

Evaluating Adaptive Automated Cargo Bikes for Urban Freight Transport: A Simulation-Based Study in Magdeburg, Germany

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23.10.2025



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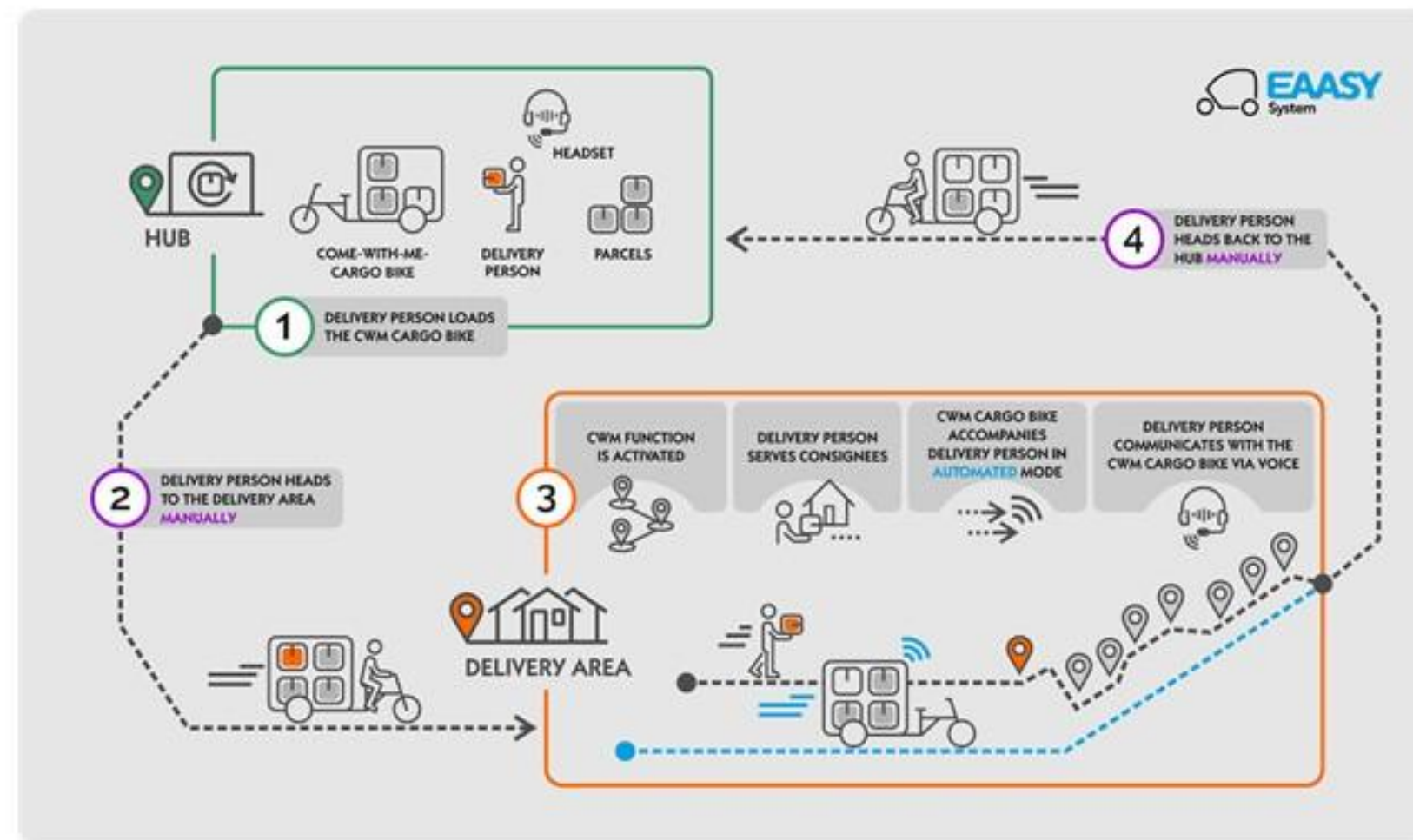


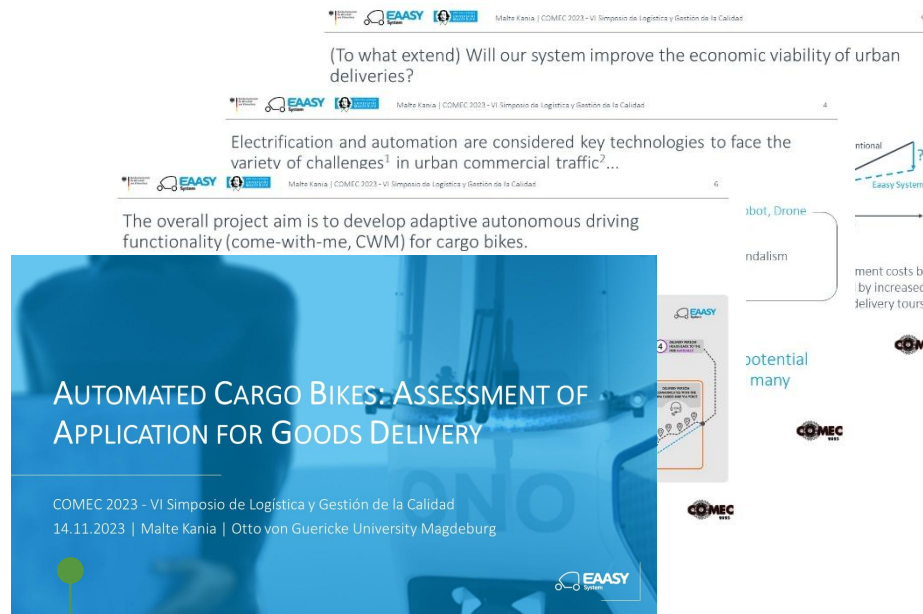
“Por una innovación sostenible”

The overall project aim is to develop adaptive autonomous driving functionality (come-with-me, CWM) for cargo bikes.

Eaasy System delivery concept:

- Based on conventional last-mile delivery using cargo bikes and micro hubs
- Delivery person can either drive manually or activate CWM mode via voice command
- In CWM mode vehicle is capable of autonomously driving behind or beside walking delivery person or navigate itself to safe parking spot





Review: COMEC 2023

- Research project: EAASY System
- Simulation model for calculating potential time savings and return on invest (conceptual model)

2023

Outline: COMEC 2025

- 1) Technical implementation
- 2) Simulation model:
Implementation and validation
- 3) Conclusion and outlook

