Collaborative Robots

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Wait...!!!
What was our idea???

FRANKA ROBOTICS

2 robot arms

Shared resources

Collaborative task

Wait...!!!
What was our idea???

Collision avoidance

Safe path Logic

FRANKA ROBOTICS

Description

Main objective

- 2 robotics arms that collaborate to builds some towers or walls

Base requirements

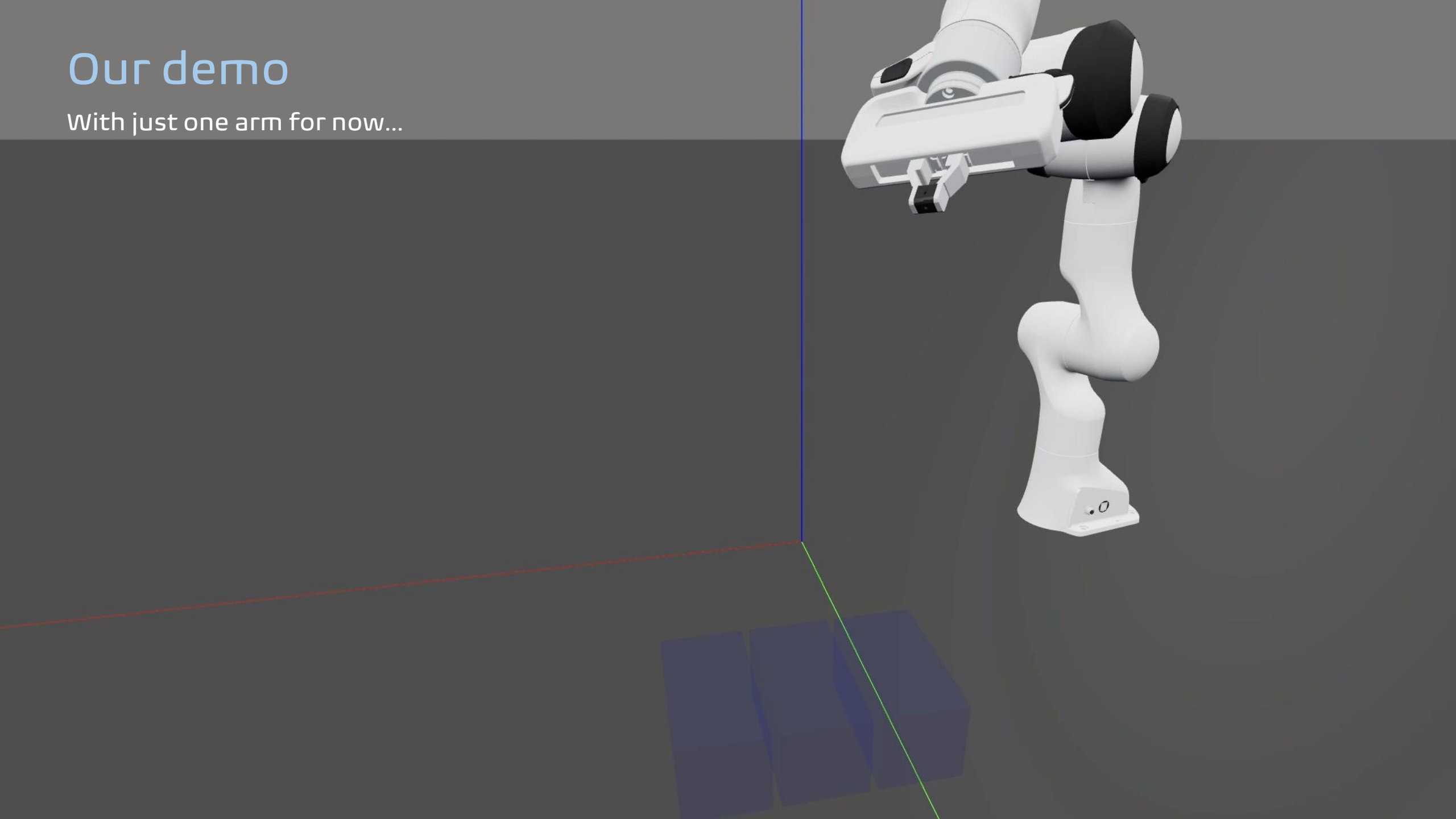
- Two robots **successfully collaborate** to complete the tower or wall
- Build a **simple vertical tower** using a predefined number of blocks
- Using a predefined number of **identical cuboid blocks**

Extra requirements

- **Collision Avoidance**: avoid collisions between robots and with the buildings
- **Sequential pattern**: buildings with different bricks' shapes and colors
- Implement different **roles** for the robots:
  Verifier : robot that checks the stability or correctness
  Wrecker : robot dedicated to disassemble the buildings
  Refiller : wonderer robot that retrieves other bricks, when there are few resources

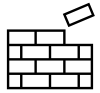
Our demo

With just one arm for now...



Our implementation

Classes



Brick : class defines a physical block object in the simulation environment,
managing its **geometry, position, and orientation** for grasping and stacking tasks.

