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FOT-Net
Field Operational Tests Networking and Implementation



REPORT ON FOT-NET SEMINAR

**FOT-Net seminar: Tools for gathering and analysing data,
especially in FOTs of cooperative systems**

Date: Thursday, 25 April 2013

Place: FOKUS, Berlin, Germany

FOT-Net seminar: Tools for gathering and analysing data, especially in FOTs of cooperative systems

On 25 April 2013, a seminar was held in Berlin, Germany, on Tools for gathering and analysing data, especially in FOTs of cooperative systems. The agenda was as follows:

Agenda

- 1 Introduction - Adrian Zlocki (IKA)
- 2 Overview on tools for data gathering and analysis in FOTs - Adrian Zlocki (IKA)
- 3 Tools for data gathering in different FOTS (15 min each) - Moderator: Yvonne Barnard (ERTICO)
Speakers: Mohamed Benmimoun (IKA), James Lenard (Loughborough University), Horst Rechner (FOKUS), and Fabian Utesch (DLR)
 - a. euroFOT (e.g. CAN and camera data)
 - b. TeleFOT (e.g. driver data)
 - c. DRIVE C2X (e.g. cooperative data)
 - d. National FOTs (e.g. independent logging platform)
- 4 Tools used in experimental design and test execution- Oliver Sawade (FOKUS)
- 5 Tools for data analysis for cooperative system FOTs (DRIVE C2X) - Bart Netten (TNO)
- 6 Tools for data analysis for cooperative system FOTs (FOTSIS) - Emilio Cacheiro (OHL Concesiones)
- 7 Experiences and good practice on tools for gathering and analysing data:
 - a. Introduction - Adrian Zlocki (IKA)
 - b. FESTA approach - Oliver Sawade (FOKUS)
 - c. Data gathering issues - Moisés Rial Martínez (CTAG)
 - d. Data analysis issues - James Lenard (Loughborough University)
- 8 Discussion on experience with data gathering and analysis tools: Lessons learned and recommendations - Adrian Zlocki (IKA)
- 9 Conclusions and wrap-up – Yvonne Barnard (ERTICO)

There were **26** seminar participants (the list of attendees may be found at the end of this document).

1 Introduction - Adrian Zlocki (IKA)

Adrian welcomed delegates and outlined the programme of the seminar with a brief introduction of the objective, topics to be covered by the invited speakers, and participations from attendees.

Adrian initiated a round table introduction of all participants in attendance.

2 Overview on tools for data gathering and analysis in FOTs - Adrian Zlocki (IKA)

Adrian explained how the objective of WP5 ('Tools for FOTs') in the FOTNET project is to look at the tools utilized in existing FOTs and to make an inventory of these tools. His presentation took the group through the process he has been engaged in:

- Establishing an Inventory List for FOT Tools
- Identification of responsible persons for different FOTs
- Data collection
- Contact with manufacturers
- Presentation of results (wiki)

Adrian explained how the tools had been clustered into 8 categories and that to date, details of 83 tools had been made available on-line. He also demonstrated how this information has been structured and how it can be accessed via the FOT-Net wiki (www.wiki.fot-net.eu)

3 Tools for data gathering in different FOTS (15 min each) - Moderator: Yvonne Barnard (ERTICO) Speakers: Mohamed Benmimoun (IKA), James Lenard (Loughborough University), Horst Rechner (FOKUS) and Fabian Utesch (DLR)

Mohamed Benmimoun gave a comprehensive presentation on the **euroFOT** project (May 2008 to June 2012) which used CAN and camera data from test sites in Sweden, Germany, France and Italy. It undertook an assessment of impacts of ADAS in real traffic and produced a cost-benefit analysis, based on results from this impact assessment. Mohamed described in detail the processes and systems used and how the process had adhered to the FESTA methodology.

James Lenard provided a presentational overview of the **TeleFOT** project – a European project based on Detailed Field Operational Trials (DFOTs) and Large Scale Field Operational Trials (LFOTs) across 8 countries involving approx 2,600 subjects over 10 million kilometres. A number of nomadic devices and functions were tested for the impact areas: Safety, Mobility, Efficiency, Environment and User uptake. A key research question was "Does the device cause distraction?" James illustrated the instrumentation used and the results and outcomes of the study.

Horst Rechner's presentation described the 6-month national FOT simTD as part of the **DRIVE C2X** project (undertaken in the Frankfurt/Main area of Germany) and the tools it had developed for data gathering and handling. Horst described the project with illustrations and process diagrams and identified best practice in automation and data quality which had been derived.

