Electric Vehicle Simulator

Review

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1. Project description
The general concept is to create an application that reads fossil fuel car data, analyzes it and gives estimation of how much money would have been saved by using electric vehicle. In addition, the app would constantly indicate the nearest car-battery loading stations.

   The main goal of the project is to create an application that simulates the ownership of Electric Vehicle.

To achieve this goal, following sub-goals must be reached:

1. To create fuel consumption estimator based on the data of smart phone’s sensors.
2. To create a functionality of showing the nearest car-battery loading stations.

2. Status of the project
Initial idea has been defined.

3. Revenue Potential
The application enables fossil fuel car owners to analyze how EV would fit to their everyday life. Thus, the main monetary effect comes from accelerating the sales of EV solutions. Currently, no estimation has been given for that potential. The project is an enabler of achieving the general EE target for E-Mobility (1 MEUR of variable profit by 2023).

4. Technological challenge
The PoC would focus on the first sub-goal: to create a fuel consumption estimator based on the data of smart phone’s sensors. The second sub-goal (indicating static loading stations based on smart phone’s geolocation) is a standard development challenge.

The first challenge of consumption estimation is to gather the consumption data about different vehicles. This can be done either by generating own dataset or by using existing datasets like Fueleconomy.com. When we consider the scope of the project, only second option (using available datasets or models) would be feasible. That said, the quality and actuality of available data is currently unknown.

The second challenge is to create the integrations and pipelines necessary to access smart phone’s sensor data. The sensors available on smartphone’s vary but it is safe to expect that GPS data (speed, acceleration and scope) is available. Academic research\(^1\) has shown that if only smart phone’s GPS data is used, it is possible to achieve 10-15% error rate on consumption estimate.

The third challenge is to create a consumption model that takes the features of the vehicle and sensor data as an input and estimates the instantaneous consumption.

The fourth challenge is to validate model’s output. To tackle this challenge, a testbed of cars with OBD (On-Board-Diagnostics) functionality needs to be created. The information on real instantaneous fuel consumption

\(^1\)https://www.researchgate.net/publication/282572193_A_co-operative_methodology_to_estimate_car_fuel_consumption_by_using_smartphone_sensors
is acquired from vehicles engine through OBD interface. This ground-truth data can be then compared with model’s output to validate the accuracy of the model.

4.1. Available technologies

4.1.1. Developer tools

Fueleconomy API – An API on top on top of fueleconomy.gov fuel efficiency data. A Tool to get latest fuel economy data for any car on the U.S. market in clean JSON format.

Fuel efficiency analysis – an example of simplistic fuel efficiency analysis in R.

NB: the initial desktop research doesn’t reveal good libraries or tools to tackle the challenge. Thus, the algorithmical complexity is expected to be high.

4.1.2. Existing applications

Fuelio and Drivvo are two examples of mobile applications with the functionality of estimating fuel consumption. The initial introduction doesn’t reveal the decent support for developing own applications on top of them.

5. Proposed roadmap

The technological complexity of the project is very high. Thus, it is our suggestion to first try existing solutions to solve the problem.

If the PoC would be developed from the scratch, the following tasks would need to be carried out:

<table>
<thead>
<tr>
<th>Nr</th>
<th>TASK</th>
<th>GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Gathering the fuel consumption data</td>
<td>The relevant and actual fuel consumption data has been gathered.</td>
</tr>
<tr>
<td>1.2</td>
<td>Integrations to smart-phone sensors data</td>
<td>The solution for retrieving smart phone’s sensor data has been developed.</td>
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<tr>
<td>1.2</td>
<td>Consumption model development</td>
<td>The consumption model is able to take features of the vehicle and sensor data as an input and estimates the instantaneous consumption.</td>
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<tr>
<td>1.4</td>
<td>PoC validation</td>
<td>Model’s output has been validated on the testbed of cars with On-Board-Diagnostics capabilities.</td>
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<td>1.5</td>
<td>Decision of future development</td>
<td>Based on the validation results, the decision has been made of whether to develop the solution for production environment.</td>
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