Aerial Robotics Kharagpur Documentation Template

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Abstract—This documentation outlines the implementation of the Probabilistic Roadmap Method (PRM) for path planning. The document discusses the concepts used in PRM, various methodologies explored, challenges encountered, and the final approach taken to achieve efficient motion planning. The results are analyzed, and potential improvements are suggested for future work.

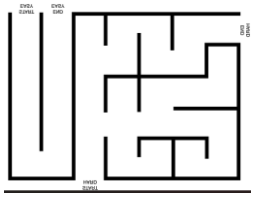
I. INTRODUCTION

The problem statement was to visualize the shortest path given a starting and ending point. There were two starting and ending points, namely hard start and easy start.

I applied the Dijkstra Method to create the shortest path after generating a number of random nodes which were related to each other on the basis of proximity. I called them parent and child nodes. And then for the final visualization, backtracked the nodes.

II. PROBLEM STATEMENT

A 2d maze was given on which there were two starting and ending points. We were required to find the shortest path between the points.



III. RELATED WORK

For understanding the basics of path planning I started learning and visualizing the algorithms. Learnt RRT too for this .

IV. INITIAL ATTEMPTS

Initially, I was not using the approach of child and parent nodes. Rather, I was just generating some random points till a point is generated in the vicinity of the end points and then tried to backtrack it but was unable to do it.

After that i tried to store only the closest node as child node which resulted in open polygons and only few connections due to which shortest path was not getting formed.

V. FINAL APPROACH

The final approach was to generate a fixed number of points, relate them as parent and child nodes based on the closeness of the points. For each node I stored 8 child nodes which I decided using trial and error. Then as each valid point is generated, valid means that the point is not lying on the obstacles, and a valid connection can be made with its child nodes , stored it in a an array.

Calculated the distance between each parent and its child node, which will act as the cost here for applying Dijkstra method. Then for applying the Dijkstra Method , I initialized the ‘d’ of each node as infinity.

After that used the following relation:

if d(u) +c(u,v)<d(v) then d(v)=d(u)+c(u,v)

Shreyas Anand helped in this.

VI. RESULTS AND OBSERVATION

Results were compared with alternative path planning algorithms such as RRT . PRM provided more efficient paths in structured environments.

RRT was also giving a very optimized path and that too quickly.

VII. FUTURE WORK

The problem with this planner is that it a takes considerable time as well as a lot of points should be generated to get an optimized path.

CONCLUSION

Overall, the problem was interesting and challenging, and confusing at the same time. Took a lot of time for giving optimized path. I also infused pygame to make it interactive. User can feed the starting and ending points by clicking on the maze.

REFERENCES

1. https://in.mathworks.com/help/robotics/ug/probabilistic-roadmaps-prm.html