**Project Report**

**1. Project Description**

This project was developed to find the shortest route between two points on a map using predefined nodes and edges, comparing two pathfinding algorithms: A\* and Dijkstra.  
The system is built on an interactive map interface using Leaflet.js, and the performance of each algorithm (distance, time, computation) is clearly presented to the user.

**2. System Features**

Predefined points (e.g., A, B, C, D) and various landmarks (Cafe, Library, Museum) are placed on the map.

Users can select start and end nodes directly on the map.

Upon selection, both A\* and Dijkstra algorithms are executed and their results (path, total distance, total travel time) are displayed comparatively.

The system supports adding and removing nodes dynamically.

User selections are saved locally using localStorage, ensuring persistence even after page reloads.

**3. Summary of Algorithms**

**A\* (A-Star) Algorithm**

Uses the g(x) + h(x) formula:

g(x): Distance from the start to the current node.

h(x): Estimated distance to the goal (calculated using the Haversine formula).

Ensures all defined "waypoints" are covered along the route.

Travel time is calculated using a speed parameter.

**Dijkstra Algorithm**

Calculates the shortest paths from the starting node to all other nodes.

Works by visiting the nearest neighbor with the smallest cumulative cost.

**4.Key Observations**

Both algorithms found the same optimal path.

A\* algorithm completed the computation almost 6 times faster than Dijkstra.

Dijkstra wasted time exploring irrelevant paths because it lacked goal-direction awareness.

A\* would be the preferred choice.

**5. Conclusion and Evaluation**

This project effectively demonstrated the theoretical and practical differences between the A\* and Dijkstra algorithms.  
It confirmed that A\*'s goal-directed strategy is better suited for real-time navigation applications.  
Additionally, dynamic node management and interactive map features increased the system's flexibility and potential real-world usability.