ROS-Industrial (Singapore, Asia Pacific)

Developer's Meet

14th September 2021

Managed by Advanced Remanufacturing and Technology Centre ARTC

I2R's Navigation Stack

Level 1

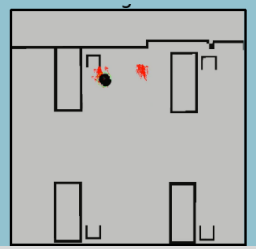
Level 2 & 3

Intelligent Navigation

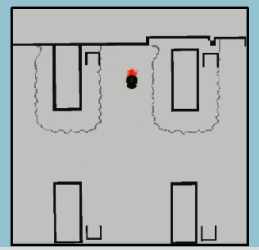
Basic modules

- **Level 1a -** Test scenario and test module: *I2R will contribute by constructing a 2-level of virtual world in gazebo with lift and curtains to be used for training test scenarios and practicing map switching*
- **Level 1b -** Modified amcl: *I2R will contribute by having more robust 2D localization in the presence of temporal large objects (e.g. curtains and doors)*
- **Level 1c -** Marker identification: *I2R will contribute on having docking marker identification in ROS2*

Existing amcl



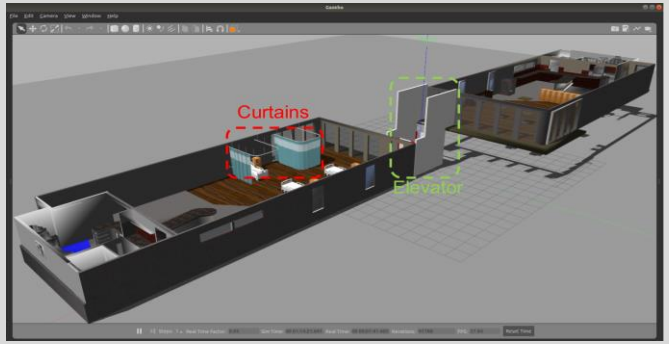
Modified amcl

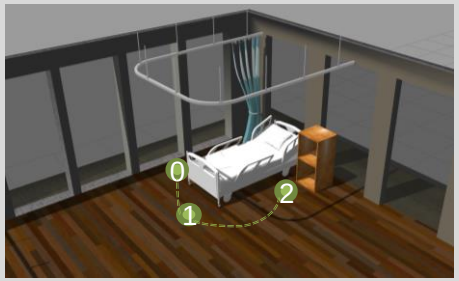


Intelligent Navigation

- Intelligent navigation with different sensor configuration and able to navigate in places in the presence of some crowd
- Accurate localization via sensor fusion
- Intelligent obstacle avoidance & path planning in crowded environment
- Able to react to code blue/red in hospital ward
- Able to move to different target pose(s) when the initial target pose is occupied
- People following
- Ability navigate towards the dynamic objects (e.g., bed, tables and etc.)
- Taking elevator (map switching)

Outcome





I2R's Navigation stack Implementation

I2R's Navigation Stack unique features:

1. Has been ported to multiple types of robots for both indoor and outdoor applications.
2. Single framework supporting both 2D and 3D lidar.
3. Able to navigate in the presence of crowd.
4. Exhibit various intelligent navigation routine behavior including giving way to wheelchair.
5. Able to response to events at public spaces. (e.g. emergency situation of code blue, red, kept to predefined side, able to decide of appropriate path based on task urgency etc).
6. Integrated with visual analytics allowing robot to move to appropriate location (eg table, trolley, bed, people etc) when the goal position has changed
7. Compatible with RMF (Robot Middleware Framework).

Final release of Level 1A module

- Developed two-level virtual world with the elevator and curtains in Gazebo (Link)

Name	Last commit	Last update
docs/img	Update od ReadMe	4 days ago
launch	Checking tests	5 days ago
models	Initial commit	3 months ago
src	Checking tests	5 days ago
worlds	Checking tests	5 days ago
.gitlab-ci.yml	Update .gitlab-ci.yml	4 days ago
CMakeLists.txt	Checking tests	5 days ago
CONTRIBUTING.md	Adding License and Contributing files	1 month ago
LICENSE	Checking tests	5 days ago
README.md	Update README.md	4 days ago
package.xml	Checking tests	5 days ago

