Automated Report Generation Solution for Analysis of Worldwide Fuel Cell Vehicle Fleet

Presented By: Taylor Roche
Outline

- Fleet Status
- Data Acquisition Infrastructure
- MathWorks Products Used

- Web Based Solution
- Sample Analyses
- Conclusion
World Wide Fleet Description
### Specifications F-Cell:

<table>
<thead>
<tr>
<th>Category</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle type</td>
<td>Mercedes-Benz A-Class (extended version)</td>
</tr>
<tr>
<td>Fuel cell system</td>
<td>PEM - 72 kW</td>
</tr>
<tr>
<td>Drive</td>
<td>Electric motor</td>
</tr>
<tr>
<td></td>
<td>Power (Continuous / Peak): 45 kW / 65 kW</td>
</tr>
<tr>
<td></td>
<td>Max. torque: 210 Nm</td>
</tr>
<tr>
<td>Fuel</td>
<td>Compressed Hydrogen (350 bar)</td>
</tr>
<tr>
<td>Battery</td>
<td>NiMh, Power (Continuous / Peak): 15 kW / 20 kW; Capacity: 1.2 kWh</td>
</tr>
<tr>
<td>Max. Speed</td>
<td>140 km/h</td>
</tr>
<tr>
<td>Range</td>
<td>177 km</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>3.6 Liter / 100km (Diesel equivalent, NEDC)</td>
</tr>
<tr>
<td>CO₂ -Emissions</td>
<td>0 g/km TTW (0 … 100 g/km WTW)</td>
</tr>
<tr>
<td>Fleet Partners</td>
<td>Government Agencies</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>Bay Area AirQuality Management District</td>
</tr>
<tr>
<td></td>
<td>California Air Resources Board</td>
</tr>
<tr>
<td></td>
<td>California Department of Transportation</td>
</tr>
<tr>
<td></td>
<td>California Department of General Services</td>
</tr>
<tr>
<td></td>
<td>South Coast Air Quality Management District</td>
</tr>
</tbody>
</table>
Data Acquisition Infrastructure

LFS site #1

Vehicle with Data Recorder

WLAN

Firewall

LFS

VPN Device

DSL Modem

Internet

Firewall

VPN Endpoint

Backend Servers

Central Site

LFS site #n

Vehicle with Data Recorder

WLAN

Firewall

LFS
Traditional Analysis Methods

- Group A
  - Software A
    - Analysis A
  - Software B
    - Analysis B

- Group B
  - Software A
    - Analysis A
  - Software C
    - Analysis C
Web Based Solution
MathWorks Tools

- Statistics Toolbox
- Mapping Toolbox
- MATLAB® Report Generator
- Database Toolbox
## Matlab Report Generation

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESRI Mapt Demo</td>
<td>Plots the drive route of the vehicle for a given MDF data file (by extracting the GPS data of the drive route) upon map data using Matlab Mapping Toolbox (note: the example uses Northern California maps).</td>
</tr>
<tr>
<td>Load Save Data Demo</td>
<td>Sample report demonstrating loading and saving Matlab data from a report. The report is delivered in TXT format.</td>
</tr>
<tr>
<td>Location Report in PDF format</td>
<td>Location Report in PDF format.</td>
</tr>
<tr>
<td>Locations Report HTML</td>
<td>Location Report in HTML format.</td>
</tr>
<tr>
<td>Mileage By Region</td>
<td>Mileage By Region.</td>
</tr>
<tr>
<td>Output Format Demo HTML</td>
<td>Sample report demonstrating output in HTML format using the Matlab Report Generator.</td>
</tr>
<tr>
<td>Output Format Demo PDF</td>
<td>Sample report demonstrating output in PDF format using the Matlab Report Generator.</td>
</tr>
<tr>
<td>Output Format Demo RTF</td>
<td>Sample report demonstrating output in RTF format using the Matlab Report Generator.</td>
</tr>
<tr>
<td>Output Format Demo TXT</td>
<td>Sample report demonstrating output in TXT format.</td>
</tr>
<tr>
<td>Output Format Demo XML</td>
<td>Sample report demonstrating output in XML format.</td>
</tr>
</tbody>
</table>

[Next](#)
Web Based Solution
Web Based Solution

Chapter 1. First Chapter

Dear Sir or Madam,

I refer to the file named "specific.d". If you need further information, please contact me.

Yours sincerely,

[Signature]

Date: [DD-MM-YYYY]

Table 1.1: Test Table

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne Smith</td>
<td>34</td>
<td>Engineer</td>
</tr>
<tr>
<td>John Doe</td>
<td>56</td>
<td>Salesman</td>
</tr>
<tr>
<td>Jane Roe</td>
<td>23</td>
<td>Student</td>
</tr>
</tbody>
</table>

1.1. 1st Section in Chapter 1

This is the figure caption.

![Figure 1.1](image.png)

Figure 1.1. This is the title for the MATLAB-generated figure.
Implementation Results

- Standardized Analyses
- Common Toolset Between Groups
- Enabling Both Internal and External Customers to perform analyses
- More Analysis, Less Toolkit Development

Productivity

Efficiency
Sample Analyses

Untangling data to provide insight and guidance.
Regional Mileage Analysis
Fuel Consumption Analysis

Fuel Consumption Analysis

- Start
- End
- Local Roads
Spatial Histogram Analysis
Pedal Position Analysis

Pedal Position History for 2 Vehicles

Percent of Time of Drive Cycle [%]

Pedal Position [%]

Vehicle 1 vs. Vehicle 2
Google Earth Integration
Looking Forward
Computational Challenges

- Increasingly Sophisticated Analyses
- Minimize Computation Time
- Large Datasets and Memory Constraints
- Automating Archive Tasks
Looking Forward

Fleet Technology

- Technology Benchmarking
- Analysis of current fleet operations guide the design parameters for the next generation vehicle
- Customer usage patterns and expectations
- Geographic and Climatic
Looking Forward

Fleet Customers

- Preparation for next fleet
- Hydrogen Infrastructure
- How many drivers per vehicle?
- Who makes a “good” customer?
- Contract working points
  - Required Mileage
  - Hydrogen Station Access
Thank You!

Questions?

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DaimlerChrysler REDNA, Inc.
Taylor.Roche@daimlerchrysler.com