PAL

20 YEARS OF ROBOTICS

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SAHRI

Start to use Tiago

SAHRI
Supervised Autonomy

Capri | JUNE 2025

TIAGo Robot

- TIAGo stands for "Take It And Go"
- Designed for research, service, and industrial applications
- Modular, customizable, and open-source friendly

TIAGo's Key Features

- **Mobile Base:** Differential or omnidirectional drive
- **7-DOF Arm:** Ideal for manipulation tasks
- **Sensors:** RGB-D camera, LIDAR, microphones, force-torque sensor
- **Modularity:** Can be configured with a pan-tilt head, screen, gripper types
- **Open Software:** Fully compatible with ROS and Gazebo

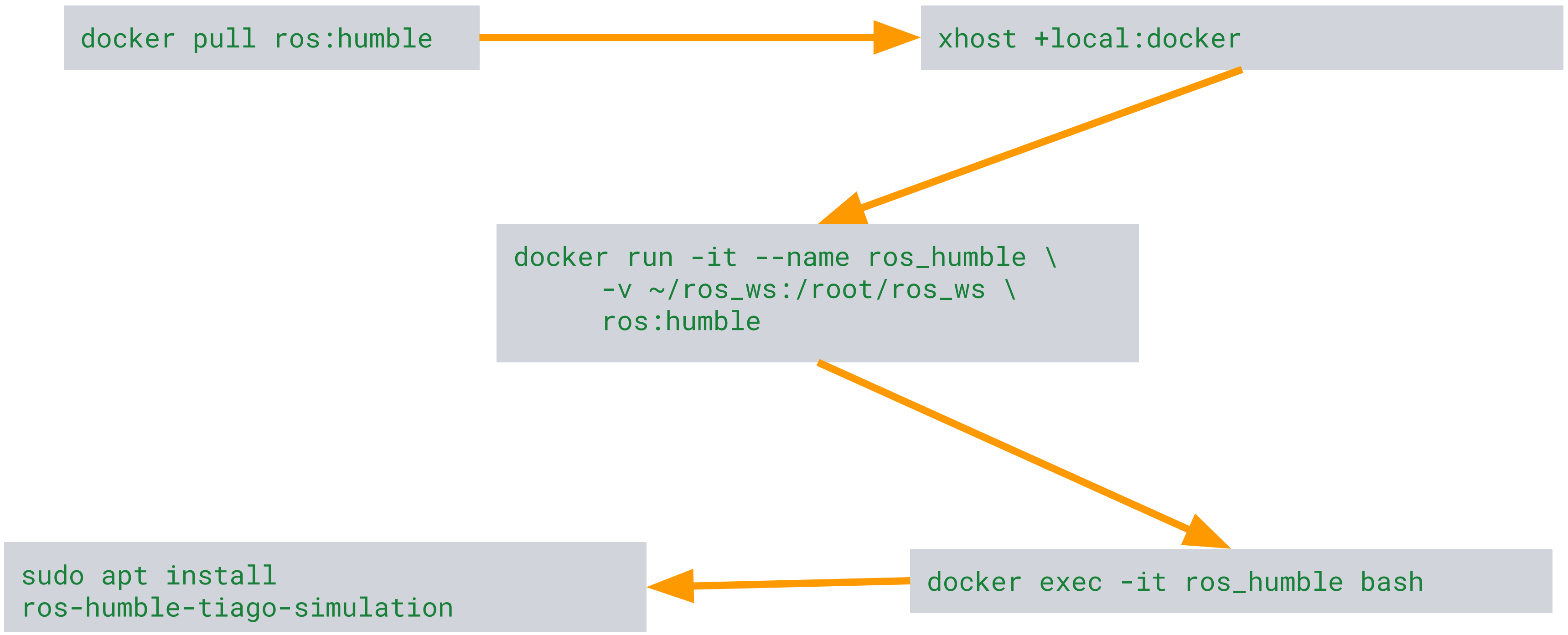
Applications of TIAGo

- **Healthcare:** Assistive tasks in hospitals and elderly care
- **Education & Research:** Ideal for robotics and AI development
- **Industry:** Indoor logistics and human-robot collaboration
- **Smart Environments:** Navigation, object manipulation, speech interaction

