NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES
(KARACHI CAMPUS)
FAST School of Computing
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Project Title

Efficient Path Planning (for a Robot) Using Convex Hull Algorithms: Graham Scan & Jarvis March

Course: Graph Theory (MT3001)

Course Instructor: Dr. Nazish Kanwal

Section: 5E

Team Members:

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Introduction:

In this project, we aim to explore the application of convex hull algorithms, specifically Graham Scan and Jarvis March, for efficient path planning of a robot. Path planning is a crucial aspect of robotics, as it involves determining the optimal path for a robot to navigate from a starting point to a goal while avoiding obstacles. Convex hull algorithms can help in identifying the outer boundary of obstacles or waypoints, enabling the robot to plan its path efficiently.

Problem Statement:

The main objective of this project is to develop an efficient path planning algorithm for a robot using convex hull algorithms, specifically Graham Scan and Jarvis March. The algorithm should be able to handle complex environments with obstacles and provide the robot with a collision-free path from the starting point to the goal.

Methodology:

1. Data Collection: Collect the necessary data for the project, including the coordinates of the obstacles and the starting point and goal for the robot.

2. Implement Graham Scan Algorithm: Implement the Graham Scan algorithm to compute the convex hull of the obstacle points. This algorithm involves sorting the points based on their polar angles and constructing the convex hull in a counterclockwise manner.

3. Implement Jarvis March Algorithm: Implement the Jarvis March algorithm, also known as the gift wrapping algorithm, to compute the convex hull. This algorithm iteratively selects the point with the smallest polar angle and adds it to the convex hull.

4. Path Planning Algorithm: Develop a path planning algorithm that utilizes the computed convex hull to generate an efficient path for the robot. This

algorithm should take into account the starting point, goal, and obstacle locations to find a collision-free path.

Efficiency Analysis:

Evaluate the efficiency of the path planning algorithm by considering factors such as computational complexity, and execution time. Compare the performance of the Graham Scan and Jarvis March algorithms in terms of their efficiency and effectiveness in generating optimal paths for the robot.

Impact:

This project's successful execution will provide valuable insights into leveraging convex hull algorithms for path planning, potentially enhancing autonomous systems' navigation capabilities. The optimized paths generated using Graham Scan and Jarvis March can contribute to safer, more efficient navigation in challenging and cluttered environments, ultimately advancing the field of autonomous robotics and transportation. The project will contribute to the field of robotics by demonstrating the effectiveness of convex hull algorithms in path planning tasks.