Evaluation of Automated Transport Systems

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The European project CityMobil

- Performed several tests, evaluations and comparisons of four Automated Transport Systems (ATS):
  - Cybercars (CC)
  - High-tech Buses (HTB)
  - Dual-mode vehicles (DMV)
  - Personal Rapid Transit (PRT)

- by means of:
  - Four demonstrators
  - Five showcases
  - Six case studies
ATS in CityMobil

- **Cybercars**
- **High-tech Buses**
- **Dual-mode vehicles**
- **Personal Rapid Transit**
Demonstrators, showcases and case studies

- Demonstrators: Castellon (ES), Heathrow (UK), Rome (IT), La Rochelle (FR)
- Showcases: Daventry (UK), La Rochelle (FR), Orta San Giulio (IT), Trondheim (NO), Vantaa (FI)
- Case studies: Gateshead (UK), Madrid (ES), Sophie-Antipolis (FR), Trondheim (NO), Uppsala (SE), Wien (AT)
The CityMobil evaluation framework

• It considers social, environmental, economic, legal, technological impacts of the ATS

• To understand:
  – which kind of transport service ATS are best suitable for;
  – which are ATS advantages compared to conventional systems;
  – how would users react to ATS;
  – which the drawbacks;
  – whether ATS will be more sustainable than conventional systems; and
  – how much do they cost.
The evaluation categories

- Acceptance
- Quality of service
- Transport patterns
- Social Impacts
- Environment
- Financial Impacts
- Economic
- Legal impacts
- Technological success
The Passenger Application Matrix

• Bi-dimensional matrix filled with each local evaluation

• The matrix:
  – features the different origin-destination (OD) trips assessed through the CityMobil demonstrators, showcases and case studies
  – provides a tool for the selection of the most appropriate ATS to be designed in different specific situations
Origins and destinations of the Passenger Application Matrix

- City Centre
- Inner suburbs
- Outer suburbs
- Suburban centre
- Major transport nodes
- Major parking lots
- Major educational or service facilities
- Major shopping facilities
- Major leisure facilities
- Corridors
Passenger Application Matrix cells

- Represent all the possible OD pairs
- Are filled with the ATS studied in the CityMobil project, inserted according to the origin-destination of the trips they cover
- Allow comparisons between the demonstrators, showcases and case studies based on the same ATS
## Passenger Application Matrix: an extract

<table>
<thead>
<tr>
<th>Destination → Origin</th>
<th>City centre</th>
<th>Inner suburbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>City centre</td>
<td>CyberCars (Gateshead, Madrid, Trondheim, Wien) PRT (Gateshead, Madrid, Trondheim, Wien, Uppsala) DMV (La Rochelle, Orta San Giulio)</td>
<td>CyberCars (Gateshead, Madrid, Trondheim, Wien) PRT (Gateshead, Trondheim, Daventry, Uppsala) HT-Bus (Gateshead, Madrid, Trondheim, Wien) HT-Bus (Gateshead, Madrid, Trondheim, Vienna)</td>
</tr>
<tr>
<td>Inner suburbs</td>
<td>CyberCars (Gateshead, Trondheim) PRT (Gateshead, Trondheim, Uppsala) HT-bus (Gateshead, Madrid, Trondheim, Wien)</td>
<td>CyberCars (Gateshead, Madrid, Trondheim, Wien) PRT (Gateshead, Trondheim, Daventry, Uppsala) HT-Bus (Gateshead, Madrid, Trondheim, Vienna)</td>
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</tbody>
</table>
La Rochelle and Orta San Giulio evaluations

- City centre → City centre cell
- Dual-mode vehicles showcases
- Acceptance and quality of service indicators evaluated through questionnaires to people who tested the vehicles during the showcases
- Each indicator was scored in the questionnaire from 5 (completely satisfied) to 1 (completely dissatisfied)
Example of five indicators

- Usefulness
- Ease of use
- Perceived comfort
- Perception of safety
- Fear of attack

La Rochelle vs Orta San Giulio
Five indicator evaluations

• People provided quite positive feedback on the tested vehicles
• In La Rochelle, people provided an average evaluation little higher than in Orta San Giulio
• The differences in the evaluations could be also due to the different kinds of vehicles available in the showcases
Trondheim and Uppsala evaluations

- City centre → City centre cell
- PRT case studies
- Similar features of the PRT schemes simulated:
  - 4-place vehicle
  - 35-40 km/h as average speed
  - PRT segregated from the other traffic
- Transport pattern and financial indicators evaluated through the simulations
## Modal share simulations

<table>
<thead>
<tr>
<th>Mode of transport</th>
<th>Modal Shares after PRT introduction</th>
<th>Modal share variations due to PRT introduction</th>
<th>Modal Shares after PRT introduction</th>
<th>Modal share variations due to PRT introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRT</td>
<td>20%</td>
<td>+20%</td>
<td>27%</td>
<td>+27%</td>
</tr>
<tr>
<td>Car</td>
<td>55%</td>
<td>-10%</td>
<td>30%</td>
<td>-10%</td>
</tr>
<tr>
<td>Slow Modes</td>
<td>25%</td>
<td>-5%</td>
<td>38%</td>
<td>-15%</td>
</tr>
<tr>
<td>Bus</td>
<td>0%</td>
<td>-5%</td>
<td>5%</td>
<td>-2%</td>
</tr>
</tbody>
</table>
Evaluation general results

• ATS are generally perceived as easy to use and useful for solving mobility problems
• ATS were evaluated as reliable, especially in partly automated applications with driver
• Comfort, privacy, safety and security performances are positive
• All the ATS could be able to cover the investment costs, if dedicated accompanying measures to encourage their use would be adopted
Evaluation of PRT and CC

• PRT and Cybercars are the best-performing ATS in small/medium cities:
  – as autonomous public transport in the city centre
  – as feeders for the public transport where the demand is sprawled
  – high installation costs would be required, but quite positive results in mobility improvement would be linked with their installation
  – Low installation costs for Cybercars circulating on the same networks of conventional vehicles (legal aspects of vehicle certification to be considered)
Evaluation of HTB and DMV

• High-tech Buses:
  – are the best-performing ATS in medium/large cities
  – require high investment costs
  – Provide high social benefits with their installation and are socially viable

• Dual-mode vehicles:
  – show same cybercar benefit as public transport feeder
  – and allow an advanced car-sharing through innovative capabilities as automatic parking and platooning
THANK YOU

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