Web API Mucar: A Solver for Optimal Multimodal Transportation Itineraries

Project Overview

The Web API Mucar project develops a solution for organizing dynamic transportation services across fragmented networks in the Franche-Comté region of France. It addresses territories such as PMA with EVOLITY, TADy, TER, and Karos, as well as Belfort-Montbéliard which includes Optymo, TER Alsace, LongLine SNCF, TGV, and Bale-Mulhouse airport. Our team, composed of HAMAILI Ahmed-Imad, MOURCELY Julien, MONNIER David, and ABIONA Boluwatife, has created a modular architecture integrating data visualization, API services, and database management to provide optimal multimodal itinerary calculations.

Technical Architecture

Data Visualization Module

The Python-based visualization component uses Folium, OSMnx, and NetworkX to create interactive maps displaying transportation data from SNCF API, OpenStreetMap, and CSV files. The Script.py implements algorithms for normalizing text, processing railway information, and creating interactive map elements with features including:

- Dynamic display of transportation networks with color-coded routes
- Interactive popups with detailed station and route information
- Real-time departure information and geographical filtering
- Caching mechanisms for optimized performance

Transit API

Built with Node.js and Express, the Transit API provides backend services with: - JWT authentication for secure access - CRUD operations for locations, modes, lines, and stops - Swagger documentation and MySQL database integration - Role-based access control for administrative functions

The API follows a modular architecture with separate route handlers, authentication middleware, and a structured database schema for scalability and maintainability.

Vue.js Web Application

The Vue.js frontend offers an intuitive interface with components for: - User authentication and session management - Listing and detailed views for transportation entities - Responsive navigation and data management - State management via Vuex for asynchronous operations

Integration and Workflow

The three components work together cohesively: 1. The Transit API serves as the central data hub with authenticated database access 2. The Vue.js application provides user interface for browsing and managing transportation data 3. The Python visualization module generates interactive maps for route visualization

This integration enables optimal multimodal itinerary calculations based on various data sources including CSV/JSON/GPX data from data.gouv.fr, student and calendar information, origin-destination matrices, and OpenStreetMap geographical data.

Future Perspectives

The Web API Mucar project continues active development as our team enhances its capabilities. Current work focuses on implementing advanced optimization algorithms, integrating additional transportation providers, and developing mobile applications. We're exploring machine learning for transportation demand prediction and real-time tracking features. By addressing fragmented transportation networks, our project contributes to more efficient, accessible, and sustainable mobility solutions across diverse territories.

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