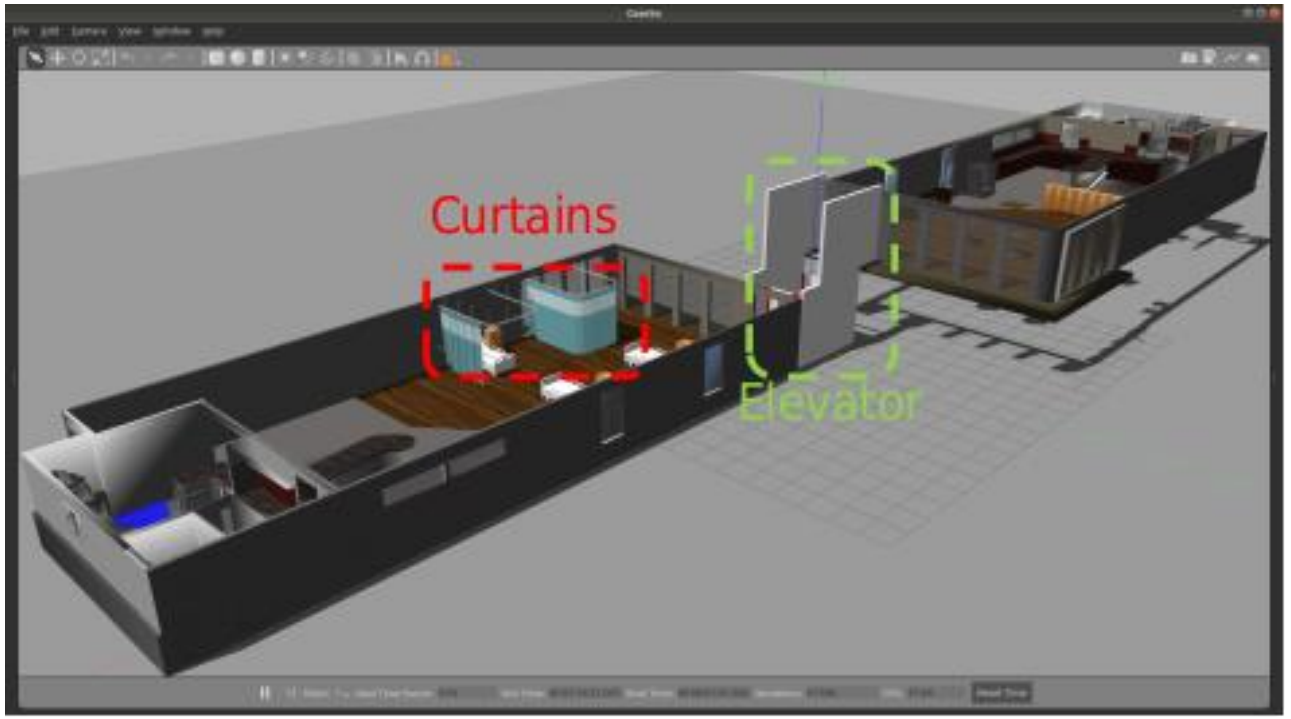
README.md

Two Level Gazebo World

pipeline passed License Apache 2.0

What is this?

This package is the two-level virtual world with the lift and hospital curtains developed for Gazebo simulator.