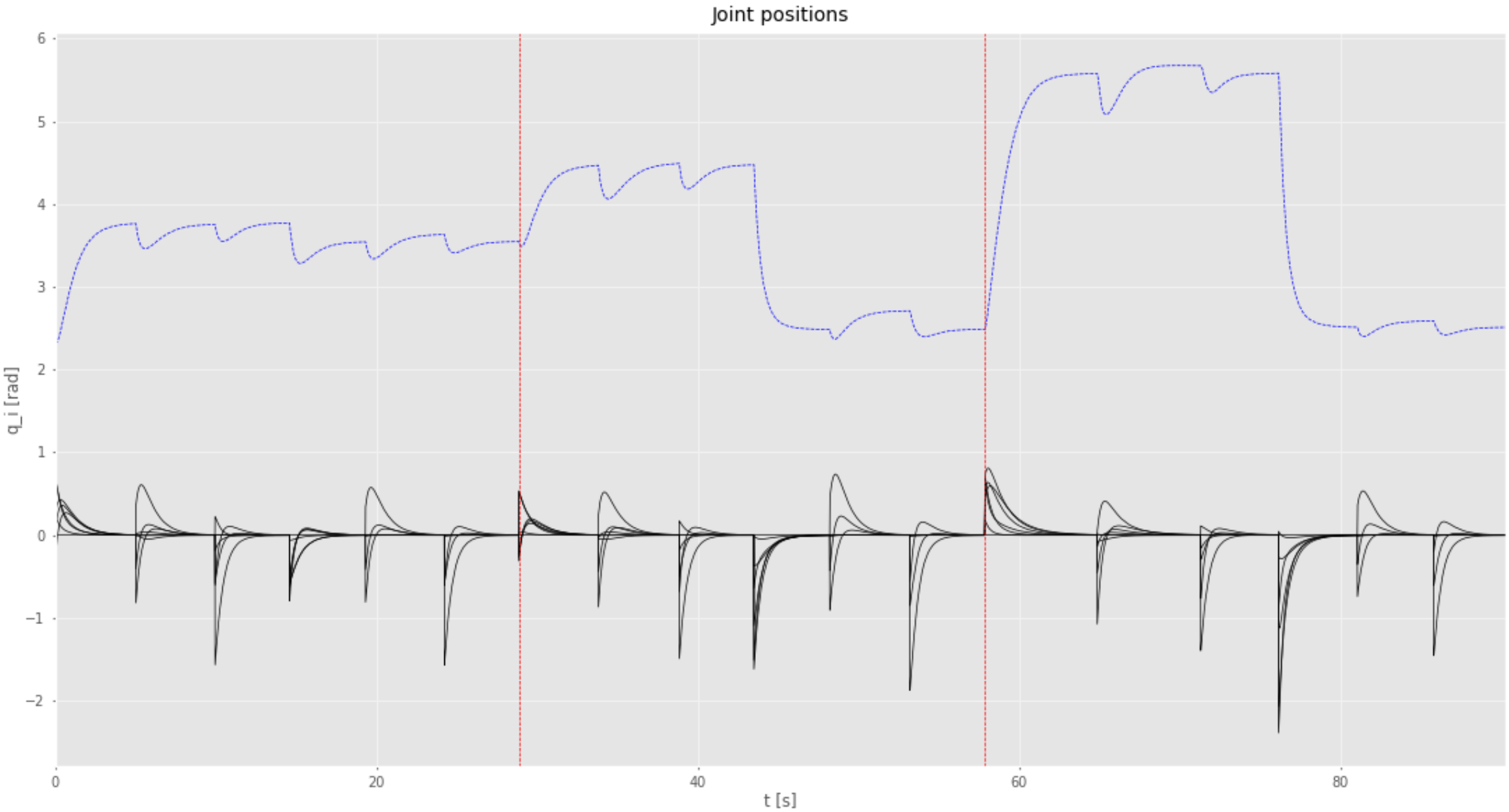
Tower : class acts as a target object, **tracking the structural state and current height**
of the assembly structure to determine the precise placement pose for the next block.

Robotic_arm : class serves as the **physical and logical agent** for the robot,
executing motion commands, applying inverse kinematics, managing its operational state,
and **logging key performance metrics** (velocity and conditioning) for analysis.

