Walkability Optimization for 15-Minute Cities

CSE 495
First Presentation

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Project Definition

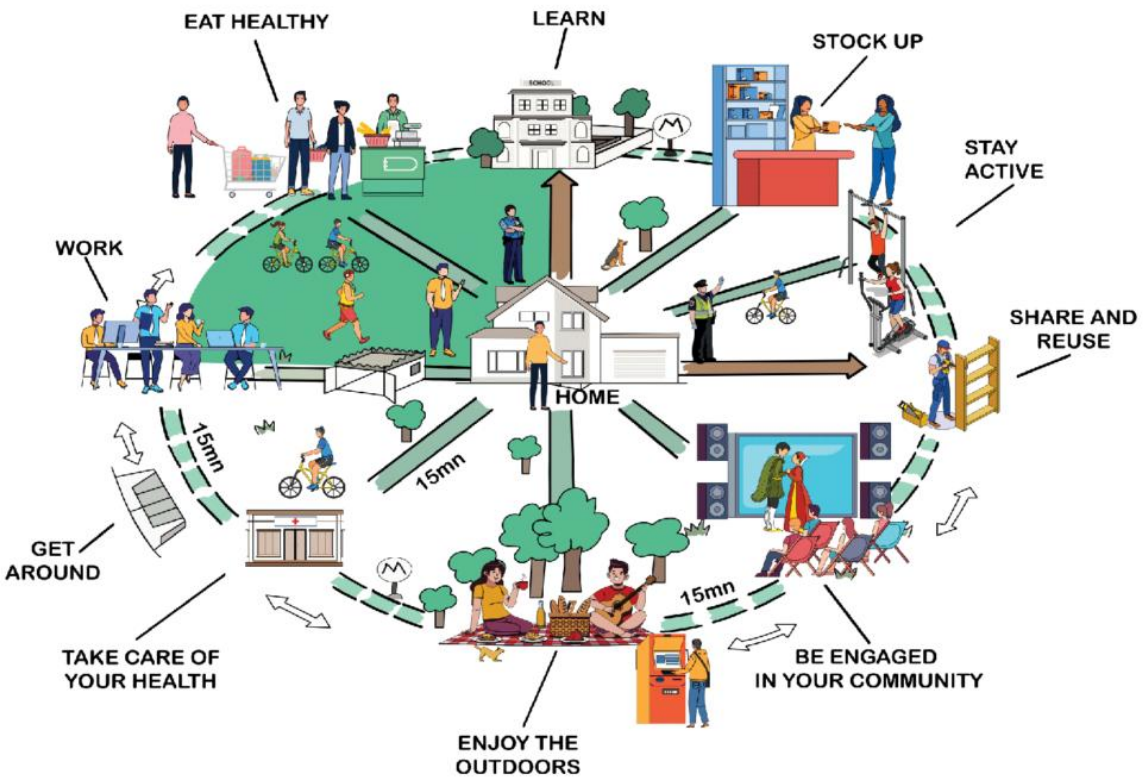


Figure 1: Concept illustration of a 15-Minute City.

- 15-Minute City is an urban planning model where residents can reach most daily needs—such as work, shopping, education, healthcare, and leisure—within a 15-minute walk or bike ride from home.
- It encourages local living, reduces car dependence, and promotes healthier, more sustainable urban environments. The idea focuses on creating compact, accessible, and inclusive cities for everyone.

