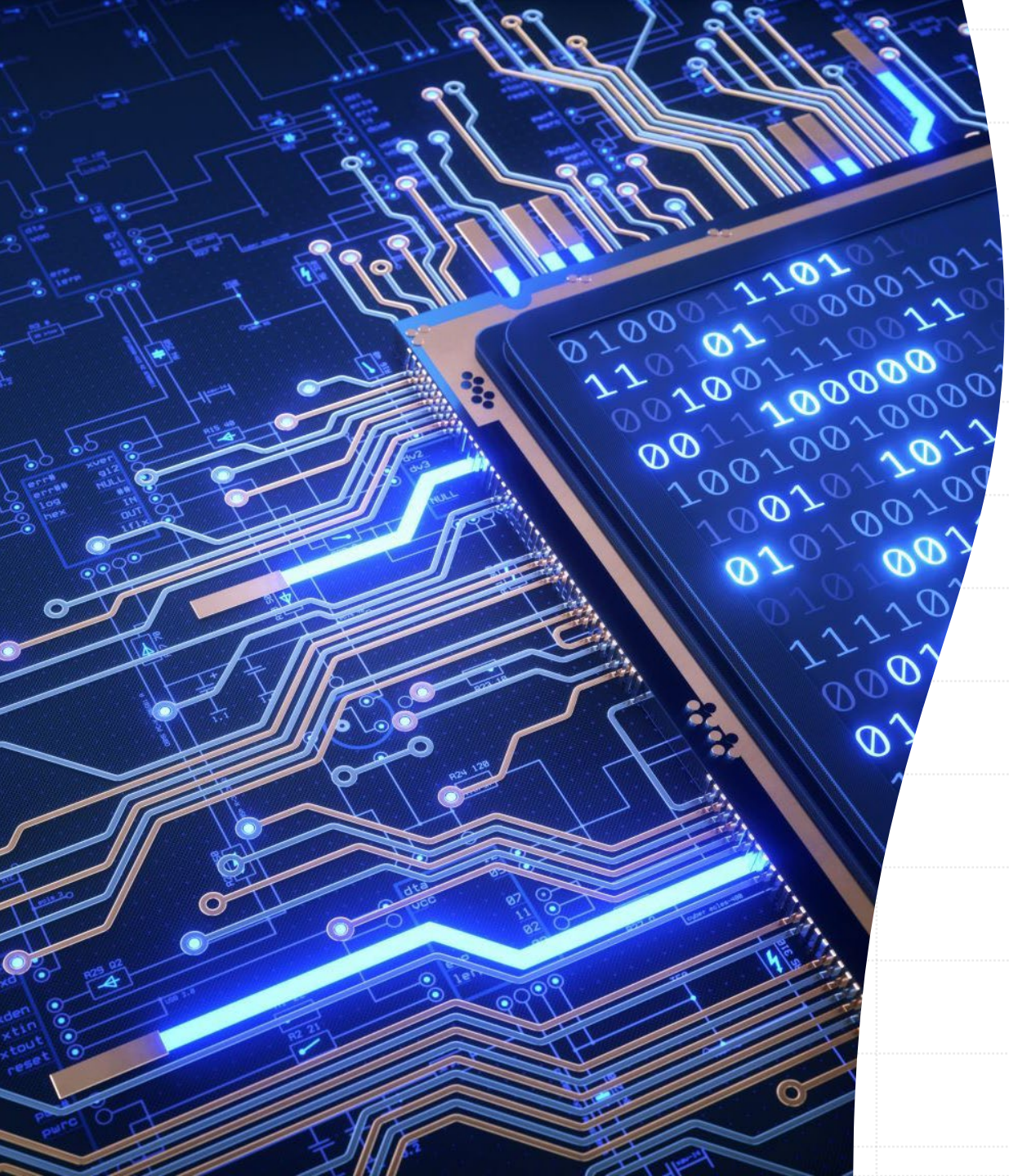
The Autonomous Navigator and Object Grasper