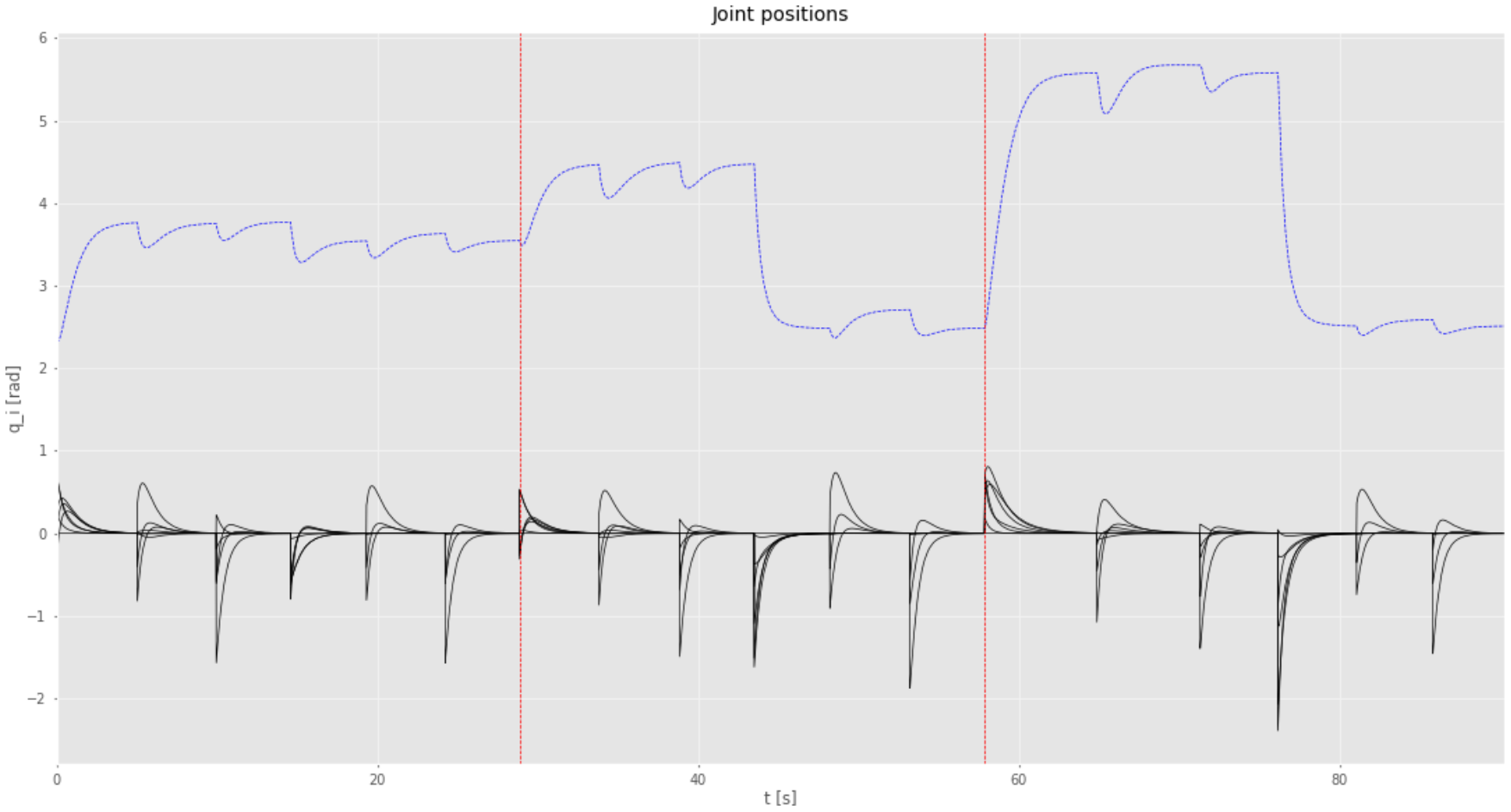
Sensor : class acts as the **interface to the simulated environment**,
providing the **Controller** with real-time, global awareness of all objects, resources, and structures
needed for task planning and collision avoidance.

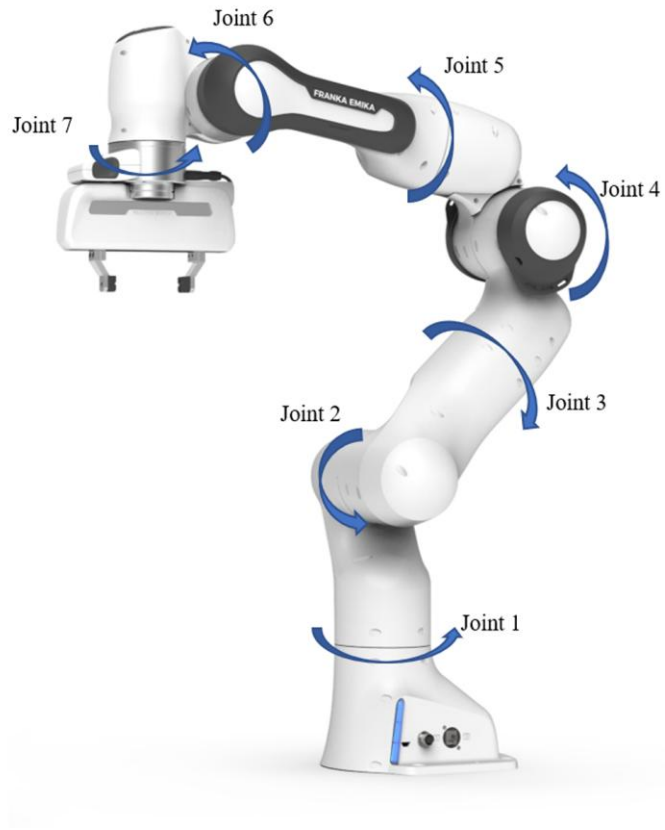
Controller : class that is the **central planning unit** responsible for determining the robot's movement strategy;
it selects the next assembly task, calculates the safety-optimized sequence of end-effector poses,
and commands the robot agent to execute the path using Damped Inverse Kinematics.

