



**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.



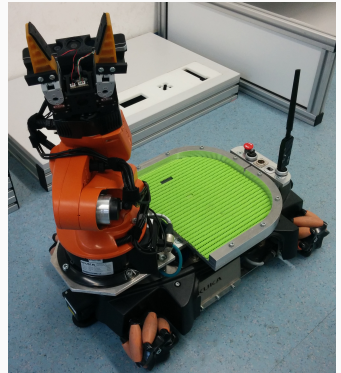
Challenges

- **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.

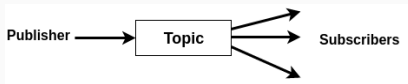
- Omnidirectional, four-wheeled
- 5-DOF manipulator with a two-finger gripper
- On-board PC with CPU, 2GB memory, 32GB SSD drive
- Sensors: vision sensors, rangefinders



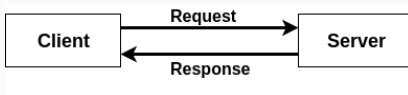
Robot Operating System (ROS)

Set of software and libraries.

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

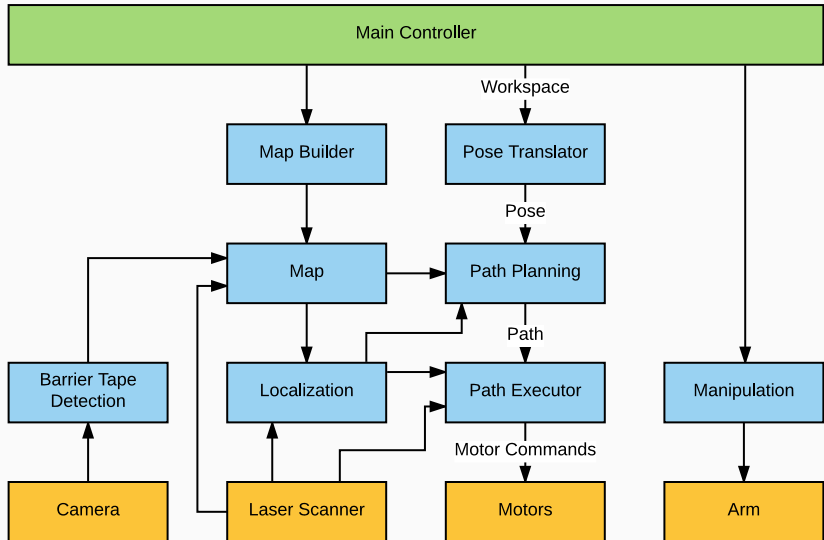


- **Service:** Offers synchronous service calls.



