GEBZE TECHNICAL UNIVERSITY

Walkability Optimization for 15-Minute Cities

CSE 495

Secondary Presentation

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Project Definition

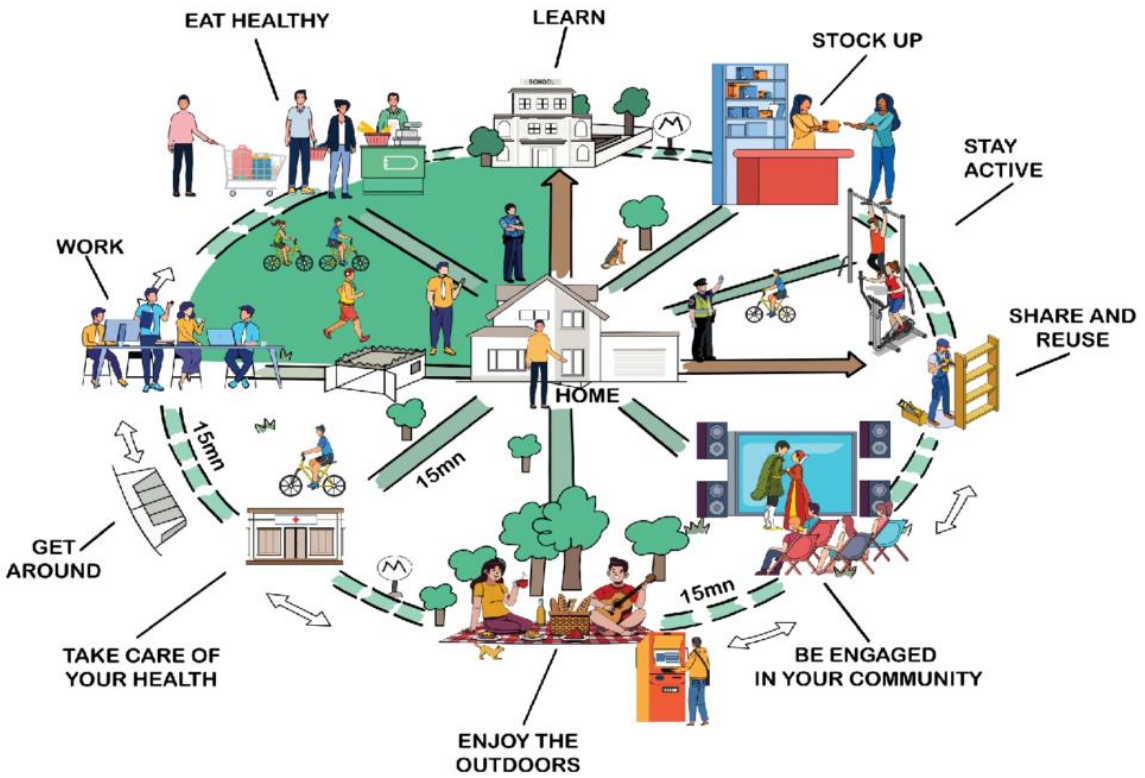


Figure 1: Concept illustration of a 15-Minute City.

- 15-Minute City means people can reach daily needs within a 15-minute walk or bike ride.
- It reduces car use and helps create healthier, more sustainable cities.

