Garbage picking Robot: RamuDroid’s Autonomous navigation

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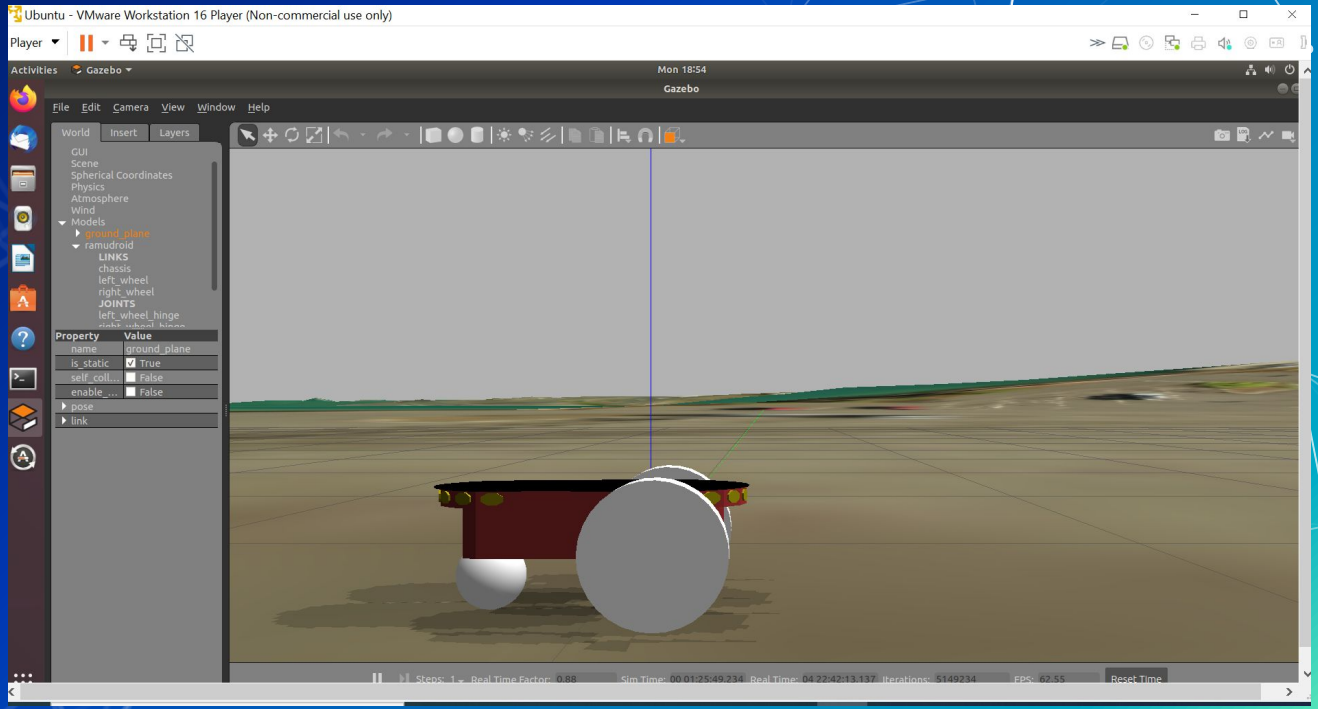
Introduction

This project aims to implement SLAM (Simultaneous localization and mapping) on RamuDroid's autonomous navigation to self drive in various outdoors terrains while avoiding obstacles.

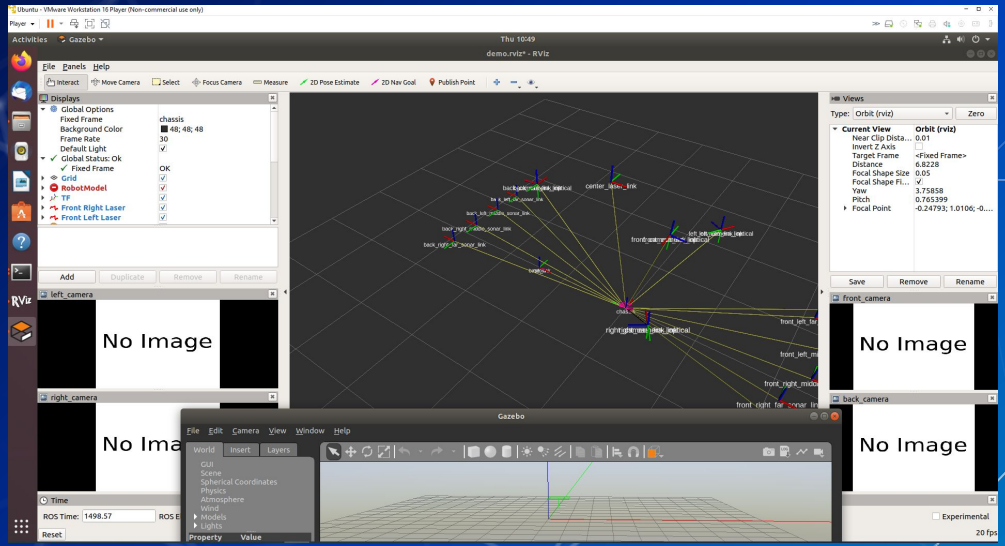
#robotics #ramudroid #autonomous-navigation

