Vityarthi Delivery Agent – Assignment Report

1. Introduction

This report presents the implementation and evaluation of search-based planners (UCS, A*, Local Search) for a delivery agent navigating static and dynamic obstacles.

2. Algorithms

- **UCS**: guarantees optimal path, but slow.
- **A***: efficient using admissible heuristics.
- **Local Search**: hill climbing with random restarts, useful for dynamic replanning.

3. Experiments

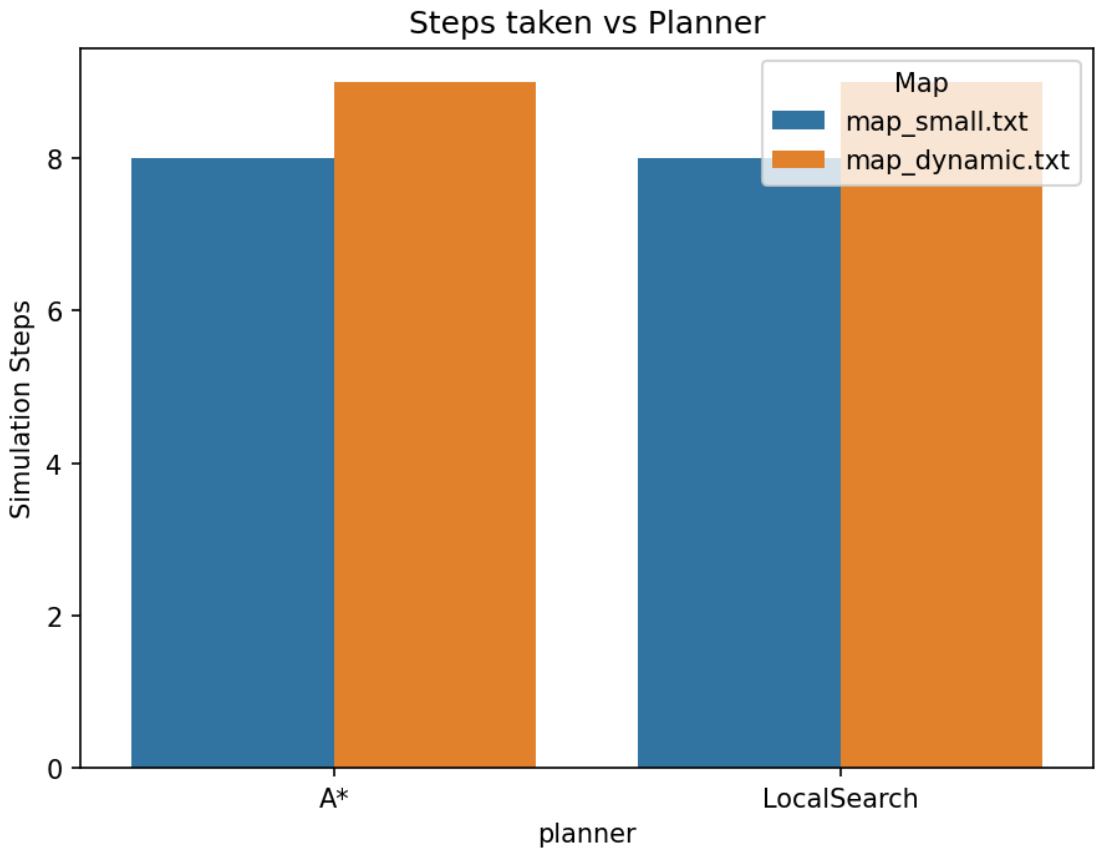
We tested planners on the given maps using the simulation framework.

3.1 Results Table

map	planner	path_found	path_cost	nodes_expanded	planning_time_ms	sim_steps	collisions
map_small.txt	UCS	True	8	21	0.1885	nan	nan
map_small.txt	A*	True	nan	nan	nan	8	0
map_small.txt	LocalSearch	True	nan	nan	nan	8	0
map_dynamic.txt	UCS	True	9	33	0.3828	nan	nan
map_dynamic.txt	A*	True	nan	nan	nan	9	0
map_dynamic.txt	LocalSearch	True	nan	nan	nan	9	0

