Societal Level Impacts of Connected and Automated Vehicles

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Together with:
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The LEVITATE project

- **Partners:** LOUGH (UK), AIT (AT), AIMSUN (ES), NTUA (EL), POLIS (BE), SWOV (NL), TOI (NO), TfGM (UK), City of Vienna (AT), QUT (AU), TJU (CN), UMTRI (US)

- **Duration of the project:** 36 months (December 2018 – December 2021)

- **Framework Programme:** Horizon 2020 - The EU Union Framework Programme for Research and Innovation – Mobility for Growth
Scope

- LEVITATE focuses on the development of a new impact assessment framework, in order to enable policymakers to manage the introduction of connected and automated transport systems, maximise the benefits and utilise the technologies to achieve societal objectives.

- Development of an open access web-based Policy Support Tool targeting Decision makers at all levels: Municipalities, Regional Authorities and National Governments.
Objectives

- Range of forecasting and backcasting scenarios: automated urban transport, passenger cars, freight services.
- Multi-disciplinary methodology to assess short, medium and long term impacts.
- Case studies: mobility, environment, safety, economic and societal indicators.
Sub-Use Cases

- **Automated Urban Transport:**
  - Point to point AUSS,
  - Anywhere to anywhere AUSS,
  - Last-mile AUSS,
  - E-hailing.

- **Automated Passenger Cars:**
  - Automated ride sharing,
  - GLOSA,
  - Parking space regulations,
  - AV dedicated lanes,
  - City tolls,
  - CAVs parking behaviors.

- **Automated Freight Transport:**
  - Fully automated delivery,
  - Fully automated delivery with night shifts only,
  - Automated freight consolidation,
  - Hub to hub automated transfer.
Methods and Impacts (1/2)

- **Microsimulation**
  - AIMSUN software: Athens, Manchester, Vienna
  - Impacts: Traffic, Safety, Emissions

- **Road Safety**
  - Models for Athens, Manchester, Vienna
  - Impacts: Crashes, Vulnerable road users

- **System Dynamics**
  - Impacts: Commuting distances, Space management/demand for parking

- **Mesoscopic Simulation**
  - MATSIM model for Vienna
  - Impacts: Modal split

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### The city of Athens in AIMSUN:

- 290x290 OD Matrices
- 2,580 Sections
- 1,137 Nodes

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[Diagram showing traffic flow between zones]
Methods and Impacts (2/2)

- **Delphi**
  - 63 experts, 2 rounds, 15 SUCs
  - Impacts: Travel time, Vehicle operating cost, Public health, Energy efficiency, Parking space, Vehicle utilisation rate, Vehicle occupancy, Access to travel, Amount of travel, Inequality in transport, Shared mobility rate

- **Operations Research**
  - Freight transport SUCs (Austria model)
  - Impacts: Energy efficiency, Travel time, Emissions

- **CBA**
  - Economic appraisal of all the proposed interventions
Policy Support Tool (PST)

Knowledge Module

- Bibliography
- Levitate results
- Tools Documentation
- Guidelines

Estimator Module

Forecasting sub-system

- Policy Interventions
  - introduction of a city toll for non-automated vehicles
  - economic incentives for AV purchase
  - provision of dedicated lanes for AVs
  - introduction of tax on vehicle ownership, traffic restrictions for non-automated vehicles
  - .... etc.

- Factors
  - Vehicle type
  - Area type
  - GDP
  - AV penetration rate (per SAE Level)
  - Automation type
  - Level of shared mobility
  - Vehicle ownership rate
  - Share of electric vehicles
  - Share of pedestrians
  - Share of cyclists
  - Share of PTWs
  - .... etc.

- Impacts
  - Crashes
  - Fatalities
  - Air Pollution
  - Noise Pollution
  - Energy efficiency
  - Vehicle purchase cost
  - Vehicle operating cost
  - Vehicle maintenance cost
  - Vehicle insurance cost
  - Direct cost of travel
  - Change in travel time
  - Travel comfort
  - Valuation of travel time
  - Congestion
  - Pavement wear
  - .... etc.

Backcasting sub-system

Utilization of forecasting in an iterative process ("goal seek"), testing alternative policy interventions until the desired impact(s) is obtained

Interrelations
PST functionality (1/2)

- Selection of **use case, sub-use case and policy implementation**.
- Selection of implementation **year** and automation scenario.
- Selection of **initial values** and details of sub-use case implementation.

As an example, the case of **Parking pricing** is being examined and the year **2036** for the pessimistic automation penetration scenario.
PST functionality (2/2)

- Estimation of **forecasted impact indicator** values for reference scenario (without SUC).

- Estimation of forecasted impact indicator values for **intervention scenario** (with SUC).

- SUC impact estimation-presentation of results.

The selected impact is **NOx due to vehicles** for this example.
Results

- Automation reduces conflicts improving **road safety**.
- Improvement of energy efficiency and thus of **public health**.
- Big environmental impact by **reducing emissions**.
- Increase of **access to travel** and thus increase of the **amount of travel**.
- Reduction of **delay time** hence increase of **total distance travelled**.
- **More impacts** to come...
Scientific and Social Impact

- **Flexible tool** for decision makers.
- **Backcasting system** providing insight on measures to reach cities objectives.
- Provide **multidisciplinary** impact assessment methodology.
- Identify **significant impacts** of CATS on safety, environment, mobility and society.
- **Bridge the gap** between technology and policy objectives.
- Support cities with **CATS implementation** without the unwanted and unforeseen consequences and rebound effects.
Future Challenges

- **Integration** of results of all different methods into a unified assessment framework
- **Investigation** of results **transferability** through comparison of theoretical approaches with simulated results
- **Establishment** of the Levitate PST as the go-to, one-stop-shop tool for the calculation of societal impacts of automation
- **Promotion** of evidence-based policy design in preparation for the advent of automation
- **Exploration** of the integration of new smart & green transport modes with automation
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