Robot Operating System (ROS)

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Day 1 - Review

BASIC COMMANDS IN UBUNTU

2. cd

The cd command is used to change directories. Either one by one or altogether.

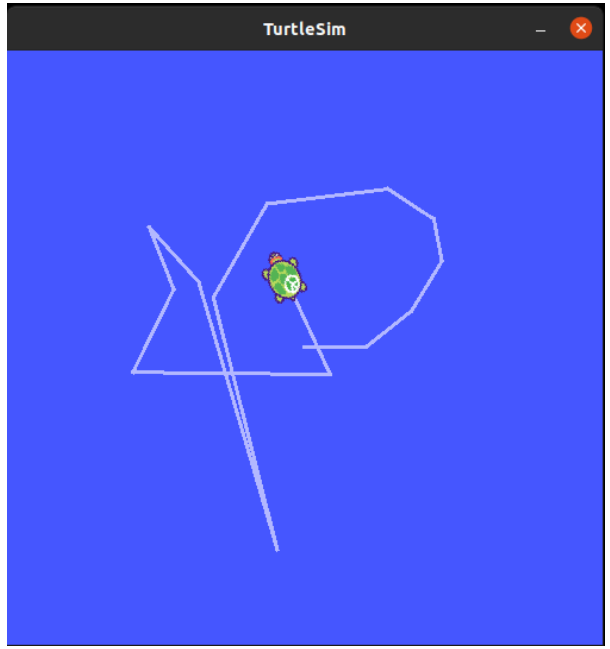
Commands:

```
cd catkin_ws → cd src → cd robots
cd ~/catkin_ws/src/robots
```

Installing ROS Noetic

4. Install ROS ☺

```
sudo apt install ros-noetic-desktop-full
```



Let us create our first workspace !

1.	`mkdir catkin_ws`	Create a workspace with a any name
2.	`cd catkin_ws`	Go inside the workspace
3.	`mkdir src`	Create a folder named 'src'
4.	`cd ..`	Go back to the catkin_ws directory
5.	`catkin_make`	Use the command catkin_make to build the ws

ROS Concepts [3]

- ROS Node
- ROS Topic
- ROS Message
- ROS Service
- ROS Parameter Server
- ROS Master
- ROS Core

Agenda – Day 2

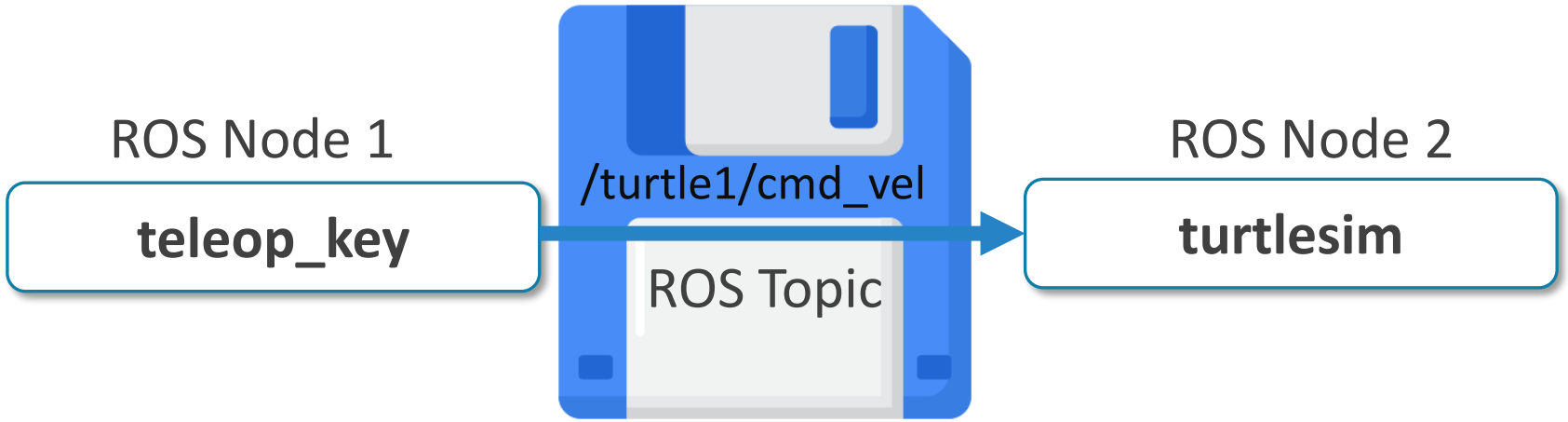
- Delving deeper into ROS Service & ROS Parameter
- Automating with ease – ROS Launch
- Establishing various communication methods with Python 3
- Mastering ROS Tools with Turtlebot3 Simulation
- Glimpse into current research trends in robotics