Fabian Utesch described the independent logging platform developed by DLR for their pilot Naturalistic Driving Study (NDS). The motivation for this study was to enable research into critical situations and accidents through observation of normal driving behaviour. Challenges included; easy installation and removal of Data Acquisition System (DAS); universal application in different vehicles; management of extensive amount of data. His presentation described the data process and illustrated the solution developed for data acquisition. He concluded that the project had successfully established a NDS data infrastructure; effective implementation of existing

experiment based workflow, vehicle independent DAS solution and a secure server infrastructure for remote analysis access.

A few questions were asked in the end of this session such as:

- How was ADAS data processed and uploaded automatically?
- How would the eye-tracking device in TeleFOT cause distraction to driving?
- How could data quality be checked early on and automate validation for quality assurance be conducted?

4 Tools used in experimental design and test execution- Oliver Sawade (FOKUS)

Oliver described the potential difficulty adhering consistently to the FESTA methodology especially when numerous groups of people can be involved at different stages of a project. He used a number of project examples and demos and concluded that best practice should ensure that there is:

- A dedicated tool-chain accompanying the FESTA process (to avoid import/export situations and to keep coherence)
- Operationalization from Hypothesis to Study design using Scenarios and Test cases
- Monitoring and test control in real time during the test

Questions from the meeting:

- How much manual effort is needed to monitor whether drivers operate the system correctly? Quite some effort is needed for trained operators to monitor drivers and to correct them if something goes wrong. Naturalistic driving studies are easier in that sense because drivers cannot do anything wrong (except with the recording equipment).
- Is there any Application Programming Interface (API) for different FOT tools? Not as such, there is an adaptation in individual projects, although some tools are generic.

5 Tools for data analysis for cooperative system FOTs (DRIVE C2X) - Bart Netten (TNO)

Bart provided an update on DRIVE C2X and in particular, the approach taken to data analysis. His conclusions were that DriveC2X:

- Has identified 2 approaches to data analysis: Technical and Impact evaluation
- Has established that detailed analysis is necessary of technical issues and data quality
- Suggests that data processing should be automated for immediate feedback on the success of a test, and details on inconsistencies in (interactions between) components
- Has developed data analysis tools that are independent of specific log format, use standard databases and tools and are configurable for different test sites and projects

6 Tools for data analysis for cooperative system FOTs (FOTsis) - Emilio Cacheiro (OHL Concesiones)

Emilio explained that FOTsis is a large-scale field test of a set of close-to-market Cooperative Services, in order to assess their effectiveness and their potential for a full-scale deployment in European roads. FOTsis works across nine test sites in four EU countries (Spain, Portugal, Germany and Greece). Its main objective is to test the infrastructure's capability to provide Cooperative Services in several experimental environments throughout Europe (these are Emergency Management, Safety Incident Management, Intelligent Congestion Control, Dynamic

Route Planning, Special Vehicle Tracking, Advanced Enforcement and Infrastructure Safety Assessment).

Emilio provided a detailed overview of the project and in particular for the purposes of this seminar, the data analysis tools. Specific data issues covered included data *handling* and data *analysis* within FOTs.

Questions from the meeting:

- Is there a joint effort in analysis tools from FOTs and DRIVEC2X? No, there is not, FOTs started from scratch, the joint effort was more on the technical site, but it would be good if the projects would work together in the evaluation.
- The problem was discussed that sensors are have to produce the data are not always synchronized, also the units in which measurements are recorded are not always the same. This makes comparing measurements between test-sites difficult.

7 Experiences and good practice on tools for gathering and analysing data:

- a. Introduction - Adrian Zlocki (IKA)
- b. FESTA approach - Oliver Sawade (FOKUS)
- c. Data gathering issues - Moisés Rial Martínez (CTAG)
- d. Data analysis issues - James Lenard (Loughborough University)

Adrian Zlocki introduced the fact that dedicated FOT-Net Working Groups (WGs) look into a specific set of issues to further enhance and revise the FESTA methodology for FOTs. There is a specific WG for Data Analysis and the main outcome has been a list of recommendations for data analysis issues. Adrian introduced in turn, three speakers who presented on their experiences:

Oliver Sawade stressed “talking data” - “before thinking *how*, think about *what* and *where from*”. His contribution also included a useful list of do’s and don’ts:

