ETH zürich

Center for Sustainable Future Mobility (CSFM)

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

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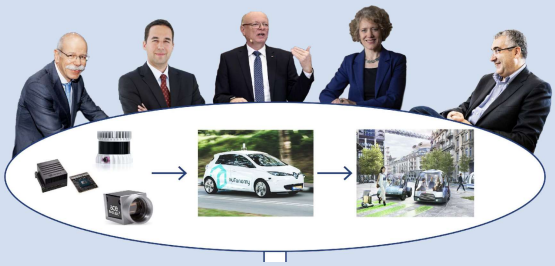
1. Motivation



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**.

2. Autonomy-Enabling Infrastructure

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

Autonomy fully on the vehicle

VS

Some autonomy on the vehicle, some on the infrastructure

for different cities to help understand the following questions:

1. Efficient planning for future **investments**

   Is autonomy-enabling infrastructure viable?
   What are the trade-offs in the interplay of mobility users, smart infrastructure operators, and, mobility and AV providers?

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

   Infrastructure control determines public resources usage
   Enforcement of inclusivity, sustainability, efficiency

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

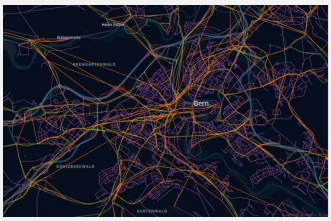
   Lack of clear requirements for AVs and AMoD systems
   How fast and along which routes should or need AVs be able to drive to have an impact?

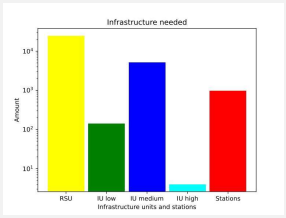
3. A First Case Study for Bern 2040

We study different autonomy-enabling infrastructure investment scenarios based on three main pillars:

1 – First-principle analysis

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

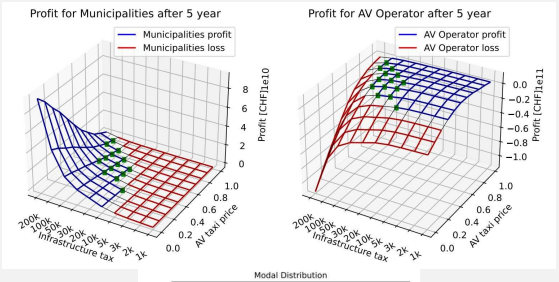


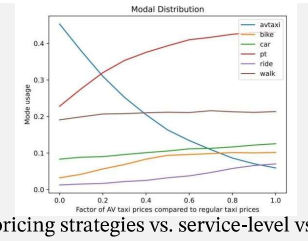


Costs: operations, depreciation, investment (hardware + software)

2 – Simulation of system designs: An agent-based approach

We use a state-of-the-art simulation framework based on MATSim, (co-)developed by SBB to simulate and analyze core drivers of the autonomy-enabling infrastructure case for key stakeholders





Assess different pricing strategies vs. service-level vs. 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. 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

Partner: amag SBB SIEMENS

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