Route Optimization Solution for Courier Services

Dr. Amol Pande[1], Atul Mahajan[2], Vitthal kudav[3], Rushikesh Manje[4], Sangaram Lad[5]

Professor & HOD, Department of Computer Engineering[1]

Student, Department of Computer Engineering[2 3 4 5]

Datta Meghe College of Engineering, Navi Mumbai, India

Abstract: *Route optimization is a key component in modern-day logistics, delivery services, and transportation planning, where the primary objective is to identify the most time-efficient and resource-effective paths between multiple destinations. The conventional approach to route optimization often relies on pre-defined or static road network data, which fails to account for the constantly changing nature of urban traffic conditions. The present work proposes a dynamic and data-driven approach for route optimization by integrating graph theory with real-time traffic data. A specific geographical area is selected and modelled as a weighted graph, where intersections or coordinates act as nodes and the roads connecting them are treated as edges. Initially, edge weights are assigned based on estimated travel times or distances. However, to enhance accuracy, these static weights are dynamically updated using live traffic data obtained from the Google Maps API. These updates reflect real-world variations such as congestion, road closures, and delays, which significantly impact the travel time along different paths. Dijkstra's algorithm, a well-established shortest path algorithm, is employed to compute the minimum time routes between any two nodes in the graph. It is particularly effective due to its ability to find optimal paths in graphs with non-negative edge weights and its relatively low computational complexity for sparse graphs. The algorithm is adapted to work with the dynamically updated weights, ensuring that every routing decision is made based on the most recent and accurate traffic conditions. The approach is further extended to support routing for multiple destinations in a single trip, commonly encountered in delivery and courier services. By iteratively applying Dijkstra's algorithm and updating travel times in real-time, the system can generate optimized multi-stop routes that minimize total delivery time and operational costs.*

Keywords: Route optimization, last-mile delivery, adaptive routing, dynamic adjustments, real-time traffic data, fuel efficiency, cost reduction, optimization algorithms, travel time minimization, OR-Tools, graph-based routing, logistics efficiency, scalability, operational savings, intelligent transportation systems, delivery prioritization, sustainable logistics, data-driven decision making, smart mobility solutions