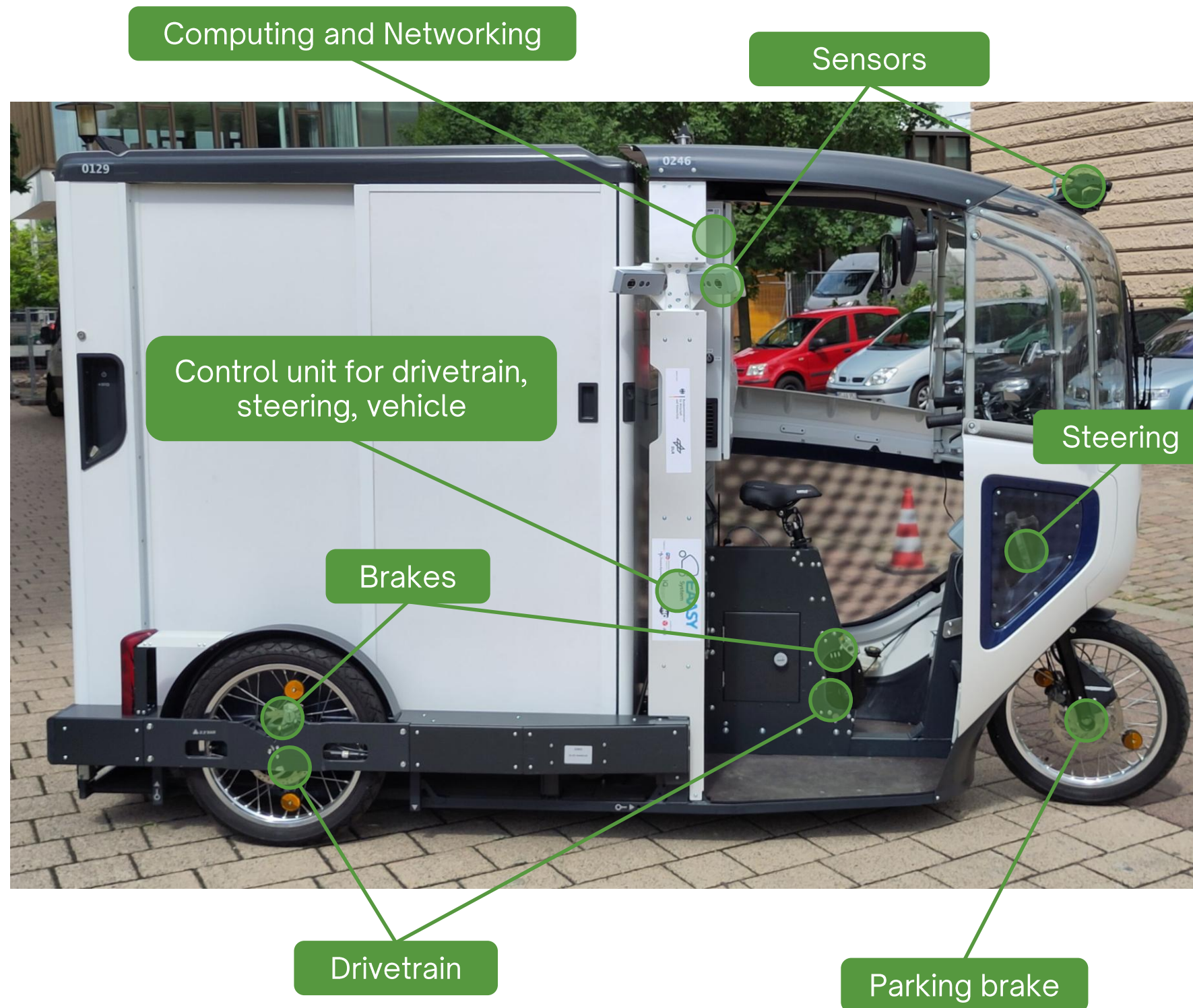
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Bike is equipped with:

- Actuators and sensors
- Environmental perception
- Computing technology
- Bus system and networking

CWM functions implemented on production vehicle:

- Speed up to 6 km/h (~3.7 mph)
- Activation via push of a button or per voice
- Separate modes for manual and automated driving
- Safety measures in hardware and software



Data

- Network manager: Manages road network and location data and access to distance matrices
- Caching system: Optimizes performance through local storage of pre-calculated data

Vehicle Modeling

- Flexible vehicle types: Delivery vans, cargo bikes, and automated cargo bikes
- Detailed parameters: Capacity, range, service times and operating costs, emissions

Route Optimization

- Implementation of the Capacitated Vehicle Routing Problem (CVRP), integration of OSRM (Open Source Routing Machine)
- Fleet optimization: Distributes stops evenly among available vehicles

Simulation

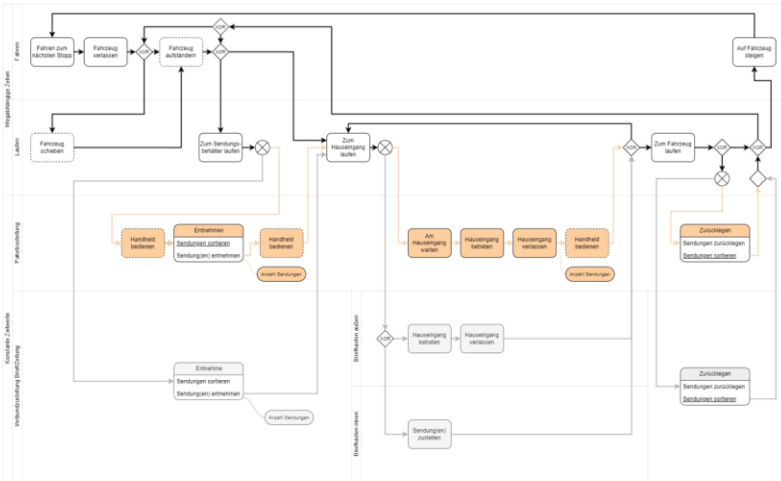
- Detailed modeling of all delivery activities, captures time and distance metrics for each activity
- Realistic variations in service times and customer availability

