FedEx

FedEX SMART Hackathon

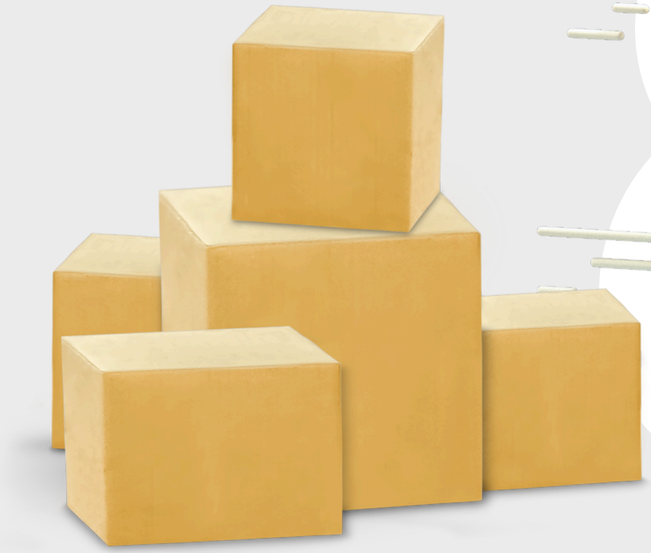
BLUESTAR

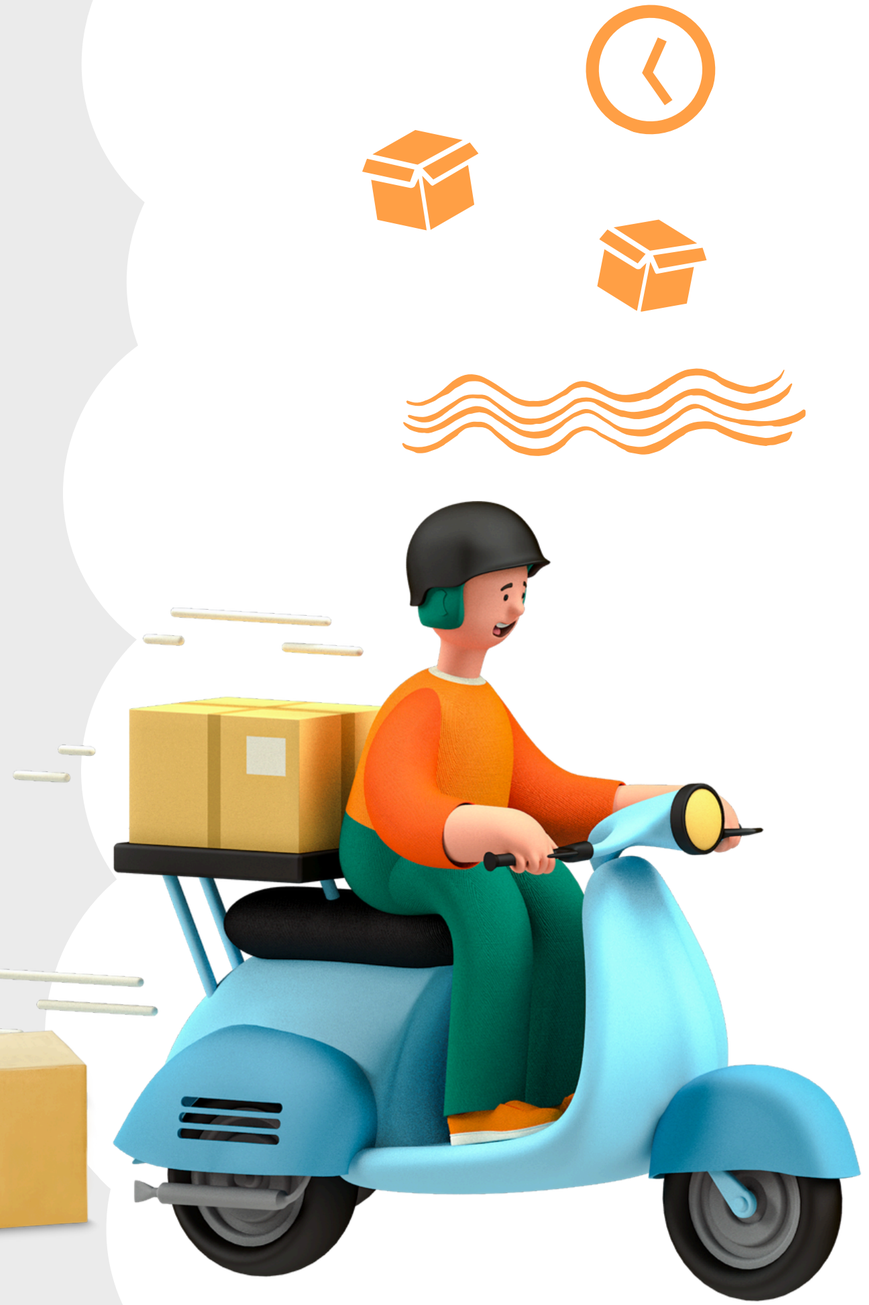
Dynamic Route Optimization and Emission Reduction System