- Make sure you start measurement collection early (but don’t forget versioning/reverse compatibility of log definitions!)
- Think about data transfer and how choosing a method will affect the study design
- Never delete log data on the source before it is safe on the redundant server storage
- If drivers are involved, the logging system has to be bulletproof and dead simple to operate
- Think about adding live monitoring

Moisés Rial Martinez summarised lessons learned from participating in a number of projects:

- Data requirements and specifications are the first step and should be done very detailed
- Pilot testing of the whole technical chain is really critical and takes time
- It is essential to use a common framework
- Be prepared for unexpected issues. It is important to implement a daily control with specific operation indicators to assure that the FOT and their different elements in the technical chain are running as expected
- Questionnaires should be also automated and included in the loop
- Data analysis is a very demanding task

James Lenard’s key points for the discussions and conclusions were:

- Quality control and data validation required during experimental trials or with minimal delay

- Caution where eye-tracker measures different parameters using (somewhat) independent methods
- Systematic investigation of eye-tracking with progressive introduction of disruptive factors

8 Discussion on experience with data gathering and analysis tools: Lessons Learned and recommendations - Adrian Zlocki (IKA)

Adrian introduced a discussion session which focused on: Experimental design, Data collection, Data processing, Data analysis, and other topics. Examples of relevant issues for discussion included:

Data acquisition

- Selection of data to be collected for Performance Indicators
- Method of data collection
- Choice of data acquisition systems

Database

- Maintenance of data after the end of a project
- Restrictions on access to OEM proprietary data
- Data synchronization
- Protection against data loss

Data analysis

- Large data-sets
- Video analysis
- Detection of driver behaviour issues such as distraction

Other

- Privacy issues
- Process automation
- Link between data acquisition and data analysis

Based on the introduction question and answers were raised with regards to lessons learned and recommendations. Discussion topics were on the DLR platform in terms of driver influence by installed measurement equipment and experience with uninfluenced drivers. At this stage the system is not yet evaluated. Furthermore the overall topic of piloting was discussed. The conclusion was that piloting is crucial for the success of a project. Workshops are needed for all the people involved in a project to understand each other's tasks and requirements. Solutions include building some flexibility in the experiment.

From crucial piloting the discussion expanded to risk management of FOT/NDS work. FESTA could be updated in terms of argumentation for piloting: what could go wrong and how to avoid it. Finally data format and large data sets were discussed. The data format seems to be more important than the tool-chain used. From experience only 10% of data is good for FOTs.

QAs:

Question with regards to the DLR platform (Fabian Utesch):

Did the subjects drive normally when such a device was installed? Not sure

Did you provide the car to the driver who can use it whenever they want to use? No

Question with regards to data

How many iterations would help?

A lot of iterations (3 months and longer). Piloting is a crucial phase. 20ish workshops to refine the experiment. Experts should be there. CTAG piloted 3 months. James (TeleFOT): the Mondeo was used in previous projects, it may not be piloting but introducing. Something like kit faults can cause considerable delay.

Workshops are needed for all the people involved in a project to understand each other's tasks and requirements. Solutions include building some flexibility in the experiment.

9 Conclusions and wrap-up – Yvonne Barnard (ERTICO)

Yvonne summarised conclusions and issues in a presentation she had put together during the day to capture key points from the day's presentations and discussions.

The group had considered the importance of the process of deciding on tools (top-down, bottom-up) and that it is important to start early with data requirements and specs. The tools required depend on research questions and also differ between technical and impact analysis. Piloting was also considered to be essential – even though it takes time, as were risk analysis and consideration of resources and the re-use of data

The discussion of automation vs. manual data logging recognised the need for quality/sanity checking (as data can be wrong!). Automated safeguards or making the data easy to interpret were highlighted here. Discussions also covered the importance of data synchronisation, interconnection and coherence (for example of data formats) between tools – not least, for data import and export efficiency.

Some other types of tools (other than for data collection and analysis) had also been covered, including: Scenario definition, Subjective driver data, Fleet management, Organisational tools, Project organisation, and Task division.

A final message that neatly captured the range of discussions was:

“Be prepared for the unexpected. Think about complementarity between projects, in tools, in analysis.....”

Yvonne closed proceedings by detailing up-coming FOT-Net events; thanking presenters and delegates for their contributions and guiding them to use the project wiki to maximise future engagement (<http://wiki.fot-net.eu/>).

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