

Conflict Resolution Strategy for FMS

Assumptions:

- All robots move at the same constant speed.
- All paths are pre-planned and known in advance.
- Time delays can be assigned at each node.
- There's a centralized system that knows all robot positions and paths.
- Each robot has a task with an assigned priority level.
- Full paths are calculated before movement begins.
- Paths remain static throughout execution. (No dynamic replanning)

Algorithm Flow:

1. Conflict Detection

- The system analyzes each robot's planned path
- It identifies two types of potential conflicts:
 - **Node conflicts:** Two robots trying to be in the same spot
 - **Aisle conflicts:** Two robots needing to use the same hallway or passage
- It calculates how soon each conflict might happen and in which direction robots are approaching

2. Scoring & Decision Making

- When conflicts are detected, each robot gets a score based on:
 - Task priority (more critical task = higher score)
 - Battery level (lower battery = higher score, so robots can charge before dying)
 - Distance to goal (closer to finish = higher score)
 - Proximity to conflict point (closer to conflict = higher score)
- These factors are combined using weighted averages to determine which robot should have priority

3. Resolution Rules

- If a robot wants to move to a spot that's already occupied → WAIT
- If two robots are approaching an aisle in the same direction, → closer one goes first
- In other cases, the higher overall score gets priority
- If scores are tied, it uses robot names as a consistent tie-breaker
- The final decision for each robot is either FORWARD or WAIT