

Assignment: Enhanced Dynamic Robot Movement Simulation

Objective: Design and implement an advanced simulation environment for a robot navigating through a dynamically created grid. This project aims to deepen understanding of basic programming concepts, object-oriented programming (OOP), algorithms for navigation and pathfinding, task optimization, and safety.

Overview: Develop a simulation for a robot moving through a grid-based environment, considering task optimization strategies and safety to ensure efficient travel and collision avoidance. The simulation should also manage the robot's energy levels and battery status.

Detailed Requirements

1. Environment Setup

- Implement a **class Environment** that generates a grid of size $n \times m$.
- Dynamically place obstacles, a start position, and an end position within the grid.

2. Robot

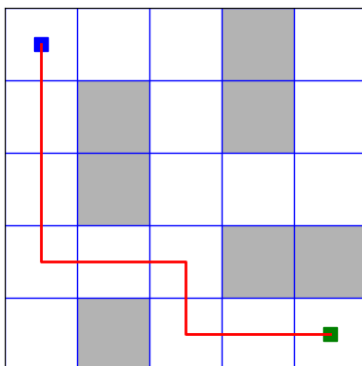
- Implement a class Robot with movement capabilities and tracking of its current position.
- Include methods to manage **the robot's energy levels** and **battery status**.
- Incorporate task optimization and safety for efficient and safe navigation.

3. Simulation

- Simulate the robot's movement, including logic for **task allocation strategies and dynamic path adjustments**.
- Account for **energy consumption** and **manage energy levels to complete tasks**.

4. Visualization

- Use libraries like **matplotlib** to visualize the grid, obstacles, paths, and the robot's energy levels over time. Example output:



5. Task Optimization and Safety

- Implement strategies to minimize travel time and energy consumption.
- Ensure robots can detect and avoid potential collisions, maintaining safety.

6. Bonus (Optional)

- Advanced pathfinding algorithms for efficient navigation.
- Different terrain types affecting movement cost and energy consumption.

Deliverables

GitHub Project Submission

Create a GitHub project named "CSE 366(Section number) - Student Id" with the following structure:

Folder: Assignment 1

- Python Notebook: The Jupyter notebook containing the simulation implementation.
- Report or Presentation: A document detailing design, challenges, solutions, and observations on task optimization and safety measures.

README.md Files

- Provide README.md files in both the project root and inside the "Assignment 1" folder. These should overview the project and offer instructions for running the simulation.

Submission Guidelines

- Ensure the repository is accessible to instructors and complies with submission instructions.
- Organize files neatly within the "Assignment 1" folder and document your work comprehensively.

Evaluation Criteria

- Correct implementation and functionality of the simulation.
- Effectiveness of task optimization and safety measures.
- Efficiency of the robot's movements and energy management.
- Clarity and organization of the submitted code and documentation.

GitHub Tutorial for Deliverable Structure

1. Create a GitHub Repository: Name it as instructed, and initialize it with a README file.
2. Create an Assignment Folder: Add a folder named "Assignment 1" and include a .gitkeep file or the assignment files directly.
3. Add Assignment Files: Upload the simulation notebook, report/presentation, and any additional files required for the assignment.
4. Add README.md Files: Detail the project overview and instructions for running the simulation in the README.md files located in the repository root and the "Assignment 1" folder.
5. Share Your Repository: Make sure the repository is set to public or shared with the necessary collaborators.