GitHub Repository

https://github.com/MukilSaravanan/ROS1_Workshop

ROS Bag

- ROS Bag records and plays ROS messages in ROS Topics [1]

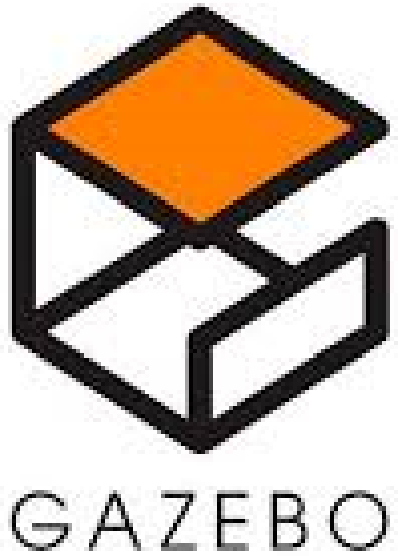


Records ROS Topics real-time

[1] ROS/Tutorials/reading msgs from a bag file - ROS Wiki

Gazebo

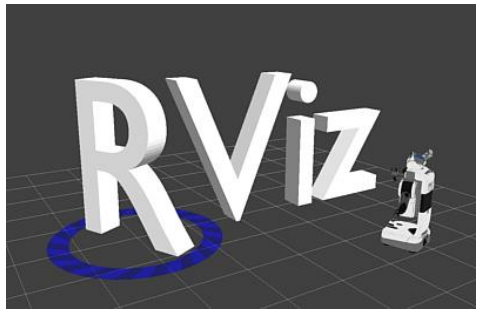
- Physics engine capable of simulating 3D dynamically changing environments [2]
- Key features
  - Import real-world robots with no cost
  - Emulate any environments and realistic scenarios
  - Bring life to robots --- wide variety of sensors