Plot: joint positions and condition number - 3 bricks

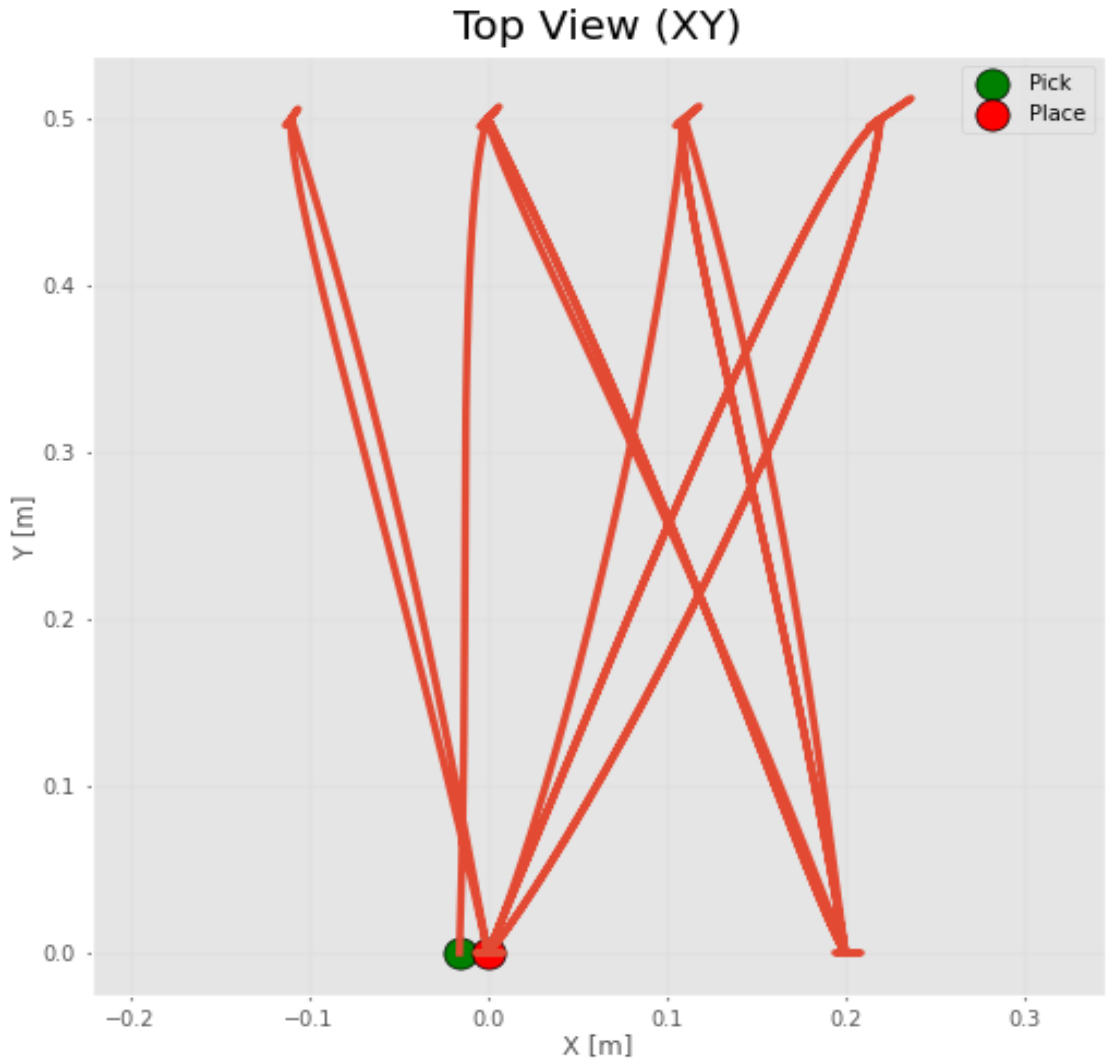


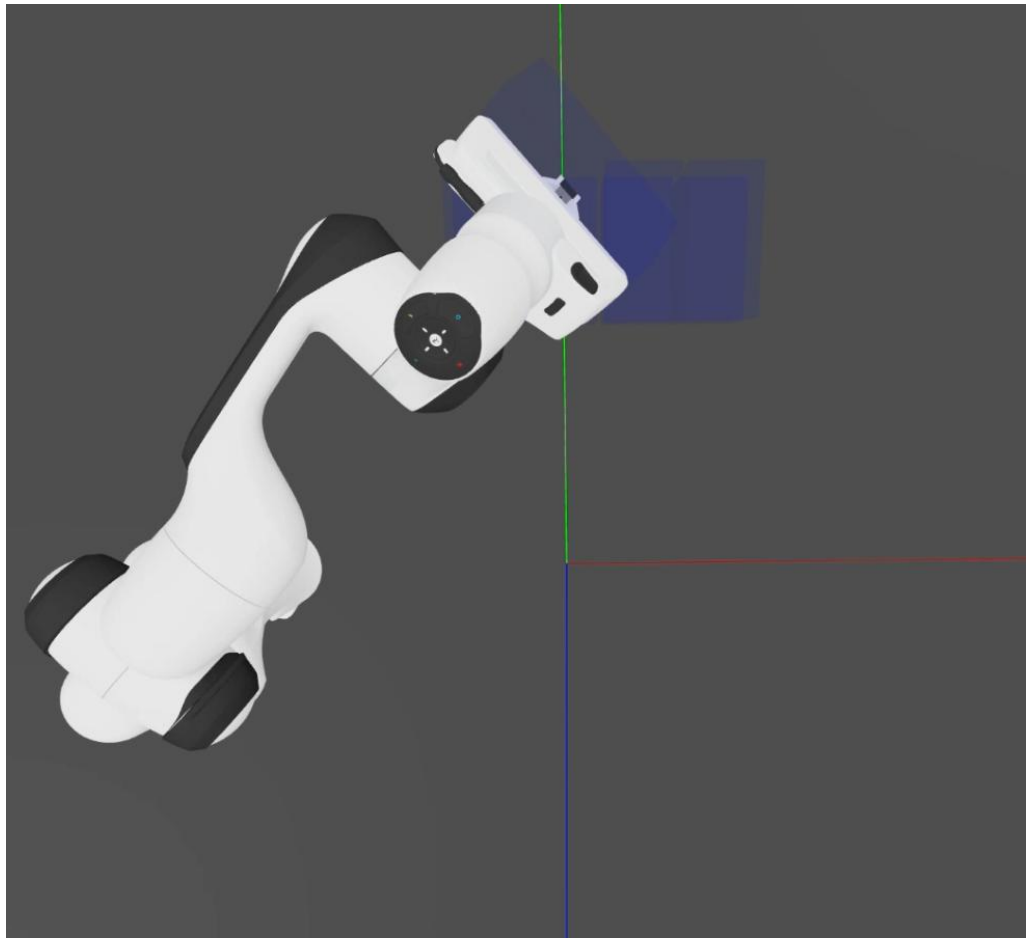
Plot: joint positions and condition number - 3 bricks



