





# **AMD-OEPNV**

SYNCHRONIZATION OF AUTONOMOUS MICRO-VEHICLES WITH PUBLIC TRANSPORT

mFUND Konferenz, 12.12.2023, dbb Forum Berlin Imen Haj Salah (M.Sc.), Dr. Tom Assmann

- 1.Project Details
- 2. Motivation and Objectives
- 3.Methodology
- 4. Results and Discussion
- 5. Dissemination





## **1.Project Details**

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Organization: Otto-von-Guericke University Magdeburg Institut of Logistics and Material Handling Systems





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Cost-effective



Public transport





Environment-friendly

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# Objective

- Develop a synchronization algorithm of autonomous bikes with PT
- Test it in a simulatiaon model
- Check the economic viability





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# Methodology

- Create sound demand scenarios for the AMD-OEPNV service
- Build a simulation model that represents the key elements of AMD-OEPNV
- Both for the Case of Magdeburg
- Develop the synchronization algorithm, implement in the simulation, test it



## **Demand generation**

GTFS Open Data

#### Tram trips extraction

Choose a specific day for the study

Extract the tram trips (schedules, stops) operating that day

#### Hourly demand determination

Assuming 2% of cars users will switch to our service, determine the daily demand

Extrapolate the data over the day to get the hourly booking

#### **AMD-OEPNV** demand

Assign the requests to the corresponding tram station based on the tram availability and schedules







Bundesministerium für Digitales und Verkehr

## **Demand generation**







4432 requests



## SIMULATION OF A CASE STUDY

- City: Magdeburg
- Tram network only
- First & last mile
- One day scenario





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#### **TECHNICAL RESULTS**

- Rebalancing algorithm developed
- Fleet management algorithm developed
  Free for usage: https://github.com/ImenHS/AMD-OEPNV
- Simulation realized for case study in Magdeburg









	AMD-OEPNV	AuRa
Total requests	4404	4404
erved customers	4337	4332
Number of bikes	147	183







- Improved efficiency compared to AuRa
- Service could be profitable with a fee over 1.7€
- Autonomous bike sharing can be offered at lower costs than taxis or bus services



#### **FURTHER WORK**



Development of multimodal routing algorithm

More detailed CO2 and user acceptance studies

### DISSEMINATION

- Algorithms are Public: https://github.com/ImenHS/ AMD-OEPNV
- Final Report: Before publication
- Journal Paper work in progress











### **COST STRUCTURE**

	Bike capital (Depreciation: 4 years)	40000 €
Costs	Charging station Capital (Depreciation: 6 years)	40490 €
	Station maintenance	600 €/ Month
	Bike maintenance	500 €/ Month
	Energy cost per kWh (update it)	0,24 € (0.4)

0.89 € per bike per day for administration costs

