Planning Project-2

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1 Abstract

This project focuses on understanding the importance of Obstacle space expansion and Search algorithm techniques specially in Path Planning.It covers topics such as Dijkstra's Algorithm and A* star Algorithm for finding optimal path for both point robots and rigid robots(here circular in shape).

2 Read Me

- Open Anaconda Navigator and launch it.
- In Anaconda Navigator check weather you have the following packages installed:
  - Math
  - Matplotlib.pyplot
  - Numpy

  if not do install them.
- Open Spyder3.3.2 in Anaconda and launch it
- Open file **astar.py** in Spyder3.3.2 and launch it for running A*star Algorithm.
- Open file **dijkstra.py** in Spyder3.3.2 and launch it for running Dijkstras Algorithm.
- The node exploration is in red and in final display for node exploration is in green and shortest path is in red.

2.1 Dijkstras Algorithm for Point Robot

- Once the file **dijkstra.py** is open for running the program for point robot give the following input to the d-algo() function.
  - startx = 180.0 (This is the start point x co-ordinate)
  - starty = 100.0 (This is the start point y co-ordinate)
  - goalx = 240.0 (This is the goal point x co-ordinate)
  - goaly = 60.0 (This is the goal point x co-ordinate)
  - reso = 1.0 (This is the resolution for space)
  - r = 0.0 (Robot radius)
  - c = 0.0 (Clearance)
- Run the code to get the desired shortest path.

2.2 Dijkstras Algorithm for Rigid Robot

- Once the file **dijkstra.py** is open for running the program for rigid robot give the following input to the d-algo() function.
  - startx = 180.0 (This is the start point x co-ordinate)
  - starty = 100.0 (This is the start point y co-ordinate)
  - goalx = 240.0 (This is the goal point x co-ordinate)
  - goaly = 60.0 (This is the goal point x co-ordinate)
  - reso = 1.0 (This is the resolution for space)
  - r = 5.0 (Robot radius)
  - c = 0.0 (Clearance)
- Run the code to get the desired shortest path.

2.3 A* star Algorithm for Point Robot

- Once the file **astar.py** is open for running the program for point robot give the following input to the a-algo() function.
  - startx = 180.0 (This is the start point x co-ordinate)
  - starty = 100.0 (This is the start point y co-ordinate)
  - goalx = 240.0 (This is the goal point x co-ordinate)
  - goaly = 60.0 (This is the goal point x co-ordinate)
  - reso = 1.0 (This is the resolution for space)
  - r = 0.0 (Robot radius)
  - c = 0.0 (Clearance)
- Run the code to get the desired shortest path.

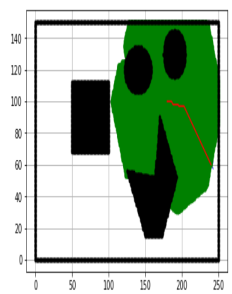
2.4 A* star Algorithm for Rigid Robot

- Once the file **astar.py** is open for running the program for point robot give the following input to the a-algo() function.
  - startx = 180.0 (This is the start point x co-ordinate)
  - starty = 100.0 (This is the start point y co-ordinate)
  - goalx = 240.0 (This is the goal point x co-ordinate)
  - goaly = 60.0 (This is the goal point x co-ordinate)
  - reso = 1.0 (This is the resolution for space)
  - r = 5.0 (Robot radius)
  - c = 0.0 (Clearance)
- Run the code to get the desired shortest path.

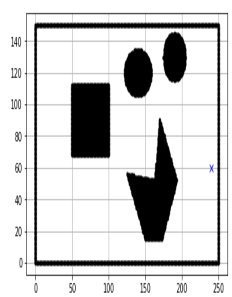
3 Dijkstras Algorithm Outputs

3.1 Dijkstras Algorithm for Point Robot

3.1.1 Valid Startnode and Endnode for Point Robot



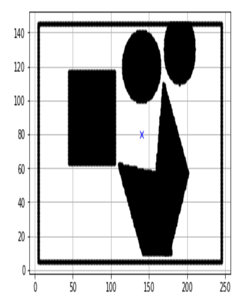
3.1.2 Invalid Startnode and Endnode for Point Robot



3.2 Dijkstras Algorithm for Rigid Robot

3.2.1 Valid Startnode and Endnode for Rigid Robot

3.2.2 Invalid Startnode and Endnode for Rigid Robot

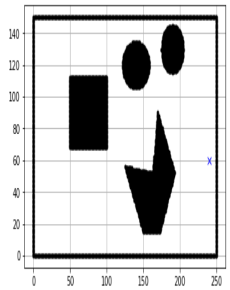


4 A*star Algorithm Outputs

4.1 A*star Algorithm for Point Robot

4.1.1 Valid Startnode and Endnode for Point Robot

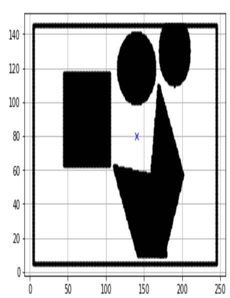
4.1.2 Invalid Startnode and Endnode for Point Robot



4.2 A*star Algorithm for Rigid Robot

4.2.1 Valid Startnode and Endnode for Rigid Robot

4.2.2 Invalid Startnode and Endnode for Rigid Robot



5 Conclusion

Through this project we can infer that the A*star algorithm gives the shortest path in much less time as compared to Dijkstras algorithm. This is due to the cost; in case of A*star the cost includes the cost to go , which makes node expansion more biased towards the goal node.However, when we compare the optimal path the path given by Dijkstras algorithm is better as compared to A* star algorithm.