Slide 1 – Title

“Hello, my name is Mohamed Eljahmi, and this is my project proposal for RBE-550.  
The project is about implementing A-star motion planning in ROS 2 for obstacle avoidance in a two-dimensional occupancy grid.”

Slide 2 – Motivation and Problem

“Motion planning is essential for safe and efficient robot navigation.  
It has many applications, including warehouse robots, aerial drones, and even surgical robots.  
A motivating example is a warehouse robot navigating between shelves.  
The main challenge is to compute efficient, collision-free paths on occupancy grids.”

Slide 3 – Background: Graph-Based Search Methods

“Classical search methods like Breadth-First Search and Depth-First Search guarantee completeness but are very inefficient.  
Dijkstra’s algorithm improves on this by expanding the lowest-cost node, which guarantees the shortest path, but it still explores in all directions.  
A-star builds on Dijkstra by adding a heuristic, guiding the search toward the goal. This makes it much faster while still guaranteeing optimal paths when the heuristic is admissible.

Slide 4: Visual Comparison between A\* and Dijkstra

As shown in the diagram, Dijkstra expands evenly everywhere, while A-star focuses more in the direction of the goal.

Slide 5 – Origins of the Algorithms

“Dijkstra’s algorithm was invented in 1956 by Edsger Dijkstra, a Dutch scientist. He came up with it during a trip in Amsterdam while thinking about how to find the shortest routes.  
Later, in 1968, Hart, Nilsson, and Raphael created A-star at SRI International. They extended Dijkstra’s work by adding heuristics, which made the search much more efficient.”

Slide 6 – Proposed Methods

“This project will be implemented in ROS 2 using a modular node-based design.  
The baseline algorithm is A-star with configurable heuristics.  
The planner will subscribe to occupancy grids, start poses, and goal poses, and then publish a planned path for visualization in RViz.  
In future stages, a figure will show the occupancy grid and the computed path.”

Slide 7 – Goals and Evaluation

“The goals are to compute collision-free paths using A-star, integrate with ROS 2 message types, and visualize the results in RViz.  
Evaluation will include path length, number of nodes expanded, and computation time.  
Possible extensions include BFS, DFS, Dijkstra, and even running on real hardware.”

Slide 8 – Schedule and Expected Results

“The schedule spans ten weeks.  
Weeks one and two cover literature review and ROS 2 setup.  
Weeks three and four are for implementing A-star.  
Weeks five to seven cover ROS 2 integration and testing.  
Weeks eight and nine are for evaluation in synthetic environments.  
Finally, week ten is for results, a video demonstration, and the final report.  
The expected outcome is a reproducible ROS 2 package with clear visualization of A-star.”