Autonomous Frontier Exploration, Mapping and Path-Planning using Octomap

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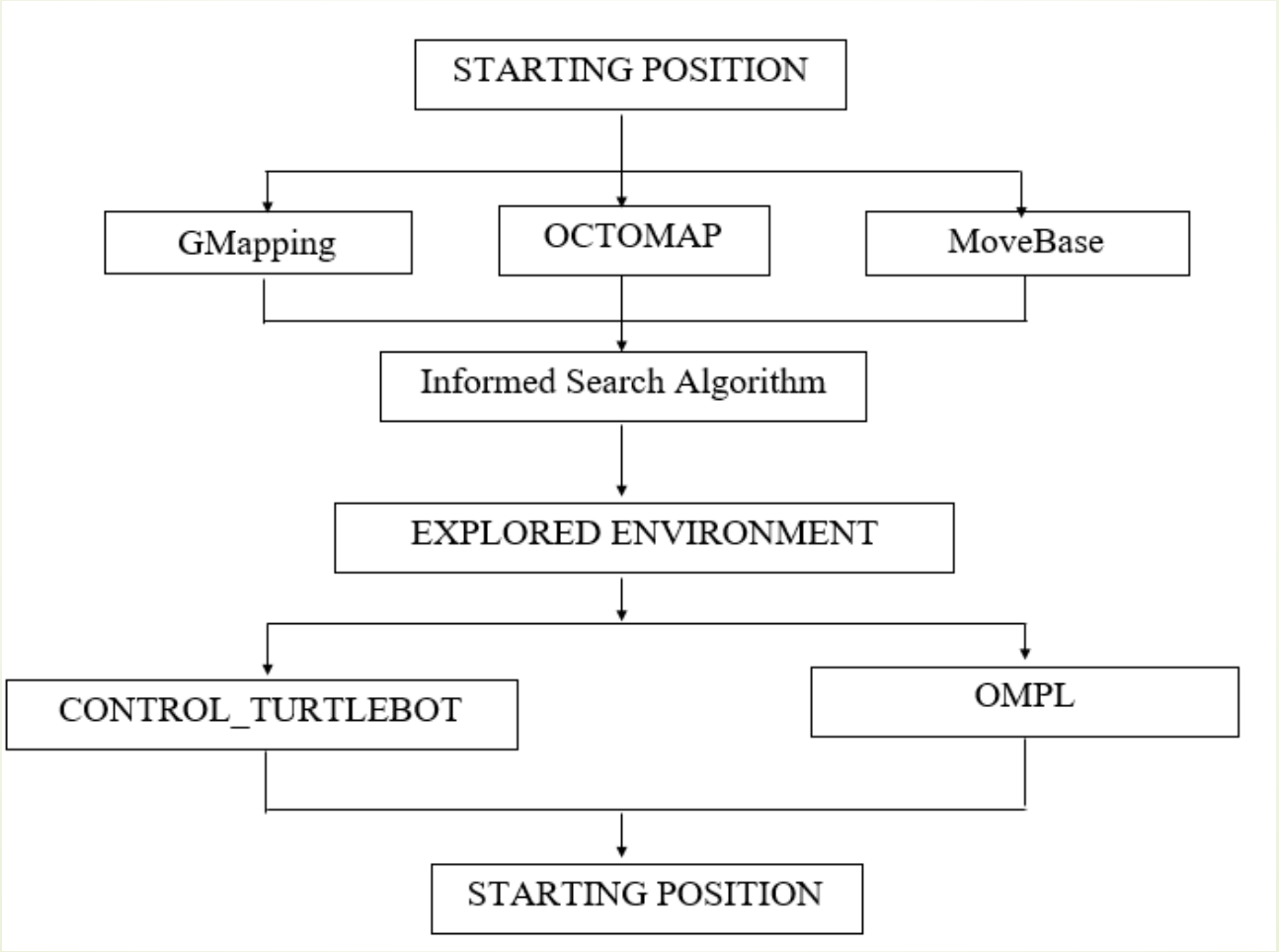
Objective

- The main objective of this project is to propose and implement an autonomous mapping and planning algorithm on simulation using Turtlebot
- **Tasks Performed:**
- Given Start Position.
- Autonomous exploration of an unknown environment until certain time.
- Return to the start position.

