Standard operating procedure project: WattWay

Documentation for WattWay Project

Introduction

1. Project Overview
WattWay is a pioneering software application specifically designed to address the challenges faced by electric vehicle (EV) users in optimizing their travel and charging requirements. The core objective of the project is to provide a reliable, user-friendly platform that enables users to identify charging stations, plan optimal routes, and manage their journey efficiently, all while leveraging advanced geospatial technology and user-centered design principles. WattWay embodies the principles of open collaboration, enabling innovation and improvement through community contributions while maintaining adherence to non-commercial licensing restrictions.

2. Target Audience
The intended beneficiaries of the WattWay project encompass a diverse range of stakeholders, including but not limited to:

1. **Electric Vehicle Owners and Operators**: Individuals seeking an efficient and accessible solution for locating charging infrastructure, planning routes, and optimizing battery usage during travel.
2. **Developers and Technologists**: Members of the developer community interested in contributing to or enhancing the application, provided that all contributions and subsequent usage remain aligned with the non-commercial and attribution requirements as specified under the applicable licensing terms.
3. **Environmental Advocates and Researchers**: Individuals or organizations aiming to leverage the platform as a model for sustainable transportation and geospatial innovation.

3. Key Features
WattWay integrates a robust suite of functionalities designed to facilitate seamless navigation, efficient planning, and enhanced user experience. The key features of the application include:

1. **Interactive Route Planning**: Users can input their starting point, destination, waypoints and charging stops to generate optimized routes tailored to their specific requirements.
2. **Dynamic Charging Station Management**: Real-time identification and integration of charging points along the planned route, with the ability to manually add or modify waypoints.

3. **Geospatial Visualization**: High-quality mapping and visualization capabilities powered by advanced GIS technology, ensuring accuracy and ease of use.
4. **Customizable User Interface**: Adaptable dashboard and features allowing users to tailor the application to their unique preferences, all within the bounds of the project's open-source ethos.

2. Getting Started

Prerequisites

To successfully set up and run the WattWay application, the following software and tools are required:

1. **Node.js and npm**: A JavaScript runtime environment and its package manager, necessary for backend development and package management. Ensure you have the latest stable versions installed.
2. **Axios**: A promise-based HTTP client for making API requests.
3. **CORS**: Middleware to enable cross-origin resource sharing for secure API communication.
4. **Leaflet.js**: A JavaScript library for interactive maps.
5. **Git**: A version control system to clone and manage the project repository.
6. **Any modern web browser**: For testing and visualizing the application's frontend.
7. **Code editor**: Such as Visual Studio Code or any preferred IDE.

Installation Instructions

For Windows:

1. **Install Node.js and npm**:
   - Download the Node.js installer for Windows from Node.js official website.
   - Run the installer and follow the instructions. Ensure the option to install npm is selected.
   - Verify the installation:

```
node -v

npm -v
```

2. **Clone the repository**:
   - Open a terminal and run:

```
git clone https://github.com/HKA-OSGIS/WattWay.git

cd WattWay
```

3. **Install dependencies**:
   - Run the following command in the project directory:

```
npm install
```

4. **Run the application**:
   - Start the development server:

```
npm start
```

   - Open your browser and navigate to http://localhost:3000.

For Linux:

1. **Install Node.js and npm**:
   - Update the package list:

```
sudo apt update
```

   - Install Node.js and npm:

```
sudo apt install nodejs npm
```

   - Verify the installation:

```
node -v
npm -v
```

2. **Clone the repository**:
   - Open a terminal and run:

```
git clone https://github.com/HKA-OSGIS/WattWay.git
cd WattWay
```

3. **Install dependencies**:
   - Run the following command in the project directory:

```
npm install
```

4. **Run the application**:
   - Start the development server:

```
npm start
```

   - Open your browser and navigate to http://localhost:3000.

For macOS:

1. **Install Node.js and npm**:
   - Download the Node.js installer for macOS from Node.js official website.
   - Run the installer and follow the instructions.
   - Verify the installation:

```
node -v
npm -v
```

2. **Clone the repository**:
   - Open a terminal and run:
   ```
   git clone https://github.com/HKA-OSGIS/WattWay.git
   cd WattWay
   ```
3. **Install dependencies**:
   - Run the following command in the project directory:
   ```
   npm install
   ```
4. **Run the application**:
   - Start the development server:
   ```
   npm start
   ```
   - Open your browser and navigate to `http://localhost:3000`.

Application Architecture

1. Technical Stack

WattWay utilizes a robust technical stack comprising:

