Overview on tools for data gathering and analysis in FOTs

Berlin, 25\textsuperscript{th} April 2013

Adrian Zlocki, ika, zlocki@ika.rwth-aachen.de
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30 – 10:00</td>
<td>Coffee and registration</td>
<td></td>
</tr>
<tr>
<td>10:00 – 10:10</td>
<td>Introduction</td>
<td>Adrian Zlocki (IKA)</td>
</tr>
<tr>
<td>10:10 – 10:30</td>
<td>Overview on tools for data gathering and analysis in FOTs</td>
<td>Adrian Zlocki (IKA)</td>
</tr>
<tr>
<td>10:30 – 11:40</td>
<td>Tools for data gathering in different FOTS (15 min each)</td>
<td>Moderator: Yvonne Barnard</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ERTICO)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speakers:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mohamed Benmimoun (IKA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>James Lenard (Loughborough University)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Horst Rechner (FOKUS)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fabian Utesch (DLR)</td>
</tr>
<tr>
<td>11:40 – 12:00</td>
<td>Coffee break</td>
<td></td>
</tr>
<tr>
<td>12:00 – 12:30</td>
<td>Tools used in experimental design and test execution</td>
<td>Oliver Sawade (FOKUS)</td>
</tr>
</tbody>
</table>
FOTNET WP5 (TOOLS FOR FOTS) – OBJECTIVES

The objective of WP5 in the FOTNET project is to analyze the tools utilized in existing FOTs and to make an inventory of these tools.

- The tool chain will consider all steps of the FOT starting from data acquisition systems, database structure, data management and analysis.
- As far as possible the experience of the FOT parties which utilized the corresponding tools will be collected and considered in the inventory.
- The suitability of a specific tool for a specific type of FOT will be treated in the inventory.
PROCESS

• Inventory List for FOT Tools
• Identification of responsible persons for different FOTs
• Data collection
• Contact with manufacturer
• Presentation of results (WIKI)
WP5 – STATUS AND MAIN RESULTS

- Tool collection in the following clusters:
  - Tools for CAN data acquisition
  - Tools for other data acquisition
  - Test planning tools
  - Test control tools
  - Test monitoring tools
  - Data base tools
  - Data analysis tools
  - (Data on driver behaviour (e.g. travel diaries etc.))
- Tool collection in Excel file
- Large European FOTs and NDSs included
- A total of 83 tools are online on the website so far
**DATA ACQUISITION SYSTEMS – TEMPLATE FOR CAN DATA**

- Information about:
  - Provider
  - Name
  - # of CAN channels
  - Memory
  - Filtering
  - Trigger
  - Diagnose
  - GPRS/GSM, GPS
  - WLAN
  - LAN

- Input
- Energy Save
- Consumption idle
- Consumption on
- Other inputs
- Other outputs
- Price
- Contact
- Casing
- Size
- Interfaces
- Audio
- Usage in FOT

<table>
<thead>
<tr>
<th>Provider</th>
<th>Name</th>
<th># of CAN channels</th>
<th>Memory</th>
<th>Filtering</th>
<th>Trigger</th>
<th>Diagnose</th>
<th>GPRS/GSM</th>
<th>GPS</th>
<th>WLAN</th>
<th>LAN</th>
<th>Input</th>
<th>Energy Save</th>
<th>Consumption idle</th>
<th>Consumption on</th>
<th>Other inputs</th>
<th>Other outputs</th>
<th>Price</th>
<th>Contact</th>
<th>Casing</th>
<th>Size</th>
<th>Interfaces</th>
<th>Audio</th>
<th>Usage in FOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTAG</td>
<td>Statlagr K</td>
<td>4</td>
<td>SDHC</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>9V-36V / 18-36V</td>
<td>yes</td>
<td>36mA</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>350mA</td>
<td>no</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMOS</td>
<td>HPC2 48S</td>
<td>6</td>
<td>CF</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td></td>
<td>no</td>
<td>250mA</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>2.500 €</td>
<td>link</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.700 €</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td></td>
<td>no</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIEM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>120 x 70 x 22 mm</td>
<td>no</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dreym. + Bruns</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td></td>
<td>no</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MHE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>1,050 €</td>
<td>link</td>
<td>no</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DATA ACQUISITION SYSTEMS - TEMPLATE FOR „OTHER“ DATA

- Information about:
  - Provider
  - Name
  - Type of recorded Data
  - Memory
  - Filtering
  - Trigger
  - Diagnose
  - GPRS/GSM, GPS
  - WLAN
  - LAN
  - Input
  - Energy Save
  - Consumption idle
  - Consumption on
  - Other inputs
  - Other outputs
  - Price
  - Contact
  - Casing
  - Size
  - Interfaces
  - Audio
  - Usage in FOT