https://gitlab.com/nurskz/two_level_gazebo_world

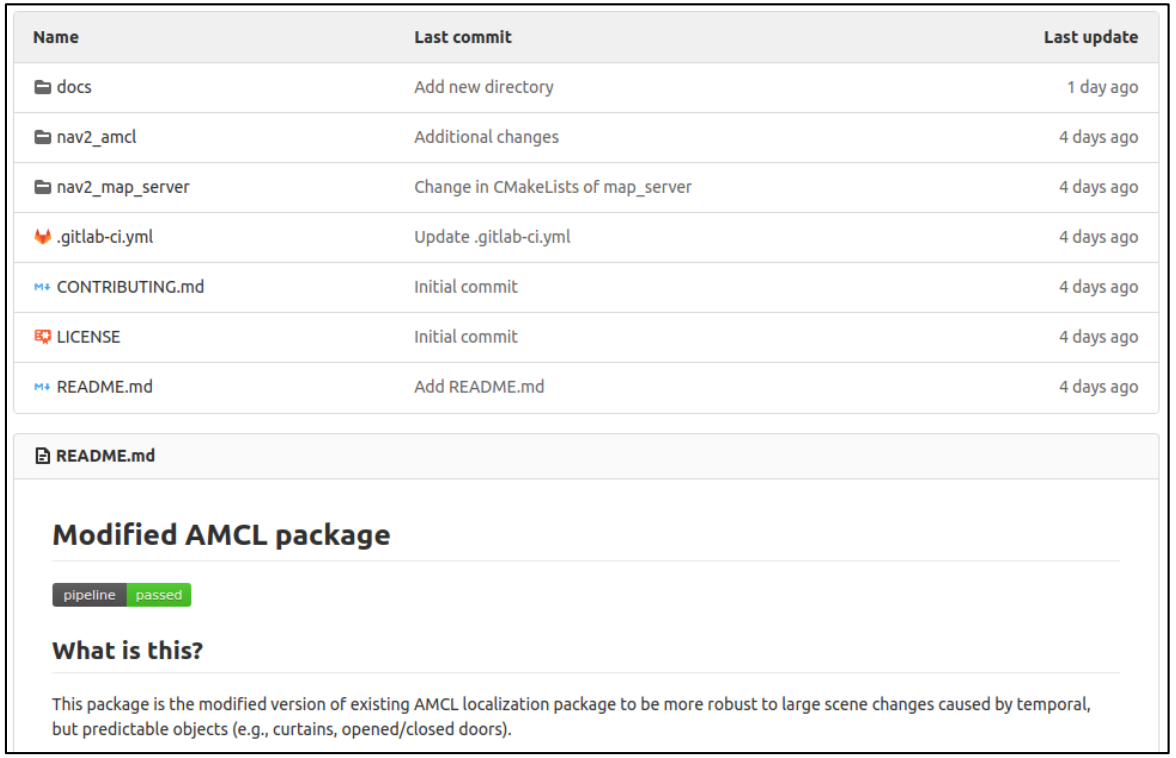
RMF , Standalone Package

- Allows multi robot systems to work under one roof / shelter
- RMF enables the robot to interact with doors and lifts automatically
- The core system takes care of allocation tasks, traffic management, etc. Adapters can connect to different parts of the infrastructure.
- RMF simplifies / standardizes messages. It is a system of systems synthesizer, allowing different systems to talk in different protocols; plugins translate between protocols. Also provides standard messages.
- RMF can resolve unexpected conflicts in a dynamic envionment.
- The RMF toolbox includes:
  - Traffic editor: annotate floor plans
  - Building map tools
  - Testing; able to use Ignition Robotics 5 models
  - rmf_core provides integration with rmf
- Use the operations dashboard for monitoring schedules and trajectories. The dashboard is migrating from rviz (foxy release) to web-based (build from source).

RMF , Standalone Package (Video)

Final release of Level 1B module

- The existing AMCL localization package is modified to be more robust to large scene changes caused by temporal, but predictable objects (e.g., curtains & doors) [Link]



Name	Last commit	Last update
docs	Add new directory	1 day ago
nav2_amcl	Additional changes	4 days ago
nav2_map_server	Change in CMakeLists of map_server	4 days ago
.gitlab-ci.yml	Update .gitlab-ci.yml	4 days ago
CONTRIBUTING.md	Initial commit	4 days ago
LICENSE	Initial commit	4 days ago
README.md	Add README.md	4 days ago

