Comparative Analysis of State-of-the-Art Path Planning Algorithms

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Opis teme: This project aims to conduct a comprehensive comparative analysis of various state-of-the-art path planning algorithms, including A*, Theta*, TO-AA (TO-AA-SIPP), Anya, Polyanya, Informed RRT*, BIT*, RRT, and RRT*. By evaluating the behavior and performance of these diverse navigation approaches, the project seeks to identify their strengths, weaknesses, and optimal application scenarios in dynamic and static environments. The ultimate goal is to provide insights that could guide the selection and implementation of path-planning algorithms in robotics and autonomous systems across various domains.

Zadaci i ciljevi: The primary objective of this project is to systematically compare and evaluate the efficacy of different path-planning algorithms to determine their suitability for various real-world applications, ranging from autonomous vehicular navigation to robotics in complex terrains. To conduct a detailed comparative analysis of state-of-the-art path planning algorithms, the project will start with an in-depth literature review to establish a strong theoretical foundation for each algorithm selected, including A*, Theta*, TO-AA (TO-AA-SIPP), Anya, Polyanya, Informed RRT*, BIT*, RRT, and RRT*. Each algorithm will then be implemented in a controlled simulation environment using standard programming languages and simulation tools used in robotics and autonomous systems. The student will develop a variety of test scenarios that incorporate static and dynamic elements to test each algorithm’s robustness, efficiency, and adaptability under different conditions. Performance metrics such as path optimality, computational time, memory usage, and adaptability to environmental changes will be systematically analyzed. This evaluation will lead to a detailed analysis, contrasting each algorithm's strengths and potential limitations across various scenarios. All findings and methodologies will be documented and reported, supplemented with visual data representations like charts and graphs, and prepared for publication. This work aims to inform and enhance future research and applications in path planning strategies.

Lista referenci:

1. Zhou, C., Huang, B., & Fränti, P. (2022). A review of motion planning algorithms for intelligent robots. Journal of Intelligent Manufacturing, 33(2), 387-424.
2. Gasparetto, A., Boscariol, P., Lanzutti, A., & Vidoni, R. (2015). Path planning and trajectory planning algorithms: A general overview. Motion and Operation Planning of Robotic Systems: Background and Practical Approaches, 3-27.
3. Thrun, S. (2000). Probabilistic algorithms in robotics. Ai Magazine, 21(4), 93-93.