



Sardar Vallabhbhai National Institute of Technology

LAB 8-9 : Robot Path Planning

INSTRUCTION:

1. Please save your lab.doc as *LAB_No_Roll_No.doc*.
2. Use/paste the snapshot of the steps followed along with result/s.
3. Mention your observation/comment after results in the doc.

PART A: Explore Motion Planning with MATLAB. [LINK]

1. MATLAB Navigation Toolbox. [LINK]

- Navigation Toolbox provides algorithms and analysis tools for motion planning, simultaneous localization and mapping (SLAM), and inertial navigation.
- The toolbox includes customizable search and sampling-based path planners, as well as metrics for validating and comparing paths.
- You can create 2D and 3D map representations, generate maps using SLAM algorithms, and interactively visualize and debug map generation with the SLAM map builder app.

Task: Apply any two motion planning algorithms available in MATLAB Navigation Toolbox. (eg. A* and RRT, etc.) [LINK]

PART B: Explore MATLAB Mobile Robotics Simulation Toolbox. [LINK]

2. This toolbox provides utilities for robot simulation and algorithm development. This includes:
 - 2D kinematic models for robot geometries such as differential drive, three, and four-wheeled vehicles, including forward and inverse kinematics
 - Configurable lidar, object, and robot detector simulators
 - Visualization of robotic vehicles and sensors in occupancy maps

Task: Run the example code of Differential Drive Path Planning and Navigation, it uses a path found in an occupancy grid using a probabilistic roadmap (PRM). Draw a flow chart of the workflow and functional dependencies for the sample code.

PART C: Exploratory Problem

3. Using Tinkercad, design a circuit for controlling a DC motor using a potentiometer. Program the Arduino board for the operation and stimulate the scenario over Tinkercad. [LINK]
4. **Creating Map using Laser Scanner and Gmapping:** Using the Gmapping package in Rviz and Navigation Stack in ROS, create a map of the environment by the robot that explores the environment for mapping the walls and the obstacles in the map. Remember that the environment and the robot should be your environment and robot models that you have constructed in lab 3. [HINT] The robot will need a LIDAR for environment mapping. [LINK]

Observation /Comments: