Freight management support system based on R&D implementation of

OPTICITIES

BIRMINGHAM
GOTHENBURG
LYON
MADRID
TORINO
WROCLAW

Presented by: Piotr Bardadyn

Agenda

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Introduction

Opti’cities – EU Smart Mobility project

SEVENTH FRAMEWORK PROGRAMME

European Commission

objectives

OPTICITIES associates major cities, groups and SMEs at the forefront in following fields in Europe to develop:

- **Multimodal solutions**. For once ITS solutions will not be a just a position of mono-modal approaches exclusively focused on public transport. Multimodal solutions will be based on reliable data for every mode and combination, with optimized end-users applicatioins and will involved the car industry as well as public transport and soft mode actors.
- **A framework on data access and exchange** policy allowing enlarged access to high quality data. This policy aims at amplifying the development of information services by centralizing (or accessing local databases) and disseminating all private and public data available at EU scale.
- **European interoperability of urban mobility data and mobility solutions**. Based on an open ITS system, the standards developed in OPTICITIES will provide cost effective and seamless multimodal services.
- **Enhance network operators' supervision capacity and management efficiency** thus allowing for smart and adapted decision making processes.
- **Develop, try out and assess high-level innovative multimodal information and transport management services**. These services will target transport managers, travellers and freight transport users or fleet managers.
- **Enhance users' accessibility to mobility services** through the display of coherent and highly reliable multimodal information.

LYON

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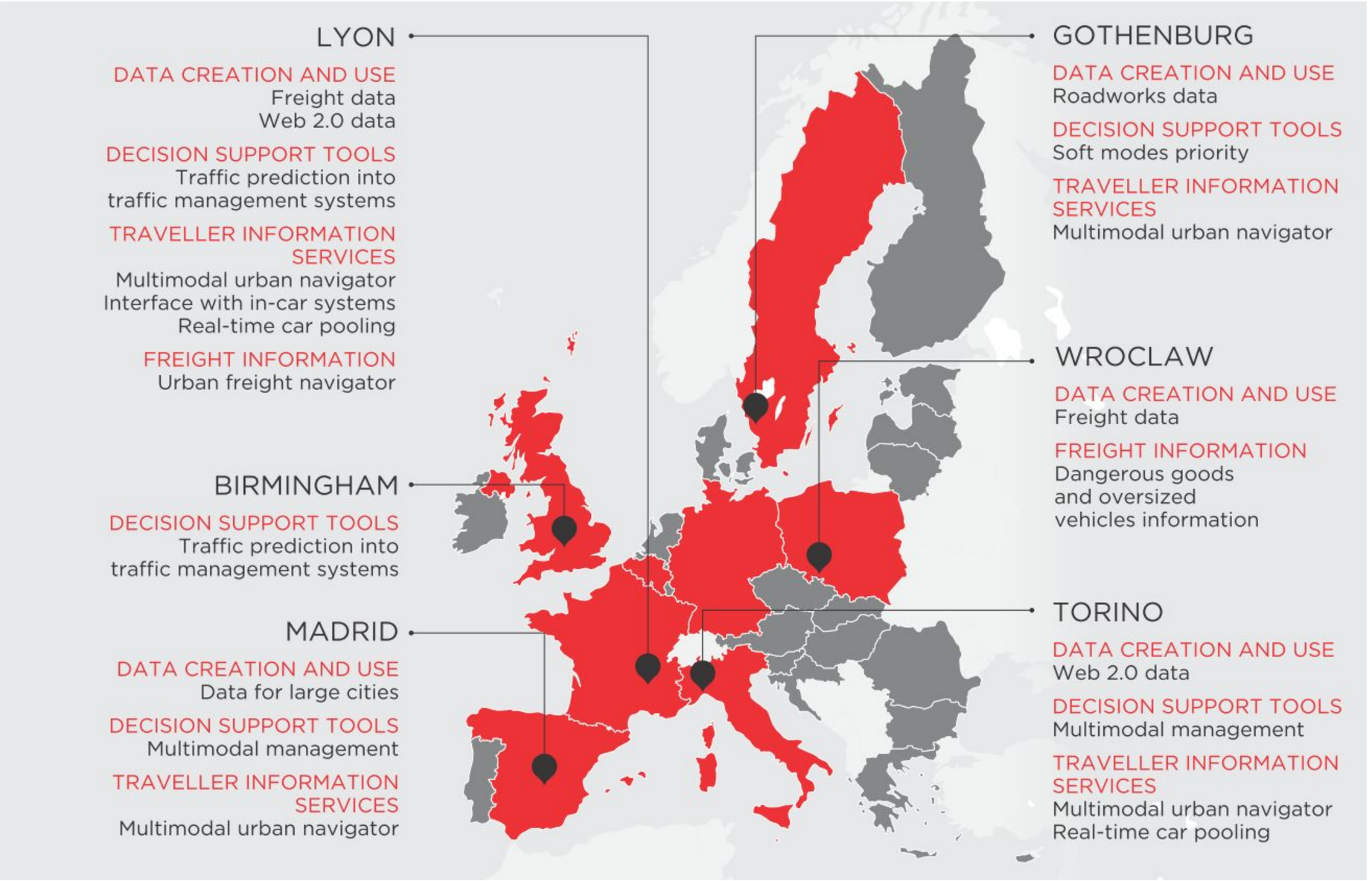