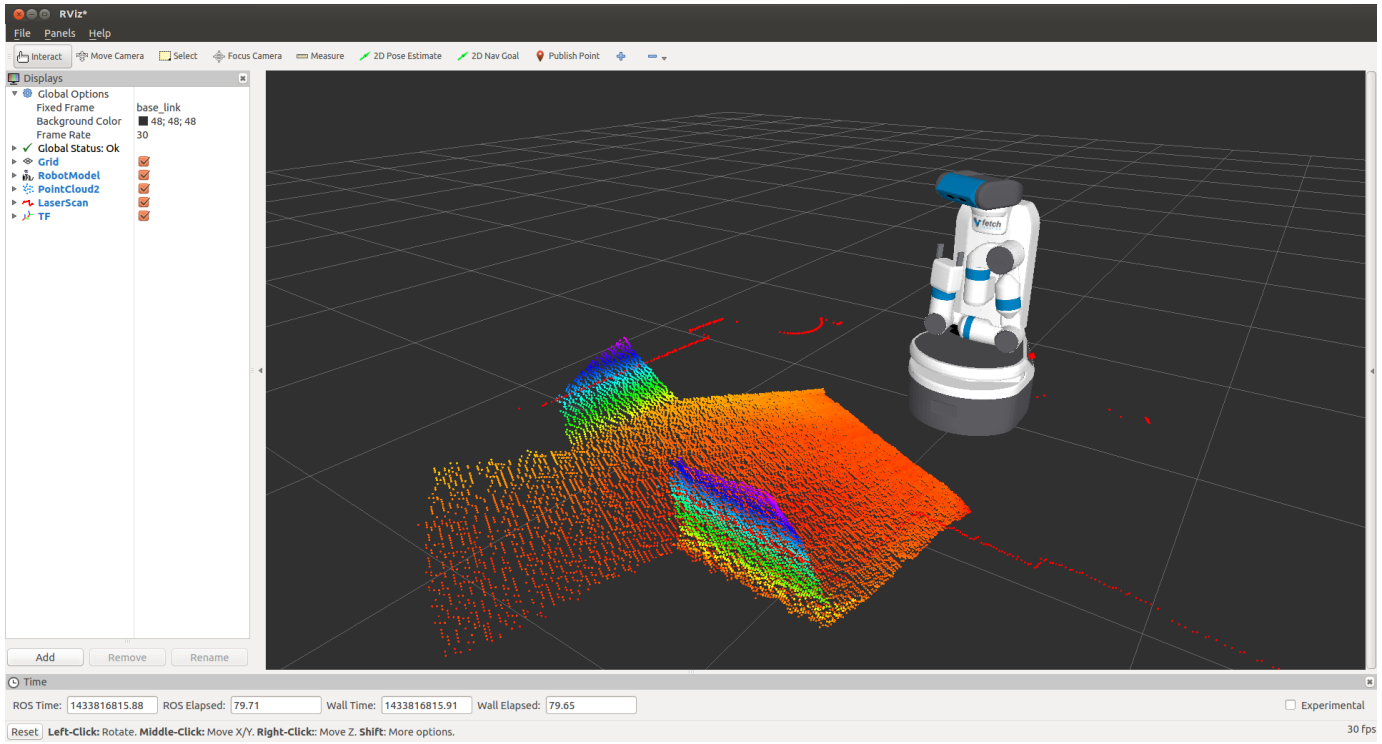


[2] Gazebo : Tutorial : Beginner: Overview (gazebosim.org)

RViz

- Visualize sensor data, robot model, map etc., [3]
- Unlike Gazebo, Rviz does not have a physics engine





[3] ros-visualization/rviz: ROS 3D Robot Visualizer (github.com)

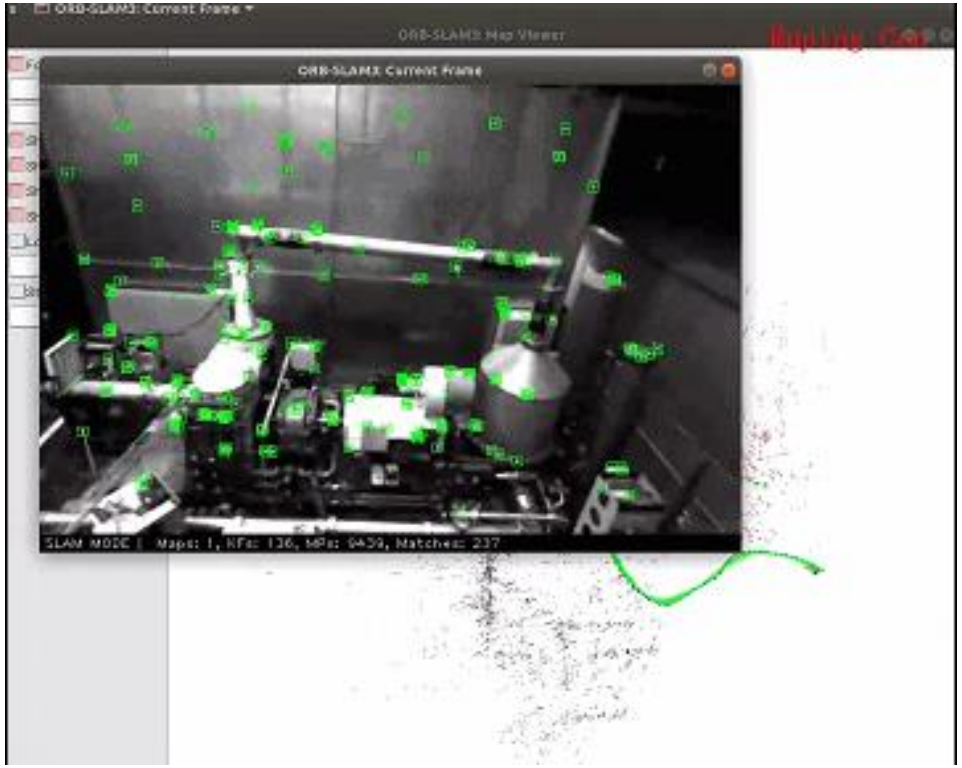
rqt

- Various GUI tools in the form of plugins [4]
- Key features
  - rqt_graph
  - rqt_plot
  - rqt_image_view
  - rqt_publisher
  - rqt_console