Modules

- **OS**: LINUX
- **Software:** ROS
- **Simulation:** Rviz Software
- **Mapping Simulation:** Gazebo
- **Language:** Python/C++

Implementation Architecture



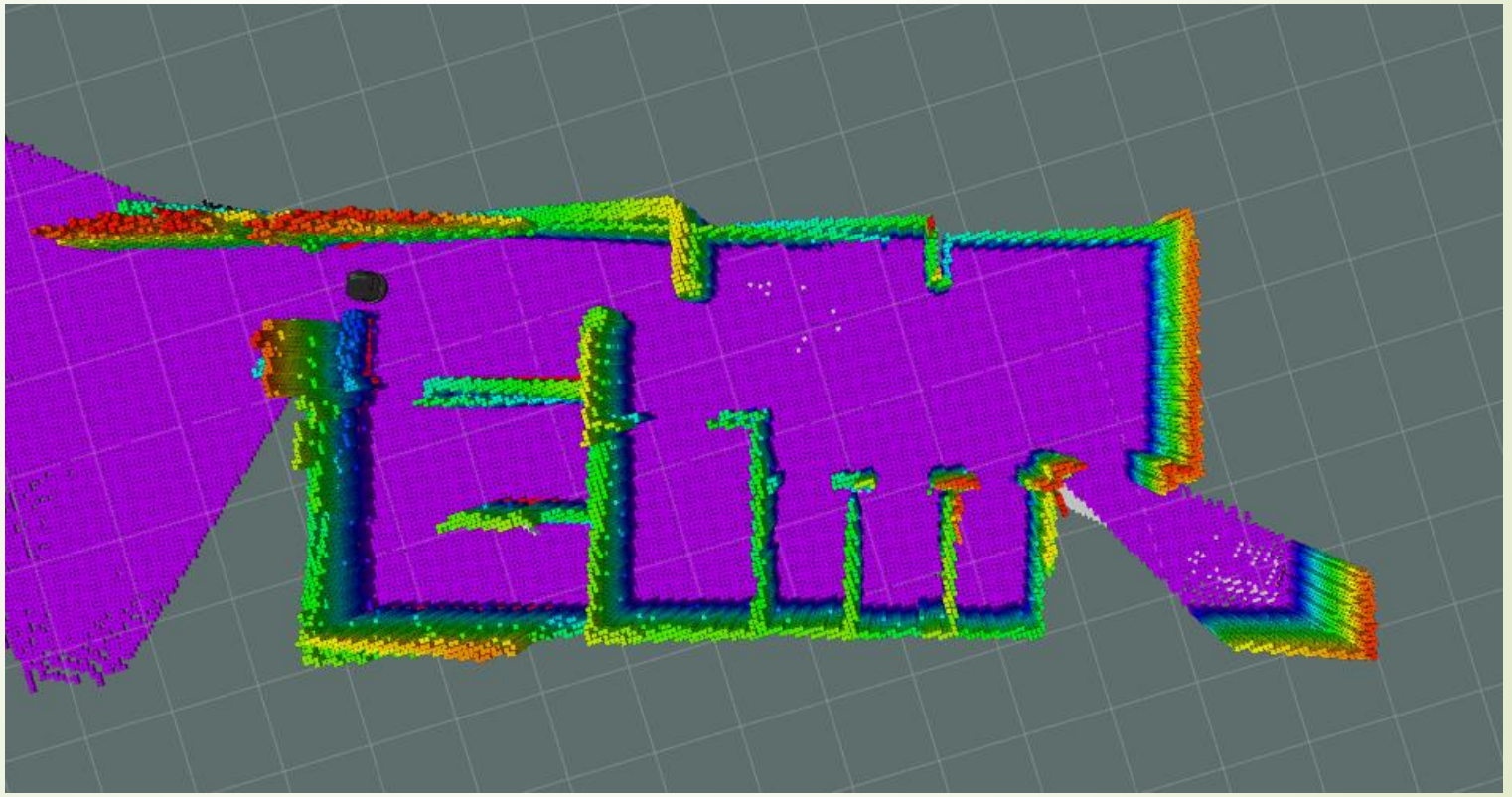
Implementation Architecture

- **EXPLORATION MODULES**
  - **Informed Search Algorithm**
    1. Obtain frontier points
    2. A* search to go to selected point
  - **G Mapping**

    G Mapping helps to built a 2D occupancy grid mapping
  - **Move Base**

    This node provides a ROS interface for configuring, running, and interacting with the navigation stack on a robot

Implementation Architecture



Implementation Architecture

- **RETURNING MODULES**
  - **Octomap**

    3D Mapping framework based on octrees for 3D occupancy grid mapping
  - **Controller_turtlebot**

    Turtlebot controller – low level controller for returning back home.
  - **OMPL**

