

# 1 Introduction to Path Planning

Path planning is a crucial aspect of robotics and autonomous systems. Its primary goal is to find an optimal or feasible path for a system to travel from its starting position to a destination, while avoiding obstacles. Path planning accounts for various constraints such as time, energy consumption, safety and environmental aspects. Path planning algorithms consider the environment and the dynamics of the robot or vehicle to plan the most efficient and safe path. Path planning enables robots or vehicles to navigate in a complex environment and reach their destination safely and accurately.

## 2 Types of Path Planning Algorithm

Path planning algorithms are classified into two categories: (global and local planners).

### 2.1 Global Planners

Global planners rely on a high-level view of the environment, with the goal of generating a global path in the configuration space. They typically use algorithms that generate a map of the environment to provide an optimal path to the destination. Examples of global planners are Dijkstra's, A\* Algorithm, and Visibility Graphs.

### 2.2 Local Planners

Local planners function at a lower level of abstraction and account for short-term information to determine the most appropriate path. They aim to react to changes in the environment while staying on the global path provided by global planners. Examples of local planners are the potential field, dynamic window and rapidly-exploring random tree (RRT).

## 3 Local Planner and Global Planner

The global planner provides an optimal path from the starting position to the destination, while the local planner calculates the most appropriate path based on the short-term information in the environment.

## 4 Challenges and Future Trends in Path Planning

Despite the significant progress achieved so far in path planning algorithms, there are still several challenges that need to be addressed. For example, real-time processing, moving target tracking, and robustness to sensor noise. In the future, path planning will be required to address more complex and diverse environments, including crowded or uncertain spaces. The combination of machine learning techniques and path planning may provide a promising path for further development.

## 5 Practical Applications of Path Planning

Path planning has many Practical applications such as:

- Robotics.
- Autonomous vehicles.
- Video games.
- Navigation.
- Industrial automation.

## 6 Conclusion and Resources

Path planning is an essential aspect of robotics that aims to find the optimal path while avoiding obstacles. Path planning is important For Navigation, gaming, and rescue missions.

RESOURCES:

1. GitHub's Robotics Path Planning Repository.
2. ROS (Robot Operating System) Wiki .
3. Path planning in robotics: algorithms and challenges by Daniele De Gregorio.