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RBE3002 Lab 3

The purpose of this lab was to introduce the rviz visualization tool for the Turtlebot and basic navigation algorithms for differential drive robots. Using rviz, a custom configuration was developed to demonstrate the grid cell path generated by the A-star search algorithm for a sample map comprising known occupied and unoccupied grid cells of one meter in length. The waypoints generated by the search algorithm are displayed in rviz as grid cells by publishing to a separate topic.

Initially, rviz was configured for the lab specifications. The model of the robot, a map, and grid cells used for visualizing the explored path were added as Displays, and the configuration file was saved. A new topic was used to publish goal poses that drove callbacks in the python lab code. Setting these start and goal positions changed the color of the tiles. A sample map was loaded, giving the robot an environment for testing the search algorithm.

The A-star search algorithm searched by expanding the eight neighboring nodes, incrementing a counter for the number of layers that are explored. The heuristics associated with nodes were Manhattan and Euclidian distances, but only Manhattan and the depth of the search layer were used as the components of the cost function. Nodes were stored in a priority queue beginning with the start. This node’s children are generated, and then assigned a priority in the queue. After all nodes are assigned, the first element is popped off the queue, continuing the search. The algorithm does not expand upon nodes that result in collisions with obstancles given 100% probability of an obstacle. This will be modified for future labs.

The waypoints from A-star were generated by determining the maximum translation in a given direction, then computing the necessary rotations for achieving the next waypoint. These waypoints were then passed into the existing navToPose function, but the robot was not able to execute the required trajectories. However, the waypoints themselves were represented as grid cells in rviz.

This lab provided an introduction into search algorithms for robotic navigation and visualization tools for robotic systems. These techniques will be helpful in completion of the final project.