

# **EtherCAT-based Industrial Manipulator**

Tokyo Open Source Robotics Kyokai Association  
(TORK, Non-profit Organization, Tokyo/Nagoya)

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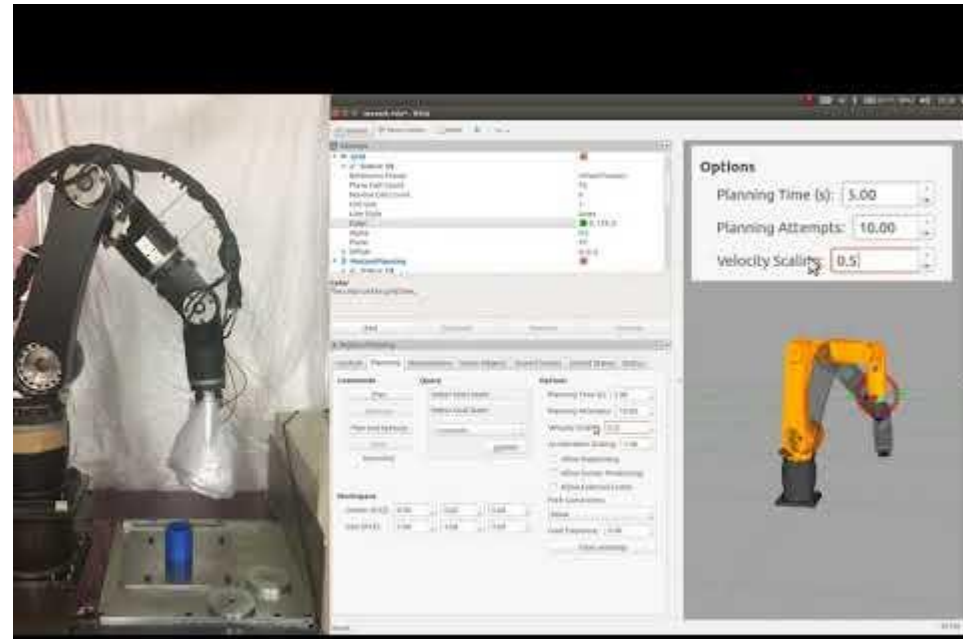
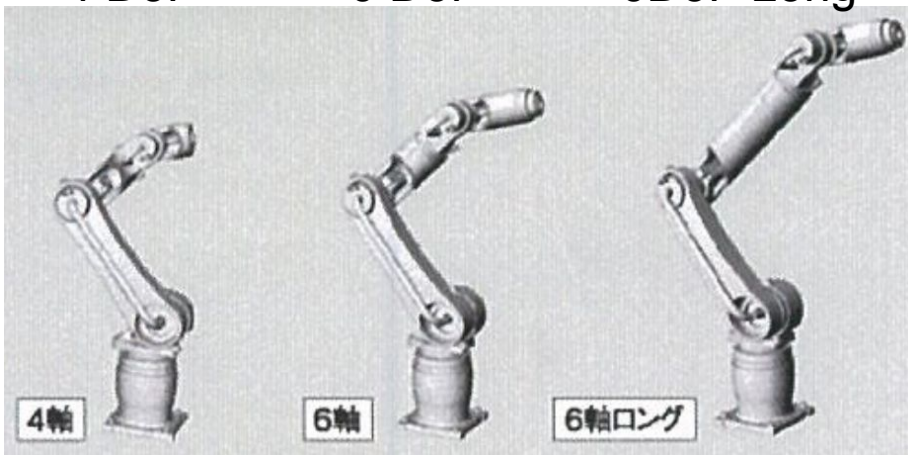
# Industrial Manipulator : TRA

- Designed by Techno21 Group Inc.
- Standard Multi-DoF Articulated Robot
  - Easy-to-order customizable robot arm
    - Various number of actuators, length of link
    - Default height : 1411 mm
    - Maximum load : 20 kg

