Project Proposal

Project Idea:

The project idea is to build a mini-navigation system like Google Maps which finds the shortest route between two locations.All the data is stored in the database and only few nodes are loaded into memory during pathfinding. The purpose is to handle large maps with low memory usage.

Technical Aspects:

1. Storage Layer

- The project will use a custom database which would be based on the B tree as required to store all map nodes and edges.
- Each node (location) will be indexed by its ID for fast search.
- Node records contain coordinates, names, and pointers to adjacency information.

2. Graph Representation & Lazy Loading

- The map will be represented as a graph,where intersections are nodes and roads are weighted edges.
- The full graph is not loaded into memory. Adjacency lists are fetched from the B-tree on demand.
- Only the currently required region of the graph remains in memory.

3. Algorithms & Data Structures Used

- Dijkstra / A* is used for shortest path calculation.
- Queue is used for BFS-based reachability and other unweighted operations.
- Stack supports path reconstruction and undo-like features.
- AVL Tree or Map/Set maintains active/loaded nodes, ensuring O(log n) operations.

5. Efficiency & Scalability Considerations

- The project will avoid loading the entire graph,reducing memory usage.
- Lazy loading + caching will improve performance during multiple queries.
- B-Tree indexing will keep disk operations optimized as data grows.