Robot Model SDF

Robot in outdoors terrain



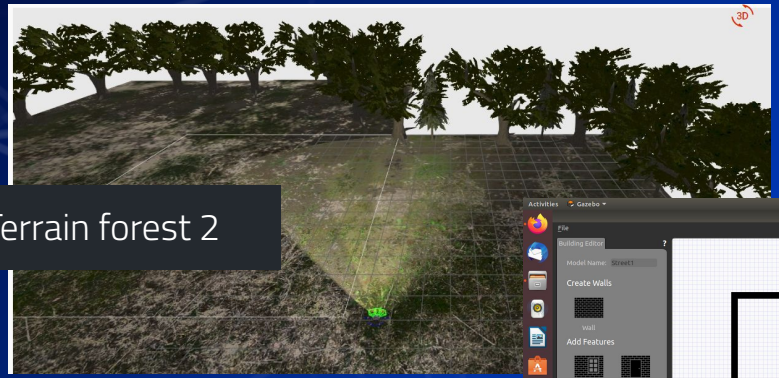
Sensors and cameras



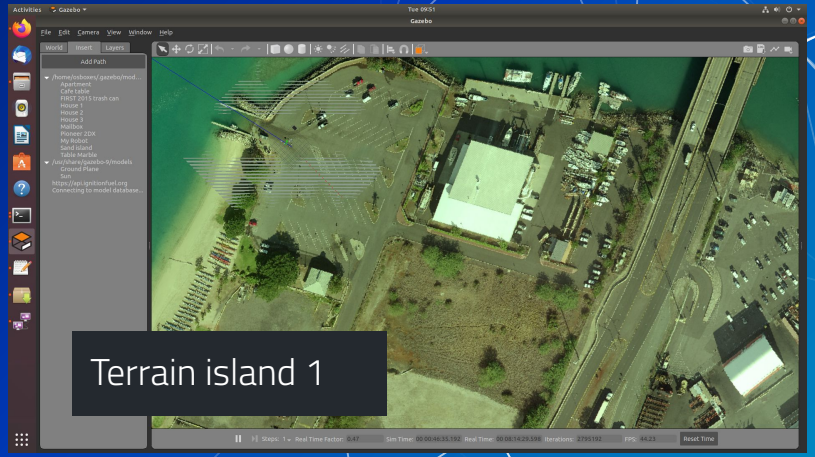
The robotic vehicle has

- 16 beam lidar
- 8 ultrasonic sensors
- 4 cameras
- 2 planar lidar.