[4] rqt - ROS Wiki

Simultaneous Localization & Mapping (SLAM)

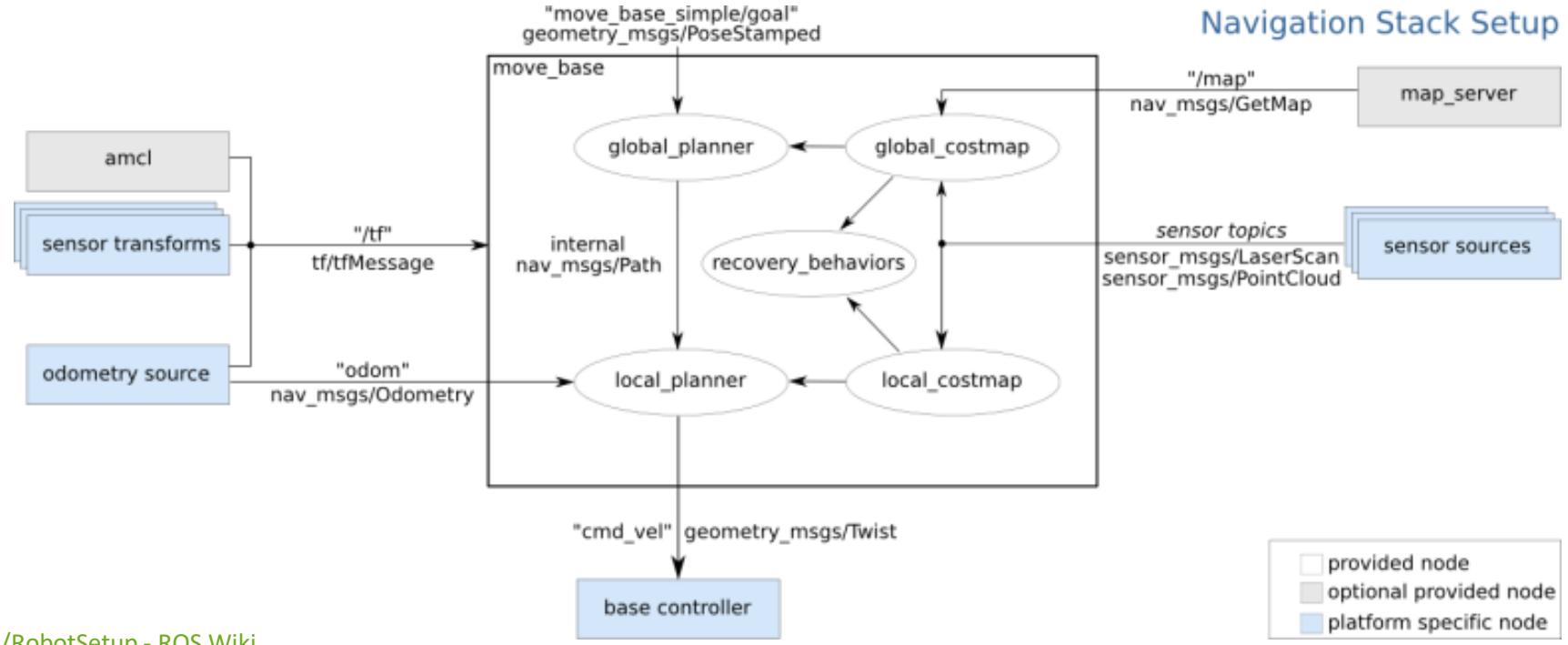
- Technique to construct map of unknown environment and simultaneous keep track of robot's localization [4]
- "Chicken-egg" problem
  - Map is needed for localization
  - Pose estimation is needed for mapping



[4] Simultaneous localization and mapping - Wikipedia
Credits: ORB-SLAM 3: A Tool for 3D Mapping and Localization | Sigmoidal

ROS Navigation Stack

- Performs navigation for mobile robots [6]
- Takes in sensor streams & gives out command velocities



