Bundesministerium für Digitales und Verkehr

Institut Für Logistik Und Materialflusstechnik

mFUND – Das Startkapital für die Mobilität der Zukunft

AMD-OEPNV: Synchronization of autonomous micro mobility services with public transport

One challenge of public transportation lies in the last mile, which can be a barrier that hinders accessibility. As a solution, we propose the integration of autonomous bikes with public transport to simplify urban mobility and create a sustainable door-to-door mobility option.

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Objective

The objective is to synchronize between autonomous micro-mobility services and the public transportation (PT). To do so, we need to develop a synchronization algorithm between autonomous bikes (as example) and PT, evaluate it in a simulation model and assess its efficiency compared to a standard autonomous bike-sharing service (AuRa) as shown in Figure 1.

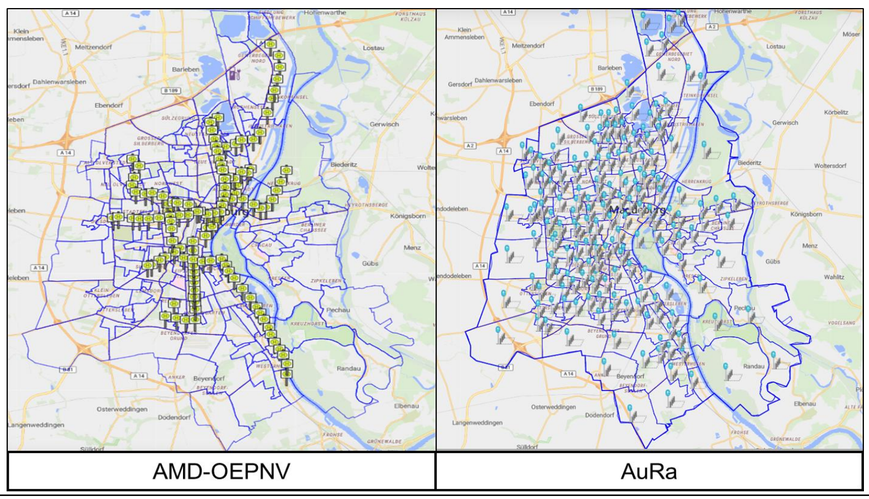

Figure 1: Station distribution of both services

Methodology

- Data analysis: We assumed that from the PT network, only tram network will be considered in this study. We have defined a methodology where we use the GTFS data and origin-destination flow to create demand requests (see Figure 2).
- Development of an optimization algorithm: The algorithm evaluates the upcoming demand at each tram station 15 minutes before the tram arrival and calculate the imbalance. If bikes are needed, we assign the nearest available bikes to the tram station. If no bike is available we do the search again after one minute till a bike is found.

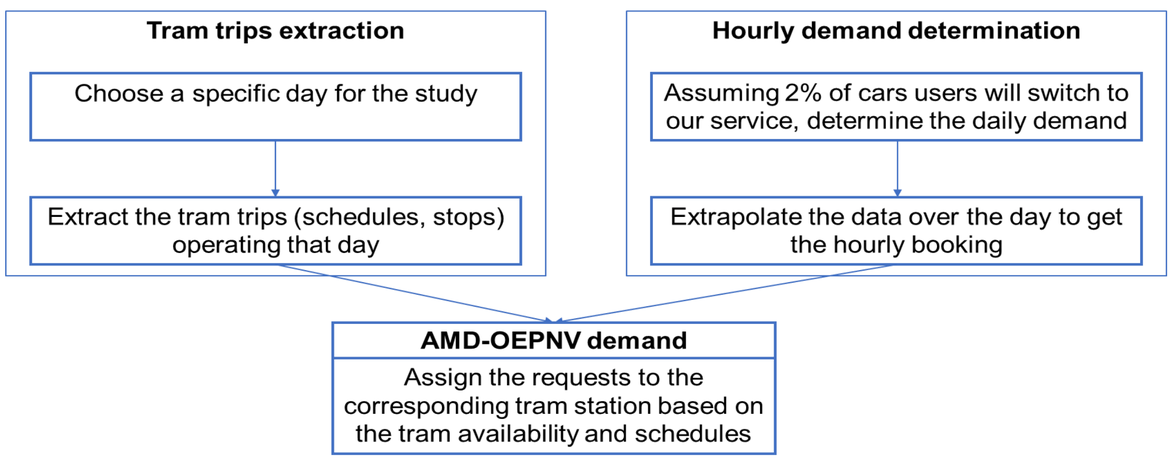

Figure 2: the methodology of demand scenarios creation,

Table 1: KPI's comparison between AMD-OEPNV and AuRa

	AMD-OEPNV system	AuRa system
Total requests	2202	2202
Served customers	2186	2168
Number of bikes	90	110