Performance Analysis

- Stops per hour, packages per hour, cost per package.
- Calculates fixed and variable costs based on operating parameter
- Compares performance across different scenarios

02/2023 | Planning Workshops

- Definition of processes and working cycles
- Requirements definition, Design of data collection



08/2023 | Final Preparation

- App development completed
- Final coordination of data collection

09/2023 | Start of Data Collection

- Initially accompanied by research fellows from OVGU
- Subsequently independently by delivery personnel

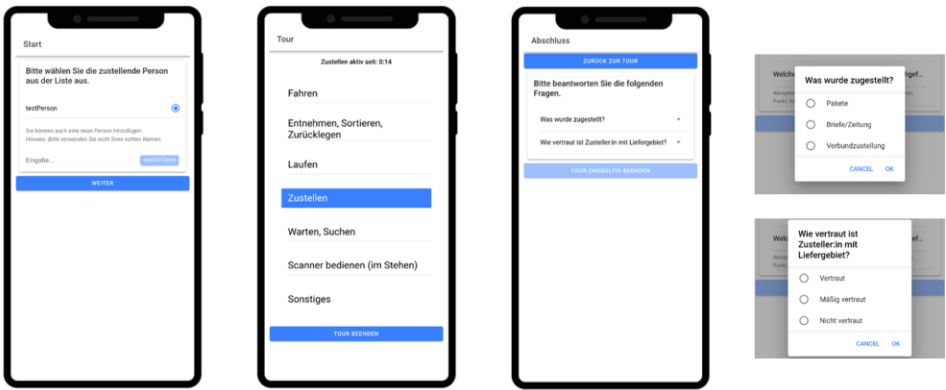
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02/2023 | Field Observations

