Hochschule
Bonn-Rhein-Sieg
University of Applied Sciences

Software Development Project

Final Presentation

Wei-Chan Hsu, Torsten Jandt, Ramesh Kumar, Danning Wang

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Introduction

Software Development Project

Basic Navigation Test

- Environment: Workspaces, waypoints and obstacles.
- Task specification: Sequence of poses.

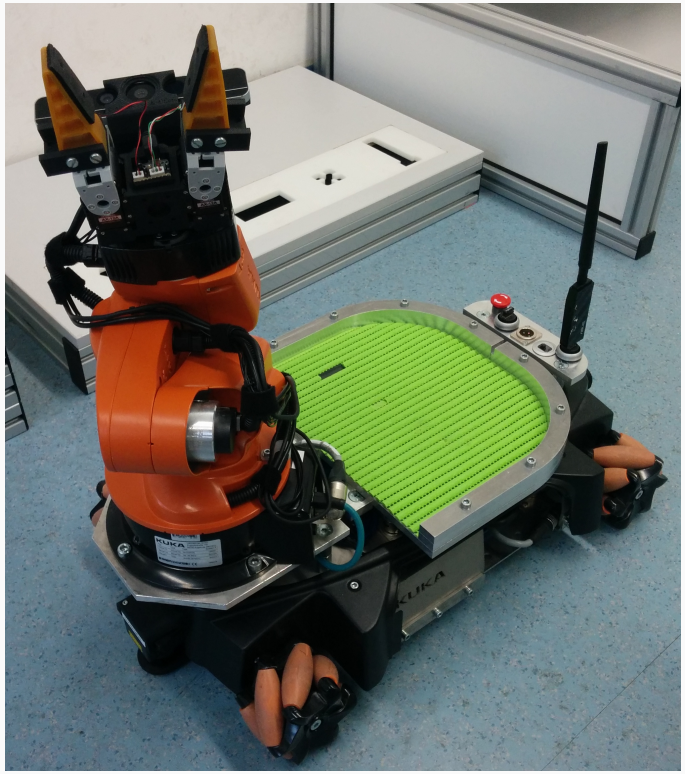
Challenges

- **Perception:** Accessing and processing sensor data.
- **Mapping:** Building map of the environment.
- **Localization:** Pose inside map.
- **Path planning:** Determine sequence of poses between waypoints.
- **Motion control:** Execution of path.

KUKA youBot

The youBot is a mobile manipulator designed for education and research purposes. It comes with fully open interfaces and API.

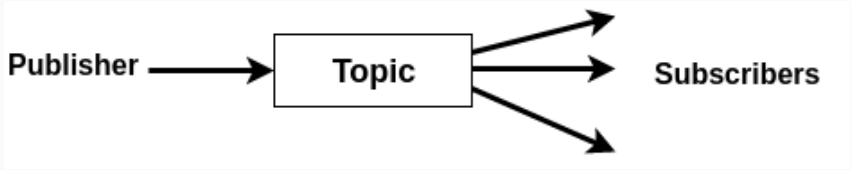
- Omnidirectional, four-wheeled
- 5-DOF manipulator with a two-finger gripper
- On-board PC with CPU, 2GB memory, 32GB SSD drive
- Sensors: vision sensors, rangefinders



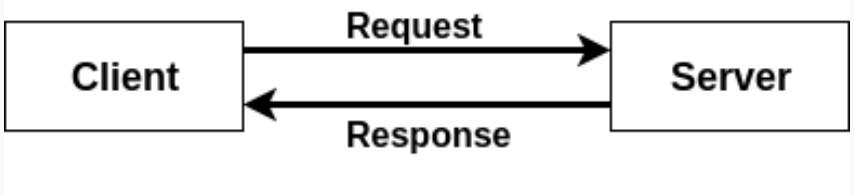
Robot Operating System (ROS)

Set of software and libraries.

- **Node**: A process using ROS.
- **Topic**: Message queue, used for communication between nodes.