4 DoF

6 DoF

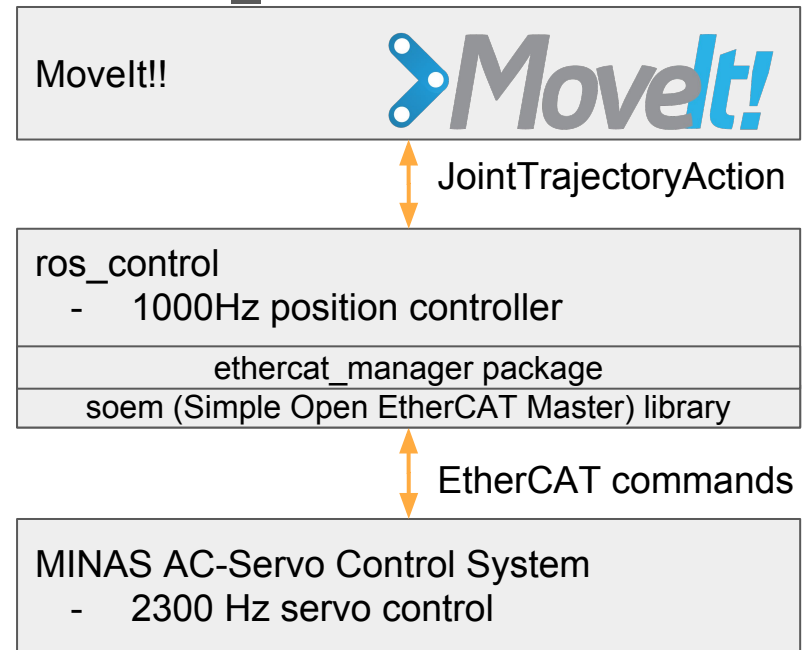
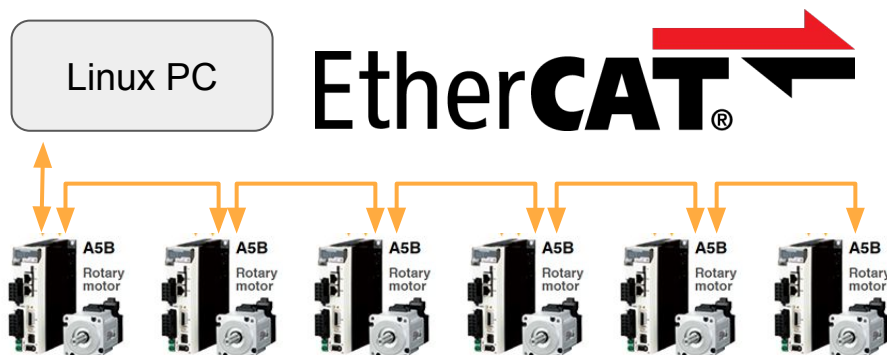
6DoF Long



# TRA System Architecture

- Hardware architecture
  - MINAS A5B controller connected via EtherCAT network
  - Linux low-latency kernel on Host machine

- Software architecture
  - Standard design using ros\_control and



# OSS Contribution & Collaboration

- Source code : [github.com:tork-a/minas](https://github.com:tork-a/minas)
  - ethercat\_manager :
    - EtherCAT driver, based on robotiq\_ethercat package
  - minas\_control
    - Linux driver and ros\_control implementation
  - tra1\_bringup, tra1\_description, tra1\_moveit\_config
- Future works
  - Device-agnostic ethercat\_manager ?
  - Safety requirements (ex. ISO 10218-1 ?)
- Special thanks:
  - Financial support from automotive parts manufacturer
- Questions?