Project Definition

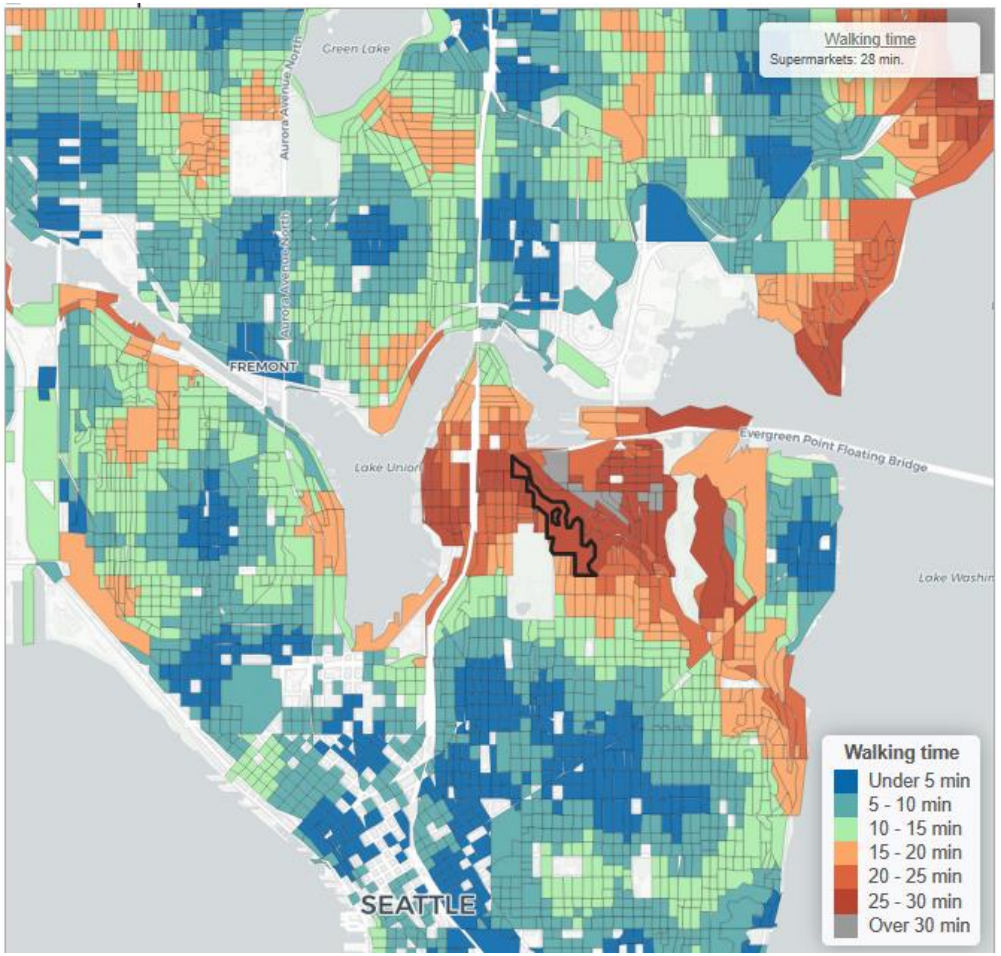


Figure 2: Walkability map showing walking times for supermarkets.

- In this project, we analyze how people reach daily services in their neighborhoods using city data and walking distances.
- We identify where new amenities—like groceries, schools, and restaurants—should be added to improve walkability and support the 15-Minute City idea.

