Path planning with Moving Obstacles using RT-RRT*

CS 5335 Project Proposal

Akash Sasikumar, Gail Renee Pinto

Problem Statement

Motion planning aims to find a sequence of discrete robot configurations state complying with constraints imposed by the environment and internal dynamics of the system [1]. It is essential for a robot configuration to be able to plan a path to the goal location from the start or current location. While this problem is trivial for a static environment, in real-life applications we see that the operational environment often has many moving obstacles. These obstacles are often moving in unpredictable directions, which makes planning tasks to avoid them difficult. When the obstacle is unknown, the robot will need to be able to dynamically determine a course of action in order to avoid a collision [2].

Proposed Algorithm

We are planning to implement RT-RRT*, an algorithm based on RRT* and Informed-RRT variants which allows a tree rewiring strategy without discarding the previously sampled paths. RT-RRT* retains the whole tree even if there are changes in the environment and rewires the nodes of the tree as the tree root changes or a dynamic obstacle blocks a node. As a result, RT-RRT* requires fewer number of iterations to search for an optimal path to the goal.

Simulation

To demonstrate the implementation of the RT-RRT* algorithm, we will be using PyBullet library for simulating our agent in a predefined environment. The environment will be a 2D or 3D maze with a fixed grid size. The maze will have static obstacles in the form of walls and a few moving agents/enemies, which our controlled agent will have to avoid while planning the path to reach the goal.

Experiments

We would be comparing our implementation of RT-RRT* with at least one other Tree based dynamic path planning algorithm such as CL-RRT or RRT^X. We will evaluate these algorithms based on the number of iterations needed to find a path to the goal and the length of the path taken to reach the goal. If time permits, experiments can be done using variations in the complexity of the environment.

References

[1] O. Adiyatov and H. A. Varol. A novel rrt*-based algorithm for motion planning in dynamic environments. In *2017 IEEE International Conference on Mechatronics and Automation (ICMA)*, pages 1416–1421, 2017.

[2] D. Connell and H. M. La. Dynamic path planning and replanning for mobile robots using rrt. In *2017 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*, pages 1429–1434, 2017.