    Simple motion planning algorithm using various sampling based algorithms

Returning to Starting position

- Two services defined
  - **Start_finding_path**

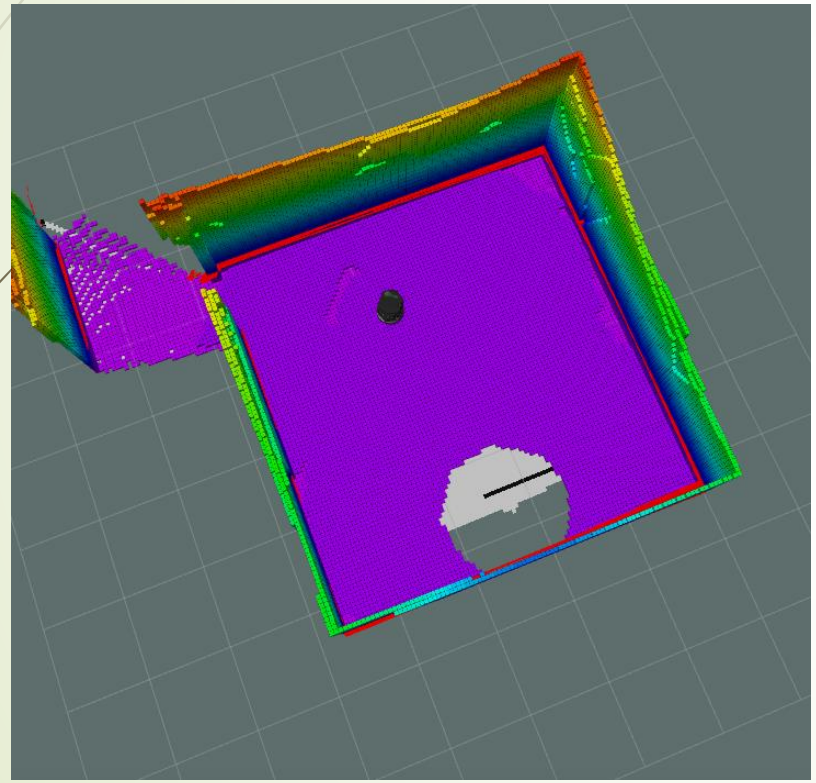
    Robot locates the path leading to initial position

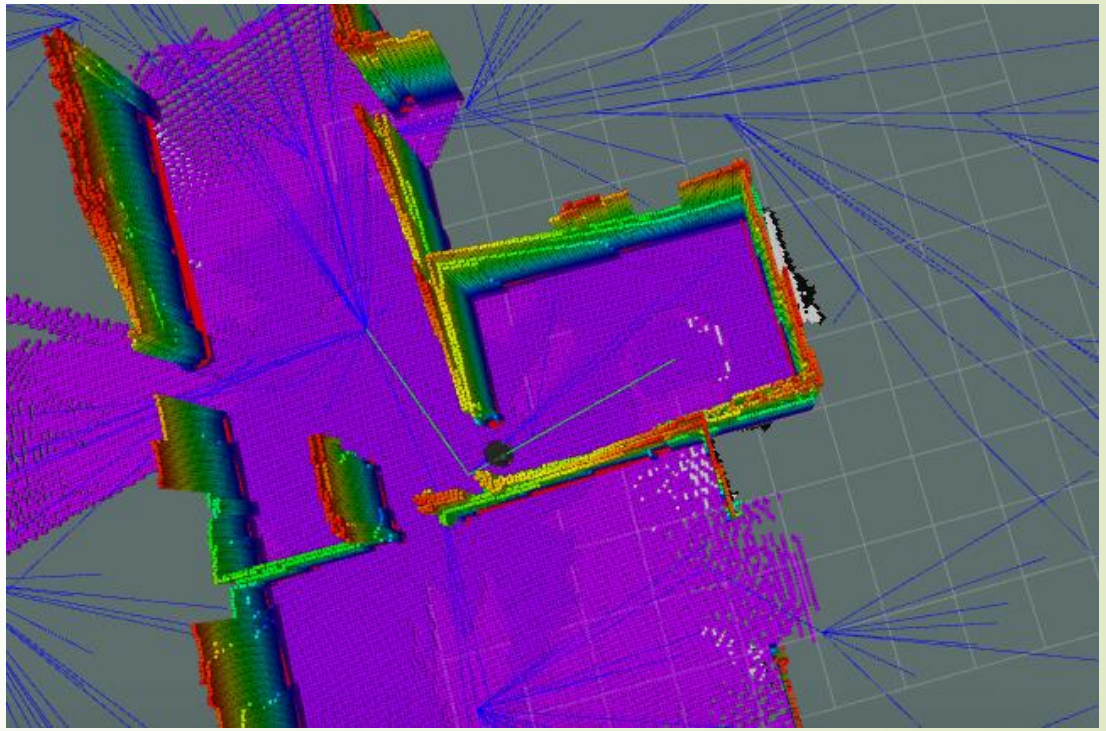
  - **Ready_to_go**

    Robot starts following optimized path towards the start location

    Obstacles are avoided

Limitations





References

- S. Karaman and E. Frazzoli, Sampling-based Algorithms for Optimal Motion Planning, International Journal of Robotics Research, Vol 30, No 7, 2011
- H. H. Gonzales-Banos and J.-C. Latombe, ”Navigation strategies for Exploring Indoor Environments,” The International Journal of Robotics Research, vol. 21, no. 10-11, pp. 829–848, 2002
- A. Martinez, E. Fernandez. Learning ROS for Robotics Programming, Livery Place 35 Livery Street Birmingham B32PB, UK: Packt Publishing Ltd., 2013
- F. Amigoni and V. Caglioti, ”An information-based exploration strategy for environment mapping with mobile robots,” Robotics and Autonomous Systems, vol. 58, no. 5, pp. 684-699, 2010


MOLTES
GRÀCIES!!