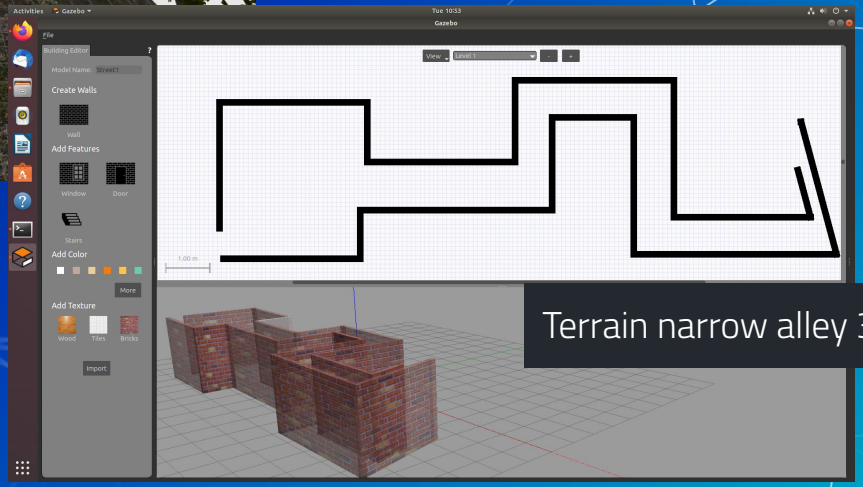
Terrains



Terrain forest 2



Terrain island 1



Terrain narrow alley 3

Elevation Mapping

Localization and Path Mapping

Computer vision

- CNN model object detection
- Path segmentation

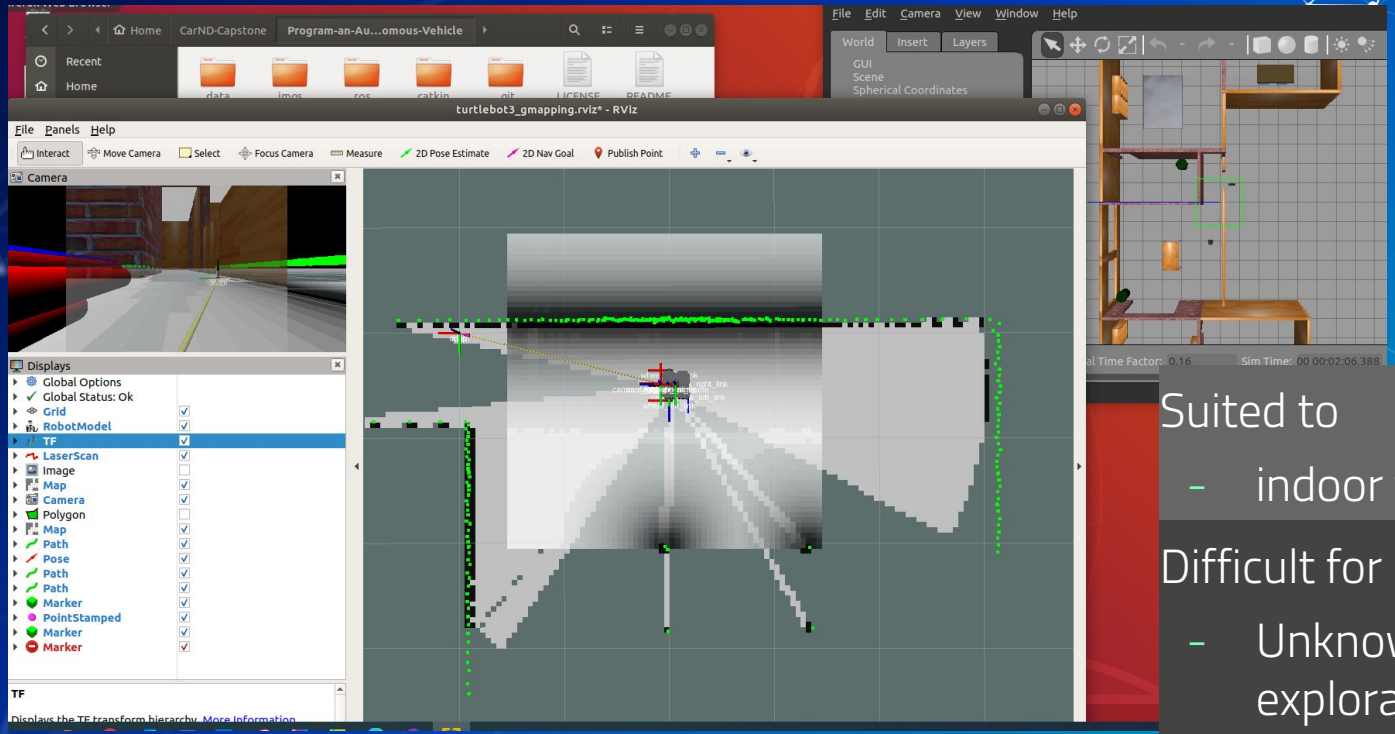
LiDAR SLAM

- ROS Navigation Stack Gmapping
- Rapidly Exploring Random Tree (RRT) algorithm
- CoreSLAM
- KartoSLAM
- Lago SLAM
- HectorSLAM
- AMCL (Adaptive Monte Carlo localization)
- Open3D SLAM: Point Cloud Based Mapping and Localization
- RTAB-Map RGB-D SLAM