- Validation of data collection design

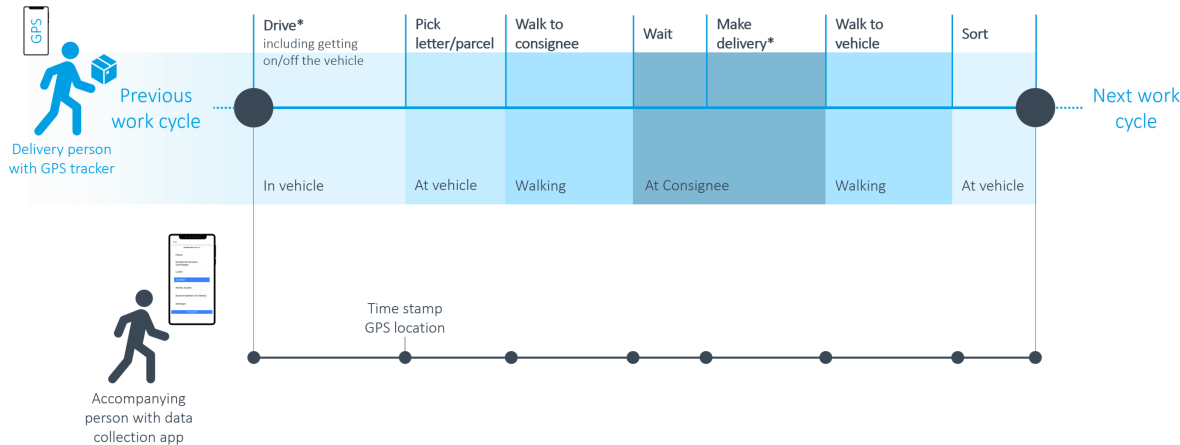
03/2023 | App Development

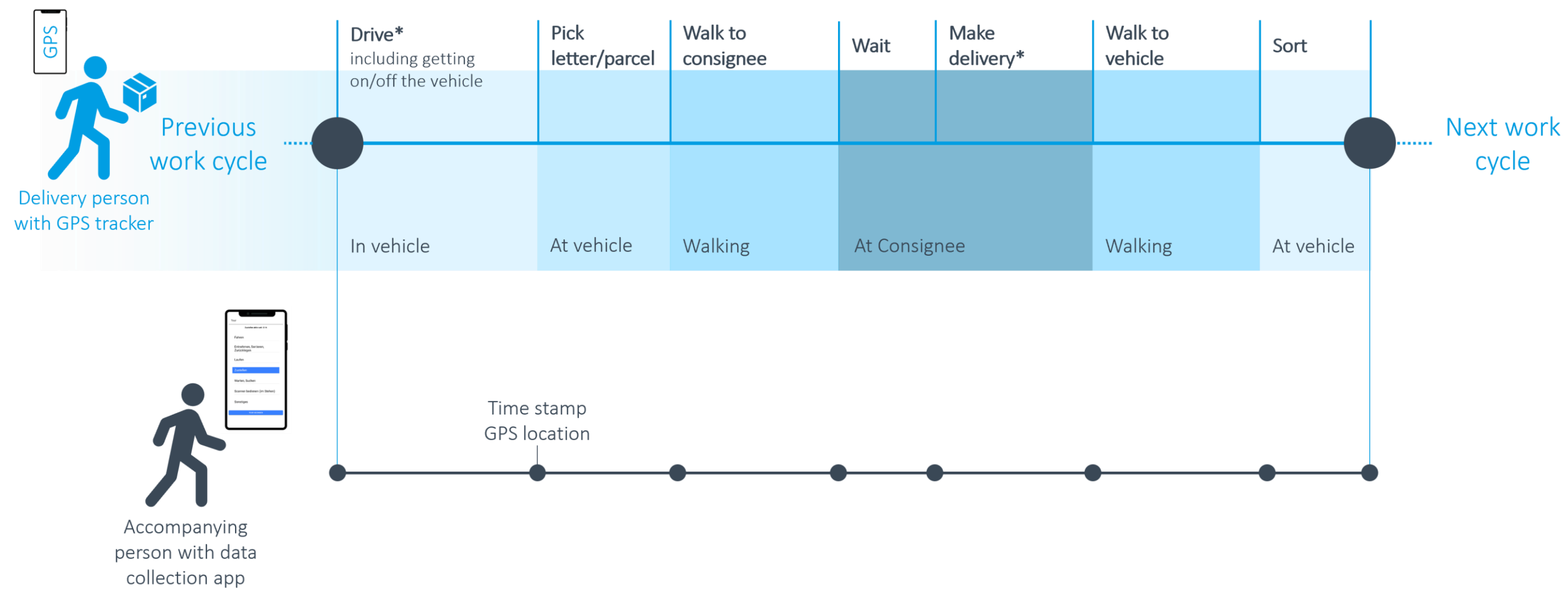
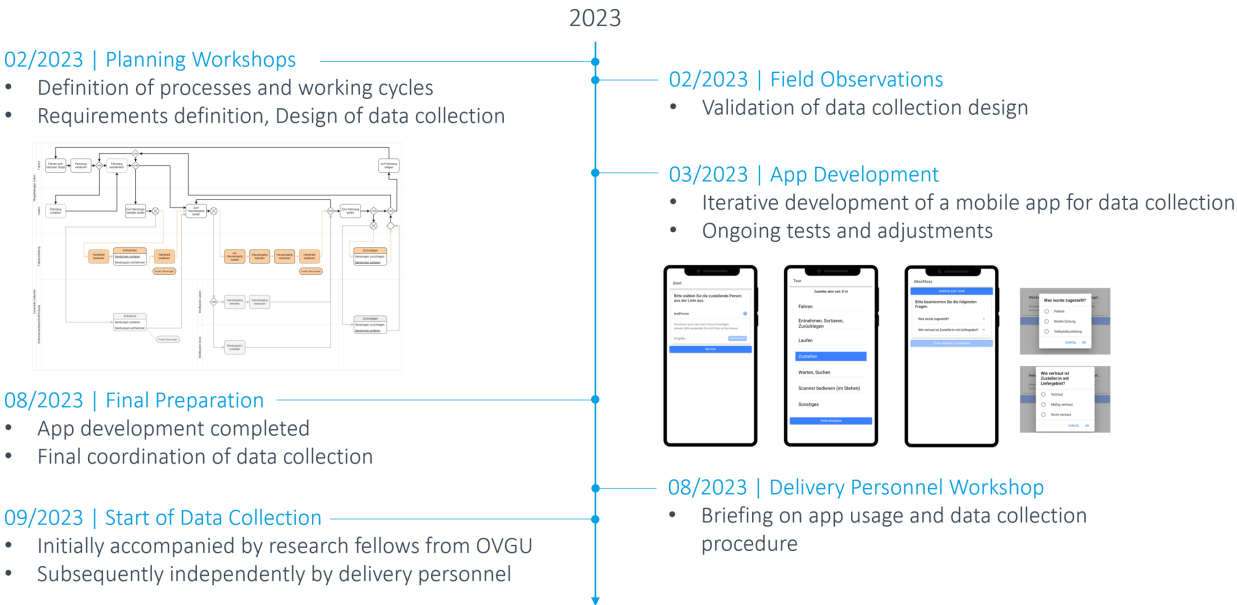
- Iterative development of a mobile app for data collection
- Ongoing tests and adjustments



