SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

A PROJECT REPORT
ON

"AUTONOMOUS NAVIGATION ROBOT USING ROS FOR INDOOR APPLICATION"

BACHELOR OF TECHNOLOGY
IN
ROBOTICS AND AUTOMATION

Submitted by

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SIMULATION RESULT ANALYSIS

A. Map Creation:

In order for the navigation stack to work, we need to provide a map of the environment that's published through the map server. This map is generated through the Hector SLAM mapping package, which utilizes data from the lidar sensor while moving the robot manually with the use of a Teleop node. This Teleop node publishes velocity commands to the /cmd_vel topic in response to user input from keyboard. Fig. 4 illustrates the creation of map

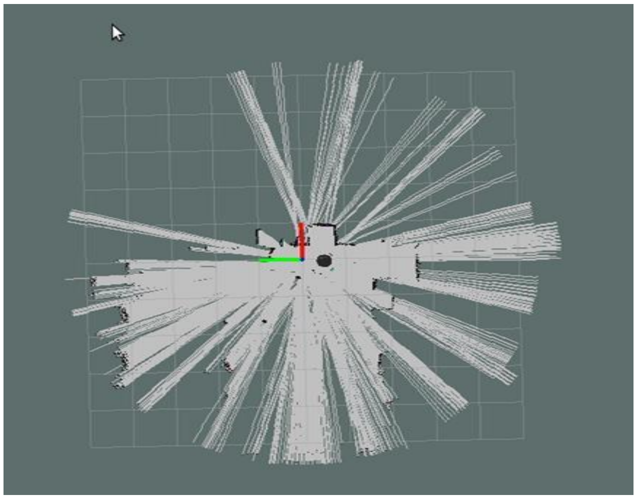

Fig. 4. Mapping using Hector SLAM

After complete mapping of the environment is done, the map is then saved using the command "rosrun map_server map_saver -f my_map". This command saves maps in two formats: an occupancy grid map stored as my_map.pgm and my_map.yaml, and as image files, often in PNG or JPEG formats. These formats respectively capture the map's data in a grid representation with associated metadata and visually as an image with obstacles depicted in dark areas and free space in light regions. The PGM format of the map is visualized in Fig. 5.

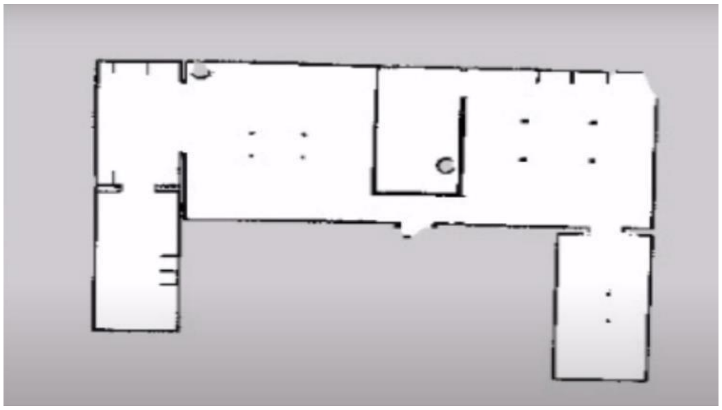

Fig. 5. Environment map using Hector SLAM

B. Robot Navigation:

Once the setup is complete, a launch file is created, which contains all the necessary nodes for execution. This also includes the ROS navigation stack, which is then launched in the terminal. Upon launching, Rviz is opened, displaying the previously created map. After this we need to specify the position of the robot's starting point in the environment on the map. This is done using the "2D Pose Estimate" tool in Rviz, as illustrated in Figure 6. This process ensures that the robot begins its navigation with a precise understanding of its initial position on the map.