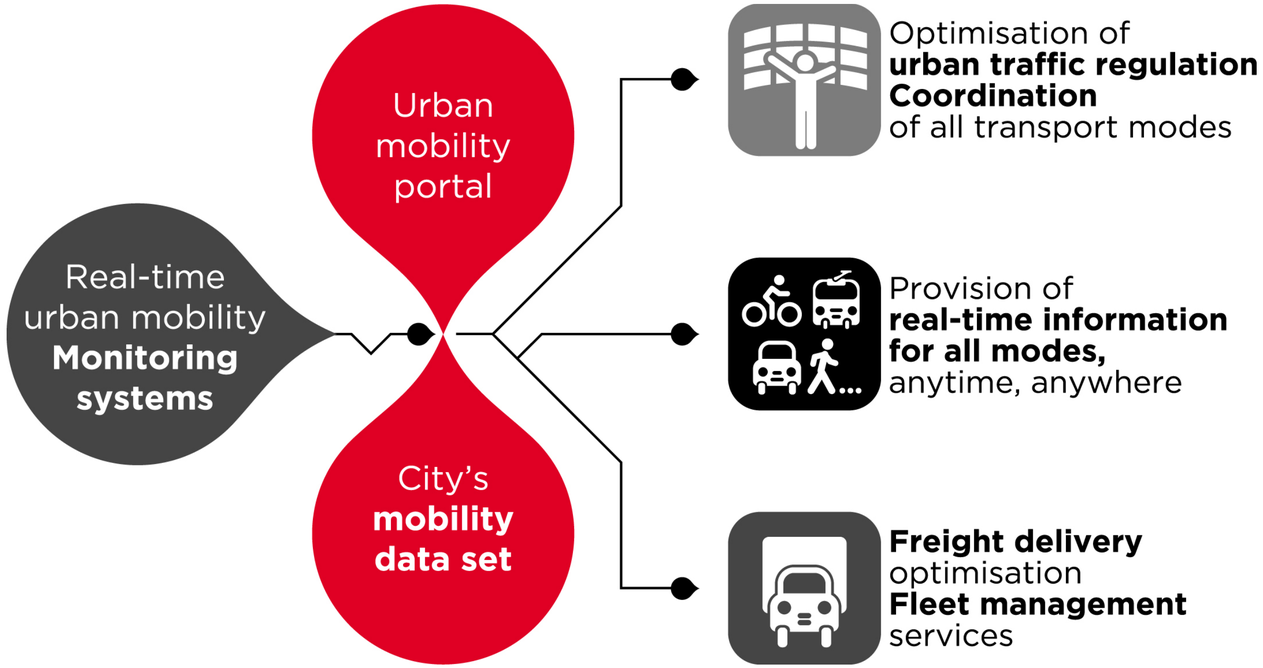
NeuroCar assists traffic management and road safety within ITS. NeuroCar detects the presence of a vehicle, read license plates (ANPR) and identify make & model of vehicle (MMR).

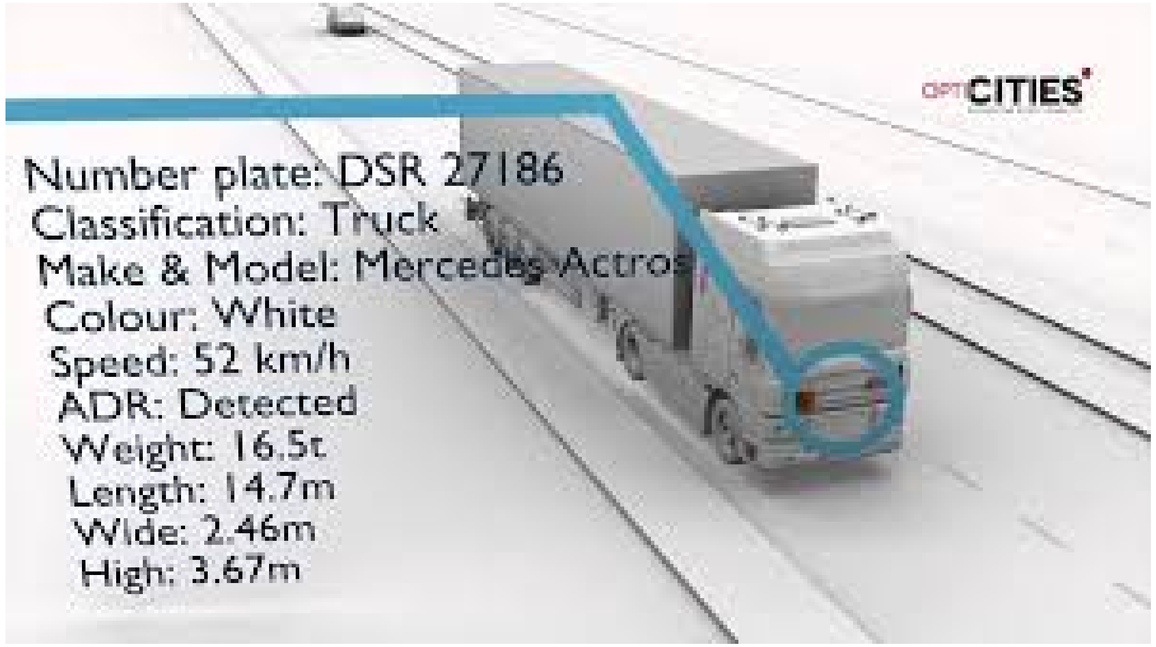
NeuroCar is a multisensoric system enabling complex vehicle identification, data analysis and real- time transfer.

OPTICITIES is aiming high, intending to develop and test interoperable ITS solutions in six different cities in order to provide urban citizens with the best possible journey conditions and to optimize urban logistics operations.