TRY IT NOW

https://bluesense-route.streamlit.app

https://github.com/Thirumurugan-12/bluesense-route





Problem Statement

Optimizing vehicle routes to ensure timely deliveries while minimizing environmental impact is a significant challenge. Traffic congestion, weather conditions, and inefficient planning can lead to delays and increased fuel consumption. A system is needed to adapt routes in real-time, factoring in traffic, weather, and vehicle details to enhance efficiency and reduce carbon emissions.

Key Points:

- **Traffic congestion and delays increase fuel consumption and operational costs.**
- **Weather conditions can lead to unpredictable delays and inefficiencies.**
- **Inefficient routing results in higher emissions, contributing to environmental damage.**
- **There's a need for a real-time routing system that optimizes for speed, fuel efficiency, and lower carbon emissions.**

Solution

Our dynamic routing system offers a powerful tool that integrates real-time data on traffic, weather, and vehicle conditions to generate the most optimal routes for FedEx deliveries. The system is designed to consider multiple waypoints for multi-destination deliveries, ensuring that vehicles travel the shortest possible routes while avoiding traffic jams and weather disturbances. This solution doesn't just reduce delivery times but also minimizes the emissions generated by each vehicle, helping FedEx in its sustainability efforts.

Key Objectives:

- Real-time optimization of vehicle routes based on traffic and weather data.
- Estimation and reduction of vehicle emissions for each route.
- Waypoint optimization for multi-stop deliveries.
- User-friendly interface for seamless interaction.

Emission Optimization

fuel vehicles

- For fuel-powered vehicles, we use emission factors (kg CO_2 per liter of fuel).

Emissions (kg CO_2)=
Distance (km)×(100Fuel Consumption (L/100 km) ×Emission Factor (kg CO_2/L)

electric

- For electric vehicles, emissions are based on the carbon intensity of the electricity grid in the region.

Emissions (kg CO_2)=
Distance (km)×(100Electricity Consumption (kWh/100 km))×Grid Emission Factor (kg CO_2/kWh)

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SYSTEM FEATURES

Our solution offers a range of innovative features aimed at delivering efficiency, accuracy, and sustainability:

- **Real-time Traffic Integration:** Using the TomTom API and Azure Maps API, our system tracks real-time traffic data to avoid congestion and roadblocks.
- **Weather Awareness:** Through the AQICN API, the system monitors meteorological conditions, helping vehicles avoid severe weather, flooding, or poor air quality zones.
- **Route Optimization with Waypoints:** Powered by OSRM and Azure Maps, the system dynamically calculates the shortest, most efficient route for multiple destinations, reducing both travel time and fuel consumption.
- **Vehicle Emission Calculation:** The system includes a custom emissions model that factors in the vehicle type, fuel type, and real-time traffic conditions, allowing FedEx to choose routes with the lowest environmental impact.
- **User Input Interface:** The system accepts vehicle-specific data (engine type, fuel efficiency) and multiple destinations, providing a smooth, intuitive user experience.

TECH STACK

Key Technologies and APIs Used:

TomTom API: Provides real-time traffic data to optimize routes and avoid delays.
AQICN API: Supplies weather and air quality data to improve routing decisions in adverse conditions.
OSRM (Open Source Routing Machine): Facilitates route generation and efficient waypoint navigation.
Azure Maps API: Powers real-time route planning and traffic data for precise, dynamic route adjustments.
Python: Forms the backend engine to process API data, optimize routes, and calculate emissions.
Streamlit: Frontend