README.md

Modified AMCL package

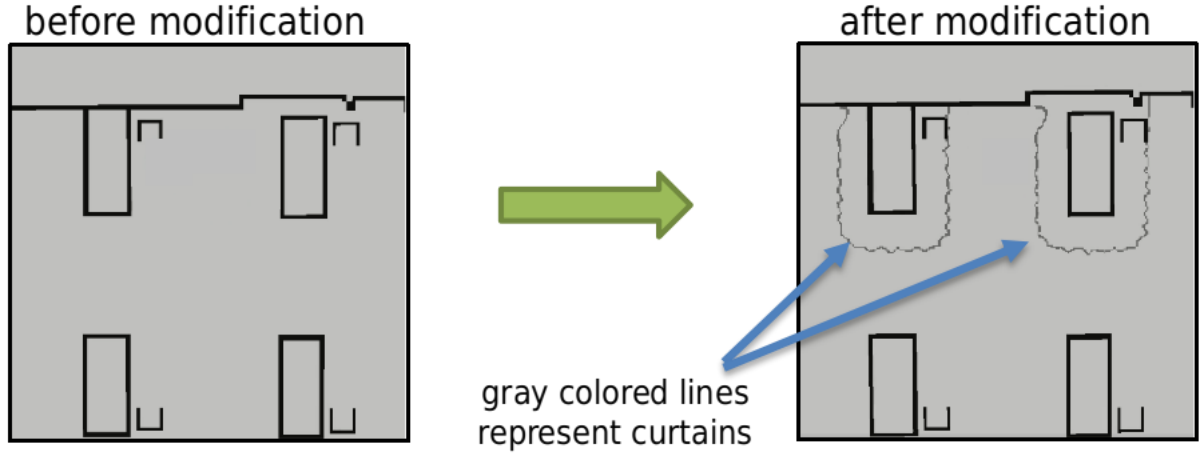
pipeline passed

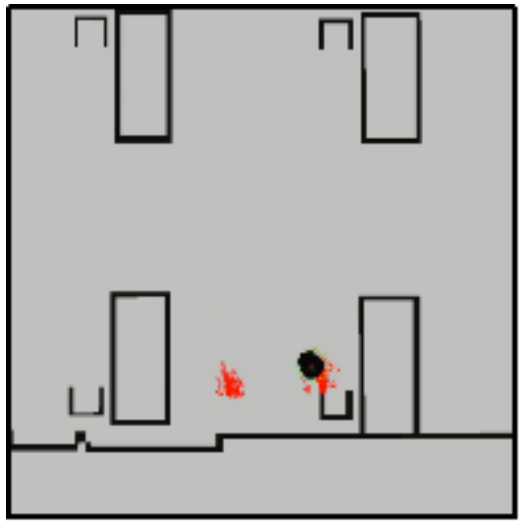
What is this?

This package is the modified version of existing AMCL localization package to be more robust to large scene changes caused by temporal, but predictable objects (e.g., curtains, opened/closed doors).

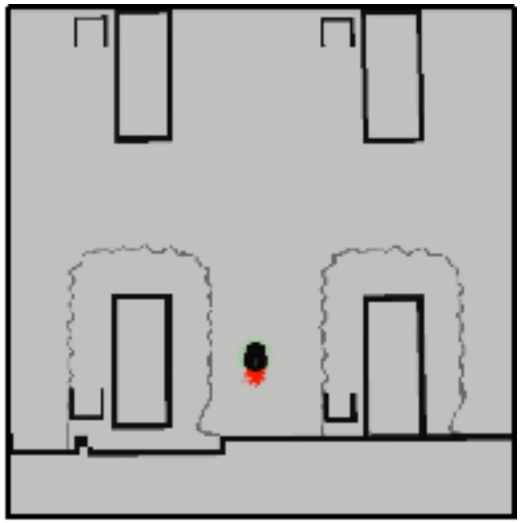
https://gitlab.com/nurskz/modified_amcl

Modified AMCL, Map Server





AMCL Localization



Modified AMCL
Localization

Final release of Level 1C module

- ROS2 wrapper for OpenCV aruco marker tracking (Link)

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.vscode	update unit test	2 days ago
Docker	update gtest and ci coverage	16 hours ago
aruco	Initial commit	4 days ago
aruco_msgs	Initial commit	4 days ago
aruco_ros2	update gtest and ci coverage	16 hours ago
docs	Initial commit	4 days ago
results	Initial commit	4 days ago
.gitlab-ci.yml	update gtest and ci coverage	15 hours ago
LICENSE	Add LICENSE	2 hours ago
README.md	Update README.md	1 hour ago
dconfig	Initial commit	4 days ago
run_cppcheck_test.bash	Initial commit	4 days ago

README.md

Aruco_Ros2

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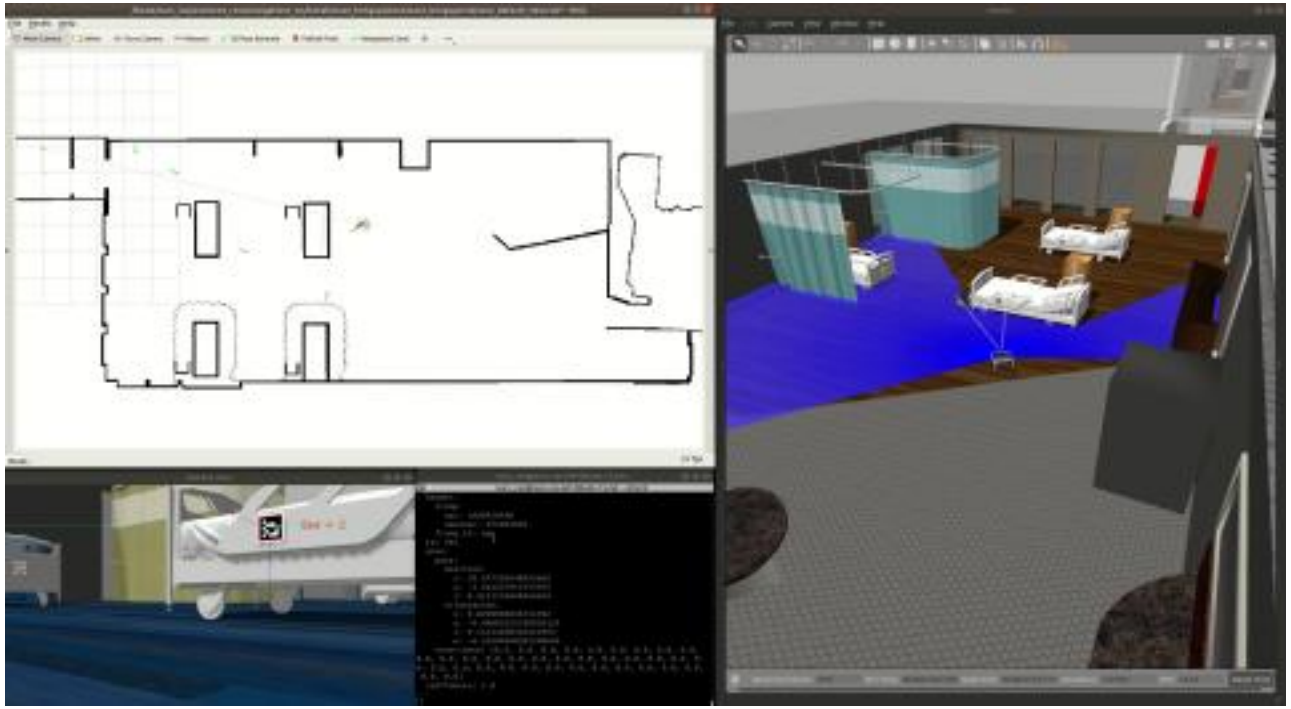
pipeline passed | License BSD 2-Clause | codecov unknown