Objective

- **Learn** the software of the robot
- **Programming** Tiago in Ros2
- **Tiago** building a tower
- **Highest** tower wins

Docker Installation



```
docker pull ros:humble
```

```
xhost +local:docker
```

```
docker run -it --name ros_humble \
     -v ~/ros_ws:/root/ros_ws \
     ros:humble
```

```
docker exec -it ros_humble bash
```

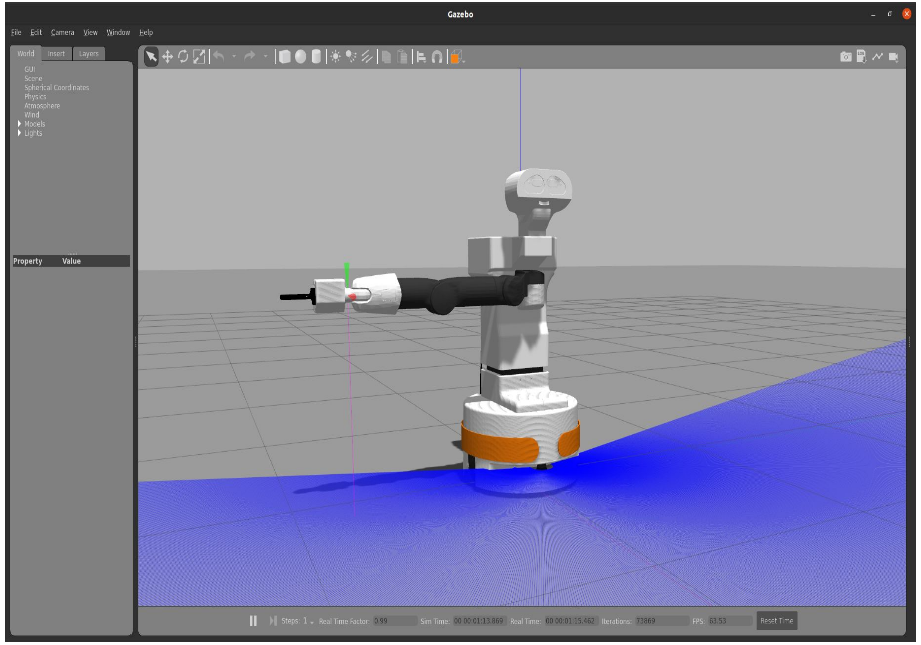
```
sudo apt install
ros-humble-tiago-simulation
```

TIAGo Simulation

```
ros2 launch tiago_gazebo tiago_gazebo.launch.py
is_public_sim:=True
```