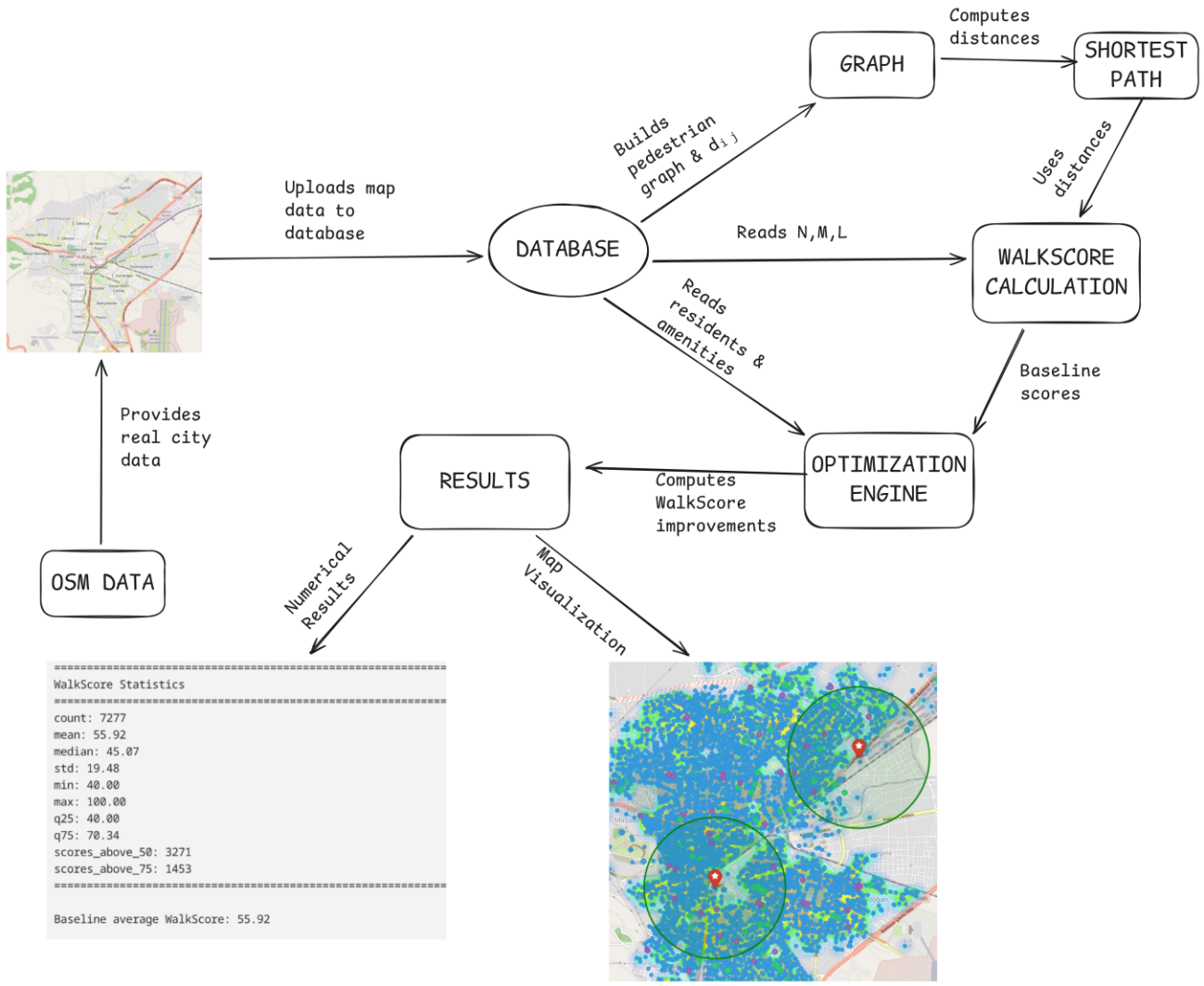
Project Design

In designing this walkability optimization system, two assumptions are made:

- **15-Minute City Concept:** Residents should access daily amenities (grocery, school, restaurant) within a 15-minute walking distance.
- **Network-Based Distance:** Real walking distances along pedestrian networks provide more accurate walkability assessment than straight-line distances.

These assumptions guide our system's design for analyzing and getting recommendations for cities, emphasizing urban accessibility and data-driven optimization.