# Industrial Manipulator : TRA

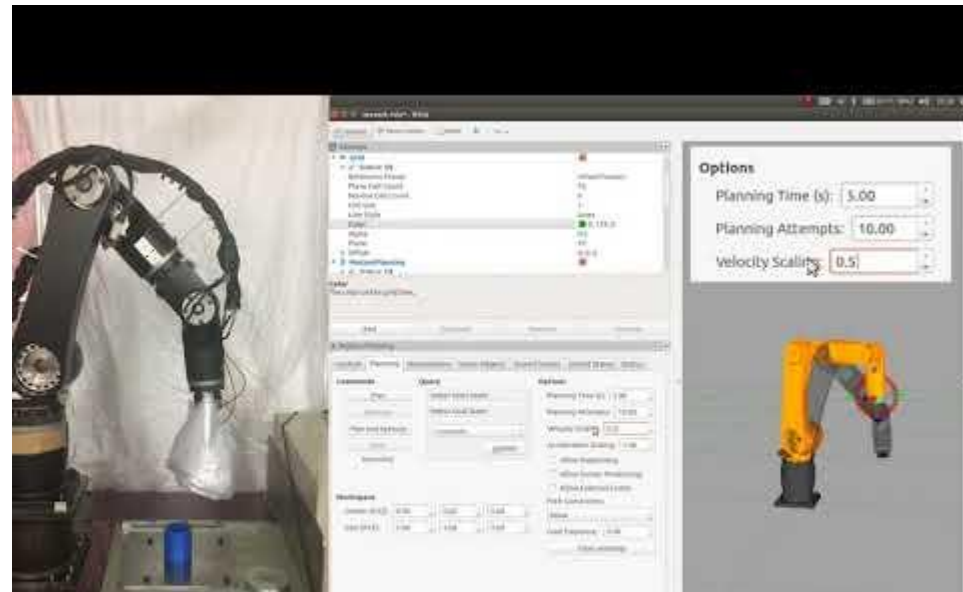
- Designed by Techno 21 Group Inc.
- Standard Multi-DOF Articulated Robot
  - Panasonic MINAS A5B : AC servo motor driver and actuators
    - “Advanced EtherCAT Servo Driver for High-Performance Motion Control”
  - Harmonic Drive Gear System



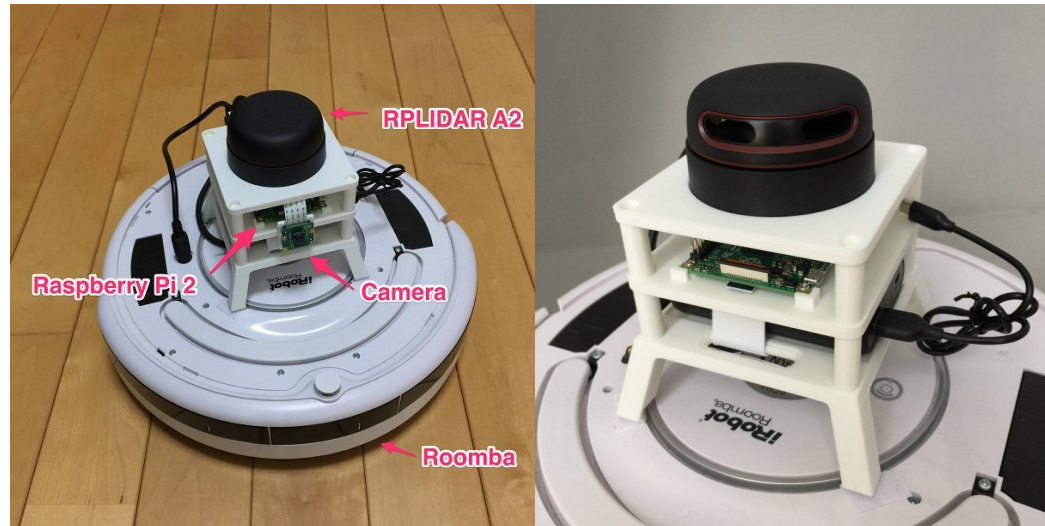
Panasonic®



HD SYSTEMS 株式会社 | ハーモニック  
ドライブ  
システムズ



# Roomblock



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# What is Roomblock?