2D mapping

Point cloud

Gmapping : Rapidly Exploring Random Tree (RRT) algorithm



Suited to

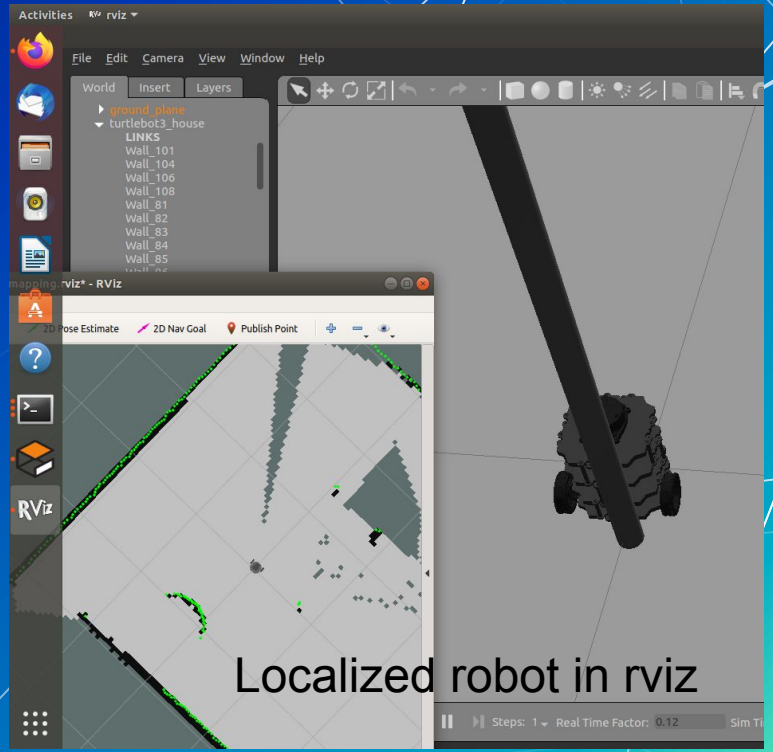
- indoor flat service

Difficult for

- Unknown environment exploration

Limitations of existing Path planning

- Frequent obstacles



Rtabmap_ros : RTAB-Map (Real-Time Appearance-Based Mapping) RGB-D SLAM

Navigation

Outdoor Path planning Enhancements

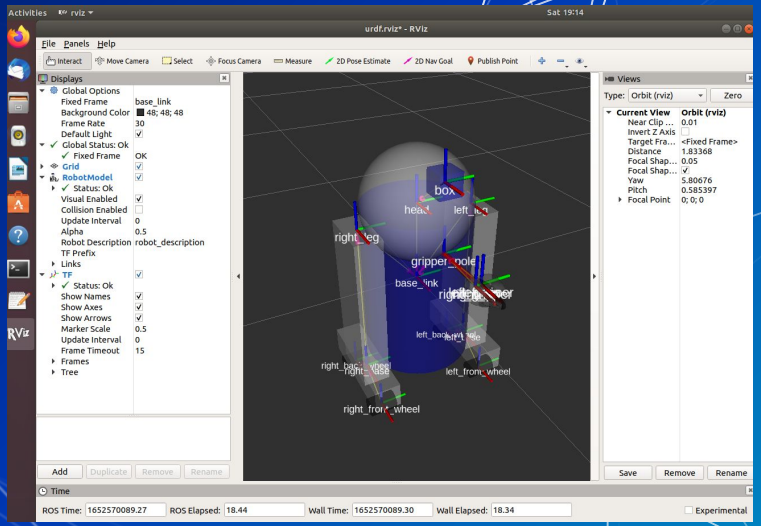
- Pose estimation (IMU & odometry)
- Closed Loop Local Mapping with sync with external GPS position
- Risk-Aware Path Planning

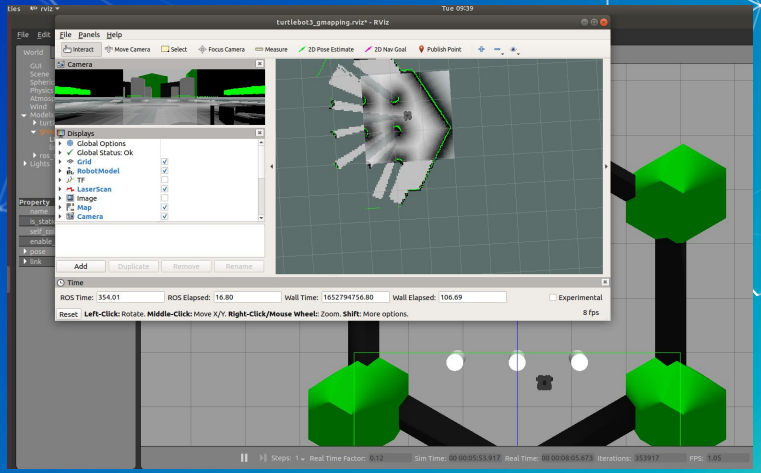
Extra Slides

References

R2D2 model building tutorial

Gmapping SLAM





Car Demo Prius