EAST WEST UNIVERSITY

Assignment-1

Enhanced Dynamic Robot Movement Simulation

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Enhanced Dynamic Robot Movement Simulation

Objective

The objective of this project is to develop an advanced simulation environment for a robot navigating through a dynamically created grid. The simulation considers task optimization strategies, safety measures, and efficient energy management.

Overview

The project includes the implementation of a simulation environment where a robot moves through a grid-based environment. It incorporates various programming concepts, such as object-oriented programming (OOP), algorithms for navigation and pathfinding, task optimization, safety, and energy management strategies.

Description about using functions

In this assignment we have used UCS and A* search algorithm. Here I have made changes in agent class. The function needs_recharge will add a charging point if the remaining steps to the goal is a multiple of 10 and charge is 0%The function add_charging_point shows the point where the robot's energy will be 0% and will recharge the robot. With the help of a visualization function,we can see where the agent can recharge along its path.

- **Identification of Charging Points:** The needs_recharge method within the Agent class identifies when the agent requires a recharge. Specifically, it checks if the remaining steps to the goal is a multiple of 10 and if the charge level is at 0%. This condition determines when a charging point should be added to the list.
- **Adding Charging Points:** When the agent identifies the need for a recharge, it adds the current location to the list of charging points using the add_charging_point method. This method ensures that charging points are recorded for potential future use.
- **Visualization:** In the visualization function visualize_grid_and_path, charging points are plotted on the grid as red circles. This provides a visual representation of where the agent can recharge along its path.

- **Integration with Pathfinding Algorithms:** Charging points are seamlessly integrated into both the A* and Uniform Cost Search algorithms. When the agent explores the grid and encounters a charging point, it considers this information in its path planning to ensure it can reach the goal while accounting for energy constraints.

Overall, charging points enhance the agent's capability to navigate the environment by providing strategic locations for recharging, thus enabling efficient and effective traversal towards the goal.

Implementation

The provided code implements the requirements outlined
- Classes `Environment`, `Agent`, and `Node` represent the simulation environment, robot, and nodes in the search tree, respectively.
- Pathfinding algorithms A* and Uniform Cost Search are implemented in the `Agent` class.
- Visualization is achieved using matplotlib to plot the grid, obstacles, paths, and charging points.

Conclusion

The enhanced dynamic robot movement simulation provides a comprehensive platform to explore various aspects of navigation, pathfinding, task optimization, safety, and energy management strategies in a grid-based environment. The implementation offers opportunities for further exploration and enhancement, including advanced pathfinding algorithms and terrain considerations.