- A robot platform for learning ROS navigation system

- Roomba
- Raspberry Pi 2
- RPLIDAR A2



- 3D printed frame (Available from **Thingiverse**)
- Mobile battery, Wifi dongle, USB Serial cable
- All are on Instructables and GitHub

- <http://github.com:tork-a/roomblock>



- <http://www.instructables.com/id/Roomblock-a-Platform-for-Learning-ROS-Navigation-W/>

- Why not Turtlebot?

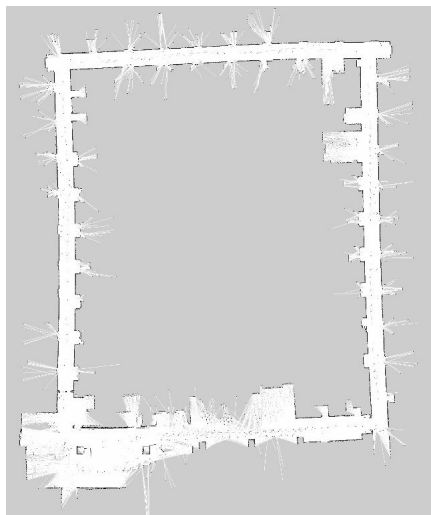
- 360 [degree] LIDAR for navigation
- Roomba cleans your house



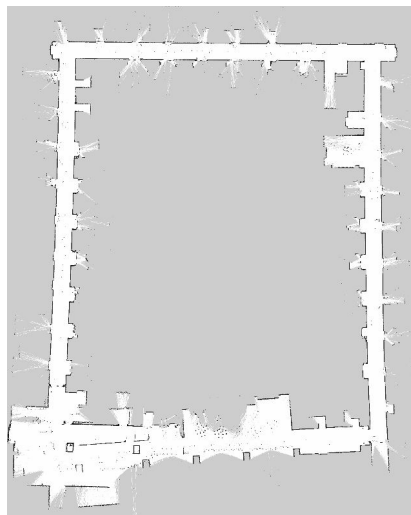


# ROS Navigation Example

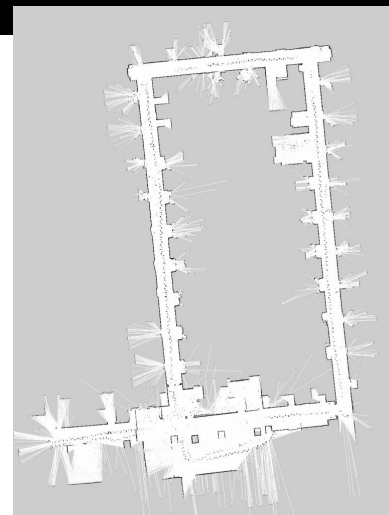
- ROS Mapping
  - gmapping
  - slam\_karto
  - hector\_slam
  - Google cartographer
- Used default parameters, might get better result if you fine tune



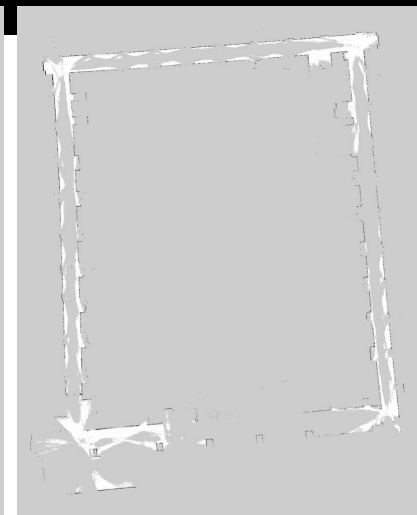
gmapping



slam\_karto



hector\_slam



cartographer

# ROS Navigation Workshop

- Hands-on seminar for ROS navigation toolkit
  - Laser-based mapping and localization
  - Path planning and execution
  - In detail explanation of move\_base node
  - Both simulation and real robot (Roomblock)
- Questions?