Project Design



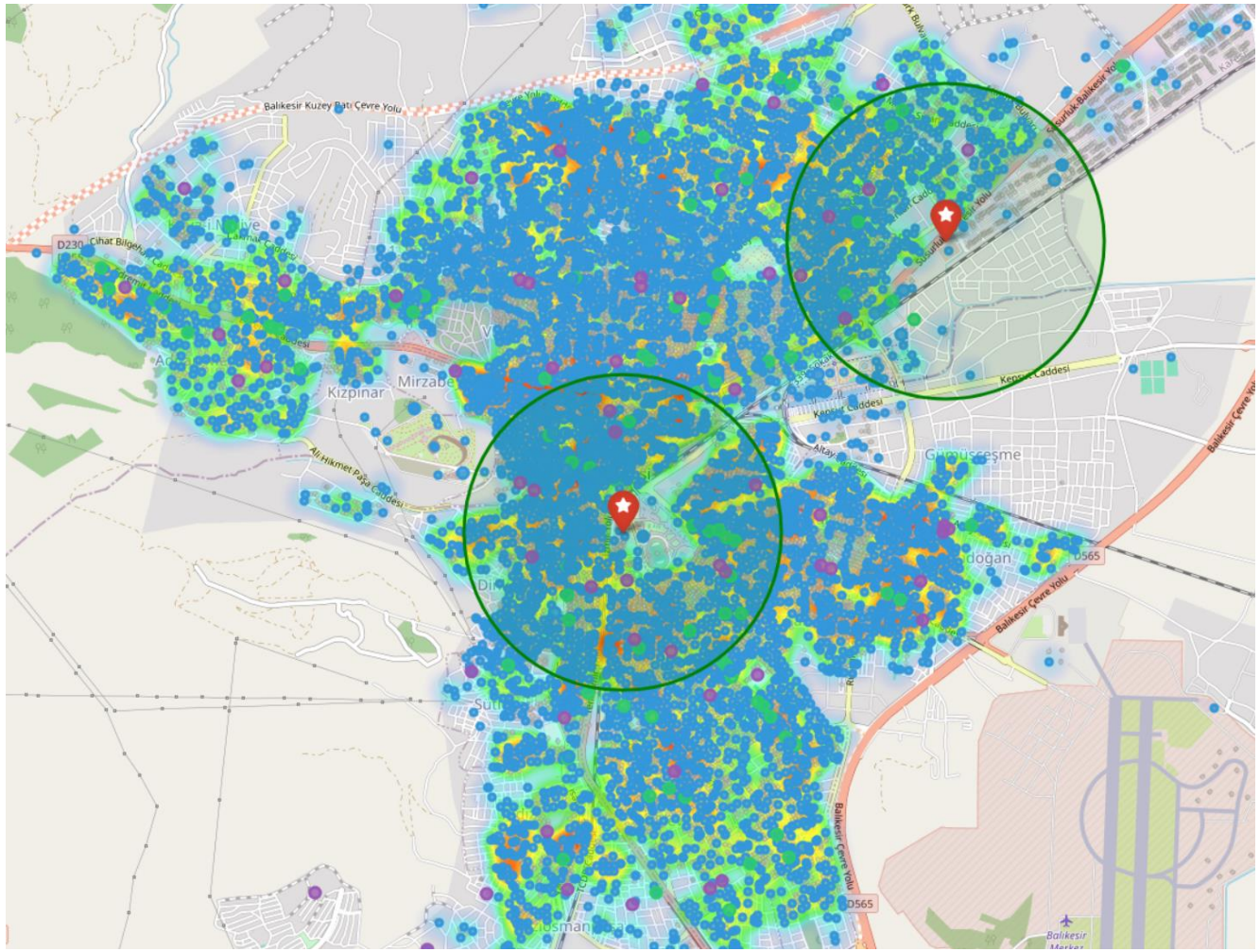
- OSM Data provides real city data.
- The graph and shortest-path modules compute distances and WalkScore values.
- The Optimization Engine improves the WalkScore based on residents and amenities.
- Results are produced as numerical summaries and map visualizations.

Completed Tasks

What things has been done so far:

- We collected and integrated Balıkesir city data from OpenStreetMap using OSMnx **(needs improvement)**.
- We built the pedestrian network and added residential points and amenities into the database.
- We constructed the graph and implemented shortest path calculations using Dijkstra's algorithm **(needs improvement)**.
- We developed the WalkScore module to measure walkability **(needs improvement)**.

Completed Tasks



The map visualization is complete with all labels and features, but some buildings are still incorrectly shown in gray and need to be fixed.

