# Fuel Route Optimization for Logistics Operations

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***Abstract*—Transportation and logistics use a lot of fuel and also add to pollution. Route planning is a simple method to reduce both cost and environmental impact. In this method, we can use Django REST API to build a system that helps to find fuel-efficient routes using. It suggests the best places where we can fuel up our vehicle and also calculate the total fuel cost for a trip.**

**The system uses the OpenRouteService API to get route details. It also takes into account vehicle information like fuel efficiency and how far the vehicle can travel on a full tank. Based on this, it decides where fuel stops are needed. Fuel price data is also used so the total cost can be estimated more accurately. To make the system faster, caching is used to store repeated data.**

**Overall, the results show that better route planning can help save fuel and reduce environmental impact, making transportation more sustainable.**

***Index Terms*—Route Optimization, Logistics Transportation, Carbon Emissions, Django REST API, Fuel Cost Optimization, Sustainable Logistics.**

## I. INTRODUCTION

The rapid growth in global trade and electronic commerce has increased the demand for effective logistics and transportation service. The logistics sector mainly employs road transport to move goods over long distances. However, freight transportation is associated with significant fuel consumption and environmental pollution. Conventional route navigation systems are mainly designed to find the shortest or fastest route, but not necessarily the most fuel-efficient route. This can result in increased costs and further environmental degradation.

In addition, with rising concerns about environmental sustainability, it is essential to develop intelligent route optimization systems to minimize fuel consumption while maintaining effective transport services. The intelligent route optimization system can determine the route and fueling locations by analyzing the travel distance, vehicle performance, and fuel efficiency.

This study proposes the development of a Fuel Route Optimization System using the Django REST Framework to determine the most effective route and fuel costs for logistics vehicles. The system incorporates route data from the OpenRouteService and vehicle parameters to determine fuel consumption.

## II. PROBLEM STATEMENT

Long-distance logistics operations related to commercial vehicles face the problem of developing an efficient routing strategy and identifying optimal refueling points for vehicles. Several routing models today focus on either the distance travelled or the time taken to travel while ignoring other important considerations, such as fuel efficiency, fuel availability, and fuel price variations.

As a result, several unfavorable outcomes are experienced, such as the following:

- Increased transportation costs
- Increased fuel consumption
- Increased carbon emissions
- Inefficient utilization of the existing routes

Therefore, it is imperative to develop an intelligent route optimization system that considers vehicle constraints, fuel consumption, and route-specific information to optimize fuel consumption and costs.

## III. OBJECTIVE OF THE SYSTEM

The main objectives of this study are as follows:

1. Design a route optimization system for long-distance logistics transportation.

2. The best possible locations for fuel stops should be identified by considering the range and fuel efficiency of the vehicle.
3. The total fuel cost for a given route was calculated.
4. The OpenRouteService API was used to integrate the route data into the database.
5. Minimizing fuel usage and emissions by route optimization.

## IV. LITERATURE REVIEW

Considerable research has been conducted on optimizing routes to make transportation more efficient and effective.
Hariharan et al. (2020) developed a dynamic route planning system for public transportation. The system optimizes bus routes based on the transportation demand. Chaubey and Panchal (2025) studied logistics routing strategies. The authors stressed the importance of technology, such as AI, ML, and GIS, in making the supply chain more efficient.

Prajapat et al. (2024) studied the routing techniques used by logistics companies such as Delhivery. The authors showed how ML techniques can improve logistics efficiency. Boriboonsomsin et al. (2012) proposed an eco-routing navigation system. The system optimizes the route to reduce fuel consumption, based on real-time traffic data. Fanti et al. (2021) proposed an eco-route planning system. The system optimizes the routes of heavy vehicles to reduce fuel consumption.

Demir et al. (2014) studied green transportation techniques. The authors stressed the importance of optimizing the route to make transportation more efficient. Leggieri and Haouari (2017) studied the green vehicle routing problem. The authors proposed optimization techniques to make the routing system more efficient without affecting the system environment. Zhang et al. (2019) studied an AI-based route-optimization system. The system optimizes vehicle routes to improve the efficiency of the transportation system.

## V. PROPOSED SYSTEM ARCHITECTURE

This flowchart shows a simplified pipeline for calculating the most efficient travel route, along with fuel stops and total cost.

1. User Input: The process begins when the user enters the starting point and destination.
2. Django REST API: Handles requests and coordinates the data flow between components.
3. OpenRouteService API: Fetches route details, such as distance and path.
4. Fuel Consumption Analysis: Estimates the amount of fuel required for a trip.
5. Fuel Price Data: Uses external data (e.g., CSV) to determine fuel costs along the route.
6. Cost Calculation & Output: Combines route, fuel stops, and pricing to compute the total trip cost. End: The final optimized route with fuel stops and total cost is returned to the user.

In short, it is a system that turns a simple route request into an optimized travel plan with cost efficiency.