08/2023 | Delivery Personnel Workshop

- Briefing on app usage and data collection procedure







eaasy_system/evaluation

Gefördert durch:

Bundesministerium
für Wirtschaft
und Klimaschutz

aufgrund eines Beschlusses
des Deutschen Bundestages

EAASY

System

Select Location

Existing Postal Codes

Add New Postal Code

Select state:

sachsen-anhalt

Select a postal code:

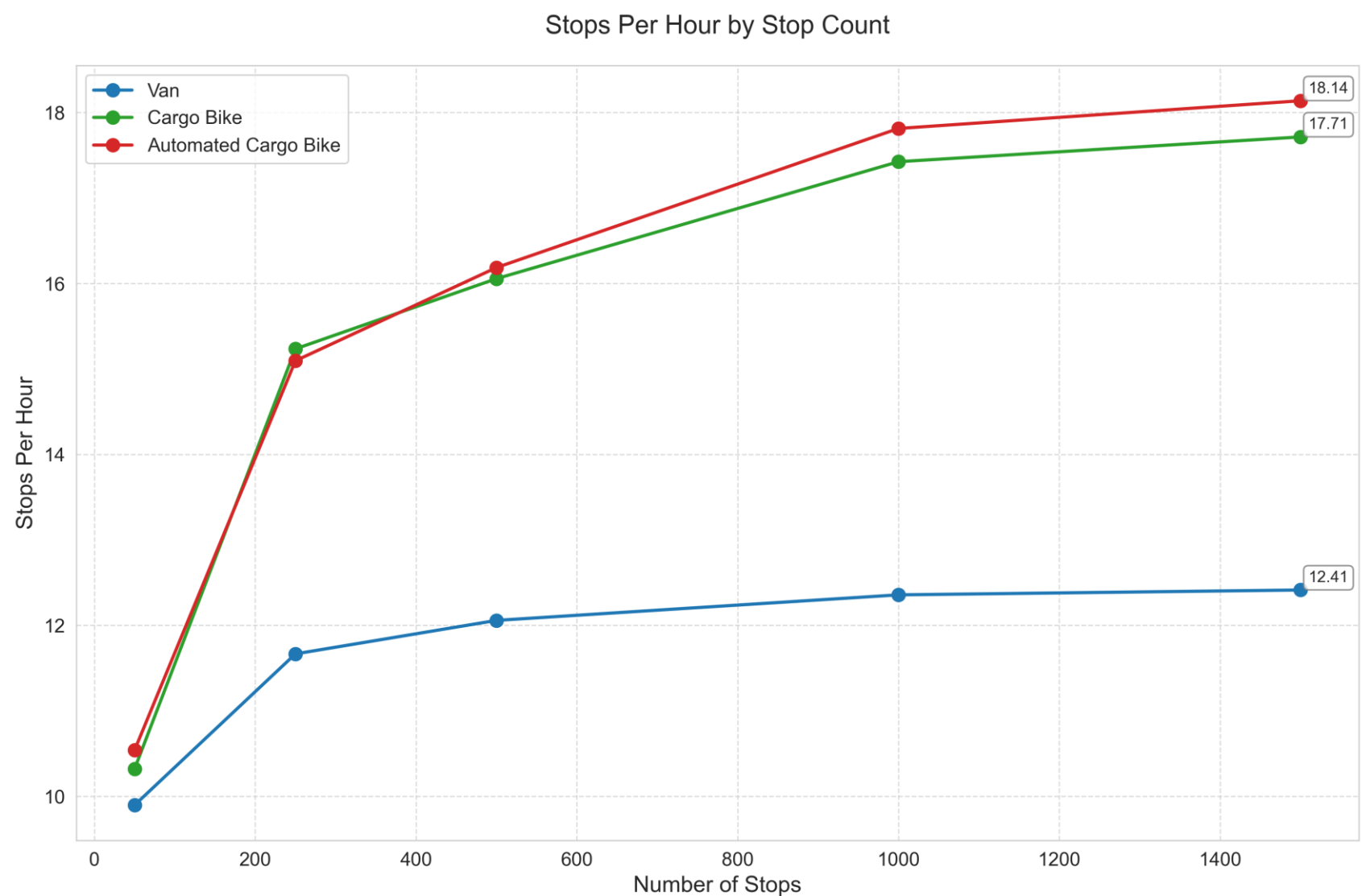
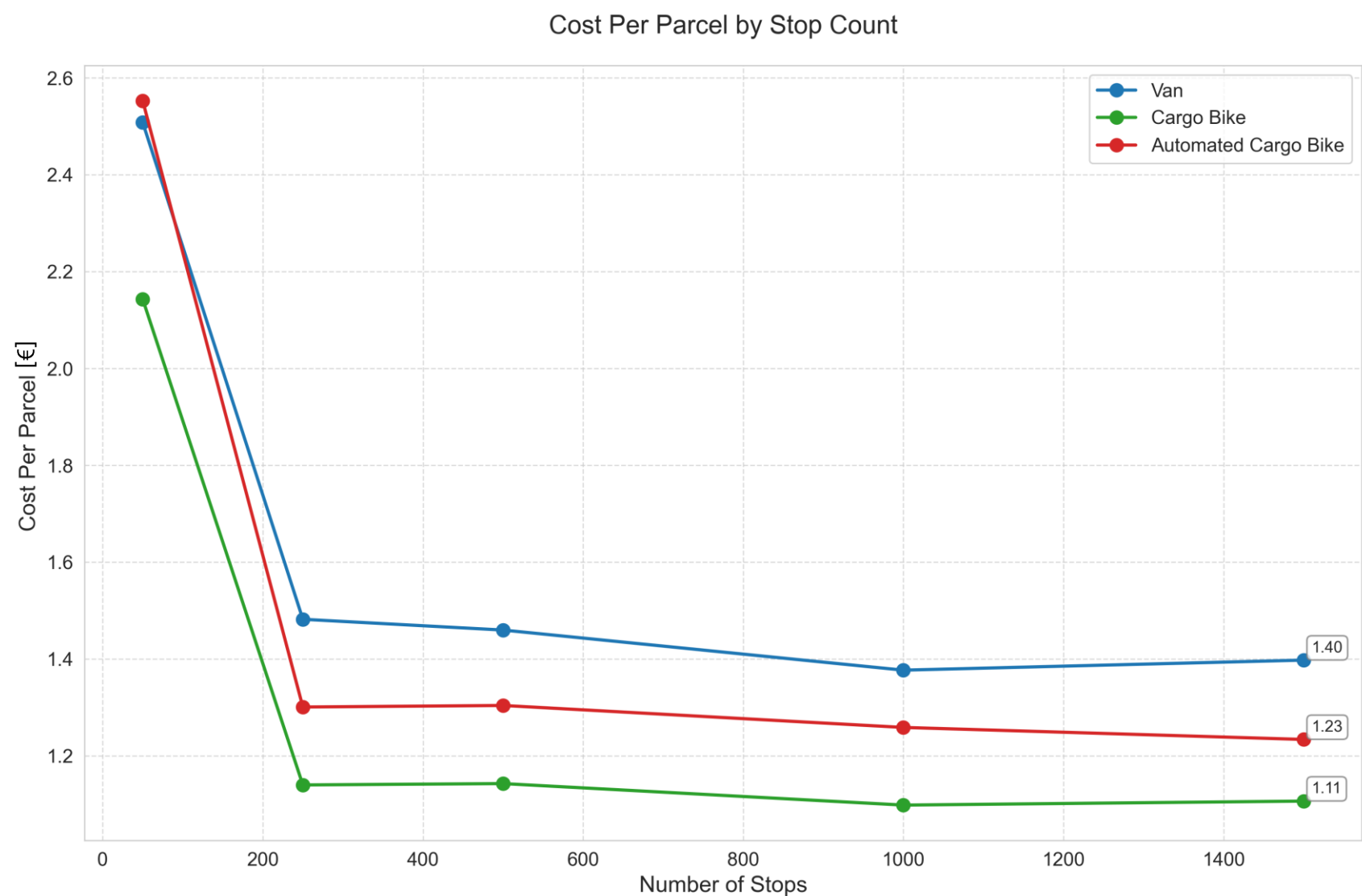
39104