OPTICITIES gathers 25 partners from across Europe (6 cities, service providers, car industry, research laboratories and major European networks) and will strive to pave the way towards smart urban mobility.

→ Ncar contribution





NeuroCar in Artificial Intelligence for Freight Management

OPTICITIES
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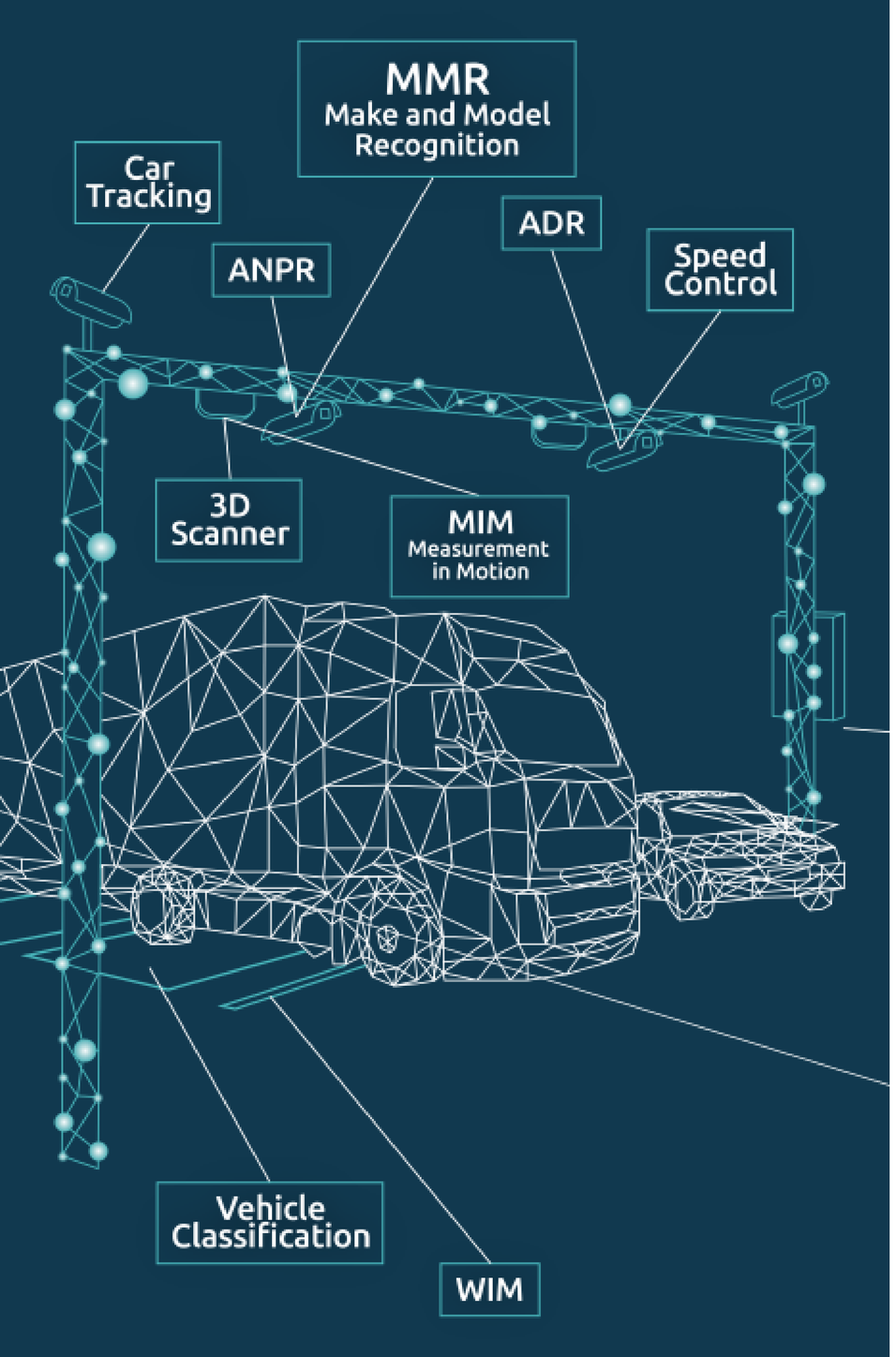
Artificial Intelligence for Freight Management

Intelligent support tools in practice

Road side data collection

Complexity of vehicle identification



NeuroCar – complexity of data

1 Video Sensors

Powered by Deep Learning algorithms

- Detection
- ANPR
- Classification
- MMR
- Color
- Speed
- Tracking

2 NeuroWIM

Loop + WIM controller

- 8+1 – BAST A1
- A (5) – COST 323
- TLS 2012/ REST

3 Lidars

- High detection perfomance
- 3D shaping

4 Data cross-check

Use of 3 different technologies keeps false positives rate down

5 Remote control

- Environment and integrity check
- Reconfiguration

6 Real – time

- Data colletion
- Recalculation of NAVI truck

NeuroCar – complexity of data

Terminal access

Each vehicle apearing in measurement field is captured and identified. Data is shown on-line via VPN access