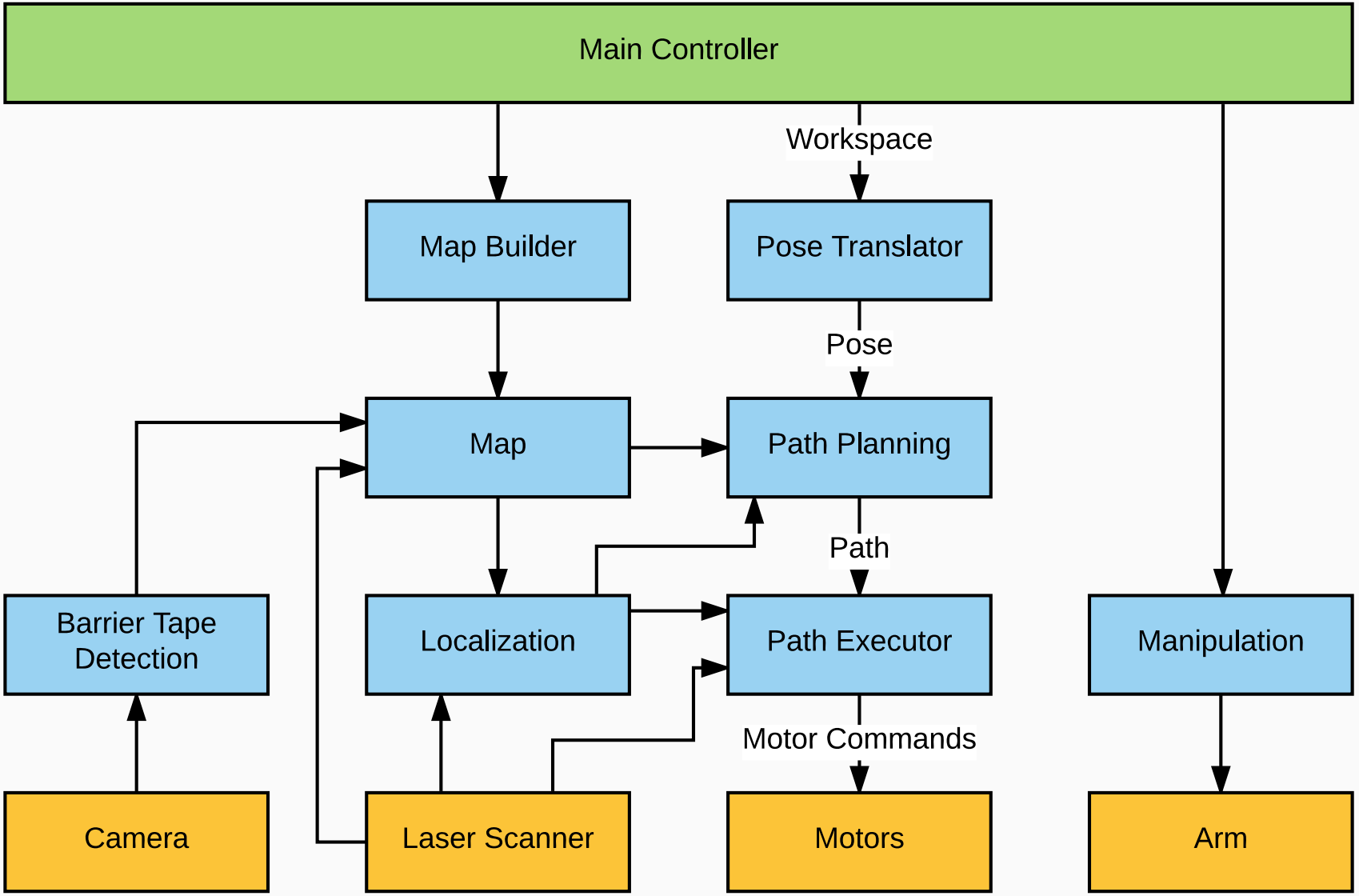


- **Service**: Offers synchronous service calls.