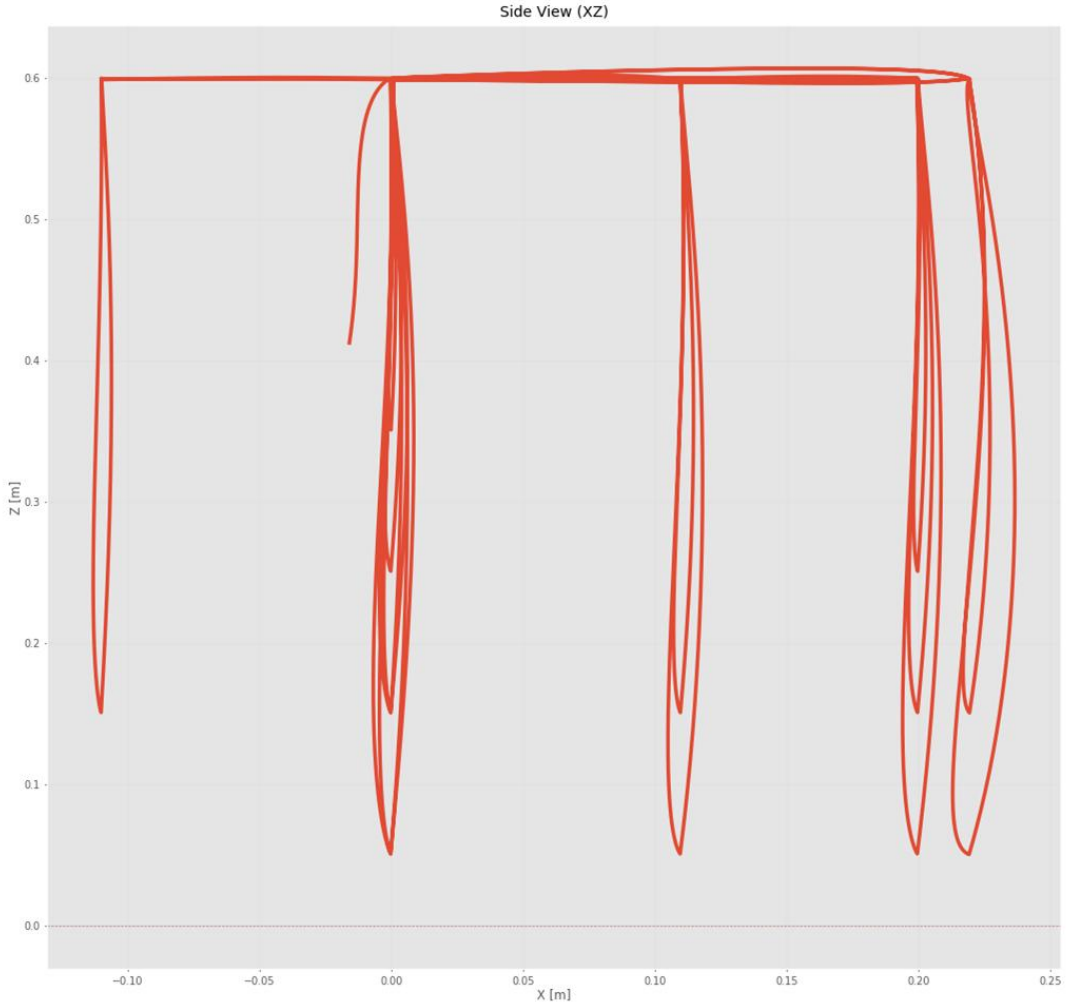


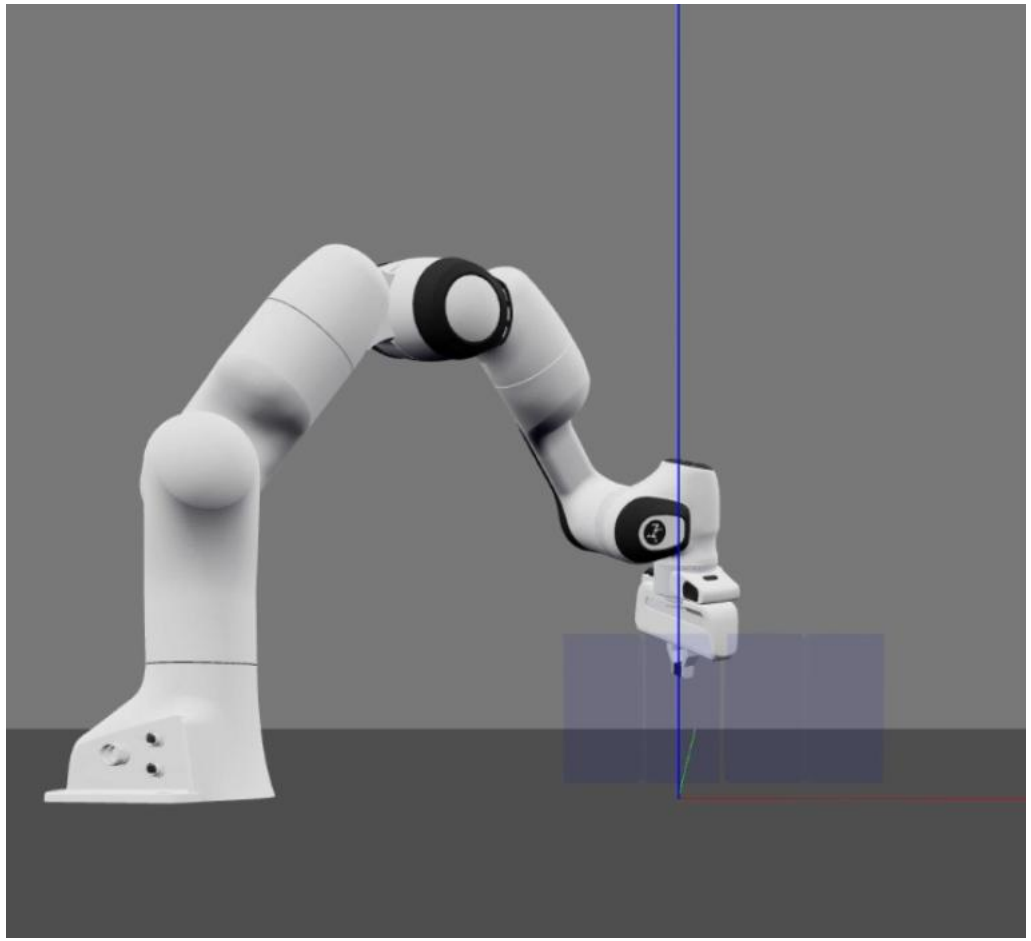
Plot: end-effector horizontal trajectory - XY plane



