

# Tutorial: Using EVRPGen for Generating Electric Vehicle Routing Problem Instances

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## 1 Introduction

Electric Vehicle Routing Problems (EVRPs) have become increasingly relevant due to the rise of electric vehicles in logistics. Traditional vehicle routing problem datasets often lack realistic road network details, such as junctions and road types. To address this limitation, we introduce EVRPGen, a web-based application for generating realistic problem instances based on OpenStreetMap (OSM) data.

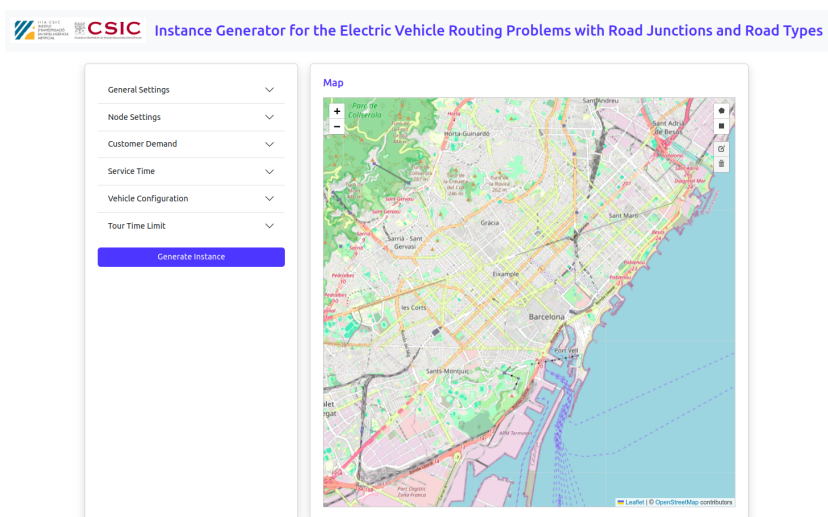


Figure 1: Vehicle Configuration Panel

This tutorial provides a step-by-step guide on how to use EVRPGen to define a geographic area, configure problem parameters, and generate instances that can be used for research and experimentation.

## 2 System Overview

EVRPGen consists of:

- A React-based frontend for user interaction.
- A Flask-based backend for instance generation.
- A RESTful API that connects the frontend and backend.
- Integration with OpenStreetMap (OSM) for extracting real-world road network data.

## 3 Getting Started

To use the EVRPGen web application, follow these steps:

### 3.1 Step 1: Accessing the Web Application

Visit the following link to access the web application:

<https://github.com/manilakbay/InstanceGenerator>

Ensure that you have a modern web browser (Google Chrome, Mozilla Firefox, or Microsoft Edge) for the best experience.

### 3.2 Step 2: Selecting the Area

Users can define the area for instance generation using either:

- **Address Input:** Enter a city or location (e.g., **Barcelona, Spain**).
- **Geographic Coordinates:** Manually enter a bounding box or polygon.

This selection will determine the road network data used in the instance.

### 3.3 Step 3: Configuring Instance Parameters

The configuration panel allows users to define several key parameters:

1. **Number of Nodes:** Specify the number of depots, customers, and charging stations.
2. **Demand and Service Time:** Choose between default, constant, or random values.
3. **Vehicle Settings:** Define battery capacity, load capacity, and charging rates.
4. **Road Network Settings:** Select whether to simplify road connections.

Figures 2 to 3 illustrate these settings.

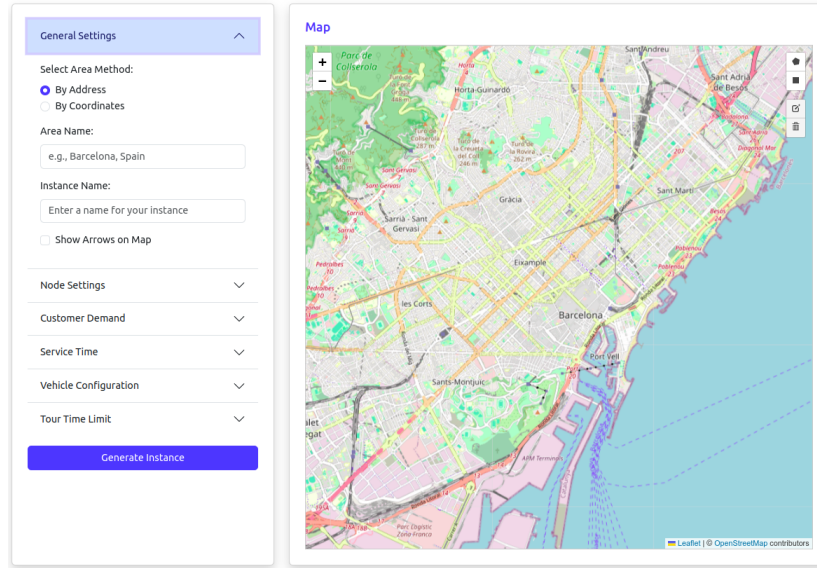


Figure 2: General Settings Panel

### 3.4 Step 4: Generating an Instance

After configuring all parameters, click the **Generate Instance** button. The application will process the request and generate an EVRP instance.

Once the instance is ready, the following outputs will be available:

- A downloadable text file with the dataset.
- A summary of instance statistics.
- An interactive map visualization.