WP5 - Tools for Data Acquisition

FOT-Net is a support action funded by the European Commission DG Information Society and Media under the Seventh Framework Programme for R&D
OVERVIEW ON TOOLS FOR DATA ACQUISITION

- CAN CASE XL LOG
- CANcorder MMC
- CANlog
- Datalogger II
- DLC-MUXDIAGII-C
- ePCII-LOG
- Exxotest USB-MUX-6C6L
- FMS-500
- GL1010
- GL3000
- imc busdaq2
- imc busdaqX
- imc busLOG
- imc C1
- Kvaser memorator Professional
- MAHTechS M5X-PRO Data logger
- Mcombox
- M-LOG
- M-TRAS
- Multilog
- Muxlog R
- MUXy fleet
- QIC minilog
- S-LOG
- UniCan
- UniCAN 2 Professional
- USB-CANlog datalogger
- USB-CANmodul2
- VBOX 3i
- VDL-1000
- VideoBox
- Vector GL-X000
OVERVIEW ON TOOLS FOR DATA ACQUISITION

- BLOM
- BroadBit data logger
- CAA
- CANGPS
- CCP
- Danew data logger
- DL1 data logger
- DRIVECO
- faceLAB
- ITS Testing Unit
- LATIS FSD
- MetaSat TVM 5.0

- Performance Box
- QIC-CAN-WLAN
- QICGPS
- Swedish LFOT1 Logger
- Telenavis data logger
- VoCAN
**WP5 - Tools for Data Analysis**

<table>
<thead>
<tr>
<th>Provider</th>
<th>Tool Name</th>
<th>Category</th>
<th>Purpose</th>
<th>Description</th>
<th>Type of Data Analysis</th>
<th>Input Data</th>
<th>Output Data</th>
<th>Limitations</th>
<th>Usage in Project</th>
<th>Graphical User Interface</th>
<th>Operating System/Platform</th>
<th>Work Mode</th>
<th>Open Source</th>
<th>Typical Users</th>
<th>Release Date</th>
<th>Year last updated</th>
<th>Contact Person</th>
</tr>
</thead>
</table>

- **Provider**: Institute for Transport Research (Fraunhofer FOKUS) - PELOPS (Program for the Development of Congested Traffic Processes in System Relevant Environment)
- **Category**: Simulation
- **Purpose**: Traffic Simulation
- **Description**: PELOPS is used for the evaluation of traffic and traffic information supported by the introduction of an extended signalization system. The simulation takes place in a three-dimensional space and integrates various parameter sets for different traffic scenarios. The simulation is based on a microscopic (cellular automata) approach and allows for the modeling of traffic processes such as congested traffic and traffic signs. The system can be extended by the setting of relevant traffic parameters.
- **Type of Data Analysis**: Impact Assessment, Hypothesis Testing
- **Input Data**: Traffic flow, traffic density, traffic speed, traffic volume, traffic capacity, traffic density, traffic speed, traffic volume, traffic capacity
- **Output Data**: Traffic flow, traffic density, traffic speed, traffic volume, traffic capacity
- **Limitations**: Longitudinal traffic only
- **Usage in Project**: Code
- **Graphical User Interface**: Yes
- **Operating System/Platform**: Linux offline
- **Work Mode**: Open Source
- **Open Source**: Yes
- **Typical Users**: Gerald Christen, christen@fka.de
- **Release Date**: 2011
- **Year last updated**: 2011
- **Contact Person**: Gerald Christen, christen@fka.de

**Additional Notes**

- **Output Data**: Traffic flow, traffic density, traffic speed, traffic volume, traffic capacity
- **Limitations**: Longitudinal traffic only
- **Usage in Project**: Code
- **Graphical User Interface**: Yes
- **Operating System/Platform**: Linux offline
- **Work Mode**: Open Source
- **Open Source**: Yes
- **Typical Users**: Gerald Christen, christen@fka.de
- **Release Date**: 2011
- **Year last updated**: 2011
- **Contact Person**: Gerald Christen, christen@fka.de
OVERVIEW ON TOOLS FOR DATA ANALYSIS

