

D2.3 - AI-based simulation model for optimal placement of micro-hubs and cargo bike pick-up stations



What is it about?

This document explains the development of an **AI-based simulation model**.

AI is an abbreviation of the letters **A** and **I** and stands for **Artificial Intelligence**.

Artificial Intelligence means: A computer or a machine is doing things like a person.

For example:

- It can answer questions.

- It can learn new things.

- It can help to find solutions for a problem.

The Artificial Intelligence helps us to find the best places for micro-hubs and cargo bike pick-up stations in urban outskirts.

And the Artificial Intelligence creates a simulation model for suitable locations.

A **simulation model** is like a copy of something real. It is not real, but it helps us to understand real things.

We use a simulation model to:

- See what can happen.

- Test ideas.

- Learn how something works.

Our simulation model uses Open Data.

Open Data means:

- Information that anyone can use.

- Information that is free.

- You can look at it, share it and use it.

For example:

- Maps.

- Traffic data.

- Numbers about people or places.

The information is:

- Online

- Easy to find.

- Not secret.

- You do not need to pay for it.

The **Open Data** we use for our simulation model are for example:

- population information
- points of interest
- maps.

It also includes **social factors**, like accessibility for older people, income levels (how much money the inhabitants have), and community needs.

All this open data we feed into a computer programme.

And we created a mobile app called the “Location Finder for Pick-up Stations”:

This app shows city maps. And the app allows us to adjust various settings to simulate different scenarios to find the best places for micro-hubs and cargo bike pick-up stations.

We also invented 3 persons (an elderly person, a person with a family and a student) to simulate the potential needs of our users. This helped us to further improve the simulation model.

The simulation model shows possible locations for:

- parcel lockers
- cargo bike rentals and
- community-friendly delivery points.

These stations are not only for logistics but also **social meeting places**.



Main objectives

- Find the **best locations** for micro-hubs and cargo bike pick-up stations in suburban areas.
- Improve **last-mile delivery** while considering social and **community needs**.
- Case studies: **Leipzig** (Germany), **Merano** (Italy), **Dresden** (Germany).



Data and approach of our model

The developed app uses available open data and information that we have entered into the system:

- Uses **open data**: population, points of interest, city maps.
- Includes **social factors**: accessibility, income, age, community needs.
- Ensures **accessibility**: stations are accessible for people with disabilities.
- Uses the information about **3 invented people** to meet the needs of elderly people, families and students.



App features

The developed app has interesting features:

- Interactive **map view** of potential locations.
- **Control panel** to select city, features and accessibility.
- **Scenario buttons** for different people.
- Weight sliders for adjusting importance of features.

Using these features the app shows the most suitable positions for:

- Parcel lockers
- Cargo bike rentals
- Micro-hubs



Future developments of our simulation model

Our simulation model could be expanded to more cities. And our model could use additional datasets. For example:

- Integrating **real-time data** and predictive modelling.
- Adding more **community and social features** (parks, cafés, local shops).
- Including **user feedback** for location suggestions.



Conclusion

Our simulation model is a planning tool. It combines technology and community needs to improve logistics in urban outskirts. This makes our simulation model useful:

- It supports sustainable, inclusive and efficient delivery.
- It offers a modern tool for building greener and more connected cities.

The case study in Leipzig confirmed that the model can provide useful, flexible solutions for suburban delivery challenges. It can adapt to different user groups and changing city needs. Other cities want to use this developed model, too.

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