2016-03-18 **13:24:33**
wroarmiikrajowejslezna **(wis, I1)**

PL **DW 5690Y**
Audi A6, black
car, 26.2 km/h

2016-03-18 **13:24:32**
wroarmiikrajowejslezna **(wis, I2)**

PL **DTR 49136**
Mercedes C, black
car, 22.8 km/h

2016-03-18 **13:24:31**
wroarmiikrajowejslezna **(wis, I1)**

GB **VX52 PUY**
Vauxhall Vectra Signum, dark blue...
car, 16.2 km/h

2016-03-18 **13:24:23**
wrozmigrodzka242 **(cen, I1)**

PL **WB 8225J**
Suzuki Grand Vitara, black
car, 56.2 km/h

2016-03-18 **13:24:21**
wrozmigrodzka242 **(cen, I2)**

PL **DW 554VF**
Mazda 6, dark blue
car, 106.4 km/h

2016-03-18 **13:24:10**
wrozmigrodzka242 **(cen, I2)**

PL **DW 368VJ**
Skoda Octavia, gray
car, 65.1 km/h

Loading vehicles

2016-03-18 **13:24:09**
wrozmigrodzka242 **(cen, I1)**

PL **PKS 80R7**
Citroen C5, dark blue
car, 54.9 km/h

2016-03-18 **13:24:02**
wrozmigrodzka242 **(cen, I1)**

PL **PKN 30231**
Renault Trafic, dark red
van, 53.2 km/h

2016-03-18 **13:23:59**
wrozmigrodzka242 **(cen, I2)**

PL **DWR 68091**
Skoda Octavia, silver
car, 78.5 km/h

2016-03-18 **13:23:49**
wroarmiikrajowejslezna **(wis, I4)**

PL **DW 595PG**
Citroen C4, silver
car, 6.4 km/h

2016-03-18 **13:23:43**
wrozmigrodzka242 **(cen, I2)**

PL **DW 810TF**
Nissan Qashqai, white
car, 93 km/h

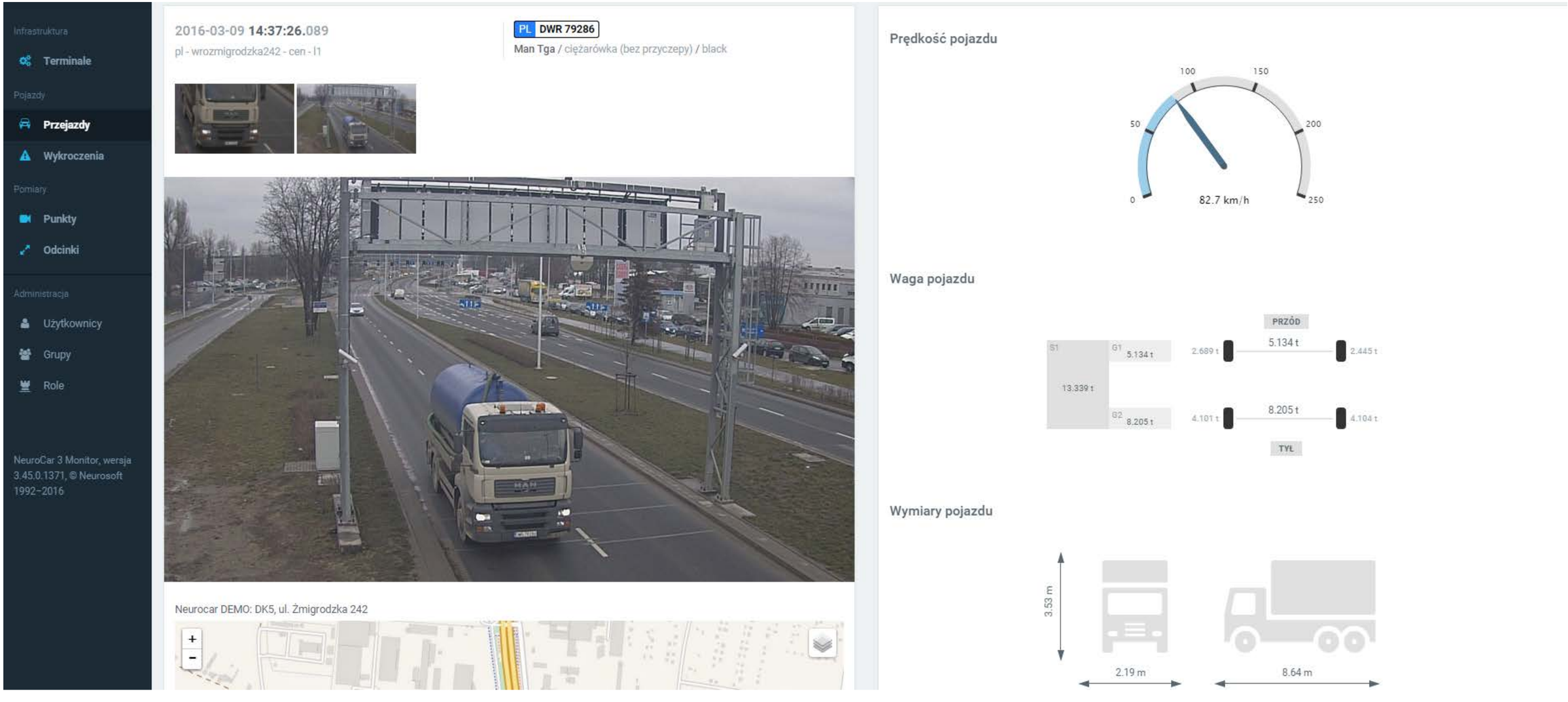
2016-03-18 **13:23:36**
wroarmiikrajowejslezna **(wis, I3)**