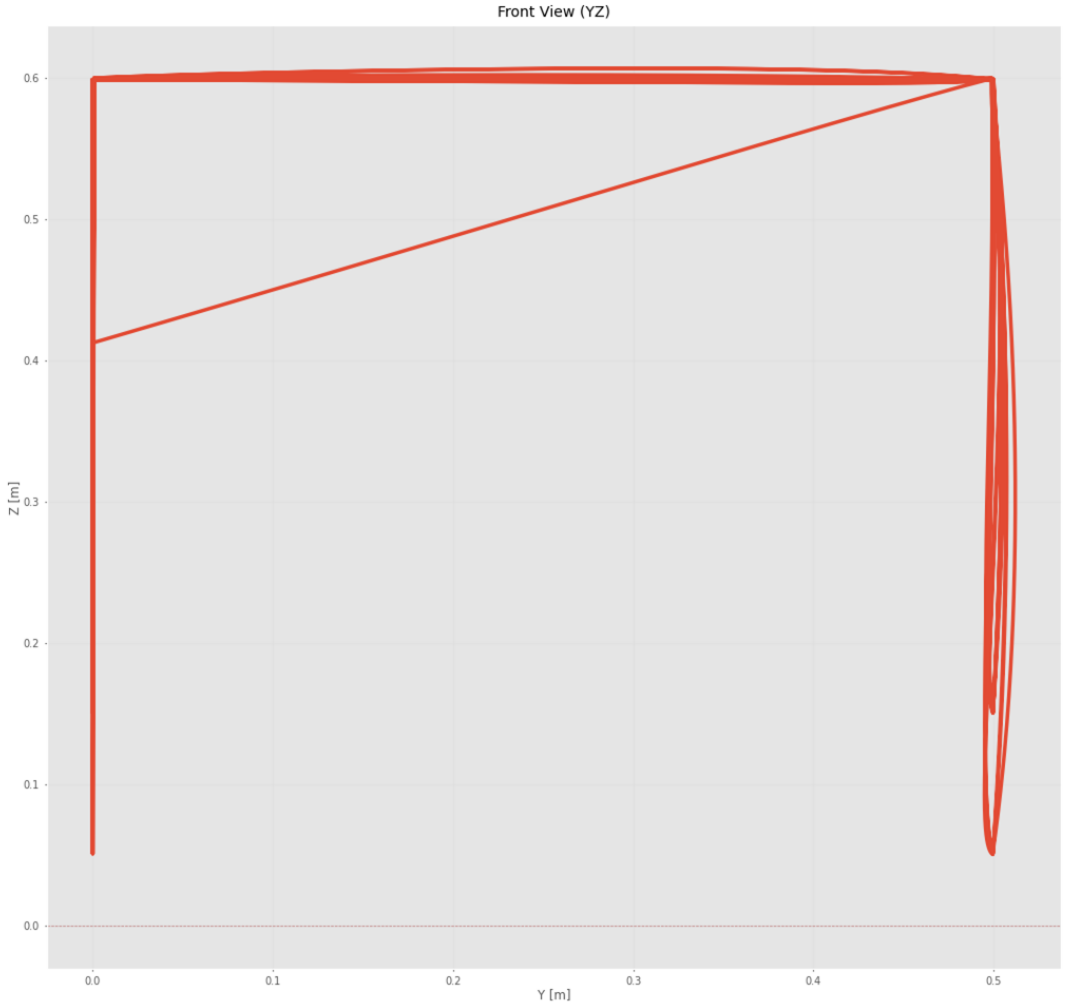


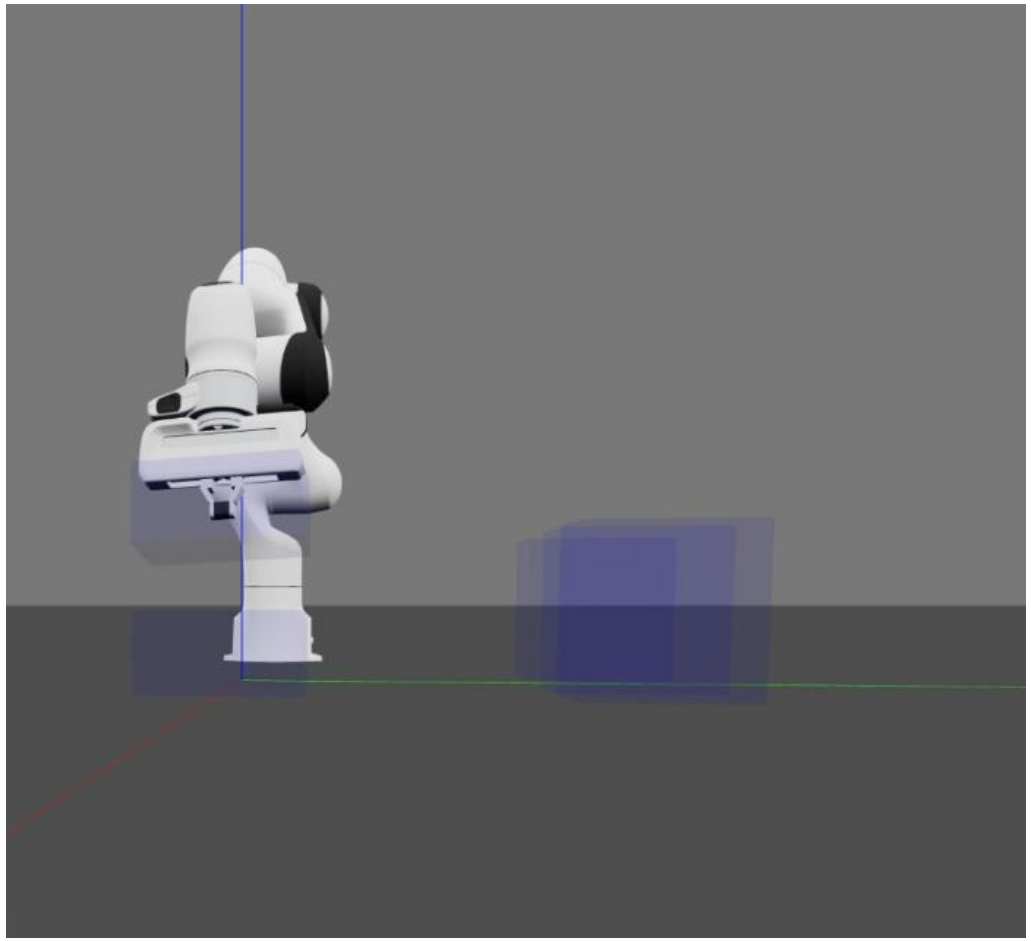
Plot: end-effector vertical trajectory - XZ plane