Moving the base

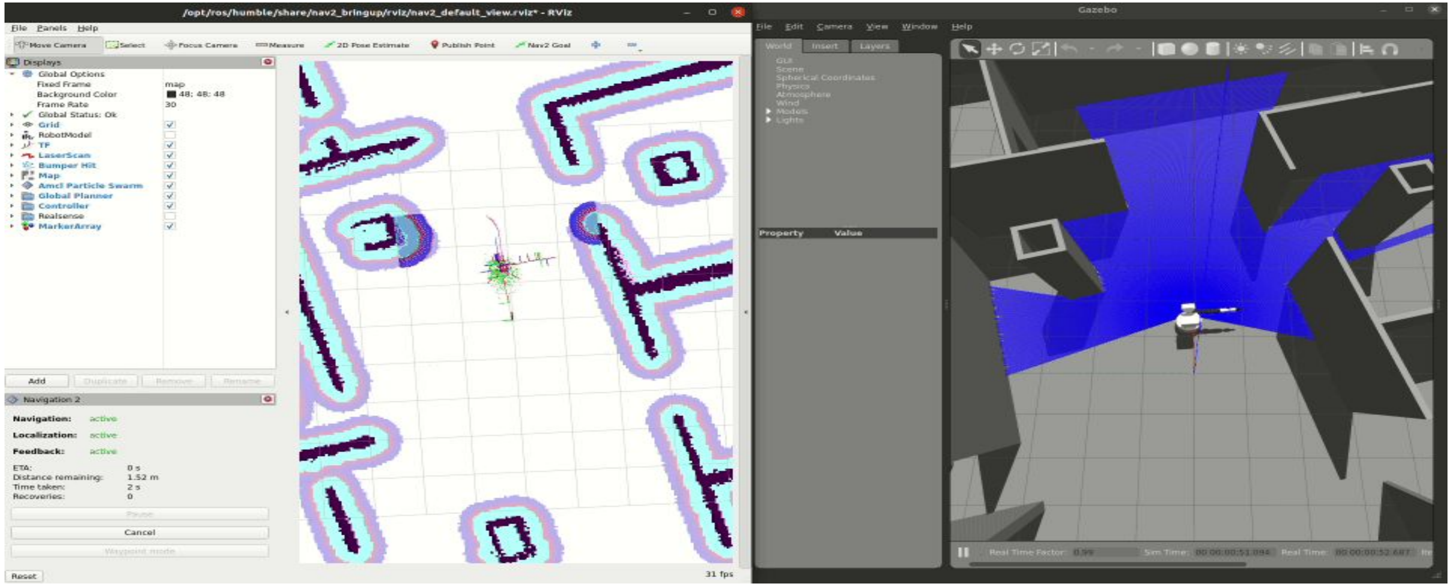
```
ros2 topic pub
/mobile_base_controller/cmd_vel_unstamped
geometry_msgs/msg/Twist '{linear: {x: 1},
angular: {z: 0}}' -r10
```



Steps: 1 Real Time Factor: 0.99 Sim Time: 00 00:01:13.869 Real Time: 00 00:01:15.462 Iterations: 73869 FPS: 63.53

TIAGo Navigation

```
ros2 launch tiago_gazebo tiago_gazebo.launch.py navigation:=True is_public_sim:=True
```

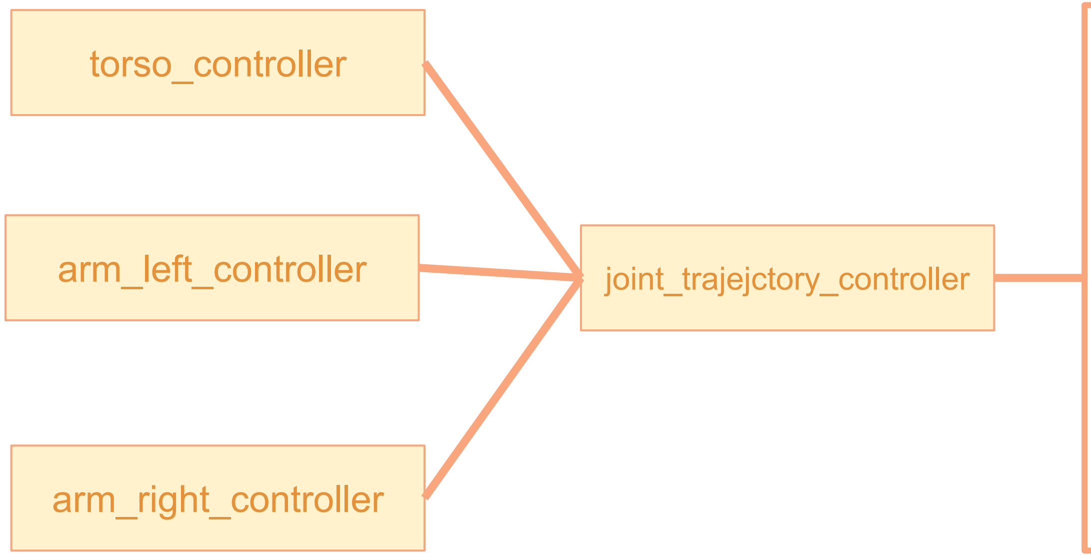


```
Global Options
  Fixed Frame          map
  Background Color     48; 48; 48
  Frame Rate           30
Global Status: Ok
Grid                   ✓
RobotModel
TF                     ✓
LaserScan              ✓
Bumper Hit             ✓
Map                    ✓
Amcl Particle Swarm    ✓
Global Planner         ✓
Controller             ✓
Realsense
MarkerArray            ✓

Navigation:      active
Localization:    active
Feedback:        active

ETA:                   0 s
Distance remaining:    1.52 m
Time taken:            2 s
Recoveries:            0
```