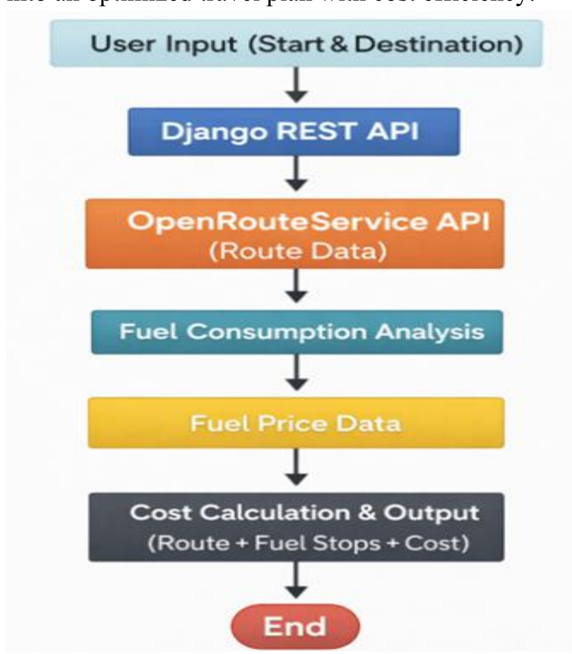


Fig. 1: System flowchart

## VI. ALGORITHM

Fuel Route Optimization Algorithm:
Input: Start Location, Destination Location, Vehicle Range, Fuel Efficiency
Output: Optimal Route, Fuel Stops, Total Fuel Cost

Steps:
1. Obtain the starting point and destination from the user.
2. The OpenRouteService API was used to retrieve the route information.

3. The total distance of the route was retrieved.
4. The fuel requirements are calculated as follows:

Fuel Required = Total Distance / Fuel Efficiency.

1. Determine the number of fueling stops required based on the range.
2. Retrieve the price of the fuel from the CSV dataset.
3. The fuel costs were calculated as follows:
4. The data are stored in a cache for quick retrieval the next time.
5. Present the route, planned fueling stops, and costs to the user.

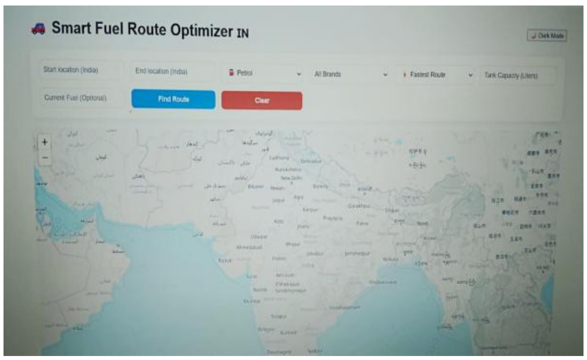


Fig. 2: API image (Real Time)

This fuel route optimization system helps a user plan a trip in the most efficient and cost-effective way. The user first enters their starting location, destination, vehicle range, and fuel efficiency. The system then uses the OpenRouteService API to find the route and calculate the total distance. Based on this distance, it determines how much fuel is needed by dividing the total distance by the vehicle's fuel efficiency. Next, it calculates how many fuel stops are required depending on how far the vehicle can travel on a full tank. It also checks fuel prices from a stored dataset (CSV file) to estimate the cost at different stops. Using this information, the system calculates the total fuel cost for the journey. To improve speed for future requests, the data is saved in a cache. Finally, the system presents the user with the optimal route, suggested fuel stops, and the total trip cost in a simple and clear way.

## VII. RESULTS AND DISCUSSION

The system created for long-haul logistics was able to effectively determine the best location to refuel and estimate the total fuel costs involved in a lengthy route. This is because it considers the fuel efficiency of each vehicle and the distance it travels. Caching also improves performance because it reduces API calls. Moreover, it reduces the fuel consumption and carbon footprint. Overall, it is evident that intelligent route optimization can be beneficial for both efficiency and sustainability.

## VIII. CONCLUSION

This study presents a carbon-conscious fuel route optimization system that seeks to strengthen logistics route planning and reduce the fuel consumption. It identifies the best fueling spots based on the fuel efficiency and range of the vehicle using route data retrieved from OpenRouteService.

It presents logistics companies with the ability to reduce their operational and environmental impact. The system was developed using the Django REST Framework and presented a flexible and scalable structure for the development of route optimization services.

## IX. FUTURE SCOPE

The proposed system has already shown promise in its route optimization capabilities; however, there are several ways in which this system can be further enhanced in the future.

One such way is the ability of the system to utilize real-time fuel price API services instead of static datasets and recalculate fuel costs as the market fluctuates. If real-time traffic data are integrated into the system, routes can be adjusted in real time to avoid traffic and increase the overall efficiency of the route while minimizing the amount of travel time required.

If the system is expanded to include machine learning algorithms that analyze past transportation data, it will allow for the determination of the most optimal route based on historical traffic patterns and transportation schedules. If the system is expanded to include the ability to optimize the fleet for multiple vehicles, logistics companies will be able to utilize larger fleets of vehicles more effectively.

If the system were expanded to include the ability to track carbon emissions, this would allow companies to reduce the negative impact of transportation on the environment more effectively. If the system is expanded into the form of a mobile app or cloud-based platform, this would allow for real-time optimization of routes for both the driver and logistics manager.

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## REFERENCES

[1] S. Hariharan et al., "Efficient and Dynamic Route Planning and Optimization System for Public Transportation," IRJET, 2020.
[2] V. K. Chaubey and H. Panchal, "Route Optimization and Cost Reduction Strategies in Logistics," IJNREFM, 2025.
[3] Y. Prajapat et al., "Route Optimization and Cost Reduction Strategies in Logistics at Delhivery," IJRAR, 2024.
[4] K. Boriboonsomsin et al., "Eco-Routing Navigation System Based on Real-Time Traffic Data," IEEE ITS, 2012.
[5] M. P. Fanti et al., "An Eco-Route Planner for Heavy Duty Vehicles," IEEE Automatica Sinica, 2021.
[6] E. Demir et al., "Green Road Freight Transportation," European Journal of Operational Research, 2014.
[7] V. Leggieri and M. Haouari, "Green Vehicle Routing Problem," Transportation Research Part E, 2017.
[8] Z. Zhang et al., "AI-driven Route Optimization for Sustainable Transportation," Transportation Research, 2019.