### 3.5 Step 5: Downloading and Using the Instance

Users can download the generated instance in a structured text format for further processing. The instance file contains:

- Node information (depots, customers, charging stations, road junctions).
- Road attributes (length, type, speed limit).
- Vehicle parameters and demand values.

### 3.6 Step 6: Exploring the Interactive Map

The web application provides an interactive map where users can inspect the generated instance. The map allows zooming, panning, and clicking on nodes to view detailed information.

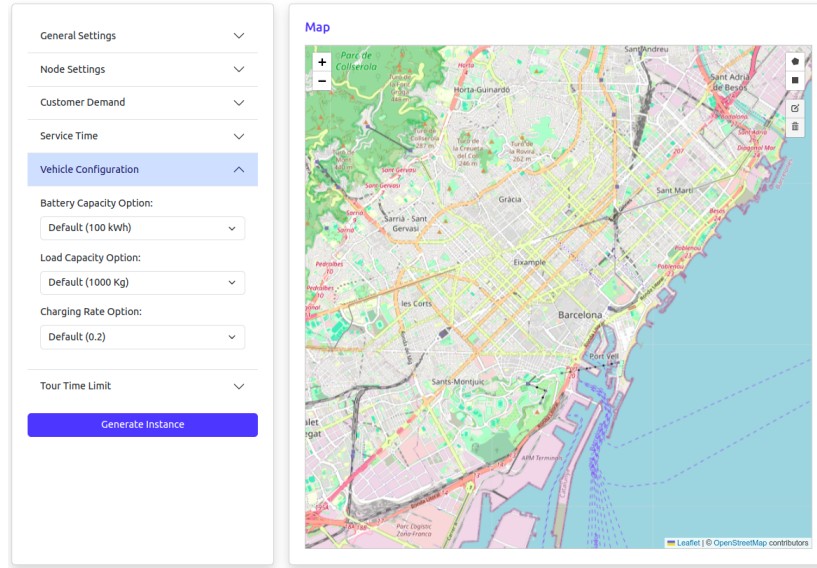


Figure 3: Vehicle Configuration Panel

## 4 Additional Features

### 4.1 Customizing Road Network Attributes

Users can toggle between different road network simplification options, which impact the connectivity and computational complexity of generated instances.

### 4.2 Visualization and Summary Statistics

The tool provides graphical summaries, including:

- A breakdown of node types (depots, customers, charging stations).
- Road type distribution (highways, residential streets, etc.).
- Energy consumption and estimated charging requirements.

## 5 Conclusion

This tutorial has provided a comprehensive guide on how to use EVRPGen for generating realistic Electric Vehicle Routing Problem instances. By leveraging OpenStreetMap data and customizable configurations, users can create benchmark datasets that better reflect real-world logistics challenges.

For further assistance or to contribute to the project, visit:

<https://github.com/manilakbay/InstanceGenerator>

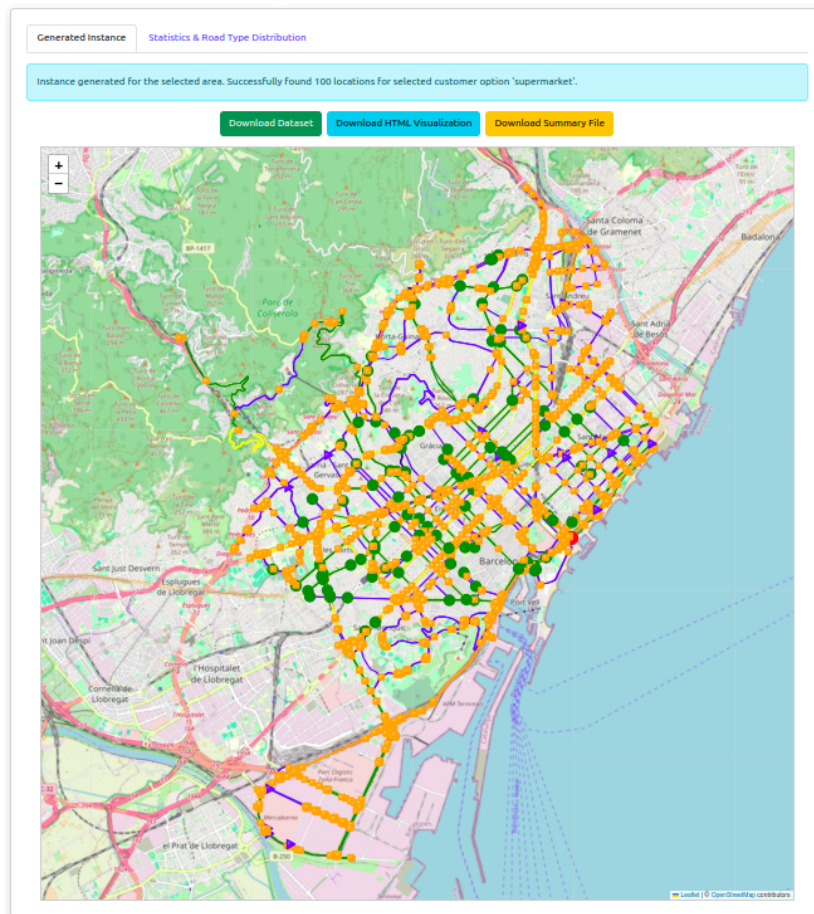


Figure 4: Generated EVRP Instance Output