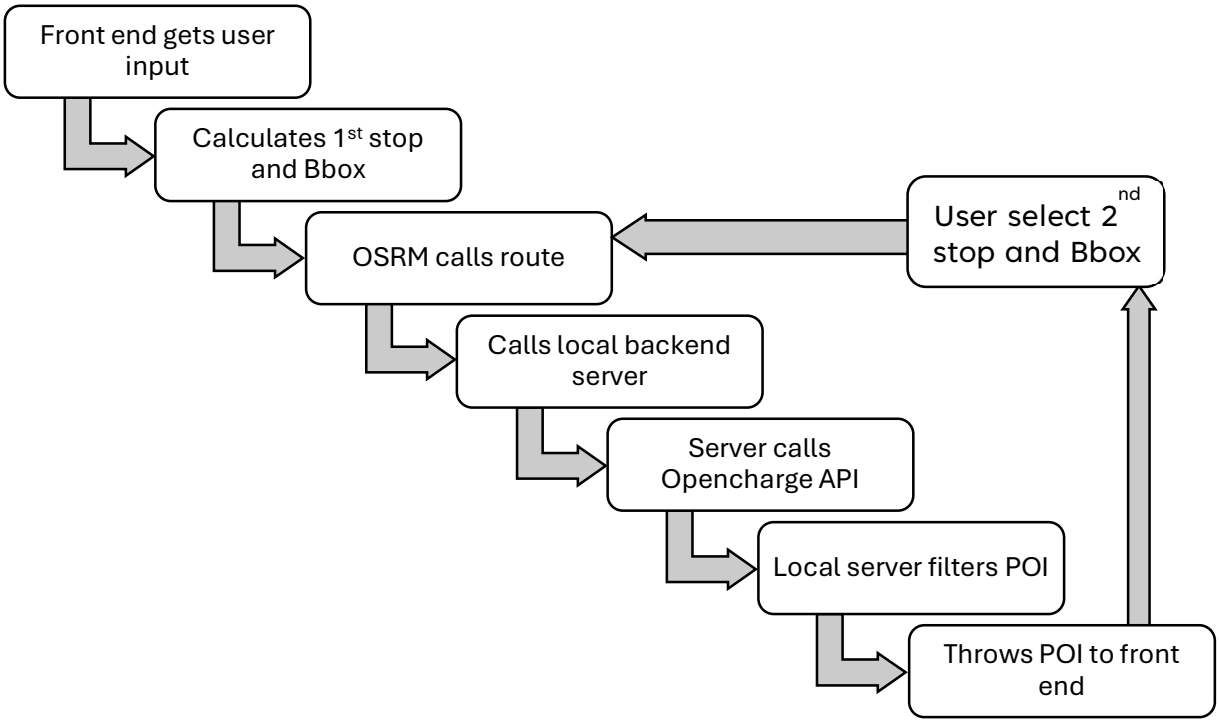
- **Node.js**: The runtime environment for building the server-side application.
- **Express:** A lightweight framework for creating the server and handling routes.
- **Axios**: A promise-based HTTP client used for interacting with external APIs.
- **CORS**: Middleware that enables secure cross-origin requests.

2. API Integrations

WattWay integrates with the following external APIs:

- **Open Charge Map API:** Provides real-time data on charging station locations and availability.
- **OSRM (Open Source Routing Machine):** Facilitates advanced route optimization and driving directions tailored to EV needs.
- **Nominatim API:** A geocoding service for converting addresses into geographic coordinates and vice versa.

3. Data Flow Diagram



Usage Guide

1. User Interface Overview

The WattWay application boasts a clean and intuitive interface with the following key components:

- **Interactive Map:** Displays real-time charging station locations and optimized routes.
- **Input Fields:** Fields to input the starting point, destination, waypoints, current battery, EV mileage, battery capacity and connection type for route planning.
- **Control popup:** Options for adding charging points and modifying routes dynamically.

2. How to Plan a Trip

Follow these steps to efficiently plan your EV trip using WattWay:

1. **Enter Start and End Points**: Use the input fields to specify your journey's starting point and destination.

2. **Add Charging Points (if needed):** Based on your EV's battery constraints, add charging stations along the route along with break time.
3. **Optimize Route:** Clicking on the Add as Waypoint button on charging point popup to generate the most efficient path.
4. **Review the Map:** Verify the suggested route and adjust waypoints as necessary.
5. **Begin Your Trip:** Use the finalized route for your journey.

3. Example Scenarios

Here are some typical use cases for WattWay:

- **City-to-City Travel**: Planning a journey from Karlsruhe to Stuttgart with intermediate charging stops.
- **Long-Distance Trips:** Optimizing routes for extended travel while ensuring adequate battery management, e.g. Karlsruhe to Berlin.
- **Custom Waypoints**: Adding specific locations to your route, such as scenic spots or rest areas, while keeping charging needs in check.

Troubleshooting

Common Issues and Solutions

1. **Issue**: Application fails to start.
   - **Cause**: Missing dependencies or incorrect Node.js version.
   - **Solution**: Ensure that Node.js (version 16.0 or higher) and npm are correctly installed. Reinstall dependencies using:

     ```
     npm install
     ```

2. **Issue**: API requests fail or return empty data.
   - **Cause**: Failed to add your own API key to server.js file, Network connectivity issues or API endpoint changes.
   - **Solution**: Generetae your API key from open charge map https://openchargemap.org/site/profile/appedit and add to server.js file, Check your internet connection and ensure the external APIs are accessible. Verify the API keys and endpoint URLs in the source code.

3. **Issue**: Map or route rendering issues.
   - **Cause**: Outdated browser or JavaScript errors.
   - **Solution**: Update your browser to the latest version and check the console for errors. Debug JavaScript issues if necessary.

4. **Issue**: Charging station data not displaying.
   - **Cause**: Incorrect API key or data fetch failure.
   - **Solution**: Verify the Open Charge Map API key and test the API independently.

FAQs

1. **What is WattWay's primary purpose?**
   WattWay is designed to optimize route planning for electric vehicle users by providing real-time data on charging stations and battery management tools.

2. **Can I use WattWay offline?**
   No, WattWay requires an active internet connection to fetch real-time data and perform route optimization.

3. **Is the application open source?**
   Yes, WattWay is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, allowing users to modify and redistribute the software with proper attribution and under the same terms.

4. **What should I do if the application crashes?**
   Check the server logs for error messages and ensure all dependencies are installed correctly. Restart the application by running:
   ```
   node server.js
   ```

5. **How can I contribute to WattWay?**
   Contributions are welcome! Please fork the repository on GitHub, make your changes, and submit a pull request. Ensure your changes align with the project's goals and coding standards.

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