Approach

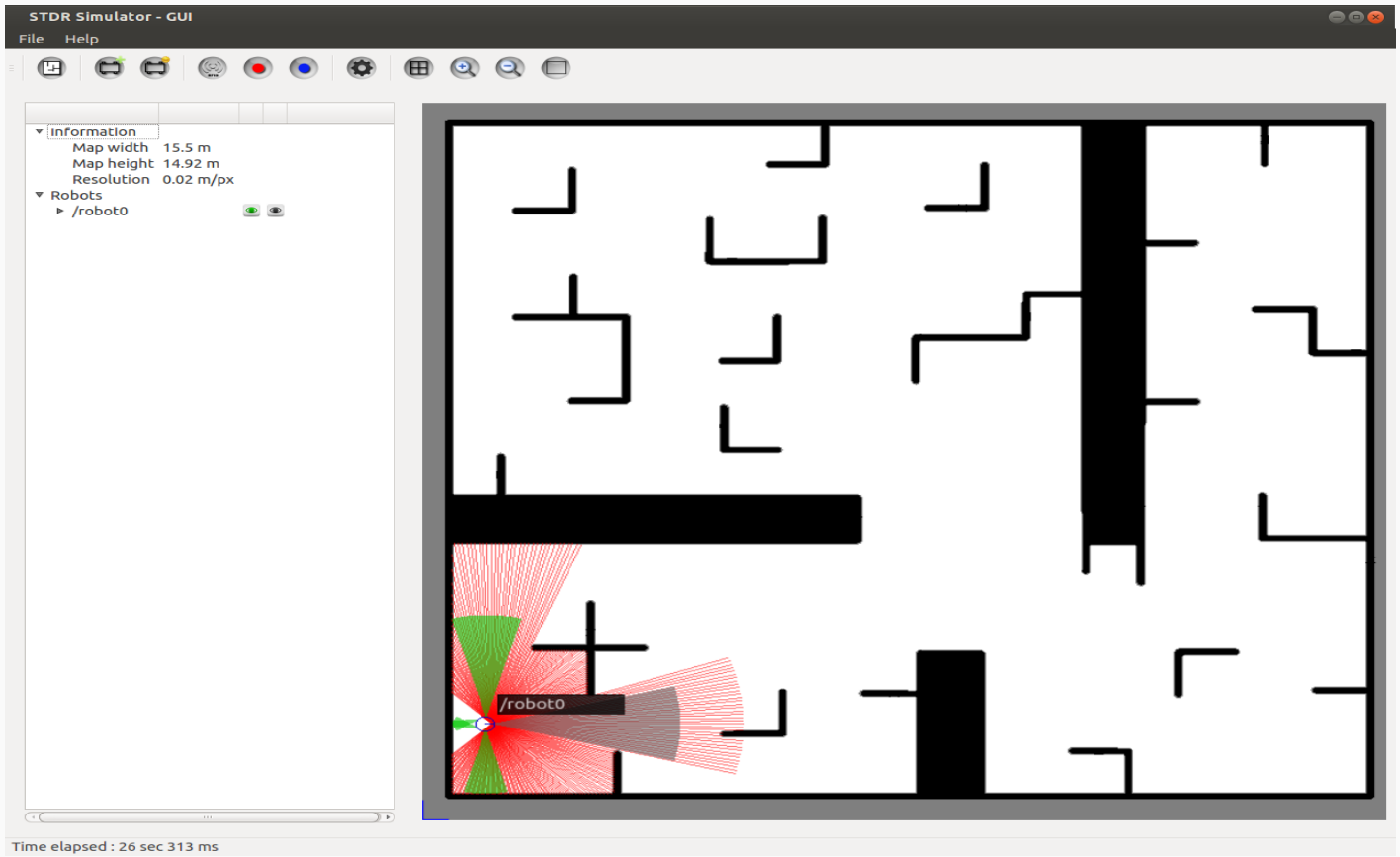
Software Modules



Realization

Simulation

- Simple Two Dimensional Robot Simulator(STDR)
- Tasks performed:
  - Map Building
  - Localization



Map building I

- Gmapping is used to build the map
  - Uses laser scanner
- Map Server
  - Provides map saver utility, to save generated map in files(yaml and pgm)
  - Offers map data as a ROS Service