Group 14

- Sravya Mareedu
- Hitesh Atluri
- Akhil Sunkara

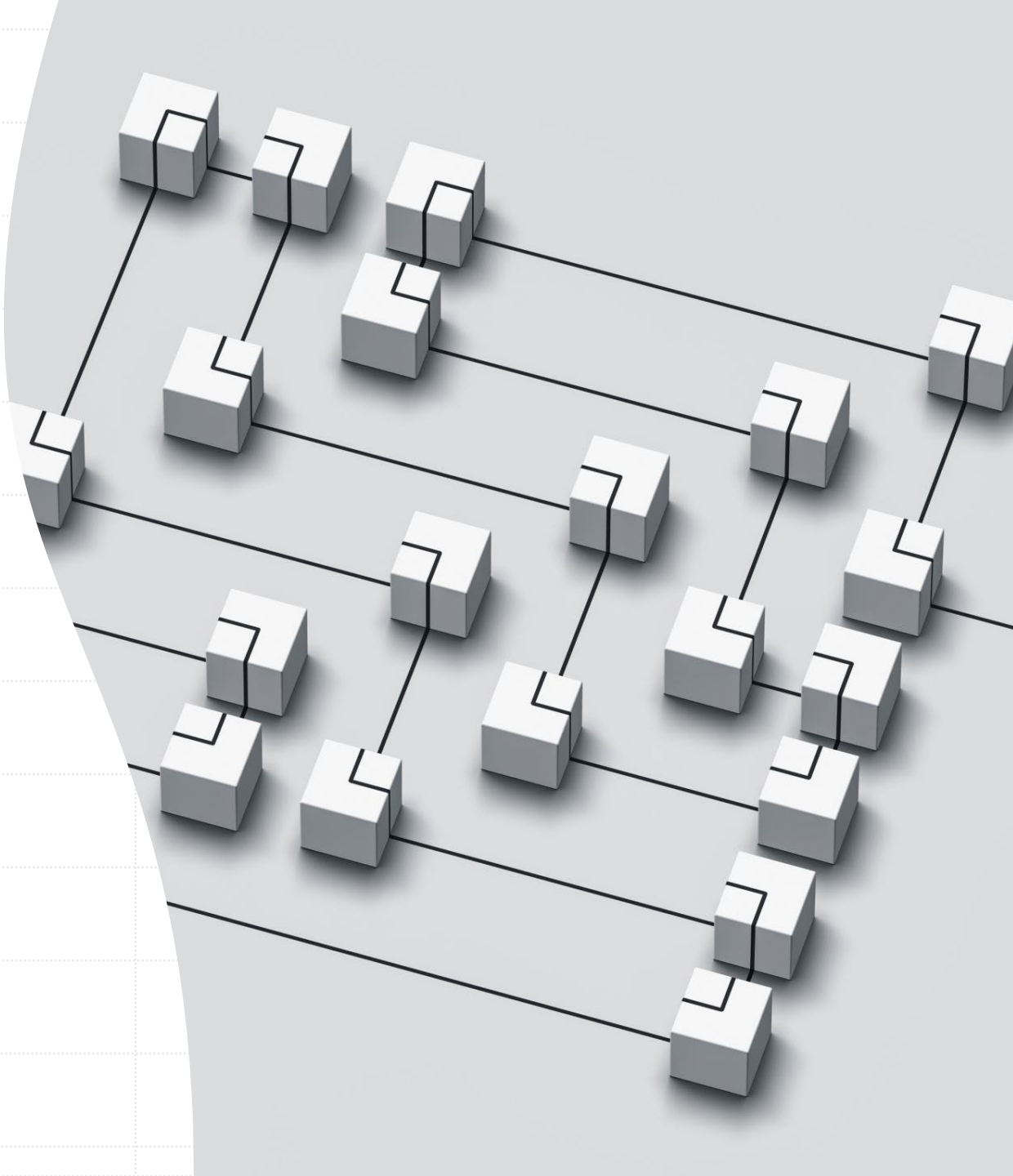


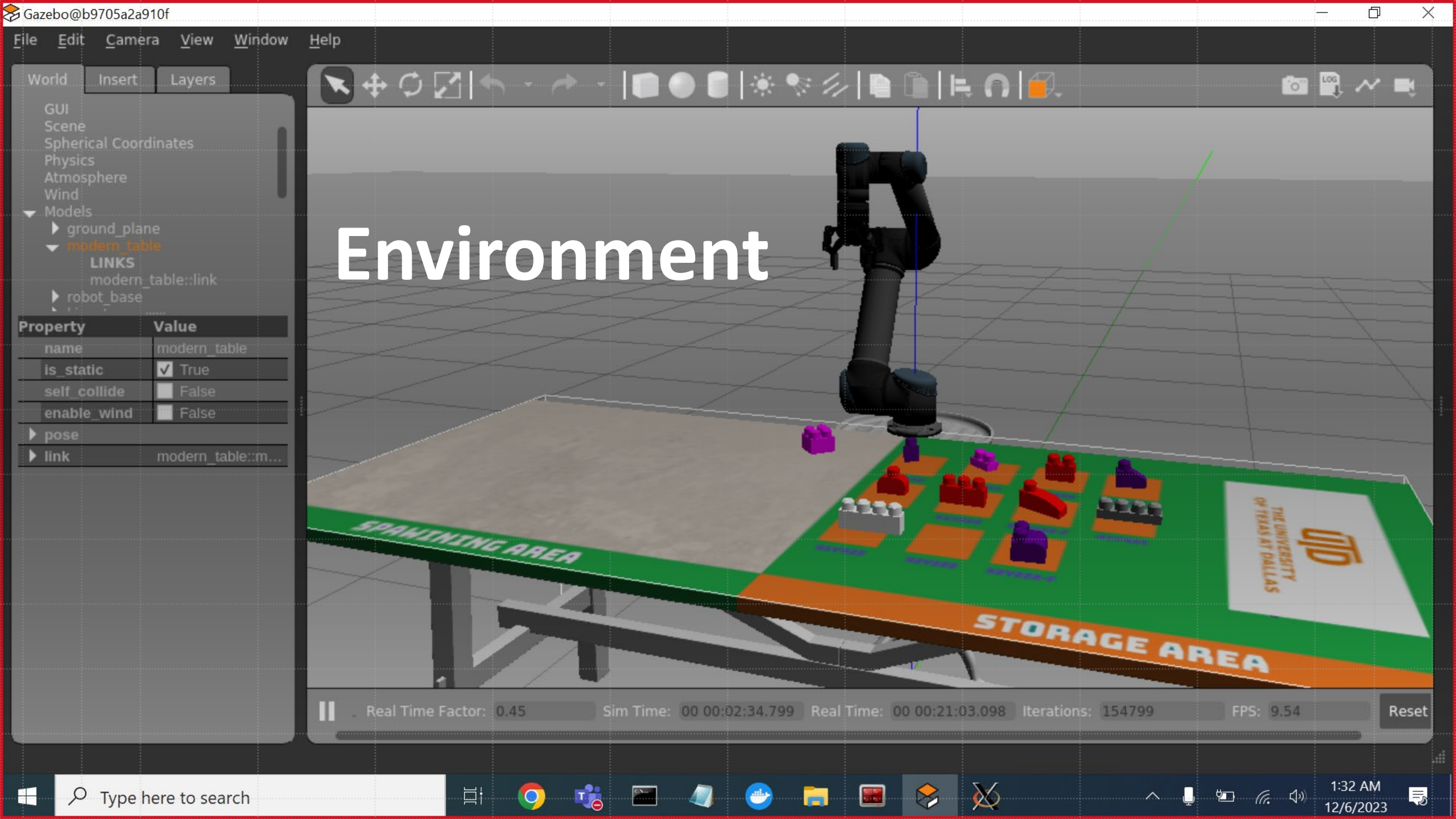
Introduction

- **Project Objective:** Enable a robot to autonomously identify, classify, grasp, and place objects into designated positions.
- **Technological Framework:** Leveraging ROS, Gazebo simulation, and advanced computer vision techniques.
- **Significance:** Holds immense relevance in industries, offering versatile applications wherever object manipulation is vital, particularly in assembly and relocation tasks.

Method

- The formulation of our approach showcases the UR5 pick-and-place capabilities in ROS and Gazebo, leveraging an Xbox Kinect cam to detect and publish positions of bricks.
- We are implementing an object grasper that detects and publishes positions of different types of bricks, placing them in their respective locations based on their types.
- For this implementation, we used Gazebo for the environment and the robot LevelManager is employed for world setup, Vision for object recognition, Motion_Planning for robot movement, Gazebo_ros_link_attacher for collision handling, and Robot for defining the robot model with PID settings.

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ground_plane
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LINKS
modern_table::link
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Property Value
name modern_table
is_static True
self_collide False
enable_wind False
pose
link modern_table::m...
Environment
SPLINTING AREA
STORAGE AREA
THE UNIVERSITY OF TEXAS AT DALLAS
Real Time Factor: 0.45
Sim Time: 00 00:02:34.799
Real Time: 00 00:21:03.098
Iterations: 154799
FPS: 9.54
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Experiments