PL **WE 789GP**
Toyota Avensis, dark blue
car, 80.2 km/h

NeuroCar – complexity of data

Backoffice storage and analysis

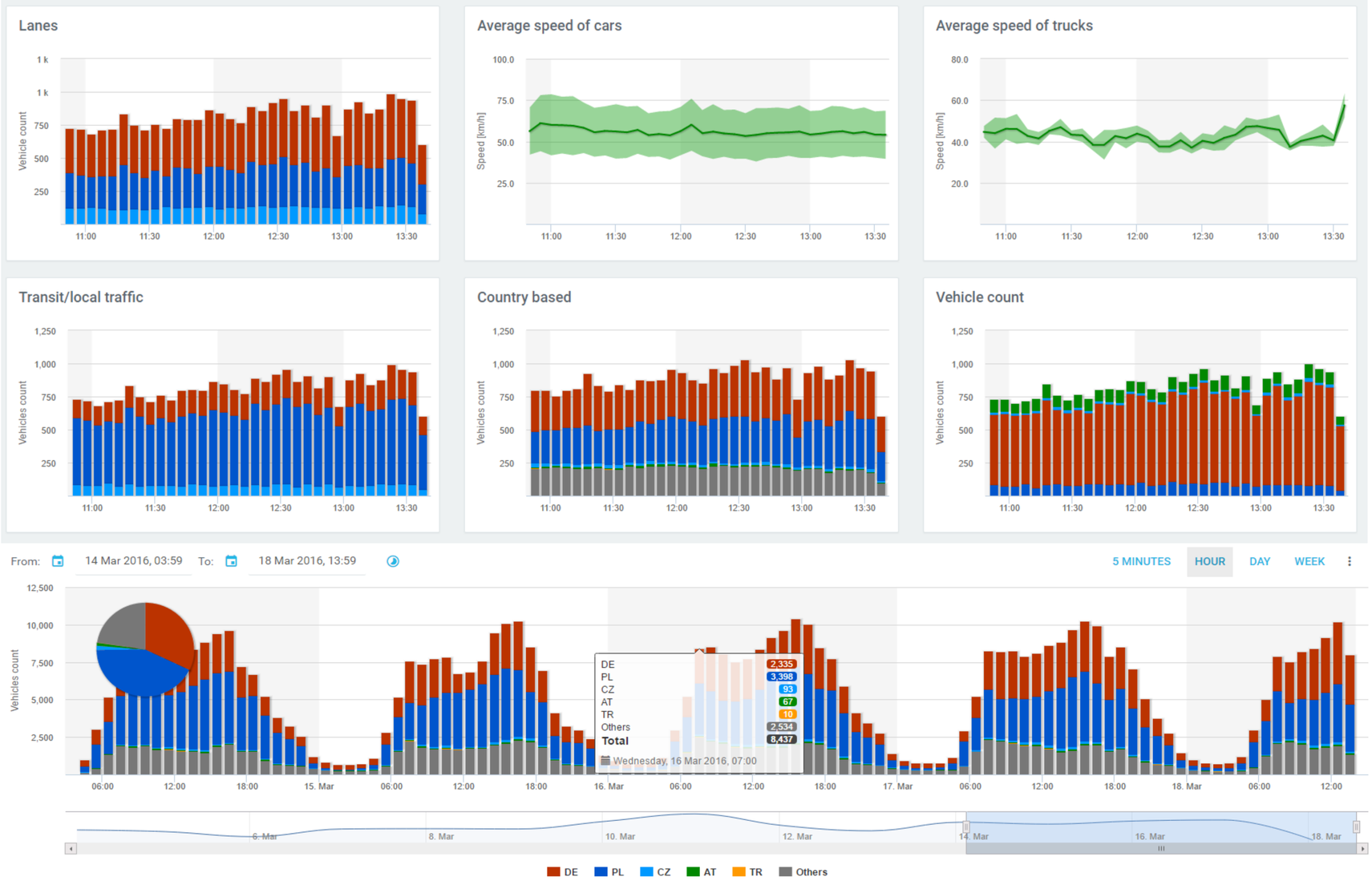
Every measurement point sends data to a central BackOffice system. Data is accessible via web interface and can be presentad and analysed immediately after storage.



NeuroCar – complexity of data

Business Intelligence

Detailed statistics will provide suitable information for anyone



Infrastructure to Vehicle communitation

On-time navigation and enforcement

OPTICITIES
ENHANCING SMART MOBILITY

MOBILE CLIENT

in vehicle; using NEURO NAVI
- [client] over: REST API

request 30-1 sec

3G/4G communication

GPS coordinates

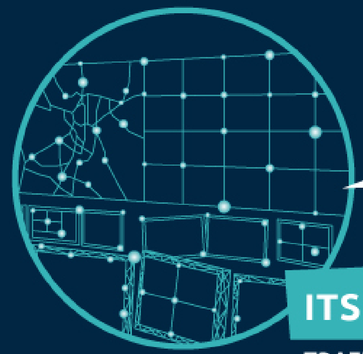
1-15 sec.
Cross-check over
ANPR/MMR recognition

NEUROCAR TERMINAL

- data aquisition (photo; json)
& **MESSENGER**
- meta data priority transfer

NEURO COMAND UNIT

FUNCTIONS:
- Register - IoT
- Harvester - Truck ID instance (from messenger)
  - GPS coordinates - set-up and vehicle trace
- routing engine_modified „Graph hopper"
- Router - core logical unit
- IfNavTruck - truck comm interface



ESB | REST

ITS CENTER

TRAFFIC DATA UPLOAD
- **Static points (REST)**
  - over 14000 static limitations (WIM/ADR)
- **DYNAMIC LIMITATIONS (Enterprice Service Bus)**
  - dynamic limitation (accidents, events)
  - semi-dynamic (scheduled road works)

SYSTEM KEY FEATURES:

- Real-time data aquisition and transer (delay < 10 sec.)
- Enforcement based on ANPR videomonitoring deployed within the city
- EU directives conforminty (ADR)
- Data and communication safety

neurocar

Neuro Command Unit

TRUCK REGISTRATION

Truck Registration is a REST service. It allows remote users to register lorries. Truck ID model is created only for the registered trucks. The vehicle registration number is used to distinguish between vehicles.