[6] navigation - ROS Wiki
Credits: navigation/Tutorials/RobotSetup - ROS Wiki

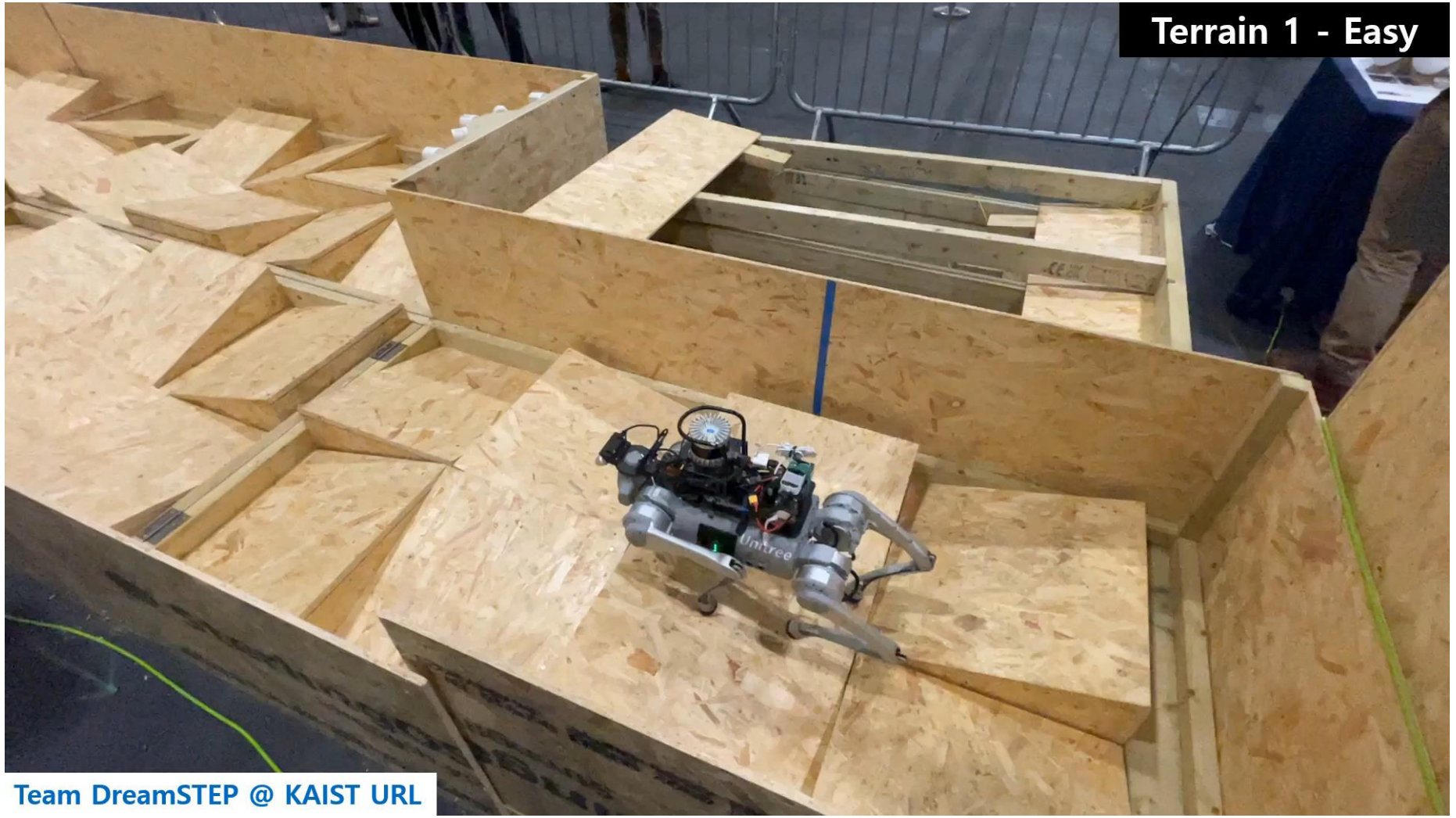
Understanding with Turtlesim

ROS Topic

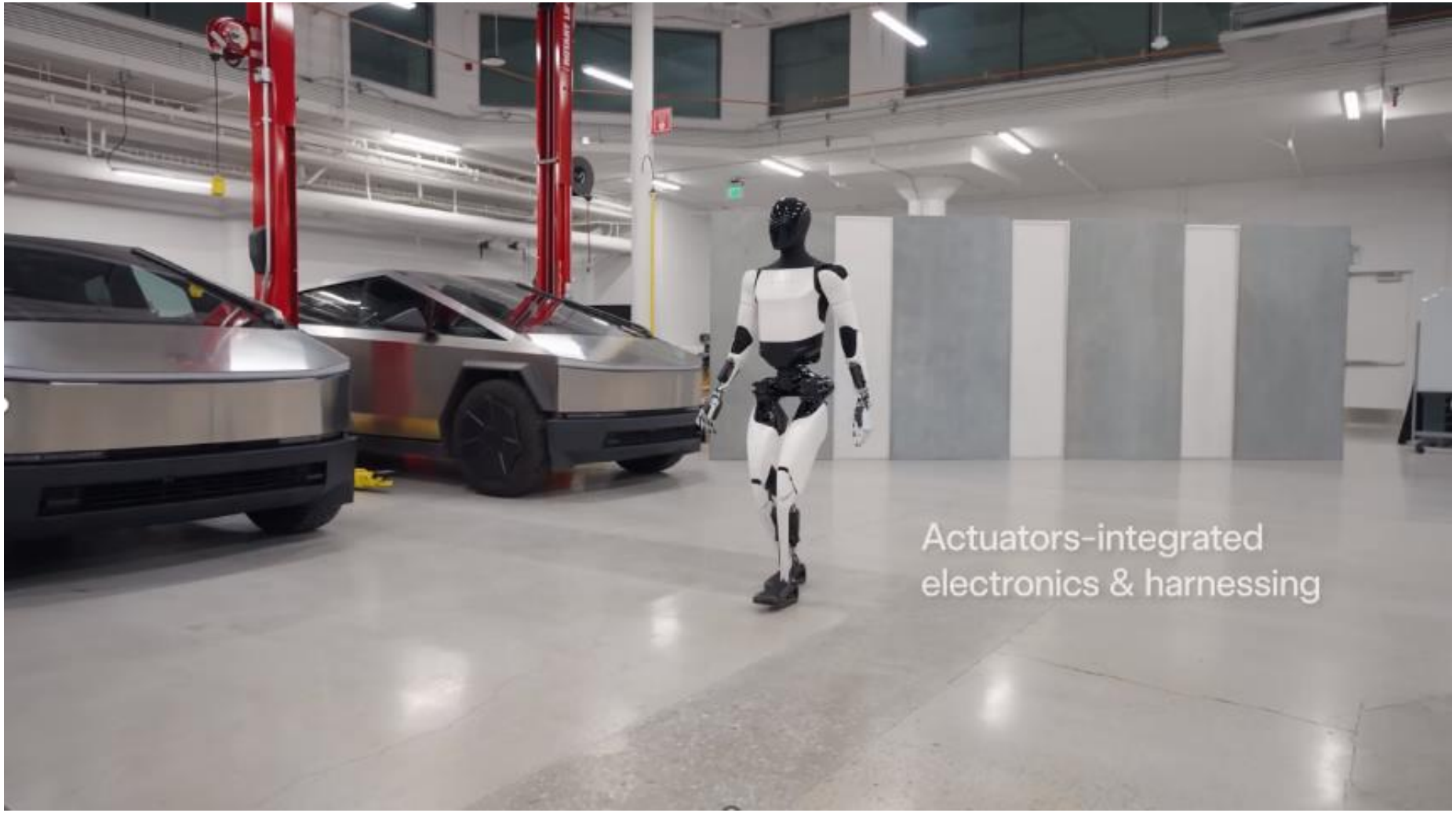
- $ roscore
- $ rosrun turtlesim turtlesim_node
- $ rosrun turtlesim turtle_teleop_key
- $ rosrun rqt_graph rqt_graph
- $ rostopic -h
- $ rostopic echo /turtle1/cmd_vel
- $ rostopic list -h
- $ rostopic type /turtle1/cmd_vel

Current Research Trends

Current Research Trends



Current Research Trends



Day 2 - Recap

- Understood ROS Service, Parameter, Launch file workflows
- Learnt various communication methods with py3
- Explored advanced ROS tools such as Gazebo, Rviz and rqt
- Had hands-on experience of robot mapping and navigation of Turtlebot3 in complex simulation environments
- Set up the aspiration for future research in robotics

Q & A

Share your feedback

Thank You

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Let’s get connected!