Faculty of Management, Economics and Social Science
Chair of Information Systems for Sustainable Society (Prof. Ketter)

Master Thesis

Charging Needs Model of Commercial Fleets

Ride-Hailing (Taxi) fleets face two paradigm shifts at the same time: Drivers might get replaced by autonomous driving capacities in the near future and the switch to electric vehicles (EV) is already underway. While these changes introduce operational challenges, they also hold great potential for more efficient and thus sustainable operations of these fleets. For this thesis, we assume both changes to be fully implemented: A ride-hailing operator has a fleet of SAEV (shared autonomous electric vehicles).

The fleet must be coordinated in such a way that demand and supply is balanced. Because EV taxis are not replenished in an instant like their combustion engine counterparts, supply is highly dependent on an effective and efficient management of charging. Thus, operators are incentivised charge vehicles as often as possible to maintain high state of charge (SoC) levels throughout their fleet. On the other hand, vehicles cannot serve trips – and thus cannot earn the operator money – while they charge. Hence, operator's need to keep the balance of charging as many vehicles as necessary, but not too many.

Aim of this thesis is predicting the need for charging vehicles in a given location (think an area of a city). This entails a multistep approach. First, the expected demand in an area at some time in the future will be predicted. Outbound demand between current time and the target time should be predicted as well. In combination with a prediction of inbound demand and the respective state of charge levels, a fleet future local fleet state can be deduced. In combination with the current local fleet state, this gives the operator the local charging needs – that is: how many vehicles do I need to charge by which amount to be able to serve local trips in the future.

This thesis can be seen as the delivery of a design science artifact that takes current local states and returns current local charging requirements. Ideally, this will be implemented in accordance with the urban mobility simulation developed by the is3-chair.

Key tasks and objectives of the thesis

- Develop a design science artifact that takes in current states of an SAEV operator and returns its current local charging needs
- Figuring out best prediction method
- Predicting in- and outflow of mobility needs
- Logically combine prediction results and develop integrated pipeline

Topics

- Mobility
- Machine Learning
- Design Science

Methods

- Prediction (i.e., ML or ecnometrics)
- Bayesian methods could also work here
- Possibly Simulation
- Software Engineering

Contact

Lennard Sund

Tel.: +49-221-47089059,
lennard.sund@wiso.uni-koeln.de

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