Default ros2 controllers in TIAGo



- Purpose: A built-in ROS 2 controller for executing **predefined joint motion trajectories**.
- Hardware interface: position
- Key Features:
  - Accepts joint trajectory goals via standard ROS 2 action interface
  - Supports position, velocity, and effort interfaces
  - Interpolates waypoints over time to compute smooth commands

[Github - Joint_trajectory_controller]()

Default ros2 controllers in TIAGo: How to send a command

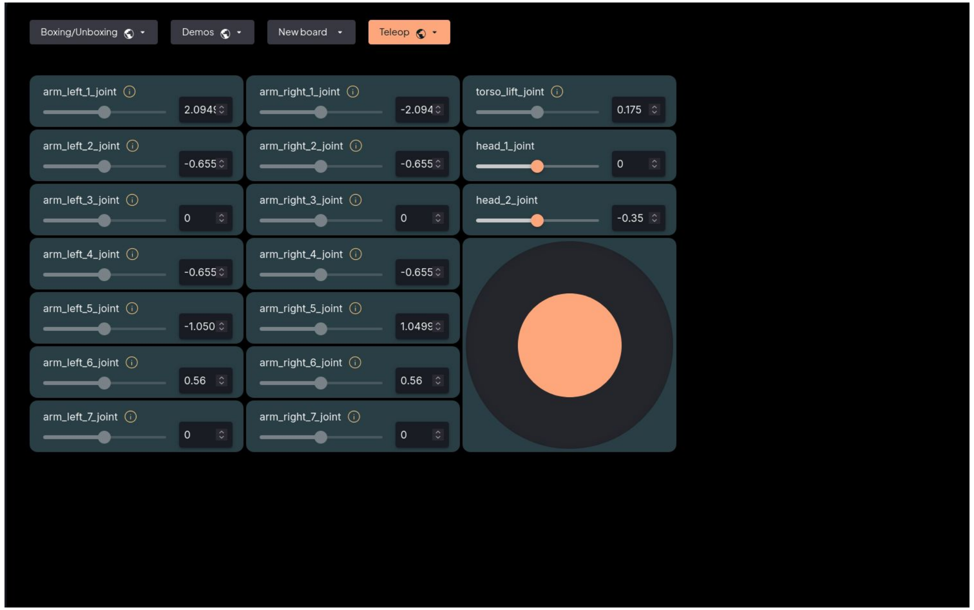
- Controller exposes an action server implementing FollowJointTrajectory
- Action Type: control_msgs/action/FollowJointTrajectory

- Send from CLI (example):

```
ros2 action send_goal
/joint_trajectory_controller/follow_joint_trajectory
  control_msgs/action/FollowJointTrajectory
  "{
      trajectory: {
      joint_names: ['joint1', 'joint2'],
      points: [
      {
            positions: [1.0, 0.5],
            time_from_start: {sec: 1}
      },
      {
            positions: [0.0, 0.0],
            time_from_start: {sec: 2}
      }
      ]
      }
  }"
```