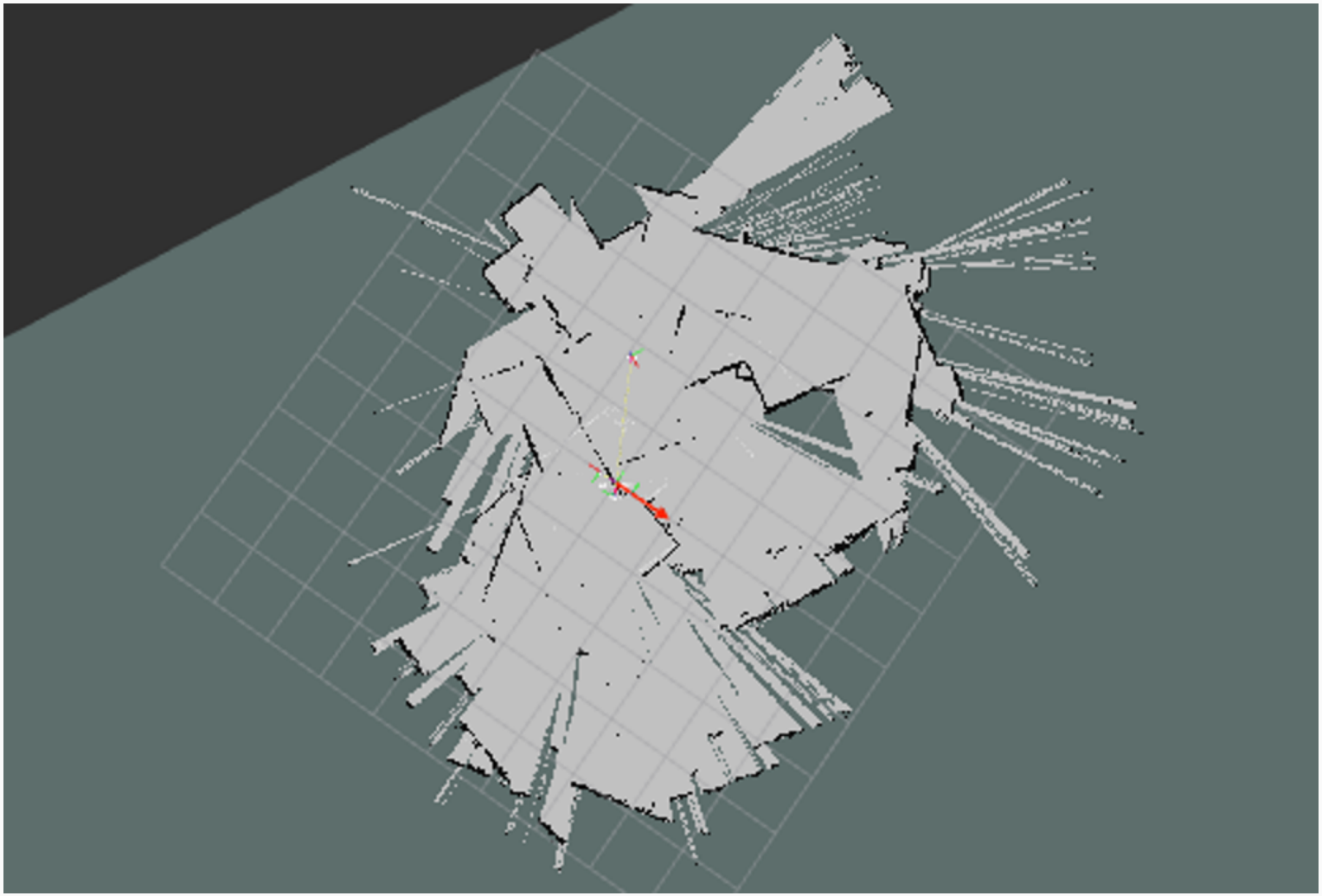
Localization I

- Adaptive Monto Carlo Localization(AMCL) is used to localize the robot
- Uses particle filter to track the pose of robot
- What it needs?
  - Laser scans
  - Initial pose
  - Transforms
  - Map