Continue to Analysis

Note:

This tool isn't online at the moment; it can only be used on a local PC.





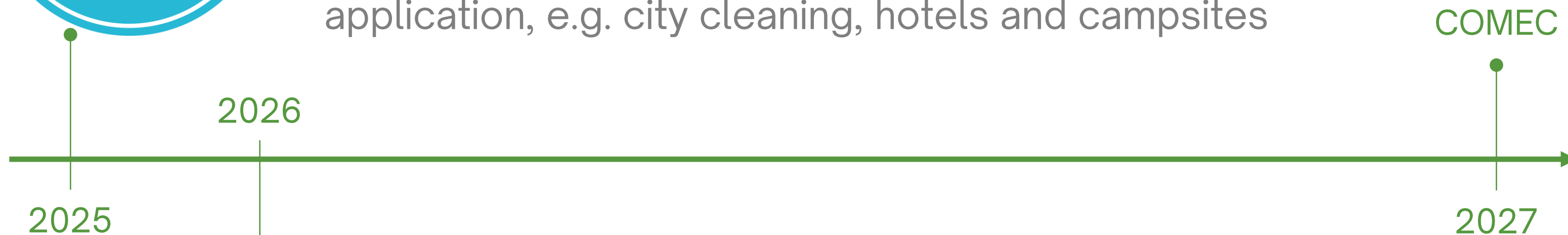
Experiment: Vehicle comparison for different stop densities in postal code area 39104





Ongoing projects:

- Aura-HWB: Further development of hardware and software; Goal: Make technology market-ready
- AuRa-Hirn 2: Transfer of technology to other areas of application, e.g. city cleaning, hotels and campsites



- Simulation modell:

- Cooperation with other logistics service providers to further refine models
- Outlook: Further develop the model within future projects



Muchas gracias

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Further information: <https://www.aura.ovgu.de/>

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