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PATH PLANNING ALGORITHMS FOR ROBOTIC ARM SIMULATION: A COMPARATIVE ANALYSIS

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ABSTRACT

Robotic arm simulation plays a critical role in industrial automation, precision engineering, and robotics research, requiring advanced path planning algorithms to optimize efficiency and precision. This paper presents a comparative analysis of several widely-used path planning algorithms, including Rapidly-exploring Random Trees (RRT), Probabilistic Roadmaps (PRM), and A algorithms, specifically in the context of robotic arm simulations. Each of these algorithms offers distinct advantages in terms of computational complexity, collision avoidance, and real-time adaptability, making them suitable for varying simulation environments and task-specific requirements.*

The study examines their performance based on key parameters such as computational time, path optimality, and obstacle avoidance efficiency, with a focus on how each algorithm handles multi-degree-of-freedom robotic arms. Simulations conducted under controlled environments provide a comprehensive evaluation of the algorithms' capabilities, highlighting the trade-offs between speed and accuracy. Moreover, the study explores recent advancements in hybrid algorithms, which combine features from multiple approaches to enhance performance for specific industrial applications.

The comparative analysis underscores the importance of selecting the appropriate algorithm based on task complexity, environmental constraints, and computational resources. Ultimately, this research provides valuable insights into the suitability of various path planning algorithms for improving robotic arm simulations, contributing to enhanced automation and precision in industrial processes.

KEYWORDS: *Path Planning, Robotic Arm Simulation, RRT, Probabilistic Roadmaps, A* Algorithm, Collision Avoidance, Computational Efficiency, Multi-Degree-Of-Freedom, Hybrid Algorithms, Industrial Automation.*

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