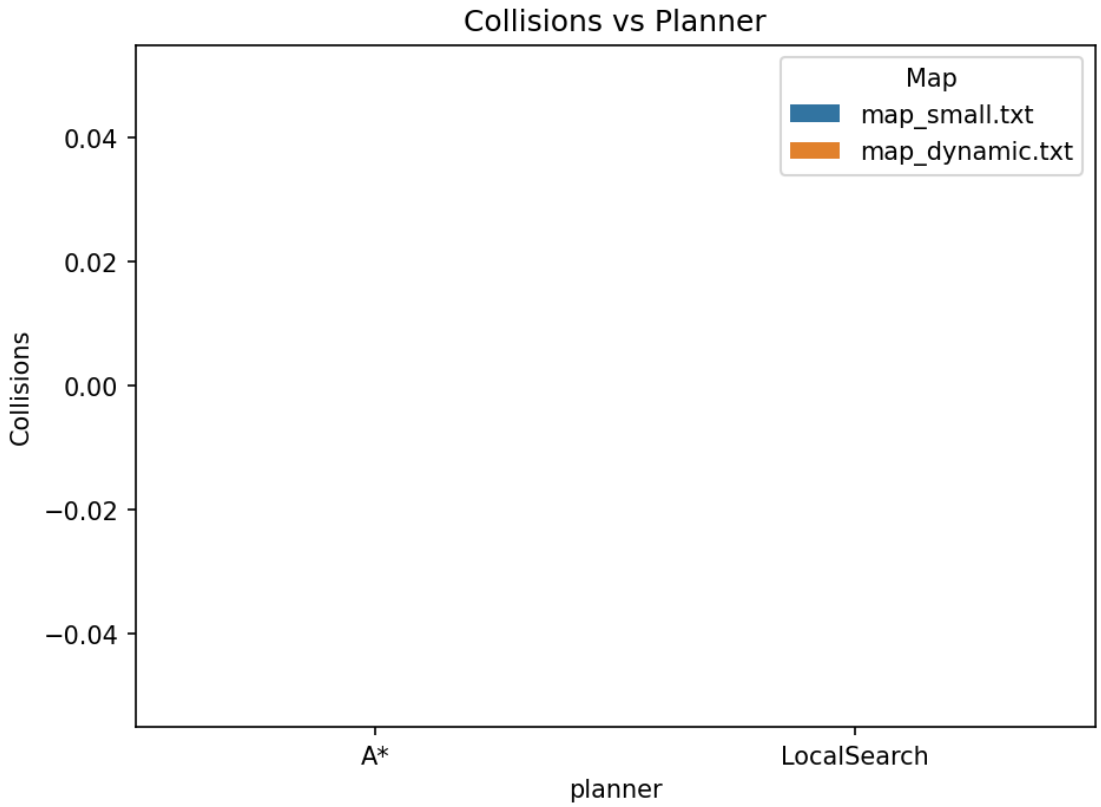
3.2 Plots

Steps vs Planner:



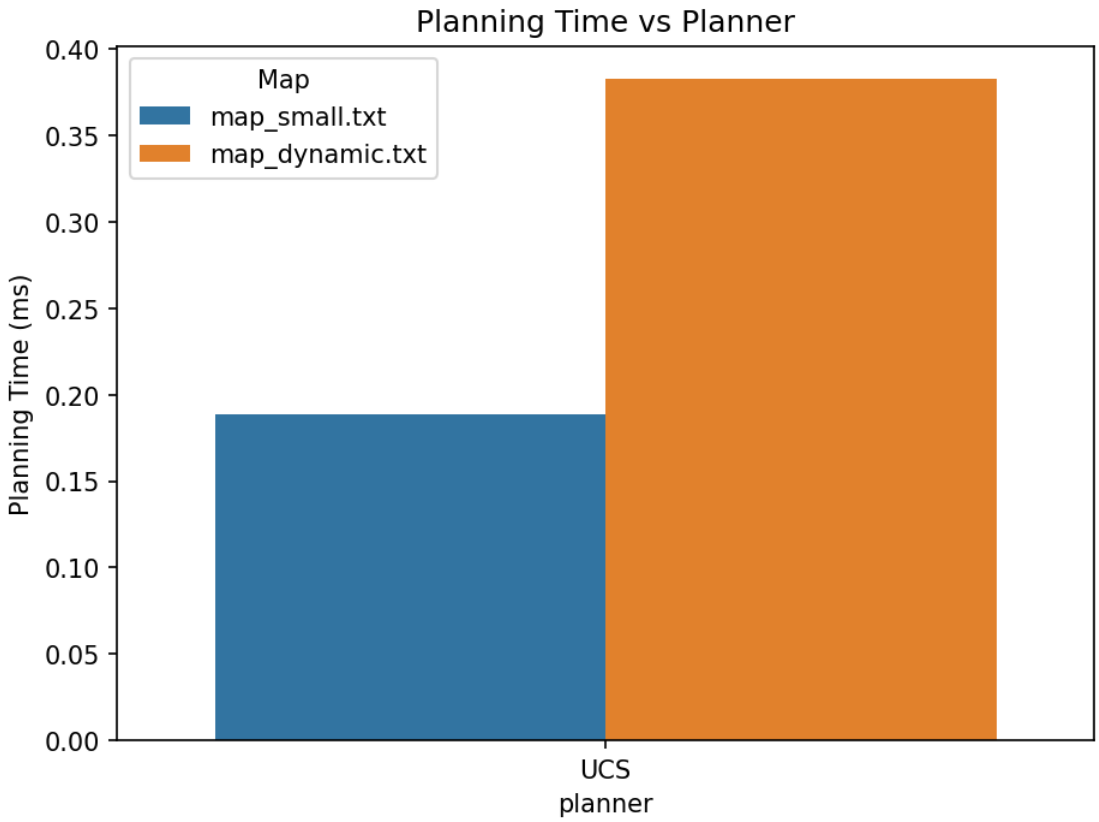
Steps vs Planner

Collisions vs Planner:



Collisions vs Planner

Planning Time vs Planner:



Planning Time vs Planner

4. Discussion

- **UCS** is correct but scales poorly.
- **A*** balances speed and accuracy.
- **Local Search** replans quickly and adapts to dynamic maps.

5. Conclusion

A* is best for static maps, while Local Search helps in dynamic environments. Future work: multi-agent coordination, larger maps, advanced heuristics.