REQUEST
API method: api/register
Full url: [server]:[port]/optci-register/api/register

```
{
   "registration_number": "DW123",
   "vin": "123",
   "make": "mazda",
   "model": "3",
   "euro_class": "1"
}
```

RESPONSE
Server always responds with text/plain data. There are 3 different types of response:

Response types			
code	**type**	**data**	**description**
200	text	""	Registration process went properly.
200	text	"This vehicle is already registered in the system."	Vehicle is already registered.
500	text	"Problem with DB connection occurred"	Problem with database on the server side occurred.

Neuro Command Unit

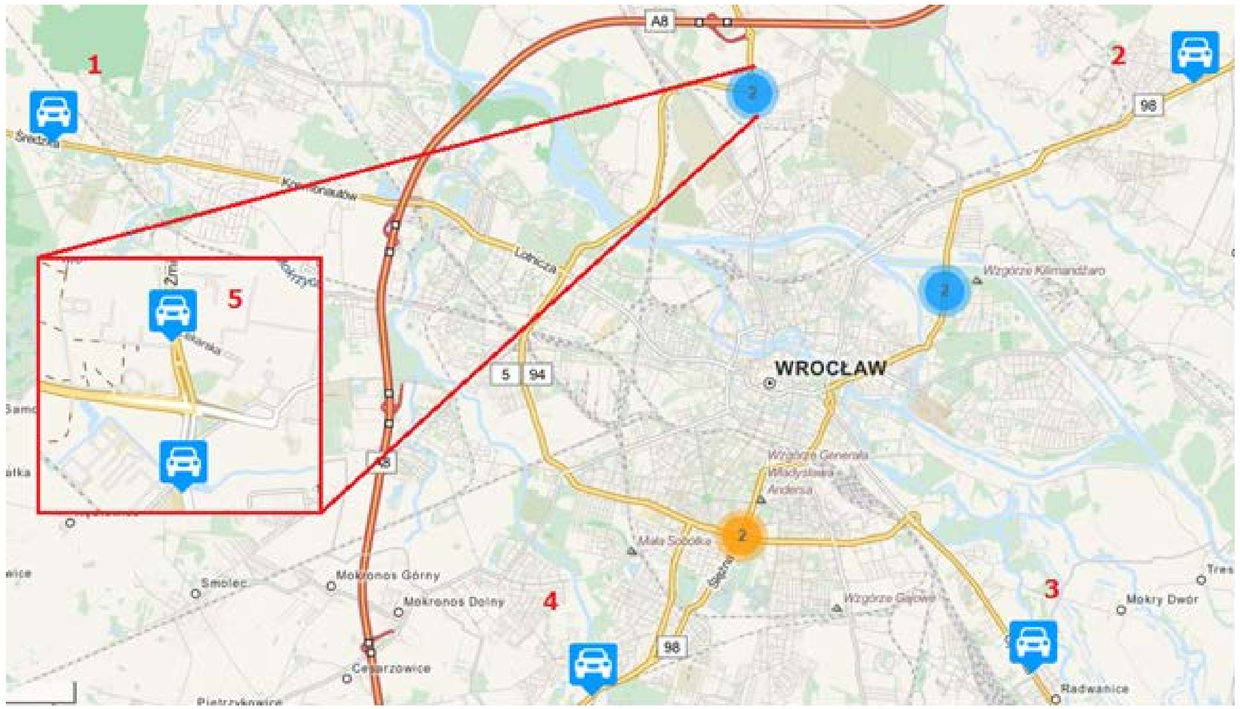
HARVESTER

Harvester is a REST service designed to receive recognition data from measurement points in the entry positions of city transportation network.

Each measurement point's **“Messenger” service (responsible for sending recognitions to defined central systems) sends a recognition JSON file with: weigh, height, ADR information and license plate of the vehicle.**
Harvester filters only registered vehicles and creates a TRUCK-EXID instance for recognized and registered vehicle in the data base of the central system.
Harvester provides one API POST method called **recoalert** which consumes the recognition JSON from “Messenger”:

host:port/optci-harvester/recoalert

The instantiated TRUCK-EXID takes part in the further navigation process, being updated by IfNavTruck (navigation) methods.



Neuro Command Unit

IFNAVTRUCK

IFNAVTRUCK is a RESTful service interface for communication between any client app (installed in mobile device, on-board unit etc.)

Check - API method called when the **truck driver is approaching the entrance-measurement point**. It is assumed that GPS positions of these points are known beforehand. If the truck is recognized and measured service will response with code 200 and JSON including lists of latitude and longitude values representing the proposed itinerary. However, if the truck is not recognized but is registered in the system, service will response with pure 200 code, which should suggest further requests until information about recognition reaches the central system.

Control - method is called when the **client app wants to check whether the truck is still following the proper itinerary** or to check if there are any new events (accidents, maintenance, entry ban hours change) on any of proposed itinerary edges. If so, a new itinerary is sent. It should be used only after the Check response ended successfully, otherwise it will keep responding with 500 error for registered trucks.