- PELOPS
- VSimRTI
- VSimRTI (V2X Simulation Runtime Infrastructure)
- VSimRTI_App_Native (V2X Application Simulator for native Applications)
- VSimRTI_App_OSGi (V2X Application Simulator for OSGi Applications)
- Agez (Integration of Communication Security into Advanced Simulation Environments)
- OMNeT++
- Jist/SWANS with extensions by Ulm University
- Sumo
- VISSIM
- PreScan
- CanOE
- Environmental Conditions Assessment (ECA)
EXAMPLE ON DATA ANALYSIS TOOLS

PELOPS

<table>
<thead>
<tr>
<th>Provider</th>
<th>Test Name</th>
<th>Category</th>
<th>Purpose</th>
<th>Type of Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haffa</td>
<td>PELOPS</td>
<td>Simulation</td>
<td>Traffic Simulation</td>
<td>Impact Assessment, Hypothesis Testing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input Data</th>
<th>Output Data</th>
<th>Limitations</th>
<th>Usage in FOT</th>
<th>GUI</th>
<th>Operating system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver Data, Vehicle Data, Environmental Data, Trajectories</td>
<td></td>
<td>No Intersecting Traffic</td>
<td>euroFOT, TeleFOT</td>
<td>Yes</td>
<td>Linux</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Mode</th>
<th>Open Source</th>
<th>Typical Users</th>
<th>Release Date</th>
<th>Last Update</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>offline</td>
<td>No</td>
<td>Engineering</td>
<td>1994</td>
<td>2011</td>
<td>Frederic Christen, <a href="mailto:chrslen@a.de">chrslen@a.de</a></td>
</tr>
</tbody>
</table>

Description:

PELOPS is used for the evaluation of traffic and infrastructure-supported traffic influences measures and driver assistance systems (ADAS). The evaluation takes place in form of macroscopic (throughout) microscopic (lane tap) and submicroscopic (drive train) parameters. Our customers are free to carry out investigations with PELOPS selling on our expertise or to purchase the program only.

If required, the comprehensive driver model allows a detailed description of the influences of a stationary traffic environment such as slopes, bends and traffic signals. This environment can be extended by the setting of environment-dependent traffic environment parameter such as weather, slippery surface etc. The evolution of the traffic element-driver is divided into a decision- and a handling model. In the decision model the parameter of the local driving strategy such as speed and lane selection are determined. The handling model converts the characteristics of the local driving strategy into vehicle specific controls for example throttle position, gear lever etc. The accurate modelling enables a realistic reproduction of complex driving manoeuvres such as “block” traffic. This is most of all needed for the investigation of fuel consumption and emissions, and also for the design and analysis of ADAS. In the vehicle model the controls are converted into dynamic vehicle quantities. The modelling of vehicles is characterized by a high level of detail concerning the drive train. Each single element of the drive train such as engine, clutch transmission (manual or automatic), retarder etc. can be parameterized.
The FOT-Net Wiki is the Free Living Encyclopedia of FOTs that anyone can edit: it is the tool “for and by” the FOT community.

It can be accessed via: www.wiki.fot-net.eu

What can I do?

Create an account
Update and upload information about your FOT
Monitor FOTs in your geographical area/field of expertise and edit the Wiki directly or contact info@fot-net.eu
Welcome to the wiki of Field Operational Tests

Welcome to the FOT-Net Wiki,
the free encyclopedia of Field Operational Tests that anyone can add!
Over 150 articles and 2,640 edits by 77 registered contributors.

This wiki intends to be a resource for anyone interested in Field Operational Tests, their organisation, their set up and their results. We strongly encourage you to contribute to this online resource.

Sign up to FOT Wiki now.

Experiencing problems using the wiki? Check the help page or contact us at info@fot-net.eu.uk.

This month's featured FOT: simTD

The simTD project includes applications in the field of traffic monitoring and management, driving and road safety, as well as additional services, and will put the results of previous research projects into practice. Realistic traffic scenarios will be addressed in a large-scale test field infrastructure around the Hessian city of Frankfurt am Main. The project will also pave the way for the political, economic and technological framework to successfully set up car-to-car and car-to-infrastructure communication.

To achieve those objectives, numerous automotive and telecommunication companies, the Hessian state government and renowned universities and research institutions have partnered up. The Federal Ministry for Economics and Technology, the Ministry for Education and Research as well as the Ministry for Transport, Building and Urban Affairs are funding and supporting the project.

The FOT execution and evaluation (phase 3) is planned to start in June 2011 and to last 15 months up to the end of the project in September 2012.

More information on http://www.simtd.de

Frequently asked questions

What are Field Operational Tests?
What is the FOT-Net support action?
What are the objectives of Field Operational Tests?
Is the data from the different FOTs comparable?

