Path planning

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1 Introduction to Path Planning

1.1 Definiton

A collision-free path from the start to the target according to an evaluation standard in the obstacle environment.

1.2 Motion Planning vs Path Planning

Path planning helps robots map out a path as straight as possible from point A to B while avoiding obstacles instead of leaving it meandering in circles. Motion planning establishes the exact actions a robot must execute to follow a predetermined path and reach its goal.

2 Types of Path Planning Algorithm

1. Generalized Voronoi Diagrams (GVD)
2. Rapidly Exploring Random Tree (RRT)
3. Gradient Descent Algorithm (GDA)

It is highlighted that GDA is a better candidate for single query problems as its generation time is shorter than RRT and its path length is optimal as the use of Voronoi Diagrams is the preferred choice for multi-query planning.

3 Local planner vs Global planner

Generally, there are two types of path planning. The first is the global path planning. Under this situation, the environment is static, and its global information is known a priority in the control design. This approach is expensive in implementation and relatively well studied in the existing literature. The second is local path planning, where

the path is generated by taking data from the sensors during the movement of the robot. Therefore, a robot can generate a new path to respond to a new environment. This method is more complicated in design but more applicable in practice.

4 Challenges in Path Planning

1. Kinematic Constraints
2. Dynamic Obstacles and their number
3. Obstacle Motion Uncertainty
4. Robot Environment

5 Future trends of Path Planning

the future design and requirements of the prediction and route planning models for smart cities to detect the accident images with high accuracy. Also, unmanned ship path planning algorithms is also another topic in the future of path learning. Moreover, Task and motion planning (TAMP) is a recent research method in Artificial Intelligence Planning

6 Practical Applications of Path Planning

1. Unmanned ground vehicles (UGVs)
2. Self-driving cars
3. Robot manipulators
4. Unmanned aerial vehicles (UAVs).

7 Conclusion

The purpose of path planning is to find a connected and barrier-free optimal path between two points in an environment with obstacles. An excellent path planning algorithm can greatly improve the performance of mobile robots. The field is still growing while facing challenges and making new trends in the media which needs deep research for finding what can enhance the field.

8 Resources

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panelBhaavin K. Jogeshwar, AbstractThis paper reviews the literature on the path planning of mobile robots using Robot Operating System (ROS). Three different types of path planning algorithms are considered here. These are the Generalized Voronoi Diagrams (GVD). (2022, May 9). Algorithms for path planning on Mobile Robots. IFAC-PapersOnLine. https://www.sciencedirect.com/science/article/pii/S2405896322000167

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