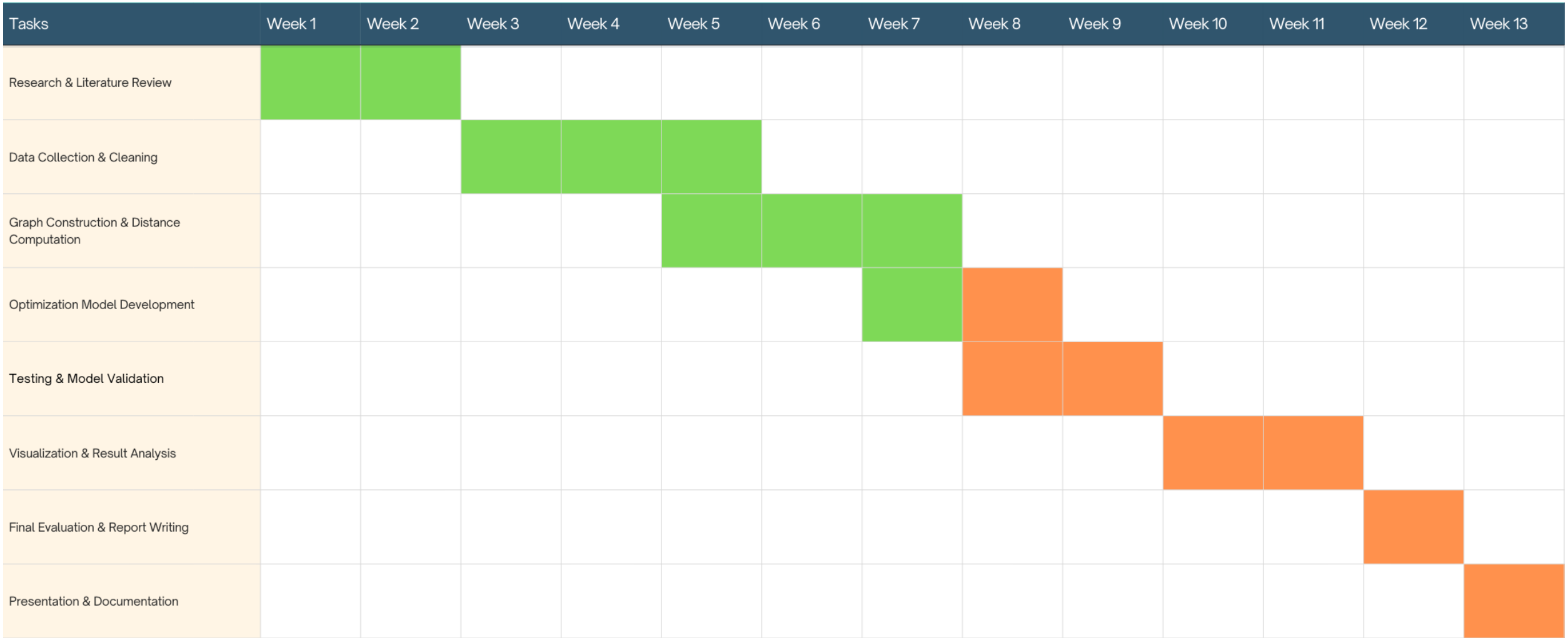
Completed Tasks

The database is structured as a collection of tables, where each table entry contains the associated data that matches with it.

Future Plans

- The number of residential locations and amenities in the database must be increased for better coverage of Balıkesir city center.
- The Greedy algorithm must be fully implemented without sampling to achieve accurate WalkScore improvements and proper optimization results.
- The optimization results must be validated against success criteria and tested with different parameter configurations.
- The project success must be measured by testing it with objective metrics and comparing results with baseline scenarios.

Project Timeline



Project Requirements

To complete this project, some of the requirements are;

- City walkability data must be collected and processed.
- Accessibility between residential areas and amenities must be calculated.
- An optimization algorithm must be implemented to suggest new facility locations.
- The results must be visualized on a map.
- Walkability improvements should be measured and compared.

Project Requirements

To satisfy the requirements, the following steps will be applied;

- **Python** will be used for data processing, algorithm implementation (MILP, CP, Greedy), model implementation (WALKOPT), and visualization.
- Data will be stored and managed in a **PostgreSQL** database.
- **OpenStreetMap** will be the main data source for amenities, roads, and residential areas.
- The implemented methods will be tested and visualized to evaluate walkability improvements.

Success Criteria

Success criteria for the walkability optimization project are;

- The system must ensure that at least **50%** of residential areas can reach all amenities within **15 minutes**.
- The average WalkScore of the selected area must increase by **at least 25 points** after optimization.
- The average walking distance to the nearest amenity must decrease by **at least 30%** compared to the initial state.
- The final results must be **visualized on maps** and verified using OpenStreetMap data.

References

1. Huang, W., and Khalil, E. B., “Walkability Optimization: Formulations, Algorithms, and a Case Study of Toronto”, *Department of Mechanical & Industrial Engineering, University of Toronto*, 2023.
2. Figure 1: https://www.burohappold.com/articles/15-minute-cities/
3. Figure 2: https://nathenry.com/writing/2023-02-07-seattle-walkability.html

THANK YOU FOR LISTENING