youBot Driver

Map building II

Map building III



Localization II

Navigation

Navigation - Local Planner

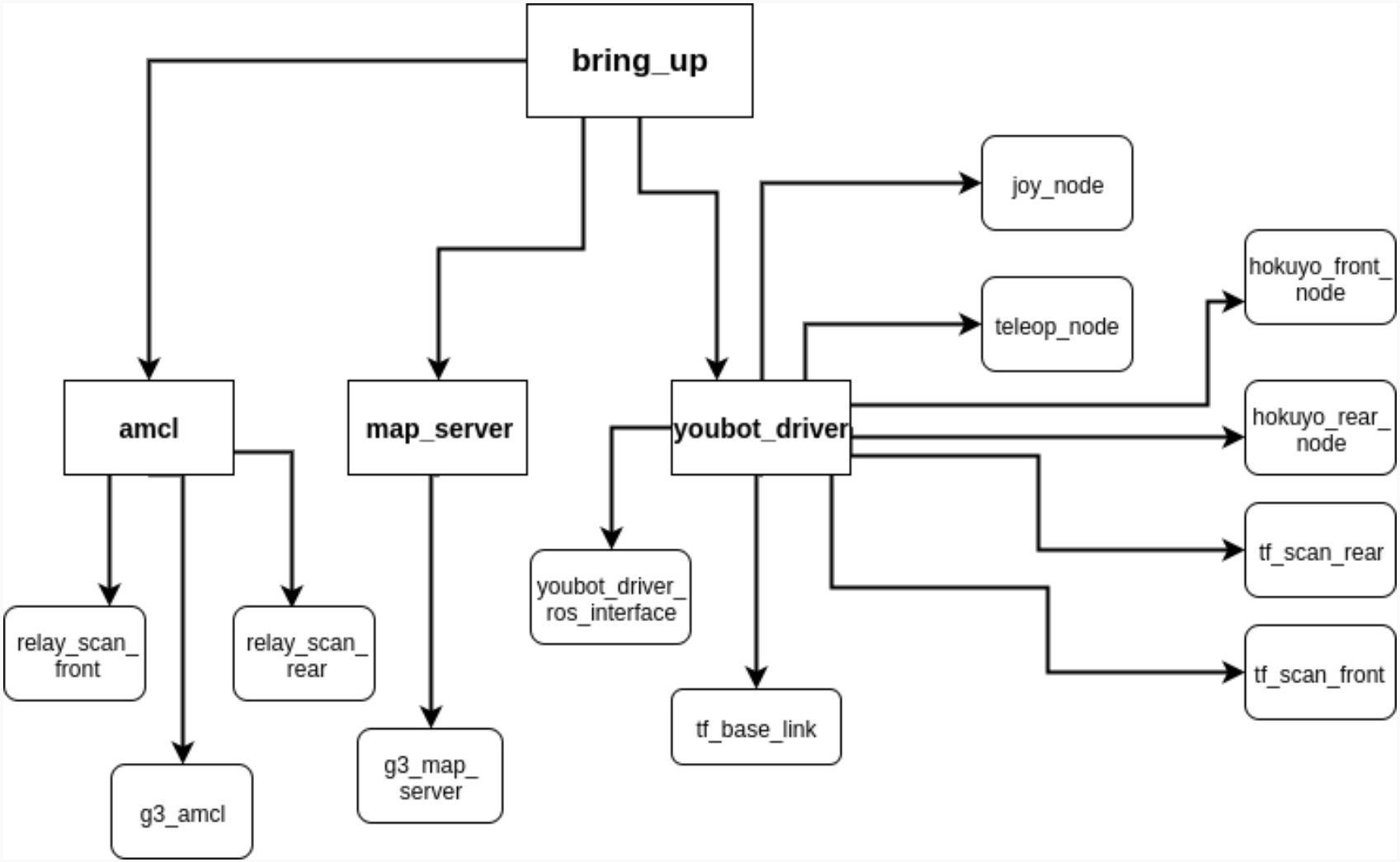
BNT.py

The node acts as path executor that reads a set of user inputs and convert them to move_base_msgs.

