Motion Planning Assignment 3

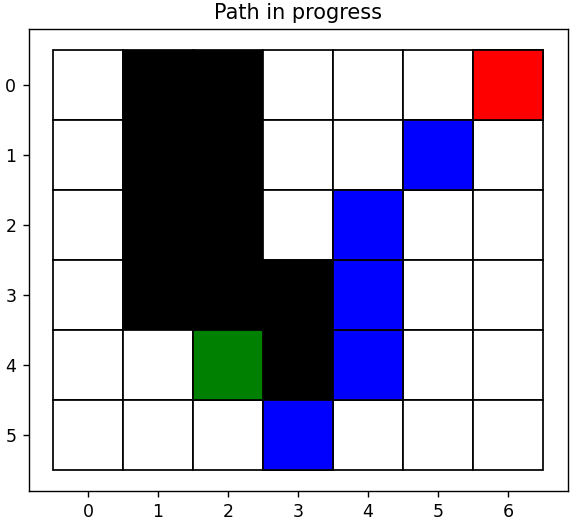
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**D\* Algorithm:**

* D\* or Dynamic A\* keeps track of both current h and the best h value that is k.
* Initially D\* starts exploring from goal to start and when initial path is found, all the path nodes will have their respective k values which serves as a “sort of heuristic” during replanning.
* When a dynamic obstacle is detected, the h values of the affected nodes become infinite, and those nodes are added to open list.
* The algorithm again starts exploring from minimum k value node in the open list, thus from the very first effected node of the original path.
* The k value helps keep track of original path so during replanning, the algorithm only replans the effected nodes and tries to connect it to the original path.
* Due to this replanning of whole path is avoided and thus D\* replans faster than A\* or Dijkstra.
* Following were the results obtained by running the D\* algorithm for given scenarios.
* **Map 1**

A picture containing text, crossword puzzle

Description automatically generated 

* **Map 2**

A screenshot of a game

Description automatically generated with low confidence A screenshot of a game

Description automatically generated with low confidence

A screenshot of a game

Description automatically generated with low confidence A picture containing text, crossword puzzle

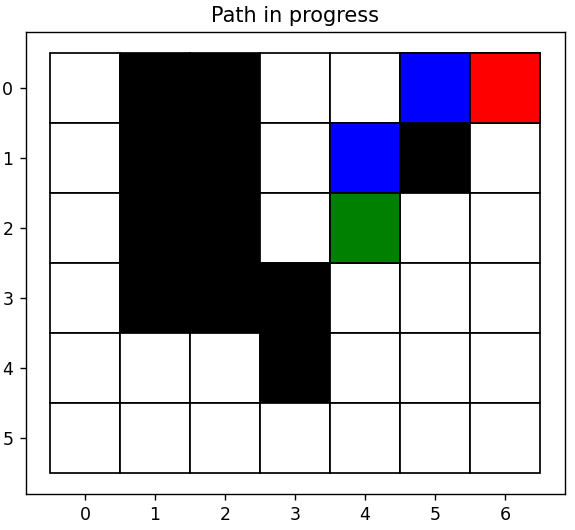
Description automatically generated

* The last dynamic obstacle was detected when it reached the goal.
* It can be seen in the third graph that how the algorithm replanned and connected the new path to the original path.
* **Map 3**

A picture containing text, crossword puzzle

Description automatically generated Chart, bar chart, histogram

Description automatically generated

 Chart, bar chart

Description automatically generated

Chart, bar chart

Description automatically generated

* No path was found at the end as the obstacles covered the goal.

**Informed RRT\*:**

* Informed RRT\* is the further optimized version of RRT\*.
* The major flaw of RRT\* being its tendency to explore and rewire all the space.
* Informed RRT\* on the other hand only add nodes and rewire where there are more chance of finding a better optimum path.
* After a path is found, Informed RRT\* only add nodes in the ellipsoid region formed by the path making sure the new nodes are added where they are needed to find a better solution.
* Following were the results obtained by applying RRT\* and informed RRT\* on the given map.

RRT\* Informed RRT\*

Diagram

Description automatically generated Diagram

Description automatically generated

* It can be seen from the above two graphs that RRT\* added nodes everywhere whereas informed RRT\* explored more in the ellipsoid region.
* Thus informed RRT\* was able to find a better optimal solution for the same number of nodes explored.