SC 627
Assignment 2: Potential Field Planner

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Methodology

The implementation is based on the potential functions as defined in the class for the obstacles and goal. For goal, we use attractive potential gradient whose magnitude is decided by the proximity of the bot to the goal, based on a threshold, which as we know is linear below the threshold and constant above it. For repulsive potential, the function is formulated such that the potential is zero till a proximity threshold from the obstacle, closer to that the potential increases drastically to avoid collision. These both potentials are then summed up to give us the total or net potential.

Some problems encountered while execution is that bot can get stuck at a local minima with the gradient being equal to zero, this could happen when there are balancing forces acting on the bot. This also happens in the case of pure python implementation. To deal with this, we choose the termination condition as the distance between bot and goal to be within some threshold.

Another scenario that can happen is when bot gets stuck in a loop i.e. it keeps on moving back and forth around a point. To deal with this, a break loop function is added which sees the history of the path and if the bot is close to the previous position, we move the bot for 3 time steps closer to the goal (i.e. towards it). This function ignores the potentials and obstacles. To avoid the loop, there may be better methods available, but is beyond the scope of this assignment.

Simulation

With the given obstacle list and environment, we get the following results

Result: Success
The total length of path: 10.3 metres
Total time taken: 277.14 seconds

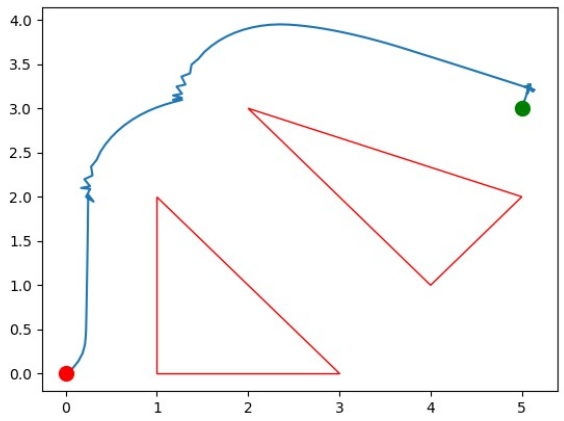

Figure 1: Planned path in python

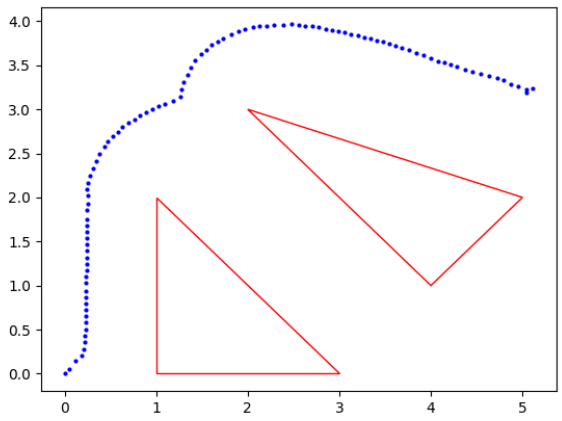

Figure 2: Resulted path in ROS