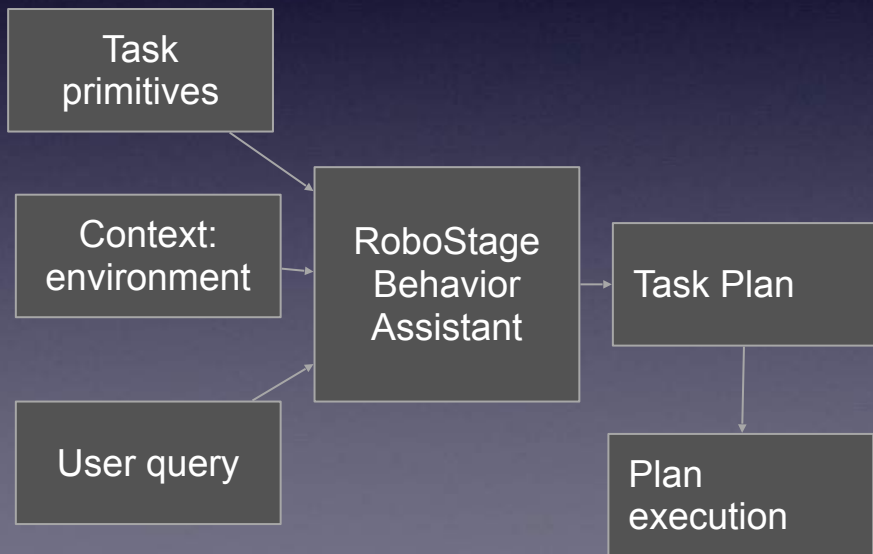
With prepared set of
action primitives.



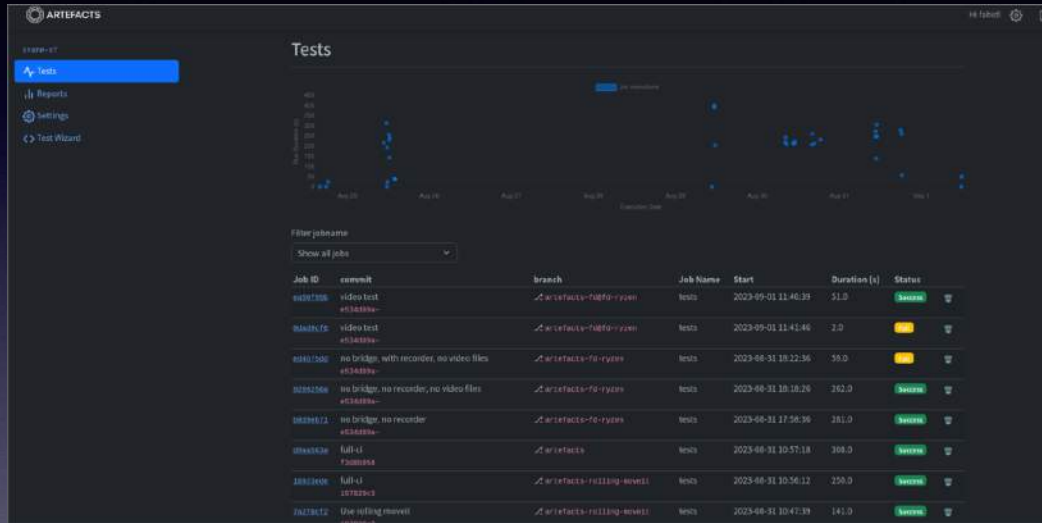
Simulation Workflow

Robot behavior and environment generation (RoboStage)

Behavior generation
(only for simulation)



Testing (Artefacts CI) with simulated environment.



Future work: test skeleton with generative AI.

Backend (Cloud for Simulation)

We have engineered our own cloud simulation platform.

- Our system has better performance than AWS/GCP components as-is.
- The platform also powers video generation.
- We also handle support functions (Asset management & AI invocation)

Next step

Environment scanning with NeRF to build 3d models for real places.
(factories, warehouses, fields, cities, ... etc for testing robots).

Our work example for MARS environment for rovers



Roadmap



Available now

Coming soon

Near future



Artefacts CI

RoboStage

Test skeleton generation

Environment scanning

RoboProp

Summary

- RoboStage: a video generator based on your own robot, and using generative AI.
- Simulation & CI workflow.
- We will inform you when RoboStage is ready!
Please use QR code ==>