The FOT Catalogue

With the aim to involve all experts, FOT-Net has created a FOT Catalogue to which everyone can contribute. It is an online list of past and present FOT activities for anyone interested in FOTs, their methodology, their set-up and their results.

With this wiki pages, we aim to build a catalogue of key information about various past, current and planned field tests in Europe, North America and the region Asia-Pacific. You can help us build the FOT Catalogue by listing or enriching information about your field test in this catalogue!

If your Field Operational Test is not listed and you would like to add a page, please use the FOT sheet template.

You can copy the code and headings and create a new FOT page based on the defined template.

The FOT Glossary

The FOT community has gradually set up a Glossary starting from the activities of FESTA and new further improved by exFOT. FOT-Net is trying to bring the Glossary to the whole FOT community in the FOT Glossary where anyone can suggest an addition or amendment.
FOT WIKI – TOOLS FOR FOTS

Conducting an FOT or NDS in a scientific manner as proposed in the FESTA methodology requires a considerable effort during the different stages. Generic tools such as document and project management tools, databases, or evaluation tools as well as dedicated tools specific to an FOT are necessary to cope with the demands of planning an FOT, operationalizing stated use-cases, collecting and handling the test data and finally evaluating the hypothesis.

In previous projects these tools were developed each time an FOT or NDS was conducted by the FOT NDS partners taking into account the specific needs and requirements of their FOT NDS. This leads to a considerable amount of work, which partly could have been avoided. If existing tools would have been used and additionally if these tools would have been developed in a more general way considering a broader field of application and not only the projects these have been developed for. A reason besides the missing general tools for non-use of FOT NDS tools is that project partners are often not aware of what is already available and accessible.

Therefore this section is aiming for an inventory of FOT and NDS tools, which can be used by all parties interested in conducting an FOT NDS. The inventory aims to list all tools and specify these tools as far as the tool specification is accessible and public. Additionally experiences gathered with these tools in existing projects will be considered in the inventory, in order to allow the reader for the choice of the best suited tool for his type of FOT. It is not the intention of the WP to rate and evaluate the tools but to indicate e.g. whether a specific data acquisition system (DAS) could be useful for an FOT with extensive data collection including also video or a better suited for FOT where only GAN data is collected. By doing so, more FOT NDS should be able to reuse existing tools and just adapt these according to their specific needs instead of developing new tools starting from scratch.

Tools are used throughout the complete project process as described in the FESTA handbook. Ideally the tools should form a chain by being interchangeable. In this section we will focus on sophisticated special tools needed for FOTs. Following the FESTA-V, these tools are categorized in

Tools for Preparing: Operationalization of high-level FOT goals to specific study design and measures
Tools for Collecting: FOT operation and data acquisition
Tools for Analysing: Data handling and evaluation
Tools for FOTs

The conduction of an FOT or a Naturalistic Driving Study (NDS) requires specific tools. In previous projects these tools were developed each time an FOT or NDS was conducted by the FOT/NDS partners taking into account the specific needs and requirements of their FOT/NDS. This leads to a considerable amount of work, which partly could have been avoided, if existing tools would have been used and additionally if these tools would have been developed in a more general way considering a broader field of application and not only the projects these have been developed for. A reason besides the missing general tools for non-reuse of FOT/NDS tools is that project partners are often not aware of what is already available and accessible.

Therefore this section is aiming for an inventory of FOT and NDS tools, which can be used by all parties interested in conducting an FOT/NDS. The inventory aims to list all tools and specify these tools as far as the tool specification is accessible and public. Additionally experience gathered with these tools in existing projects will be considered in the inventory, in order to allow the reader for the choice of the best suited tool for his type of FOT. It is not the intention of the WP to rate and evaluate the tools but to indicate e.g. whether a specific data acquisition system (DAS) could be useful for an FOT with extensive data collection including also video or is better suited for FOT where only CAN data is collected. By doing so, future FOT/NDS should be able to re-use existing tools and just adapt these according to their specific needs instead of developing new tools starting from scratch.

The following tools shall be considered:

**Tools for data acquisition.** These tools considers all tools which can be used for data collection in the field and its storage in the vehicle

**Tools for data management.** These tools considers all tools which can be used for data management, which starts at storage of the data in the vehicle and ends when the data is stored in a database on a server

**Tools for data analysis.** These tools consider all tools for processing and aiding the data analysis, which starts after the data is put on the database

The collected data will be constantly updated by the FOTNET consortium partners, but can also be updated by the user of this wiki. If you or your company would like to contribute to the tools list, please feel free to add to this wiki or contact us directly.