User Workflow

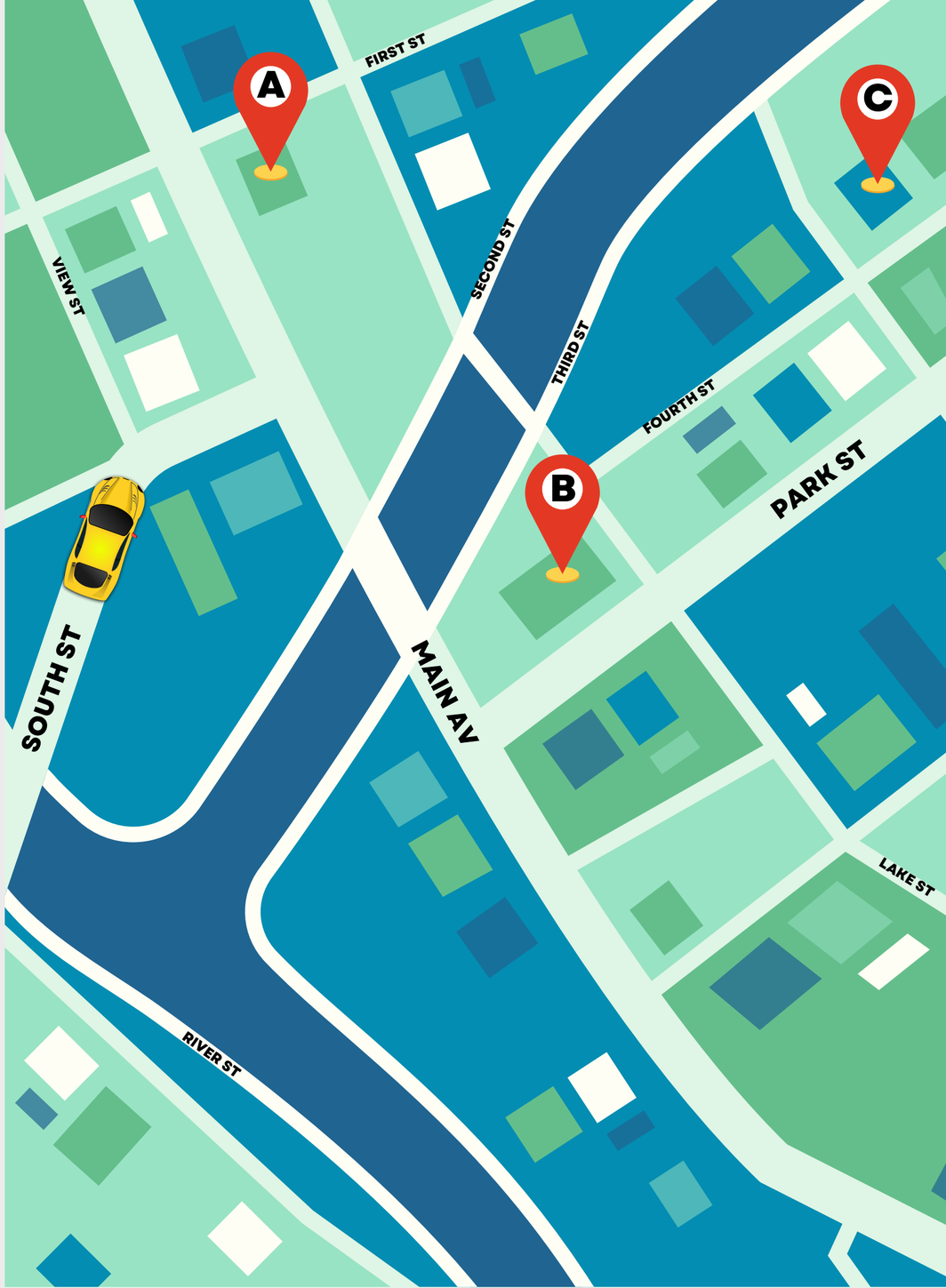
- **Vehicle and Destination Input:** Users input vehicle-specific information (engine type, fuel consumption) and the delivery destinations, which can include multiple waypoints.

- **Real-time Data Integration:** The system collects real-time traffic and weather data from various APIs, considering the current conditions along the potential routes.

- **Optimized Route Generation:** Using the OSRM and Azure Maps APIs, the system calculates the most efficient routes, including waypoints, while factoring in real-time conditions.

- **Emission Estimation:** The system then estimates emissions for each route option, allowing users to weigh route efficiency against environmental impact.

- **Route Selection:** The user is presented with multiple route options, including details on travel time, fuel consumption, and emissions. Based on this data, the user can select the most suitable route.



Thank you