Approach

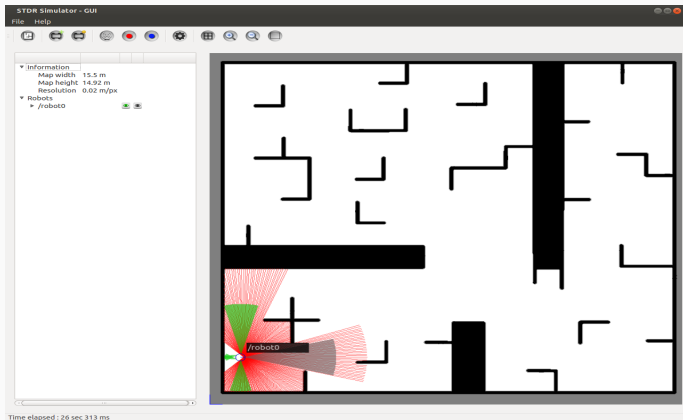
Software Modules



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

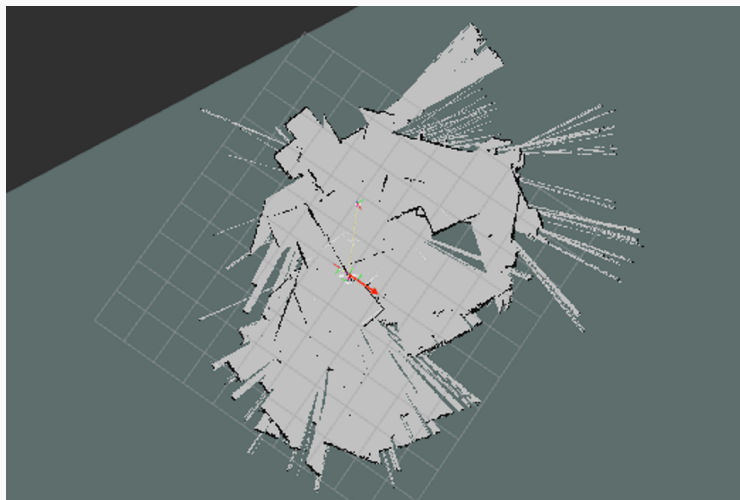
Localization I

- Adaptive Monte 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

- Drive base
- Laser scanners
- Arm
- Joystick
- Camera
- Transformations

Map building II

Map building III

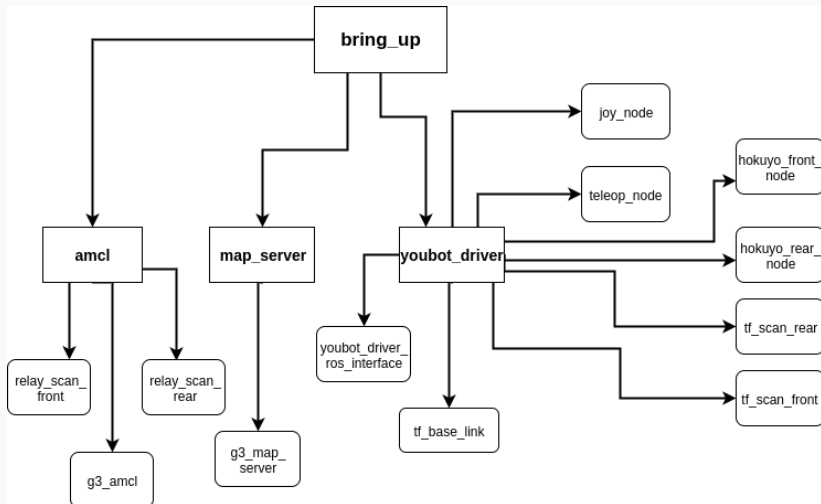


The node acts as path executor that reads a set of user inputs and convert them to `move_base_msgs`.

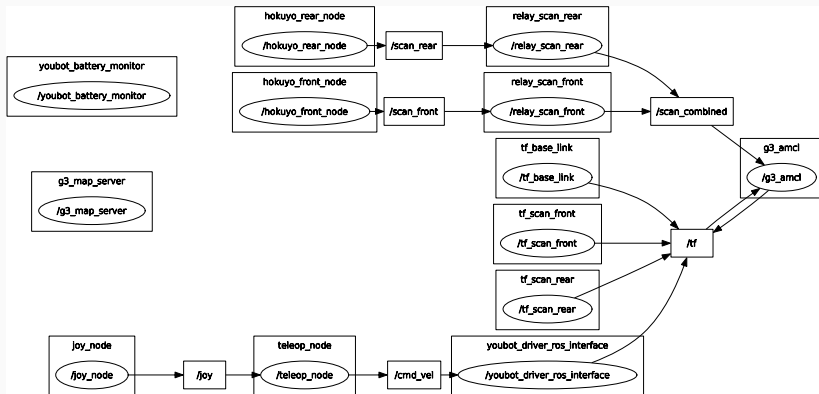
- Class: Position, Pose, Environment, Workspace, PathExecutor
- Functions:
 -
 - Clear cost map
 -

Results

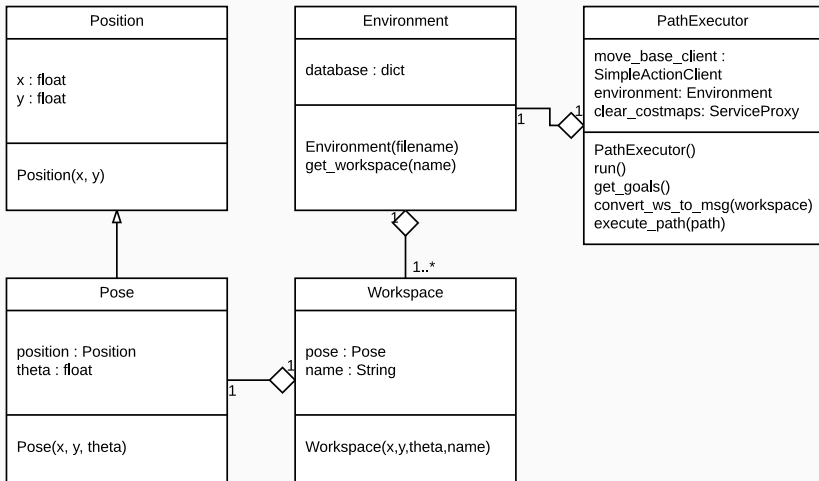
Launch Files



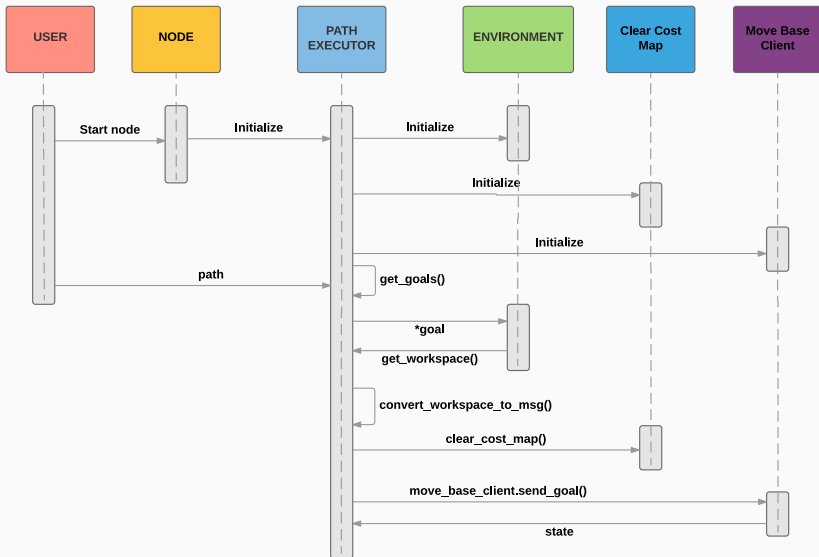
RQT Graph



Class Diagram



Sequence Diagram



Conclusions

Conclusions

Future Work