SIS55: Benefit of IoT and Big Data for Automated driving and User Trust Challenge

What does Society Think?

User Acceptance Evaluation of IoT-Driven Autonomous Driving

ITS World Congress 2017
Montréal, Canada

François Fischer, ERTICO
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1 – The AUTOPILOT Project

Automated Driving Progressed by the Internet of Things
1.1 – Introducing AUTOPILOT

- **Idea**: Large-scale pilots at intersection between IoT and automated driving
- **Pilot Cities**: Tampere, Versailles, Livorno, North Brabant, Daejeon, Vigo
- **Length**: January 2017 to December 2019
- **Partners**: 44, coordinated by ERTICO – ITS Europe
- **Budget**: €24.16 Million
- **EU Grant**: €19.92 Million
1.1 – Introducing AUTOPILOT

**Objectives**

- Enhance the driving environment perception with IoT sensors enabling safer highly automated driving
- Foster innovation in automotive, IoT and mobility services
- Use and evaluate advanced V2X connectivity technologies
- Involve users, public services, business players to assess the IoT socio-economic benefits
- Contribute to the IoT standardisation and eco-system
1.1 – Introducing AUTOPILOT

- Provide common methodology pilot test activities
- Prepare all pilot sites for test activities (adaptation and authorisation)
- Complete pilot tests and collect data for evaluation

<table>
<thead>
<tr>
<th>Pilot sites</th>
<th>Location</th>
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<tbody>
<tr>
<td>VTT</td>
<td>Tampere, Finland</td>
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<tr>
<td>VEDECOM</td>
<td>Versailles, France</td>
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<tr>
<td>CNIT</td>
<td>Livorno-Florence, Italy</td>
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<tr>
<td>ETRI</td>
<td>Daejeon, Korea</td>
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<tr>
<td>TNO</td>
<td>Brainport, the Netherlands</td>
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<tr>
<td>CTAG</td>
<td>Vigo, Spain</td>
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1.2 – The AUTOPILOT Approach

**Step 1**
IoT Eco-System

- Objects provide data to IoT platform using IoT standardised protocols

**Step 2**
IoT Platform

- Objects are created virtually in the IoT platform

**Step 3**
AUTOPILOT Applications

- IoT platform develops applications using data from IoT data sources

**Step 4**
AUTOPILOT Services

- Applications enable services that support autonomous driving

AUTONOMOUS DRIVING progressed by IoT
1.3 – Practical Application: Level 4 Urban Driving

Gardens of Versailles Castle
Renault Twizy 1-seater for international tourists
1.3 – Practical Application: Level 3 Highway Driving

Traffic Control Center C-ITS

1. Sensors on the road side perceive a danger on the road surface (water, ice, oil, pollutants).

2. RSU queries the sensor network and detect the road conditions. Sends Hazardous location – Surface condition DENMs to the relevant zones and to Traffic Control Center.

3. RSU forwards DENMs to the approaching vehicles.

4. Vehicle shows warning information to the driver and takes action.

Users

Highway Livorno-Florence

4-seat cars for accredited driver

CONTINENTAL cloud
TIM ETSI OneM2M PLATFORM
FCA cloud
C2X On-Board Unit

Standard IoT Protocols
1.4 – The Evaluation Trilemma

- **Internet of Things**: New and intangible
- **Users, Stakeholder, Society**: Multi-faceted and constrained
- **Autonomous Driving**: Recent and dynamic
2 – Evaluating User Acceptance

Exposure, Imagination and Creative Approaches
2.1 – Evaluation Objectives

• **General Direction** Does IoT bring Automated Driving to a new dimension?

• **Specific Direction** Does IoT accelerate User Acceptance of Automated Driving?

• **Specific Objectives** Formulate IoT-related improvements for AD functions

  Determine IoT’s added user value to AD without IoT
2.2 – Creative Iteration

- Personal Factors
- Preferential Factors
- Geographical Factors
- Assess Experience
- Design Feedback
- Design Changes
- Geographical Factors
- Trial Run
2.3 – Multiple Perspectives

User Acceptance Evaluation

Perceived usefulness
Ease of use
Perceived control
Perceived trust
Perceived security/safety
Willingness to pay
Data control and access
Stress/Mental Workload
2.3 – Multiple Perspectives

- Individual Needs and Perceptions
- User Acceptance
- Quality of Life
- Business Impact
- Societal Trends and Attitudes
2.4 – Hypothesis-Driven Testing

- Formulation of testable hypotheses
  - If the IoT reduces frequency of velocity changes, user acceptance of AD improved
  - Data upload into the IoT cloud inhibits acceptance of automated driving
  - The infrastructure development needs of IoT surpass the economic added-value
  - Visualisation of IoT Infrastructure increases user acceptance of AUTOPilot applications
  - Advance warnings of puddles on the highway negatively impact driver attentiveness

- Qualitative and quantitative evaluation
2.5 – Indicative Timeline

- **Late 2017**: Finalisation of methodology
- **Mid 2018**: Pilot Sites fully operational
- **Early 2018**: Design iteration completed
- **Late 2018**: First round of full tests completed
- **Mid 2018**: Second round of test and design
- **Late 2019**: Publication of final results

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User Acceptance Evaluation
## 2.6 – Conclusion: What does Society Think?

<table>
<thead>
<tr>
<th>Better Questions</th>
<th>First Answers</th>
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<tbody>
<tr>
<td>• What does society know?</td>
<td>• Piloting as experience and exposure</td>
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<tr>
<td>• What does society want?</td>
<td>• Stakeholders as co-designers</td>
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<tr>
<td>• What does society need?</td>
<td>• Limited understanding of IoT</td>
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<tr>
<td>• Which part of society?</td>
<td>• Contradictory view on AD</td>
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User Acceptance Evaluation

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Thank you for your attention

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