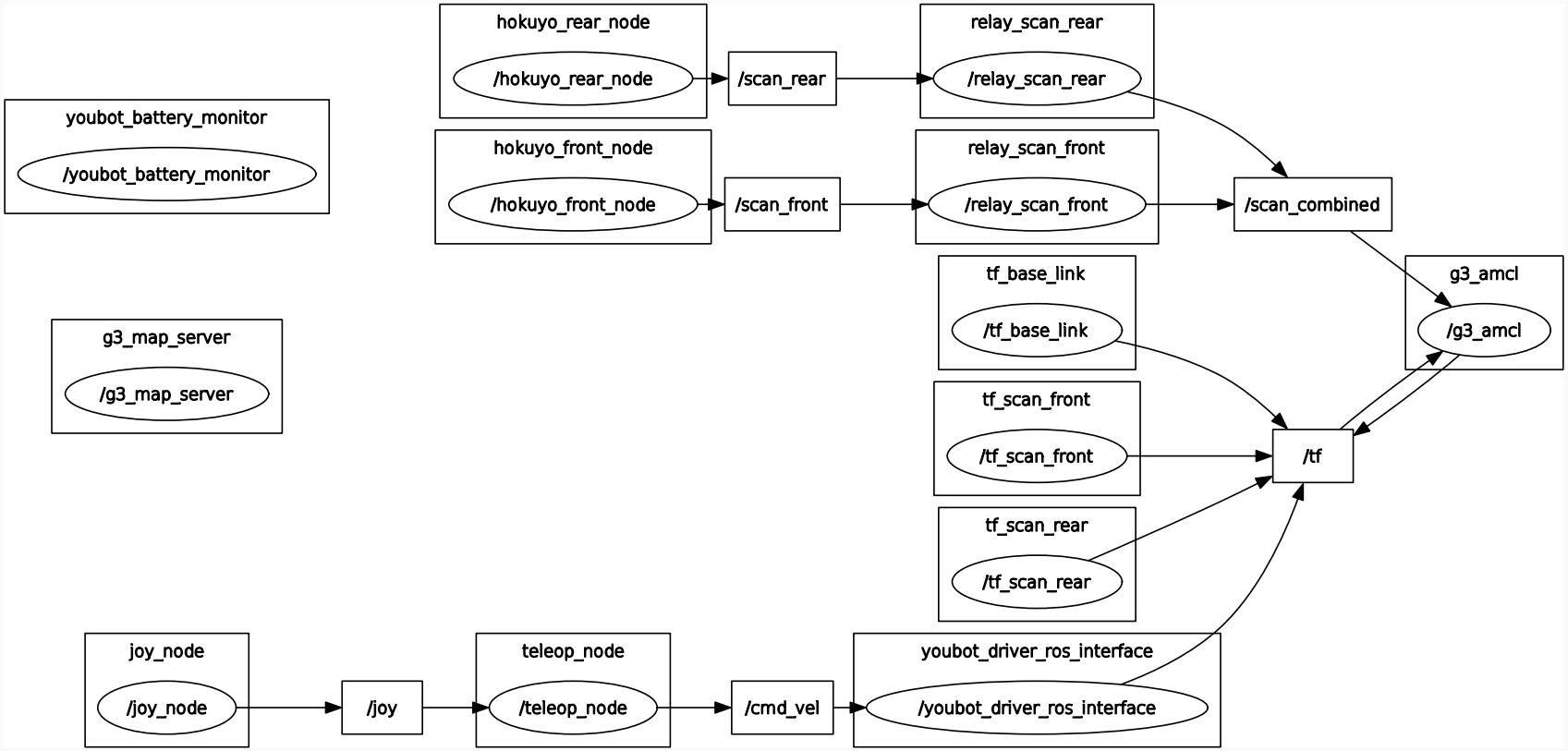
- Class: Position, Pose, Environment, Workspace, PathExecutor
- Functions:
  -
  - Clear cost map
  -