Alert - this method can be called when **client app 'knows' that something went wrong** and 'wants' the central system to generate new itinerary. The central system will always generate a new itinerary without further investigation of truck situation that caused the request.

Back - **client app should call this method after the truck delivered goods and the driver wants to get out of the city** towards the next destination outside the city. Response will contain itinerary leading to one of the selected exit points of the city, that would guide to given destination in the most suitable way.

Checkout - additional **method for the client to confirm that the truck reached the destination or left the city** heading to another destination. It should be called when the user is satisfied with destination he reached, all goods were delivered etc. This request ended the experiment.

Neuro Command Unit

Graphhopper Server modules

Graphhopper Core - is a fast and memory efficient Java routing engine.

For the purpose of OPTICITIES WP 5.3 task - 'Dangerous Goods & Oversized Vehicles Service' **new functionalities were added to Graphopper in order to customise it to make it useful as a itinerary generator.**

Additional **information is strictly connected to limitations that a lorry has to face while reaching a destination point**.

The limitations can be divided into two groups: **inner** - size, weight of a lorry; type of freight or cargo etc. and **outer**: static limitation (road signs), semi-dynamic (e.g. planned road works or road exclusions), dynamic (current traffic, road accidents etc.). Therefore, a custom graph edge weighting had to be created to make GraphHopper an impeccable tool in terms of itinerary generation.

Graphhopper Web - provides necessary API methods for all routing requests of the system.

It requires maps in either .osm or .pbf format. Graphhoppr Web uses GraphHopper Core as a itinerary generator engine.

Originally GraphHopper contains a set of services. The main service is

Route
'Route' is a http GET request which returns JSON with itinerary and additional information such as instructions ("Turn Left", "Turnaround"...), distance, time, etc. Which extra information are returned is determined by the list of parameters.

Neuro Navi

Client Navi application

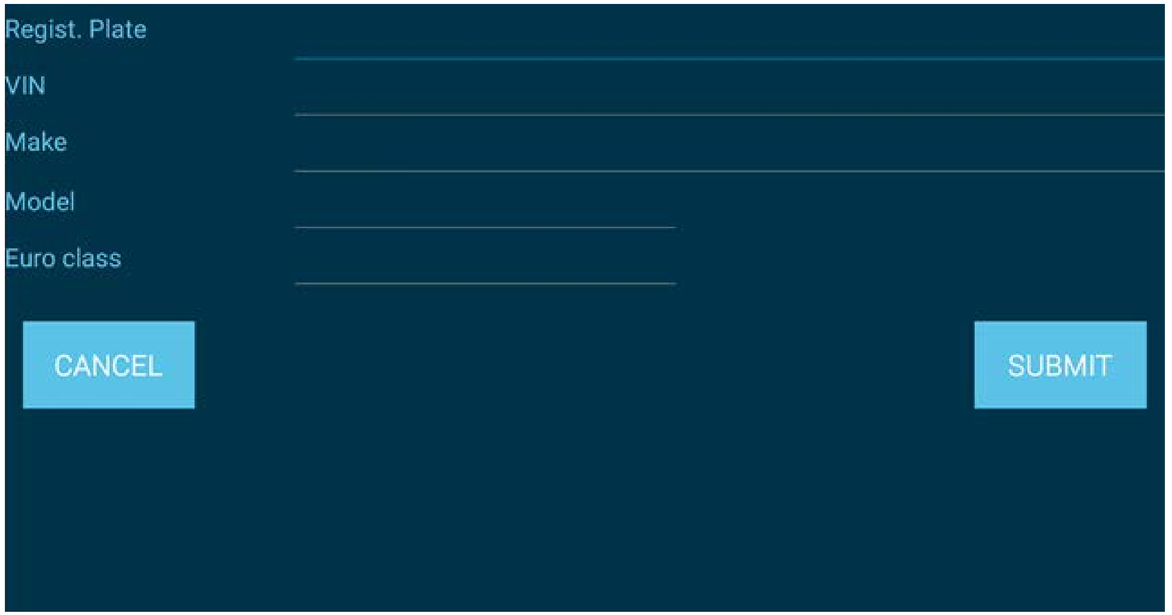
Due to the withdrawal of Volvo participation in D531 Neurosoft proposed to develop a concept navigation client application as a demonstration of central navigating system functionality. NeuroNavi is a **mobile application developed for Android**.

Its simplistic, **user-friendly graphical interface is designed to support truck drivers** with clear information and maximum responsiveness.

