AUTOMATION PILOTS ON PUBLIC ROADS IN THE NETHERLANDS

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PROJECTS

- **Udrive**: Large Scale Naturalistic Driving Observations in Europe
- **MRE Pre-automated Driving**: Real life scenarios for testing of Automated Driving
- **ENABLE-S3**: Valet parking pilot
- **EU project Autopilot**: Brainport pilot
UDRIVE: FACTS AND FIGURES

Programme: 7th EU Framework Programme
Project type: Collaborative project, large-scale integrating
Coordinator: SWOV Institute for Road Safety Research (NL)
Consortium: 19 partners, 10 countries
Duration: October 2012 – July 2017
Budget: € 10.5 million
EU funding: € 8 million
NATURALISTIC DRIVING DATA

› Natural behaviour in natural surrounding
  › No experimental interventions
  › Insight look “over the shoulder” of the driver
› Allows to study exposure, prevalence and risk
› Direct observation of conflicts and (near) crashes
  › Exact and detailed information what preceded
  › No bias by post-hoc reporting
MAIN RESEARCH AREAS AND ANALYSES

- Crash causation and risk
- Everyday driving
- Distraction and inattention
- Pedestrians and cyclists
- Motorcycle behaviour
- Eco-driving

- Pre-processing and data enrichment
- Preliminary Analyses Plan
- Safety Critical Events
THE DATA ACQUISITION SYSTEM (DAS)

- GPS/GSM antenna
- Microphone
- CAN/3D acc. and connectors adapter
- ON/OFF video recording
- Automotive Computer
- IR Spot
- MobileEye
- Cameras

Automation pilots on public roads in The Netherlands
CAMERAS

- Front view wide (3 cams)
- Face view (1 cam)
- Driver’s activity (1 cam)
- Driver’s feet (1 cam)
- Cabin view (1 cam)

7 cameras
ACCESS TO UDRIVE DATA

- Data available for post project research
- Data access for non-partners
- Analyses can be performed remotely on the dataset!

Central Data Center (CDC)
  - Located at SAFER, hosts all data
  - A copy of the database will be available in NL
UDRIVE FINAL EVENT COMING SOON

http://www.udrive.eu
PRE-AUTOMATED DRIVING

- Consortium: NXP, TNO, TASS International
- Sponsor: Metropole Eindhoven Region (MRE)
- Goals:
  - Collect real-life scenarios for testing Automated Driving functions
  - Collect data for system requirements of sensor systems
- Funding: 460 k€
- Duration: April 2015 – March 2017 (finished)
TEST SETUP

› Interaction between vehicles in mixed traffic
  › 3 instrumented Toyota Prius vehicles, Mercedes C-class with NXP radar
  › Highway and rural platooning Helmond-Eindhoven A270
  › Duration: 2 days of naturalistic driving
  › Experienced drivers
  › Radar, lidar, video recordings and vehicle data
CONCLUSIONS AND LESSONS LEARNED

- Real life scenarios provide valuable insights in addition to controlled environment tests
  - Enormous variability of manoeuvres
  - Real life requirements for sensor systems
- Bridges and tunnels provide major reflections that are challenging for radar processing
- Instrumentation of vehicles is never a routine job – careful attention and check-double check
ENABLE-S3 VALET PARKING PILOT

- Validation of highly Automated Cyber Physical Systems
- Multiple application domains, including Automotive

- Project Budget: 68 Mio EUR
- Public Funding: 33 Mio EUR
- Duration: May 2016 – April 2019

- 71 Partners:
  - OEM: AIRBUS DEFENCE, IXION AEROSPACE SL, PHILIPS MEDICAL SYSTEMS, RENAULT SAS, THALES ALENIA SPACE, THALES AUSTRIA, TOYOTA EUROPE
  - V&V environments: AVL, AVL DE, BTC EMBEDDED, DSD.ATENTECHNIK, MAGILLEM, MDAL SARL, MODEL ENGINEERING SOLUTIONS, NM ROBOTIC, RUGGED TOOLIN OY, SIEMENS INDUSTRY SOFTWARE NV, VIRES SIMULATIONSTECHNOLOGIE GMBH

TNO innovation for life

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18 May 2017
USE CASE 1.5 VALET PARKING

› Use case leader: Denso Germany
› Goal: stable architecture for valet parking
› Goal of pilot:
  › Collect valet parking scenarios, in particular vehicle – pedestrian interactions
  › Characterise sensitivity of vehicle sensors for indoor environment of parking house
VALET PARKING TEST

- Instrumented Toyota Prius vehicle
- Environment: ego vehicle, pedestrians, shopping carts
- Date: 22-23 March 2017, 5 hours of parking
- Assumptions: No ADAS used while driving
- Equipment used: GPS, VBox, Busdaq, Radar, MobilEye, Lidar
- Context: naturalistic driving and parking with mixed traffic with unautomated cars and vulnerable road users and during rush hour and during quiet hours. Different light conditions.
CONCLUSIONS AND LESSONS LEARNED

› Real life test trips provide valuable insights in addition to controlled environment tests
  › Enormous variability of situations, e.g. forgotten shopping cart, greasy floor, ‘random’ pedestrian trajectories
  › Real life requirements for sensor systems, e.g. contrast, blinking TL light, radar reflections
› In car scenario annotation is valuable but produces motion sickness
› Instrumentation of vehicles is never a routine job – careful attention and check-double check, also during tests
EU PROJECT AUTOPILOT: BRAINPORT PILOT

- Demonstrate added value of Internet of Things for Automated Driving
- Innovation Action - 3 Years: 01/01/2017 – 31/12/2019
- 44 beneficiaries – coordinator: ERTICO
- Project costs: €25 million - EU contribution: €20 million

- Brainport region: IoT enabled Automated Driving for supporting Real-Time Car Sharing services
6 pilot sites

Brainport, NL
- Automated Valet Parking
- Highway pilot
- Platooning

Tampere, FI
- Automated Valet Parking
- Urban Driving

Daejeon, KR
- Urban Driving

Vigo, SP
- Urban Driving
- Automated Valet Parking

Livorno, IT
- Urban Driving
- Highway pilot

Versailles, FR
- Automated Valet Parking
- Urban Driving
- Platooning
FOUR MAIN HUBS FOR CAR SHARING AND IOT

- Eindhoven Airport
- University campus
- High-Tech campus
- A270 Test site

20 km
MAIN THEME OF BRAINPORT PILOT

› Real-time Car Sharing supported by Automated Driving
  › Vehicle on demand
  › Automated Driving for Mobility-as-a-Service
  › Storage and retrieval of vehicles
› Enabling use cases
  › Driverless car rebalancing
  › Platooning & Highway pilot with electronic lane allocation
  › Automated Valet Parking
› IoT for
  › Routing, scheduling and logistics of vehicles
  › Hybrid control via infrastructure and vehicle systems
  › Legacy traffic assessment
  › Use of emergency lane for Automated Driving
FACILITIES OF THE BRAINPORT

- TASS Mobility Centre Control Room
- Extended coverage of C-ITS communication network and cellular
- Camera surveillance
- Traffic innovation Centre
- Road exemptions for Automated Driving experiments
THANK YOU FOR YOUR ATTENTION

Take a look: TIME.TNO.NL