

Software Intern Recruitment Task

Fleet Manager Conflict Resolution

Task Overview:

We are looking for a Software Intern who excels in problem-solving and thrives on tackling challenges related to conflict resolution in a fleet manager system. The system manages a group of mobile robots working collaboratively in a warehouse. This task will evaluate your ability to design practical solutions, think critically, and work effectively in real-world scenarios. Feel free to use tools like ChatGPT for assistance, but focus on showcasing your unique problem-solving approach and thought process. Kindly attach the link to your chat with the AI tool in the [Google Form](#). Go through the tasks carefully and submit a detailed report showing your approach and proof of work along with any code snippets or output figures.

Task 1: Conflict Resolution Case Study

Scenario: You are tasked with designing a conflict resolution module for a fleet management System (FMS) overseeing a group of mobile robots in a warehouse. In this system:

- Mobile robots are assigned tasks like navigating to specific locations, picking items, and delivering them.
- Conflicts arise when:
 - Two robots are scheduled to access the same aisle or node at the same time.
 - One robot delays task completion, disrupting the schedule for other robots.

Refer to **Fig.1**. It is an example of a warehouse layout (top view) where two robots have to take the shown path in respective directions. They can only move through those paths and all they can do is to stop or slow down to resolve the conflict.

Questions: (Concept only)

1. Propose a strategy to prioritize which robot should gain access to the common path (aisle) if the FMS is yet to send the paths to the robots. Consider factors like task urgency, proximity, and overall operational efficiency.

Explain your reasoning and trade-offs in detail. Suggest how your solution would adapt if the number of robots increased significantly.

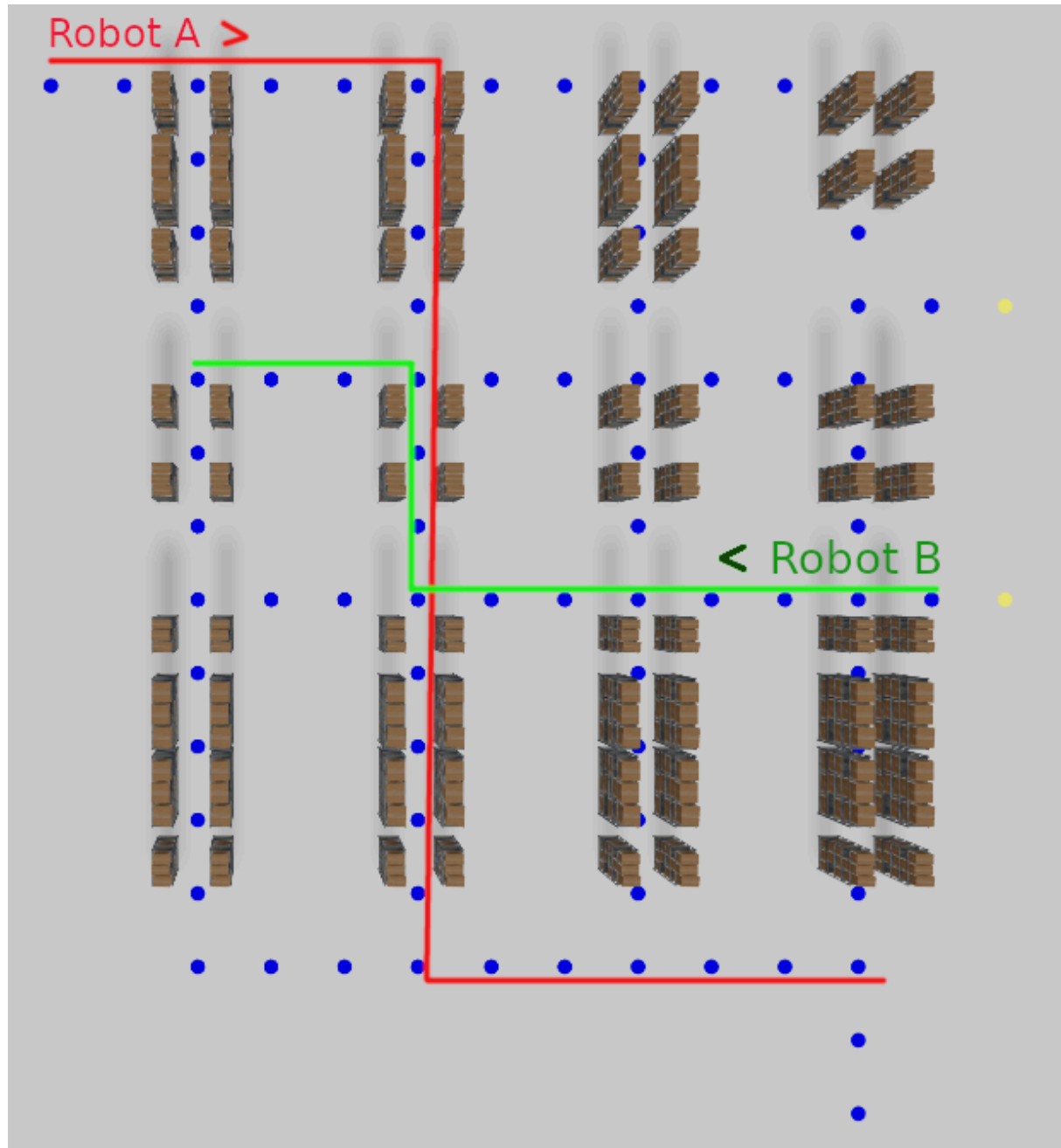


Fig.1 Warehouse Layout with two example robot paths



Task 2: Algorithm Design (Coding exercise)

Problem:

Imagine the FMS has sent the paths to robots without considering any scheduling constraints. The robots are moving along the path towards the conflicting region. Paths of robots are expressed as an array of node ids that it has to go through (Nodes are blue dots in Fig. 1).

1. Write a pseudocode algorithm that:

- Detects conflicts in the paths of robots dynamically as they approach the conflicting regions.
- Resolves the conflict by stopping (output: robot name, the time to it should be stopped) one of the robots based on any assumed priorities (e.g., task urgency, remaining battery life - can be hardcoded in the beginning).

2. Provide a small explanation of how your algorithm ensures reliability and safety.

Task 3: Behavioral Assessment

Question:

Describe a time you faced a major problem that required out-of-the-box thinking to solve. Relate it to how you would approach challenges in designing a fleet manager for autonomous mobile robots.

- Highlight your thought process and the steps you took to resolve the problem.
- If you used external tools or resources, mention how you integrated them into your solution.

Evaluation Criteria:

As you work through the tasks, here's how we'll evaluate your submission

1. Creative Problem-Solving

We're keen to see innovative approaches and the tools you leverage to tackle challenges. Remember, it's not just about solving the task—it's about your approach, creativity, and how you utilize tools to craft effective solutions. Your process matters as much as the result.



2. Analytical Thinking

How well you explain your decisions and justify your reasoning with clarity and confidence.

3. Collaboration & Communication

Effective communication and the ability to present your ideas clearly is crucial.

4. Adaptability

Show flexibility and composure when dealing with dynamic or unpredictable scenarios.

Good luck! We are excited to see your unique approach to these challenges