ETH zürich

Center for Sustainable Future Mobility (CSFM)

Autonomy-enabling Infrastructure for Future Mobility Systems: An Inside-Out Approach

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Motivation

Everybody is talking about **Autonomous Vehicles** (AVs) and their usage in **Autonomous Mobility-on-Demand** (AMoD) systems in future cities.

Things that are *unclear*, include **service requirements**, **autonomy requirements**, and needed **infrastructure**.

Challenges

We study the rationale of **autonomy-enabling** infrastructure

Autonomy fully on the vehicle

VS

Some autonomy on the vehicle, some on the infrastructure

This helps solving three main challenges:

1. Efficient planning for **investments** in the next 50 years

   Public transit investments?
   Autonomy-enabling infrastructure investments ?
   What can be outsourced? Scalability? Sustainability?

2. Active **control** and **regulation** of mobility providers

   Infrastructure control determines public resources usage
   Enforcement of inclusivity, sustainability, efficiency
   How to cover expenses?

3. Clarification of **requirements**, to speed up introduction of AVs

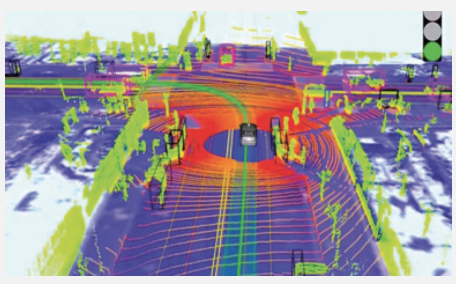
   Lack of clear requirements for AVs and AMoD systems
   Standardization procedures should start early (see SBB)

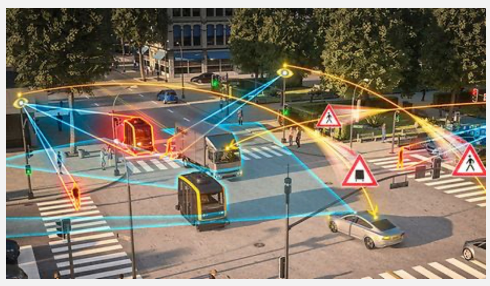
Research plan

The plan features four working packages

1 – Analytical studies for autonomy-enabling infrastructure

Impact of city topology, demand, and operational conditions of AMoD systems on **costs**, **efficacy**, and **scalability** of the approach





Costs: operations, depreciation, investment (hardware + software)

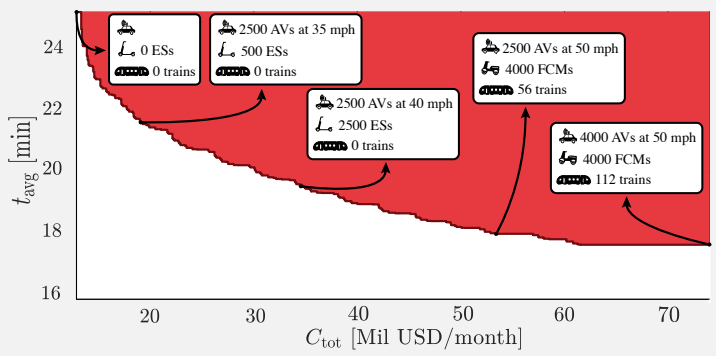
2 – Development of simulation tools targeted to the problem

Modular autonomy-enabling infrastructure changes
- Network re-sizing
- AMoD operations

Assess impact of interventions vs. efficiency, cost, sustainability

3 – Optimal infrastructure planning via co-design

Solve multi-objective optimization problem
Modular and flexible (cost structures, time horizons)
Find rational investment solutions and important trade-offs



4 – Detailed case studies

Swiss and international case studies
Leveraging data from SBB AG and Siemens Mobility

5 Conclusion and expected impact

This project is important for three stakeholders:

Authorities - Investment planning, policy making, regulation
Mobility companies – service design
Academia – gap filling in the literature

References

Visit Gioele's homepage to see/read/hear more:
https://gioele.science

Partner: amag SBB SIEMENS

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