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Lidars

Lidar, stands for **Light Detection And Ranging**, is a crucial technology in robotics for measuring distances to obstacles using light so we can sense and understand the environment the robot is interacting with. Lidars types can be put in three main categories: **1D lidar or point lidar** for specific distance measurements by shooting a beam of light like in a drone or a UAV to measure its distance from the ground or a mobile robot to measure its distance from a wall, **2D lidar** commonly used for scanning in a 2D plane by taking a 1D lidar and strapping it into a spinning motor, and **3D lidar** for generating a detailed three-dimensional representation. ROS provides has really good support for lidars.

Unlike other software, ROS simplifies working with different lidar models by requiring the appropriate driver node for each model. These drivers publish laser scan messages or point clouds, ensuring compatibility with various lidar types.

Path planning

Path planning is the process of finding a feasible and optimal trajectory for a robot to move from a start pose to goal pose, while avoiding obstacles. ROS deals with path planning by using a **navigation stack** which has two main parts: a **global planner** and a **local planner.** The global planner is responsible for generating a high-level plan that guides the robot towards the goal. The local planner is responsible for generating low-level commands that drive the robot along the global plan. To use a path planner in ROS, the user needs to configure the navigation stack using a setup that includes a configuration file, a map, a costmap, and a pose transform. Launching the navigation stack allows users to send a goal pose to the move_base node, which coordinates global and local planners to generate and execute the path for effective robot navigation.

Path tracking

Path tracking in robotics involves making a robot follow a given path, using algorithms like **pure pursuit** and **Stanley**. Pure pursuit steers the robot towards a predetermined point on the path, determined by a lookahead distance, while Stanley adjusts the steering angle based on the error between the robot's heading and the path's tangent at the nearest point. ROS deals with path tracking by providing tools to create, communicate, and control paths. ROS offers various packages implementing path tracking methods, allowing users to select and customize the most suitable approach for their robot and scenario.