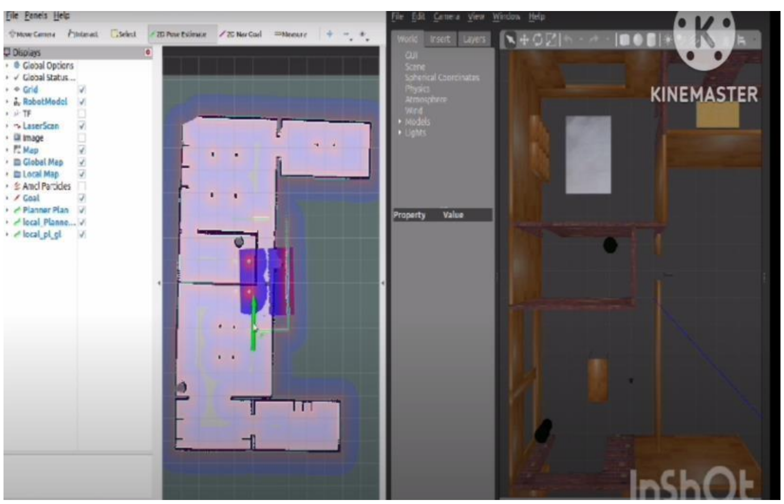

Fig. 6. Setting initial position of robot

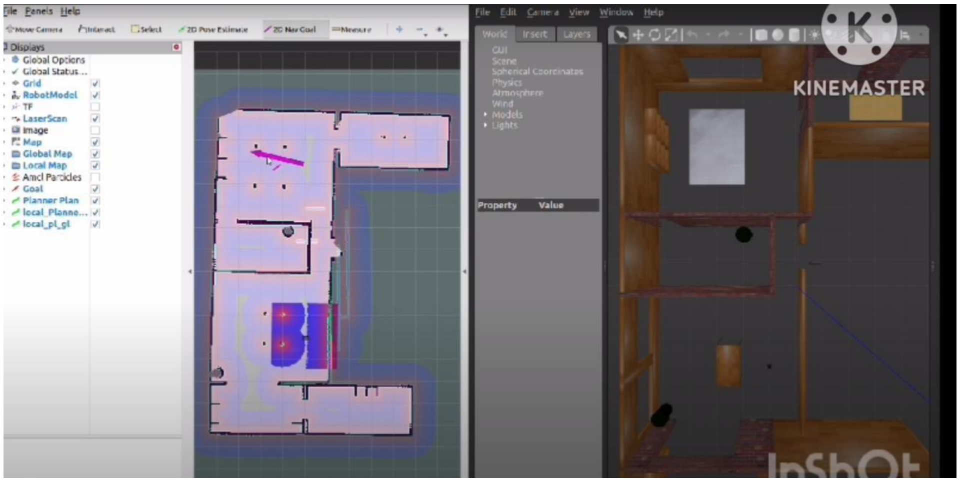

Fig. 7. Setting goal position

After this, we need to specify the point where the robots need to reach. This can be achieved by specifying the goal location in RViz by using the "2D nav goal" tool on the map. This results in the generation of a global path generated by global planner, from from the robot's initial position to the designated goal. This path is visually represented in green on the map, as shown in Figure 7, providing a clear and intuitive route for the robot to follow, ensuring it reaches the designated goal accurately and efficiently.

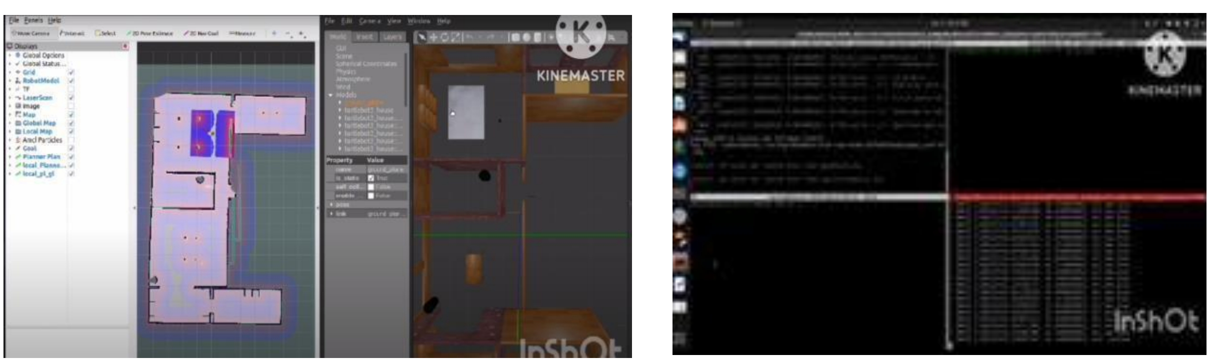

Fig. 8. Robot in goal position

In the navigation process, a short-term local path is created by the local planner, serving as a crucial step by step guide to the robot as it progresses towards its goal. This local path directs the robot as it moves towards its goal while avoiding obstacles like the chair depicted in Figure 8. By following this dynamically generated path, the robot successfully reaches its designated goal location, ensuring efficient and obstacle-free navigation.