Results

We compared the integrated service AMD-OEPNV with the AuRa service (autonomous bike service with no synchronization to public transport) using a simulation model built in Anylogic to test the services for the first mile and last mile assuming a one-day scenario. For each case, we calculated the minimum number of bikes that would allow 94% service level for each hour of the day. The number of bikes needed for each system and the number of requests served are presented in Table 1. AMD-OEPNV allows us to reduce the number of bikes needed in the system by 16%. This has an impact on the trip cost as shown in Figure 3 by reducing it significantly from 1,95€ to 1,54€. We can summarize the main findings of this project in the following points:

- The synchronization algorithm would allow a more efficient service where autonomous bikes and public transport are combined compared to a non-synchronized service by reducing the number of bikes needed and correspondent costs in the system.
- Such a combined service would have approximately an additional cost of 1,5 € per trip. We believe that these costs are quite reasonable compared to car-sharing services and could be split between the two service providers as the AMD-OEPNV will attract new passengers to public transport

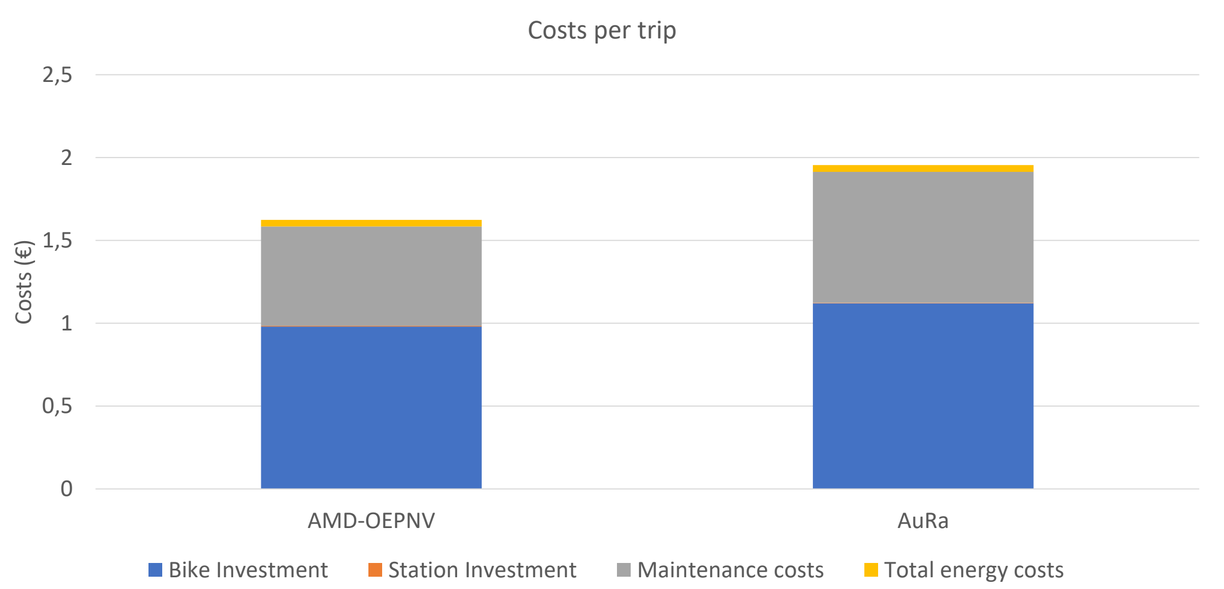

Figure 3: Costs comparison between AMD-OEPNV and AuRa

Acknowledgment

The AMD-OEPNV project (19F1099A) is funded as part of the mFUND innovation initiative by the Federal Ministry for Digital and Transport

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