

Assignment: Implement a Custom DWA Local Planner in ROS2 Humble

Objective

The goal of this assignment is to implement a **custom Dynamic Window Approach (DWA) local planner** for a **TurtleBot** in **Gazebo** using **ROS2 Humble**. The candidate should code the planner from scratch (without using `nav2_dwb_controller`)

Task Details

1. **Set up a ROS2 Humble Environment**
 - Install **Gazebo** and **ROS2 Humble**.
 - Use a **TurtleBot3** simulation in a simple environment.
2. **Implement a Custom DWA Local Planner**
 - Implement a **DWA-based algorithm** from scratch to compute `cmd_vel`.
 - The planner should:
 - Sample velocity commands within dynamic constraints.
 - Predict the robot's trajectory for each velocity sample.
 - Evaluate trajectories using a **cost function** (distance to goal, obstacle avoidance, path smoothness).
 - Return the best `cmd_vel` for safe and efficient navigation.
3. **Integrate with ROS2 Navigation Stack**
 - Subscribe to **odometry** (`/odom`) and **LaserScan** (`/scan`) topics.
 - Publish velocity commands to `/cmd_vel`.
 - Visualize planned trajectories using **RViz Markers**.
 - Test the planner inside **Gazebo** with obstacles.
4. **Expected Output**
 - The TurtleBot should be able to **navigate to a goal** while avoiding obstacles.
 - The candidate should **log meaningful debugging messages**.
 - The candidate should provide a **short README** with setup instructions.