Software package and ROS2 wrappers of the Aruco Augmented Reality marker detector library.

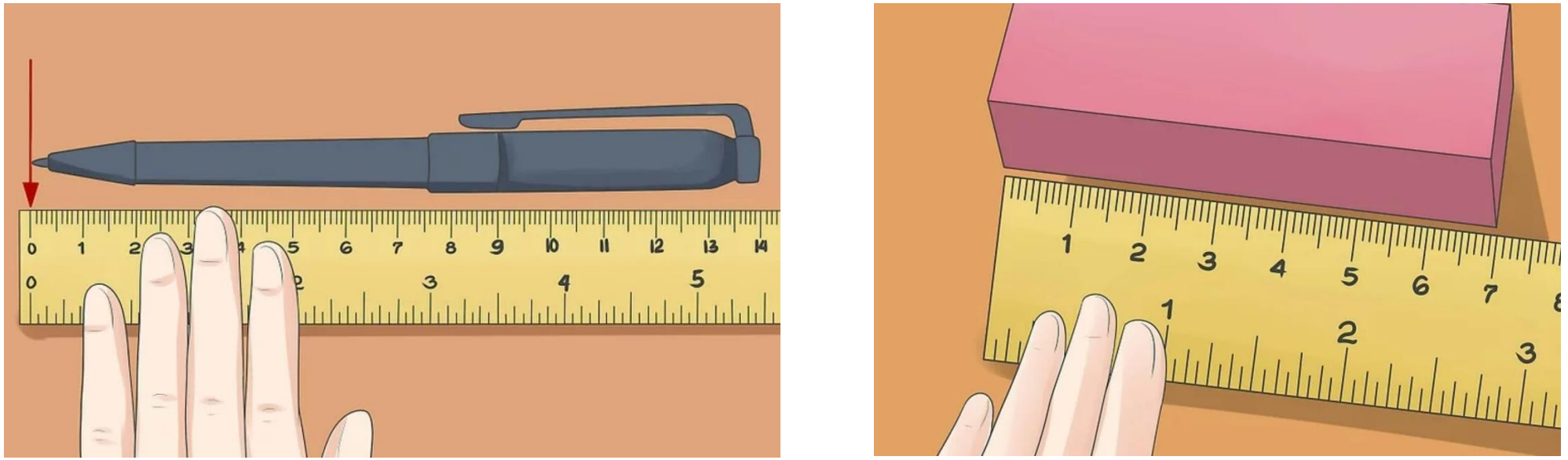
Features



https://gitlab.com/raymondchaneee/aruco_ros2

Marker Identification

A fiducial marker or fiducial is an object placed in the field of view of an imaging system that appears in the image produced, for use as a point of reference or a measure.



Ruler used as a Fiducial marker

Package Adoption

Adoption steps by industry partners (typically non-end user, but system integrator or robotics service provider):

1. Discussion of the needs and project scoping.
2. Training of engineer staff on the use of I2R's navigation stck.
3. Integration into required platform or software, if any, to realize a prototype robot.
4. Evaluation and testing, including on site.
5. Deployment and commercialization by industry partner.
6. Feedback by partner and further upgrade by I2R