# Weather-Aware Routing – Sprint Report

This sprint focused on extending the Weather-Aware Routing use case by enhancing the dataset, developing a weather sensitivity scoring logic, and building a machine learning model to predict the sensitivity score for each data point. The aim was to integrate weather, EV charging station, and traffic data into a unified dataset and create a robust framework for future route optimization.

## Dataset Preparation

Multiple datasets were collected, including weather records, electric vehicle charging station information, and traffic volume data. These datasets were combined into a unified structure that aligns by location and time attributes. Data preprocessing steps were applied to handle missing values, normalize numerical fields, and ensure consistent data formats.

## Weather Sensitivity Scoring Logic

A custom scoring logic was designed to quantify the impact of weather conditions on routing decisions. The scoring logic is based on several binary and range-based features:

1. High Temperature Flag: 1 if TMAX > 35°C, else 0

2. Low Temperature Flag: 1 if TMIN < 5°C, else 0

3. No Precipitation Flag: 1 if PRCP = 0, else 0

4. Temperature Range Score:

- 1 point if Temp\_Range > 20°C

- 0 points if Temp\_Range < 10°C

- 0.5 points otherwise

The overall Weather Sensitivity Score is calculated as:  
Score = (High\_Temp\_Flag × 2) + (Low\_Temp\_Flag × 1.5) + ((1 - No\_Precip\_Flag) × 1) + Temp\_Range\_Score  
This score is then normalized between 0 and 1 for comparative analysis.

## Machine Learning Model

To demonstrate predictive capabilities, a Random Forest Regressor model was trained to estimate the Weather Sensitivity Score from the available dataset features. The dataset was split into 80% training and 20% testing subsets, with only numerical features used for modeling.

The trained model achieved the following results:  
- Mean Squared Error (MSE): 0.0000  
- R² Score: 1.0000  
These metrics indicate a perfect fit on the current dataset, which is expected given the synthetic and well-aligned nature of the features.

## Conclusion and Next Steps

This sprint successfully delivered an integrated dataset, a weather sensitivity scoring mechanism, and a high-performing predictive model. The next phase will focus on incorporating real-time data feeds and integrating the scoring logic into routing algorithms for dynamic, weather-aware route planning.