Default ros2 controllers in TIAGo: How to send a command

Using the Webgui



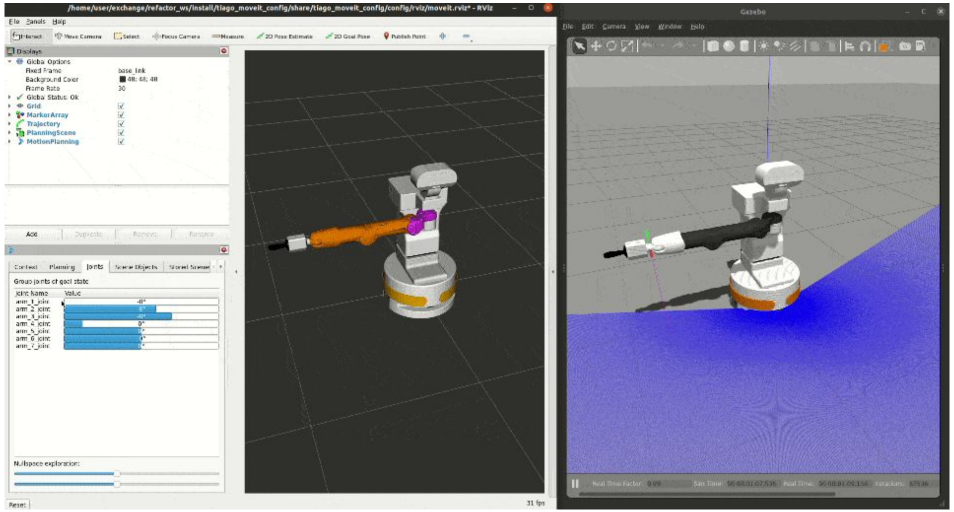
arm_left_1_joint	2.094	arm_right_1_joint	-2.094	torso_lift_joint	0.175
arm_left_2_joint	-0.655	arm_right_2_joint	-0.655	head_1_joint	0
arm_left_3_joint	0	arm_right_3_joint	0	head_2_joint	-0.35
arm_left_4_joint	-0.655	arm_right_4_joint	-0.655		
arm_left_5_joint	-1.050	arm_right_5_joint	1.0499		
arm_left_6_joint	0.56	arm_right_6_joint	0.56		
arm_left_7_joint	0	arm_right_7_joint	0		

TIAGo Moveit

```
ros2 launch tiago_gazebo tiago_gazebo.launch.py
moveit:=True
```

Launch Moveit

```
ros2 launch tiago_moveit_config
moveit_rviz.launch.py
```



/home/user/exchange/refactor_ws/install/tiago_moveit_config/share/tiago_moveit_config/config/rviz/moveit.rviz* - RViz

Global Options	
Fixed Frame	base_link
Background Color	■ 48; 48; 48
Frame Rate	30
Global Status: Ok	
Grid	✓
MarkerArray	✓
Trajectory	✓
PlanningScene	✓
MotionPlanning	✓

Group joints of goal state

Joint Name	Value
arm_1_joint	-0°
arm_2_joint	0°
arm_3_joint	-0°
arm_4_joint	0°
arm_5_joint	0°
arm_6_joint	0°
arm_7_joint	0°

Nullspace exploration:

Play Motion2

- Executes pre-recorded or user-defined motion trajectories
- Supports joint-space and pose-space motion
- Fully integrated with ROS 2 action servers
- Plays back motions safely and smoothly

```
home:
      joints: [torso_lift_joint, arm_1_joint,
      arm_2_joint, arm_3_joint, arm_4_joint,
arm_5_joint,
      arm_6_joint, arm_7_joint]
      positions: [0.25, 0.20, 0.35, -0.20, 1.94,
-1.57, 1.37, -1.58,
                 0.18, 0.50, -1.34, -0.48, 1.94,
-1.49, 1.37, -1.58,
                 0.15, 0.50, -1.34, -0.48, 1.94,
-1.49, 1.37, 0.0]
      times_from_start: [0.5, 4.0, 7.0]
      meta:
           name: Home
           usage: demo
           description: 'Go home'
```