PUBLIC SUMMARY OF DELIVERABLE

D5.3 – Connected Vehicles Pilots Release 1

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This document is a public summary of a confidential deliverable of the TT project. It serves as a summary of the release 1 demonstrators and provides links for external actors to connect to the TT pilot leaders if they are interested in more information.

DISCLAIMER

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Motivation

TransformingTransport (TT) demonstrates, in a realistic, measurable, and replicable way the transformations that big data can bring to the mobility and logistics market. TT is structured into 13 different pilots in 7 pilot domains, which cover areas of major importance for the mobility and logistics sector in Europe. The **Connected Vehicles domain** focuses on connected cars and connected trucks.

Road transport is the second biggest source of greenhouse gas emissions in the EU, after power generation. It contributes about one-fifth of the EU's total emissions of carbon dioxide (CO_2). Moreover, road transport is one of the few sectors where emissions have been rising rapidly over the last 20 years. In the period from 1990 to 2016, emissions from road transport increased by 23 %. This increase acted as a brake on the EU's progress in cutting overall emissions of greenhouse gases, which fell by 24 % in that same period[1]. Passenger cars alone are responsible for around 12 % of EU CO_2 emissions.

Logistic service providers, fleet operators and truck drivers have to cope with various challenges in their day to day business. Customers expect 100 % reliable and accurate transport execution from pick up to delivery processes. The traffic network infrastructure however often reaches its capacity limit especially in certain urban areas, at international seaports, cross-border areas or other logistic hot spots.

Big Data real-time analytics can greatly contribute to make road transport more sustainable and safe. The purpose of the two pilots comprising the Connected Vehicles domain within TransformingTransport is to demonstrate how this can be possible and what benefits Big Data can bring to this sector. Specifically, the pilots will focus on:

- Test **high added value services** powered by large scale aggregate analytics such as predictive maintenance, traffic accidents identification, empowering efficient driving and CO_2 emissions reduction;
- Optimize the **management of vehicle fleets** through continuous monitoring, vehicle dataset analysis and decision support systems;

[1] EEA Report 2018. "Annual European Union greenhouse gas inventory 1990–2016 and inventory report 2018" (https://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2018 (European Environmental Agency (Submission May-2018).

- Increase **efficiency and competitiveness** by optimally defining routes based on predictive analysis and mobility patterns.

The first pilot is called **Sustainable Connected Cars** and will be carried out by SoFLEET, Autoaid and Answare. This pilot is focused on cars that belong to different sorts of companies. These companies are interested in achieving an efficient management of their fleets. Thanks to telematic dongles installed on the cars and a Big Data architecture, the partners will study techniques and algorithms to offer a decision support system to achieve predictive maintenance of a fleet, monitoring and promote eco-friendly driver behaviours and identification of traffic jams. The dongles gather valuable information from the vehicle such as location, speed, accelerations and fault codes (DTCs). Big Data is able to deal with this huge amount of information and provide functionalities such as data collection, predictive analysis and data visualization.

The second pilot is called **Sustainable Connected Trucks** and will be carried out by PTV, JDR, TomTom and Fraunhofer IGD. The main objective for this pilot is the enhancement of planning and optimization systems for fleet managers. In order to achieve this goal, it will be necessary to assess traffic flow for trucks journeys and to detect and analyse logistic hotspots such as terminals, toll stations and ferry stations. Large amounts of Big Data processing, specifically related to truck fleets all over Europe, will be necessary for this task. Additionally, the use of satellite images as an extra data source on different planning stages in the context of applications for truck fleet managers will be incorporated in this pilot to detect not only the current state of a location but also its changes over time.

Connected Cars Pilot

The main ambitions within the Connected Cars Pilot are to analyse drivers' behaviours to reduce fuel consumptions and to identify and evaluate breakdowns and possible maintenance needs in the vehicles. Recommendations for both objectives will arrive to drivers and fleet managers through a notification system using the users' mobile phones and a desktop fleet management application.

The main data sources used in the demonstrator are vehicle specifications and real-time information of different parameters and GPS locations, transmitted through telematic dongles within the cars to a networking cloud (e.g. speeds, start-up time, final time, fuel consumption, diagnostic trouble codes (DTCs) frames and GPS position). From this cloud, these features are sent to a Big

Data infrastructure for their analysis. Additionally, information on roads and weather conditions are available.

There are many factors that contribute to fuel consumption like trip statistics, type of road, intensity of traffic, weather conditions, vehicle or driving performance. These factors are being measured or quantified. A set of advices or suggestions to drivers has been defined to improve situations where the fuel consumption indicator can be improved.

When an issue is detected, e.g. a car spends a lot of fuel, the driver behaviour statistics are poor, or a breakdown is detected, a finer-grained analysis can be obtained displaying the trips dashboard by the fleet manager.

We have developed a way to detect anomalies that involves the comparison of data from different vehicles and dates. When a trip is finished, its main statistics such as duration, fuel consumption or distance are received by the system. These statistics are the building blocks to ultimately calculate the performance indicators. We have also a dataset with the vehicle specifications, such as model, dimensions and fuel consumption. By grouping vehicles with a common specification, e.g. same model, statistics or measurements for groups can be obtained. Anomalies could be detected by comparison of the statistics or indicators of a vehicle with the indicators of the group of vehicles it belongs to. A candidate anomaly can be obtained comparing figures for a same day. But, an abnormal figure can be circumstantial, e.g. weight, weather conditions, roads could be different.

The system can extract the codes relative to DTCs, malfunctions, warnings or alerts. A service by Autoaid will give, when it is invoked, the severity and description of every code included in the request. Maintenance information (e.g. mileage and next revision date) is also considered in the severity evaluation. Performance comparations with group of cars (e.g. cars belonging to a same model) or with historical data is used to detect maintenance needs.

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Connected Trucks Pilot

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As part of the current demonstrators, the pilot concentrates on the use case of a defined truck corridor between Amsterdam and Frankfurt with alternative routes and points of interests along the corridor. This truck corridor will be investigated in terms of routing and travel times as well as different analyses on specific points of interest. These points include traffic situations along the corridor and operative times at the airport. For this area, each partner will contribute with different data sources, data analyses and results to get a common understanding about truck related information. Making use of these initial findings, the initial corridor together with the points of interest will be expanded in the remainder of TransformingTransport, covering a larger amount of data and area across Europe. Mapped to this use case, a demonstrator was developed for analyses on this geographical area. The added value is shown by the status quo of a typical planning process as basis for the demonstrator: Alternative routes and related attributes are depicted, coming from theoretical calculations based on historical data. A planner would choose the standard route for the trip due to the shortest distance or driving time. However, further aspects of the planning process such as waiting times or handling times are not considered although they are important for the planning.

With the help of Big Data and data analytics, this process can be improved by several analyses, data sources and approaches. The details of this planning process are visualized in a planning dashboard where a new estimated trip time, including the results of the Big Data analyses for the corridor and the points of interest are provided. Now, the focus for choosing a specific route lies not only on the distance or the driving time. In point of fact, additional analyses such as stopping times at specific points, seasonal trends and cost indications are considered to improve the planning process and to find the best route integrating all aspects.

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