Neuro Navi

Registration

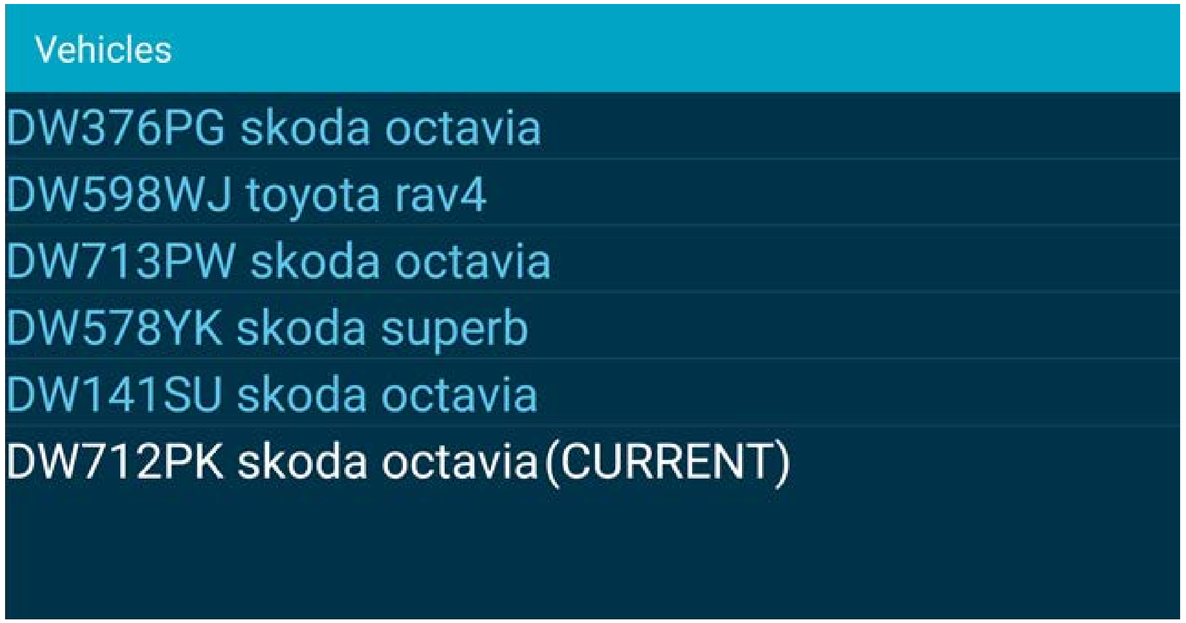
At this point of the project, only registered vehicles may take part in navigation procedure. This is why the client application has an implementation of Register API method of optci-register component of the central navigation system



Neuro Navi

users and vehicles

The navigation app is designed to be used by a driver of many different vehicles, so each registered vehicle is always available to pick from the list of vehicles:



Neuro Navi

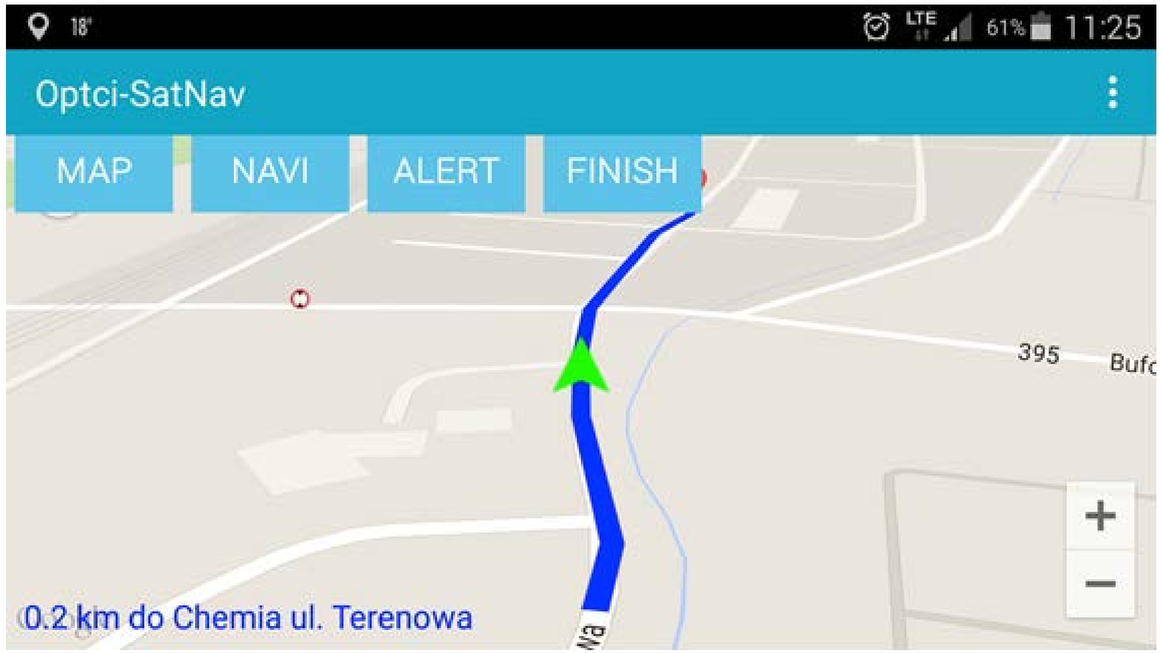
INTERFACE

CHOOSING THE DESTINATION

For the purpose of OPTICITIES experimentation Neurosoft developed a special view containing a list of destinations for trucks with various problematic cargos (f.ex. dangerous goods). There is also a regular searching mechanism in the main navigation interface, that allows to find any location in the city of Wroclaw.

MAIN NAVIGATION INTERFACE

The main navigation window interface consists of a map, an itinerary drawn on the map and some functional buttons. The key fact is that the navigation client app uses Google maps only as a canvas for the drawn itinerary. The central system generates itineraries based on Open Street Map format inside the Graphhopper server component. The interesting fact is that both Google Maps and Open Street Map solutions use very detailed GPS measurements for their maps and no inconsistency between itinerary poly-line and the canvas map street was observed.



How it could work for you?

Parking management system

Occupancy verification

The European Patent Office

Make & Model Recognition

- automatic recognition of the make and model
- vehicle classification 4+1
- spot speed
- color
- autocalibration

Contact us today

Neurosoft Sp. z o.o.

Ul. Życzliwa 8
53-413 Wrocław , Poland

Neurosoft GmbH

Kippekausen 52
51427 Bergisch Gladbach
Germany

Our Phone

(+48) 71 738 83 1
(+48) 515 149 903

Email / Website

piotr.bardadyn@neurosoft.pl
www.neurosoft.com