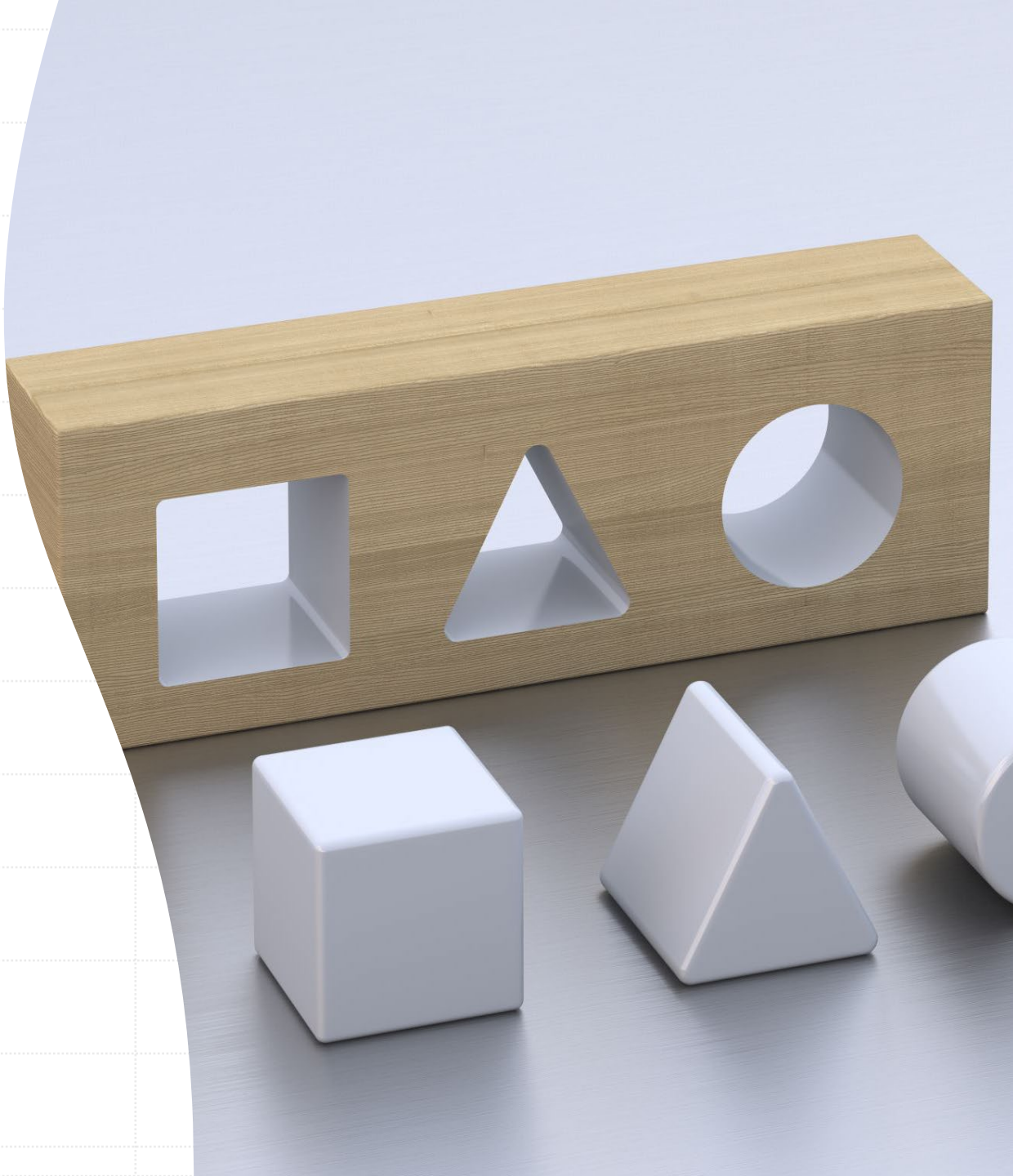
We endowed our robot with various capabilities, and to assess them, we conducted experiments, including:

Object Placement

- Single object on initial stand, positioned with its base naturally touching the ground.
- Object will be placed on its respective position on the final stand that will be marked near the colored boxes.