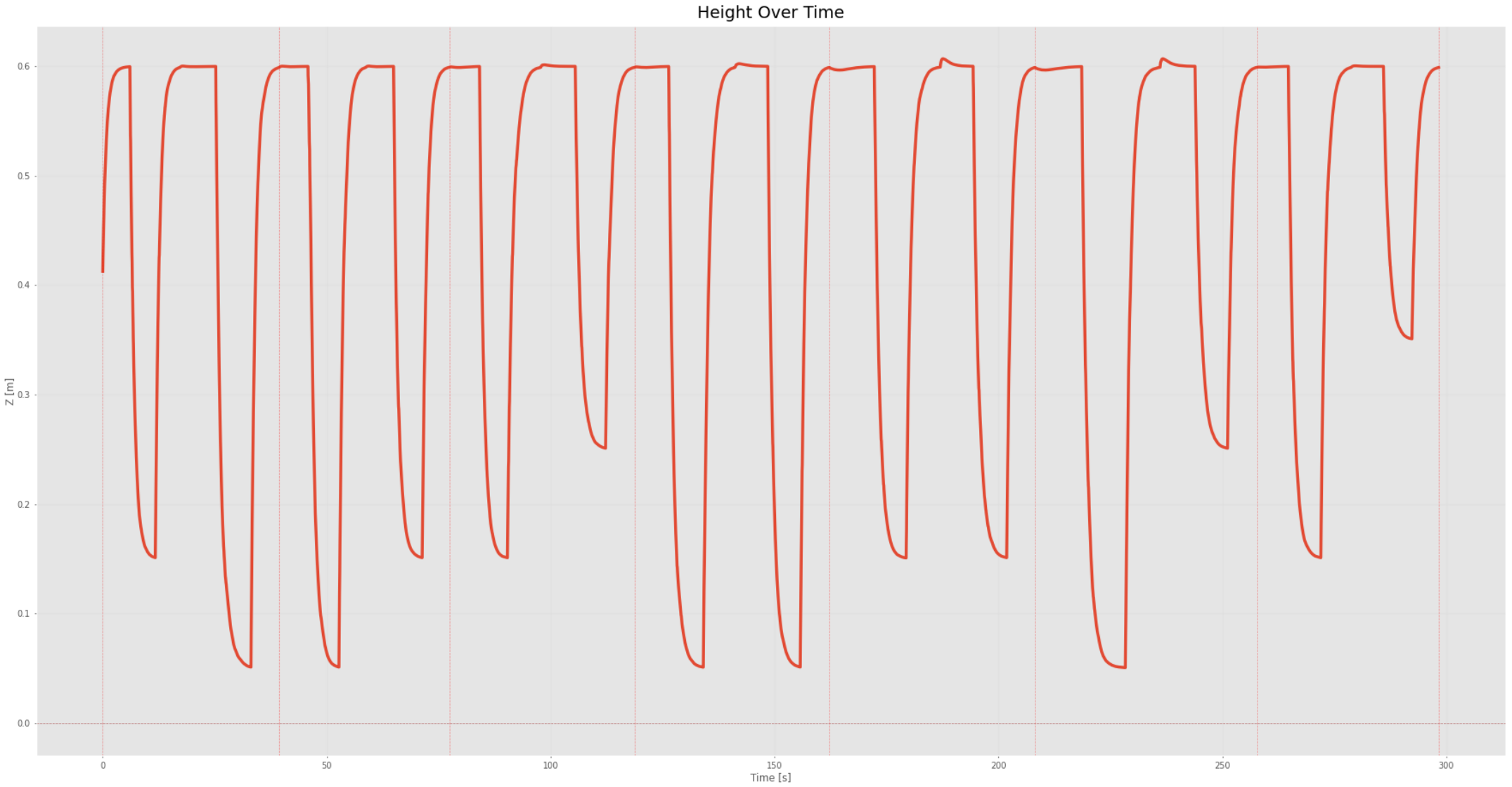


Plot: end-effector vertical trajectory - YZ plane





Plot: height over time



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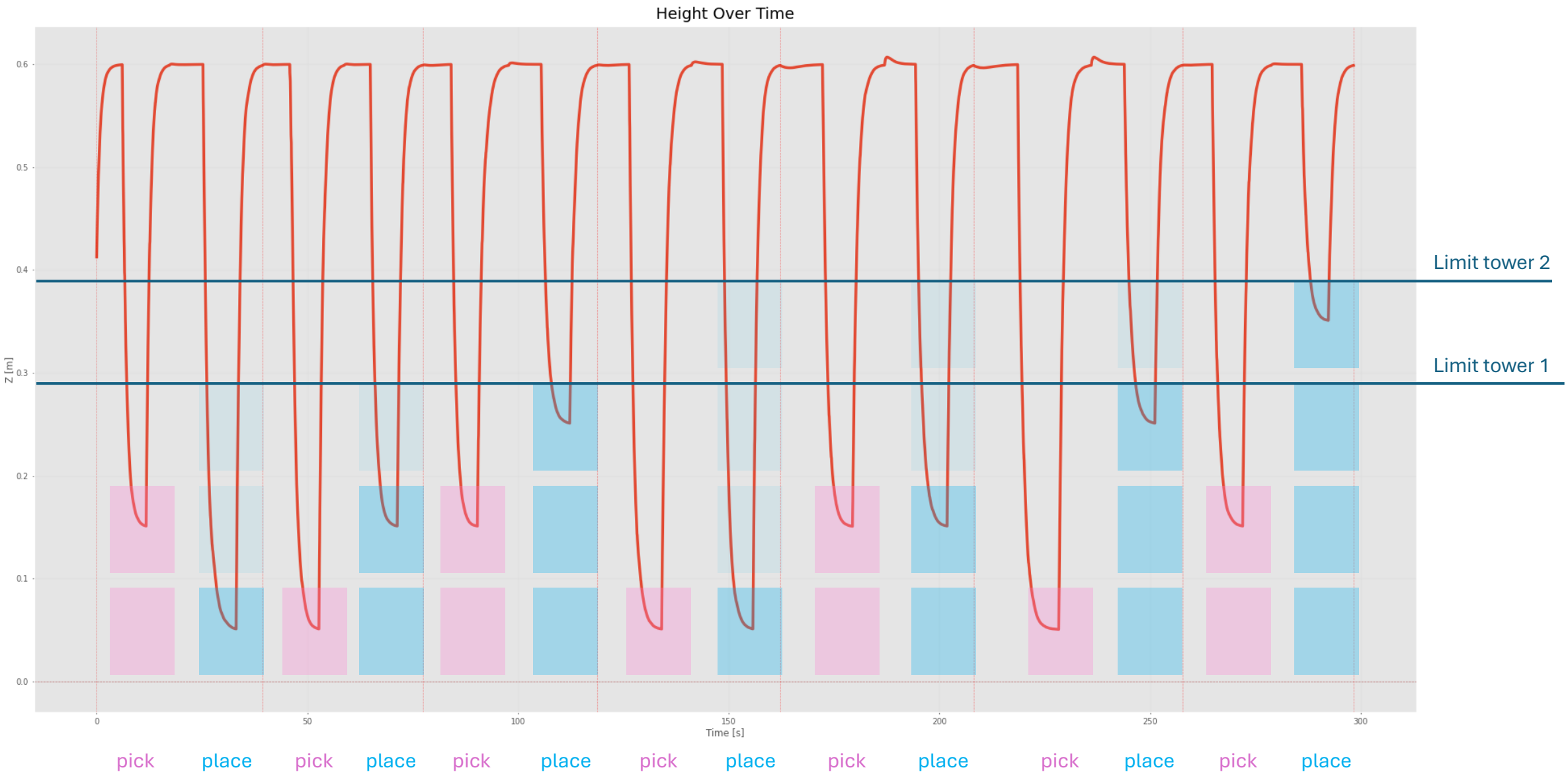

Final objective

The actual project codebase is already structured for **multi-robot** and **multi-tower** assembly.

We are currently implementing **dynamic collision avoidance** between the two agents and structures.

We aim to complete before the end of the project a **complex wall assembly following a predefined colour pattern** as a key demonstration of cooperative control.

Thank you for your attention!!!