Results

Launch Files



RQT Graph


hokuyo_rear_node
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/scan_rear
relay_scan_rear
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youbot_battery_monitor
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hokuyo_front_node
/hokuyo_front_node
/scan_front
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/relay_scan_front
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g3_amcl
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teleop_node
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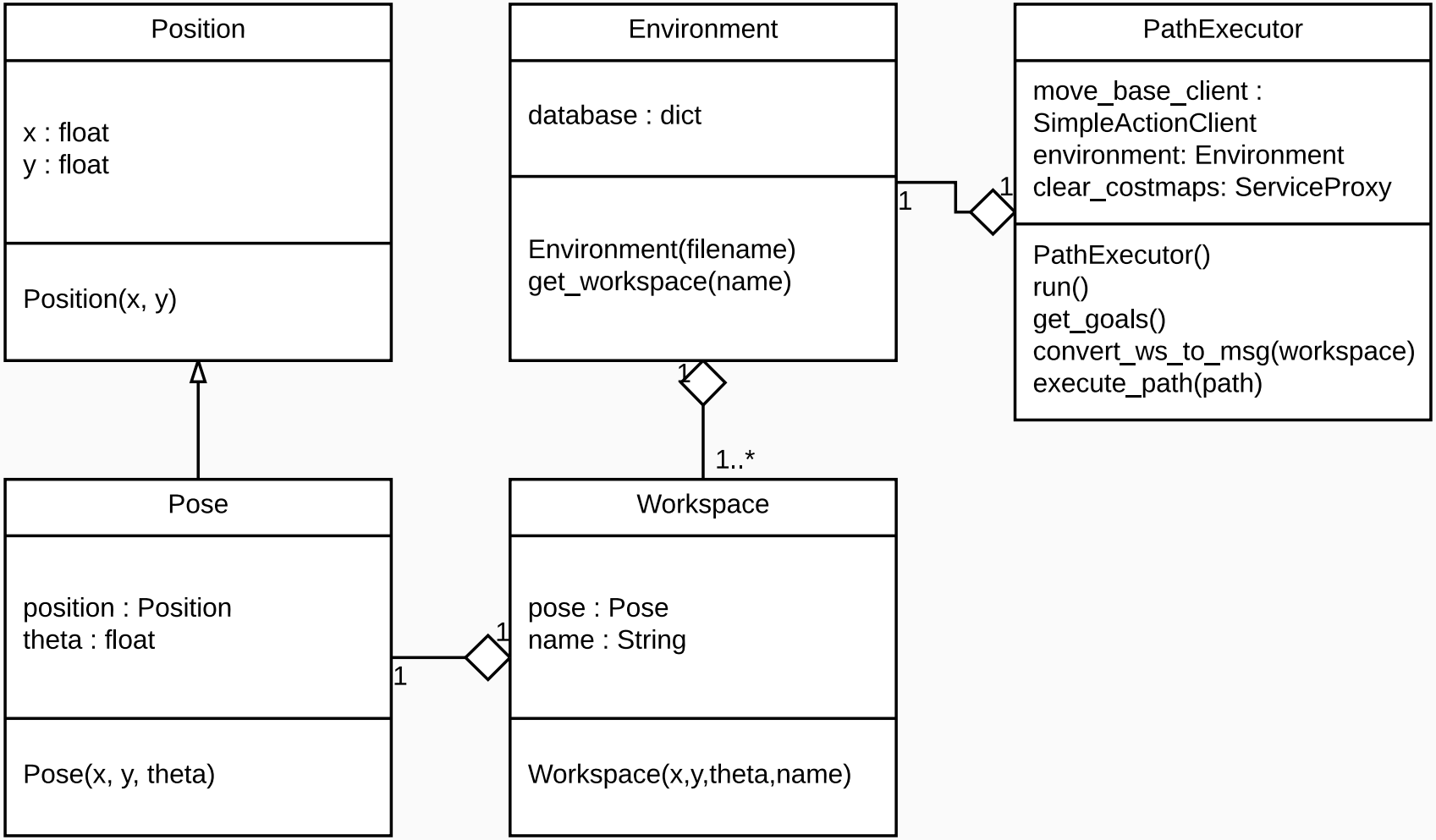
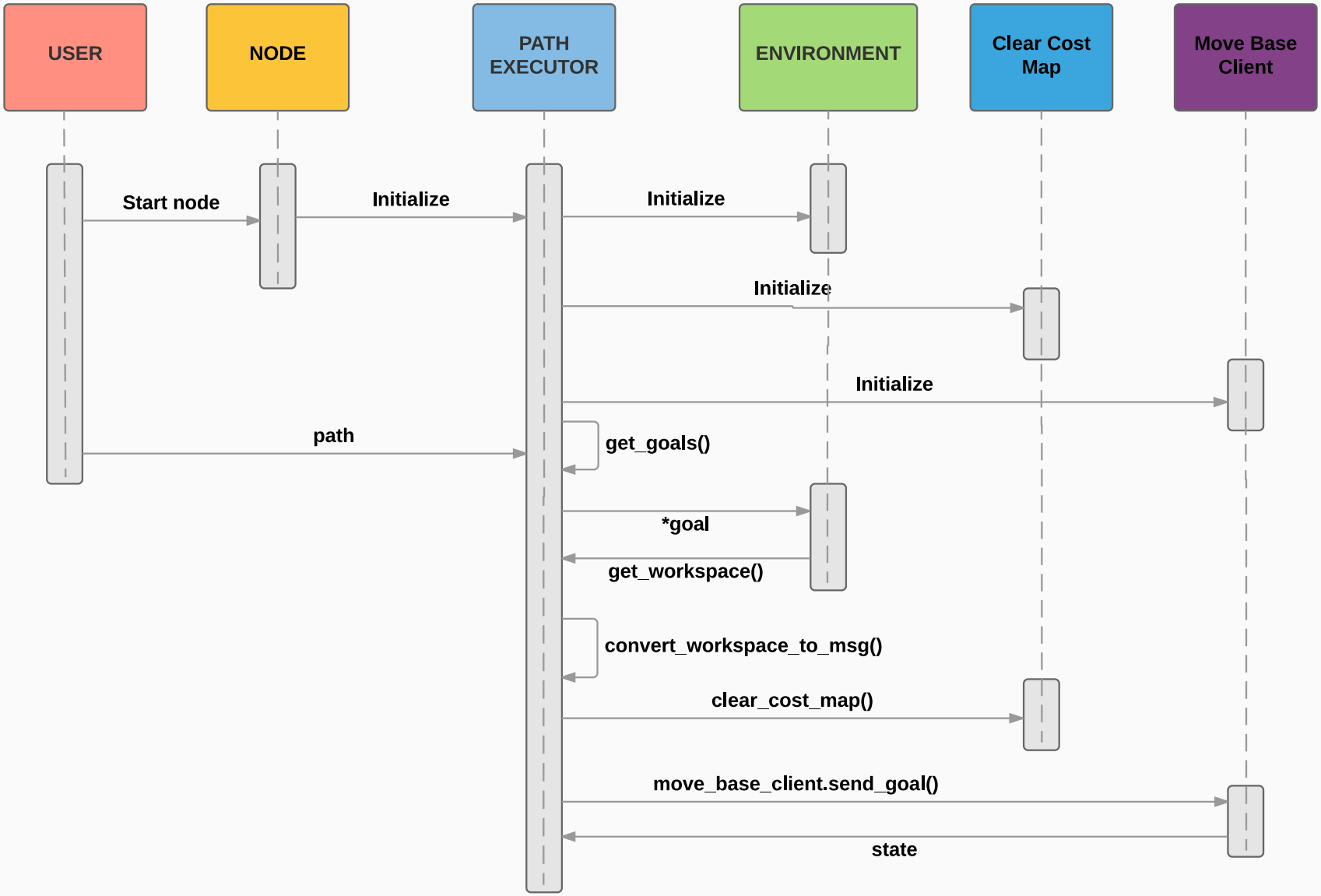
/cmd_vel
youbot_driver_ros_interface
/youbot_driver_ros_interface

Class Diagram



Sequence Diagram



Conclusions

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Future Work