Multi-Object Placement

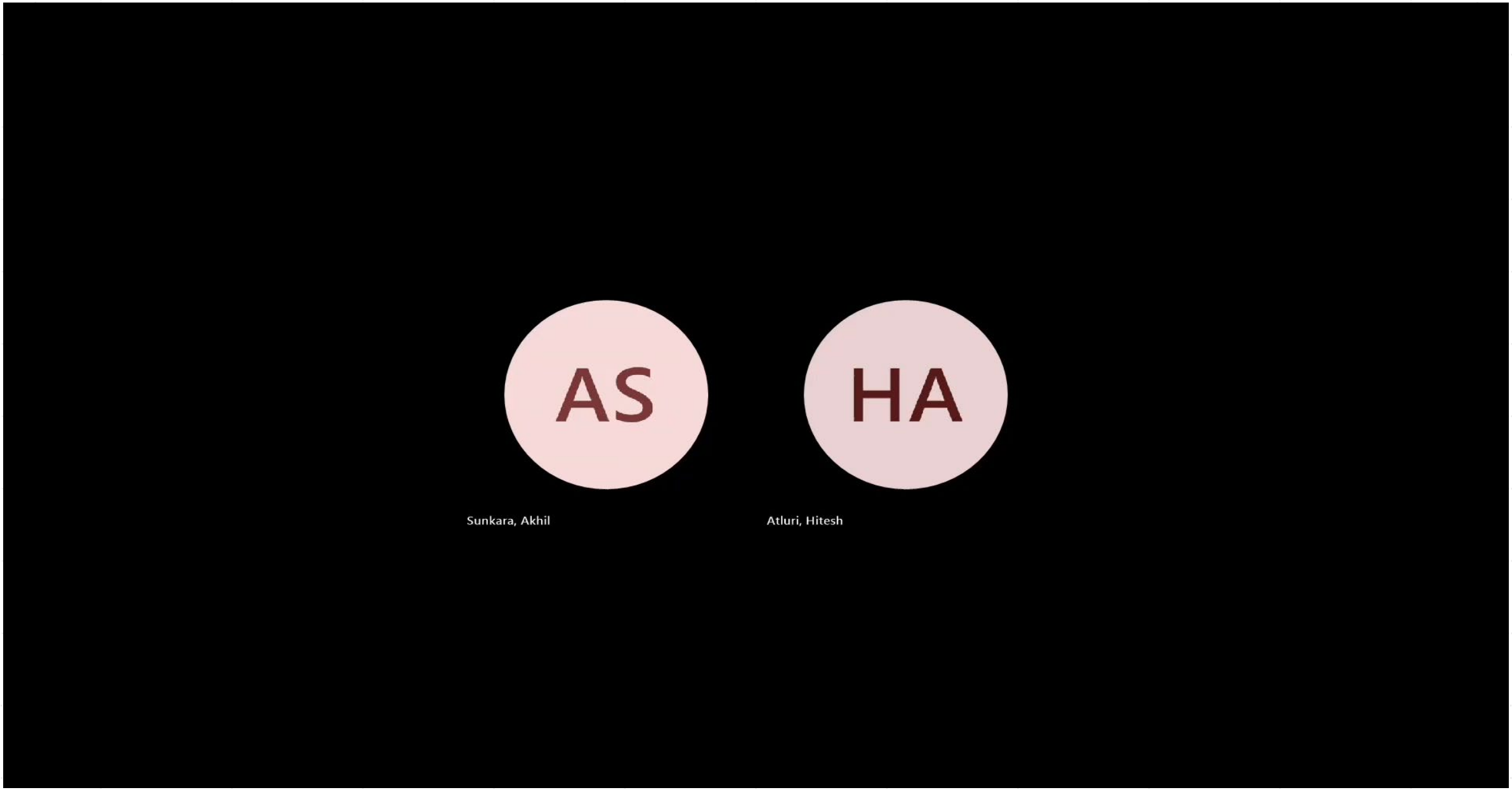
- Multiple objects on the initial stand, one for each class, arranged without a specific order.
- Objects placed with their bases naturally in contact with the ground.
- Each object must be picked up and stored in the prescribed class position.



Demo - 1


Microsoft Teams
Call with Sunkara, Akhil
2023-12-06 07:07 UTC
Recorded by
Atluri, Hitesh

Demo - 2



Conclusion

- The UR5 Pick-and-Place Simulation project successfully demonstrates the fusion of ROS, Gazebo simulation, and computer vision techniques in achieving autonomous pick-and-place tasks with a robotic arm.
- Simulating the UR5 robot's functionalities for precise object manipulation.
- Utilizing Kinect-based object recognition to identify and categorize various types.
- Demonstrates the feasibility of integrating robotics, simulation, and computer vision for complex assembly tasks.
- Provides insights into the potential applications of autonomous robotic arms in industries requiring precise manipulation and assembly.

Future Work

Advanced Object Placement

Storing each object in the designated class position; stack objects of the same class to form towers.

Composite Object Creation

Sequentially pick up and assemble objects to create the desired composite object on the final stand.

THANK YOU!