Project Definition

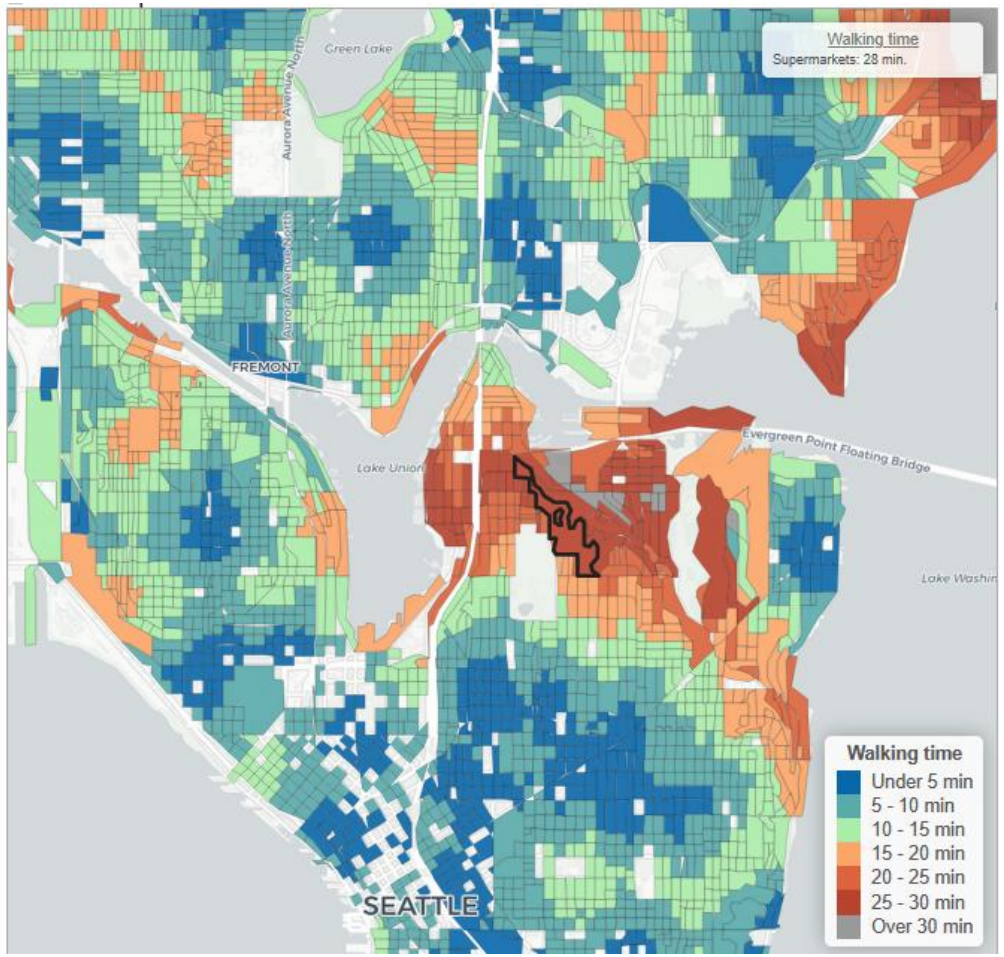
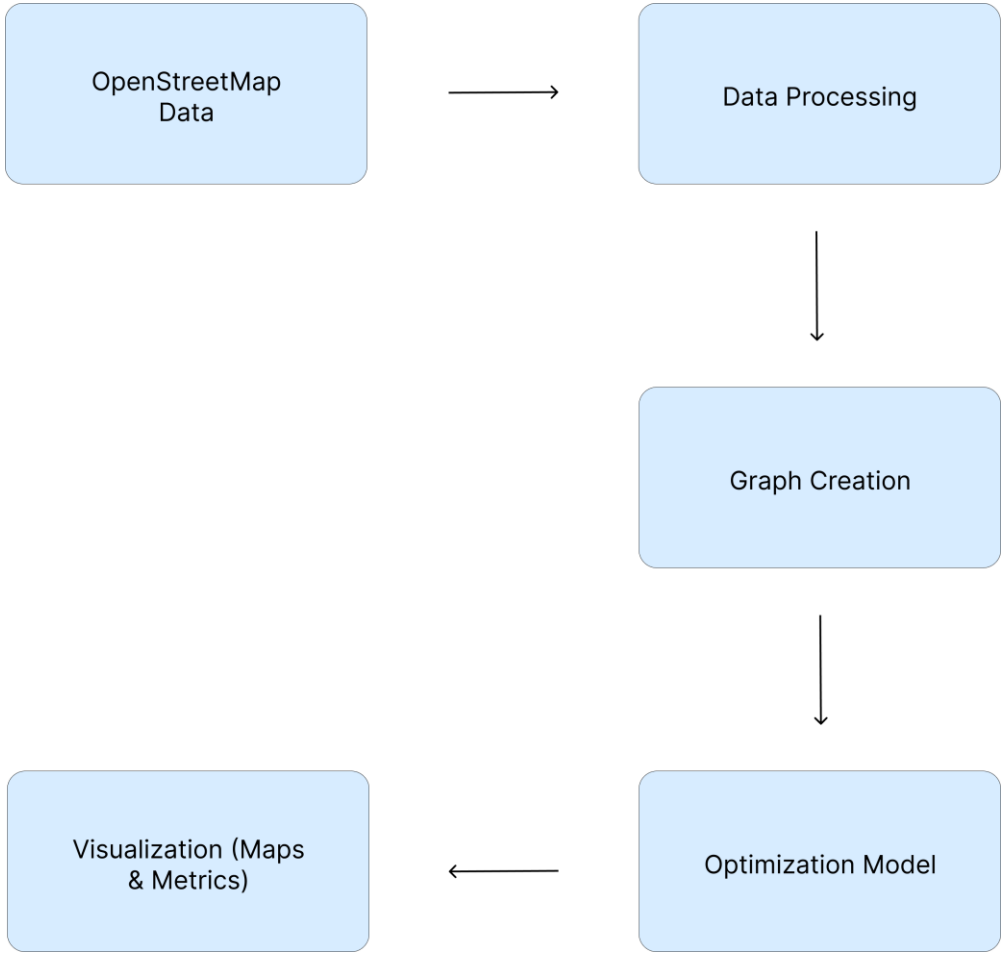


Figure 2: Walkability map showing walking times for supermarkets.

- In this project, we analyze how people access daily services in their neighborhoods.
- By using city data, we study walking distances and identify where new amenities—such as groceries, schools, and restaurants—should be added.
- The goal is to improve walkability and support the idea of the 15-Minute City.

Project Design



- **Data Collection Layer**
  Using **OpenStreetMap (OSM)** to gather data on roads, residential areas, and amenities (e.g., hospitals, restaurants, schools).
  Store and manage data using a **PostgreSQL** (not final call) database.
- **Preprocessing & Network Creation**
  Construct a **pedestrian network graph** and compute **shortest walking distances** between residences and amenities using Dijkstra's or other algorithms.
- **Optimization Engine**
  Implement optimization models like **MILP (Mixed-Integer Linear Programming)** for exact solutions and **Greedy heuristic** for large-scale or real-time optimization.
  Objective: maximize average WalkScore and minimize walking distance to all amenities.
- **Visualization & Analysis**
  Display optimized results on an **interactive map**.
  Show *before vs. after* comparisons for accessibility and WalkScore improvements. Also evaluate how many households reach all amenities within 15 minutes.

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;

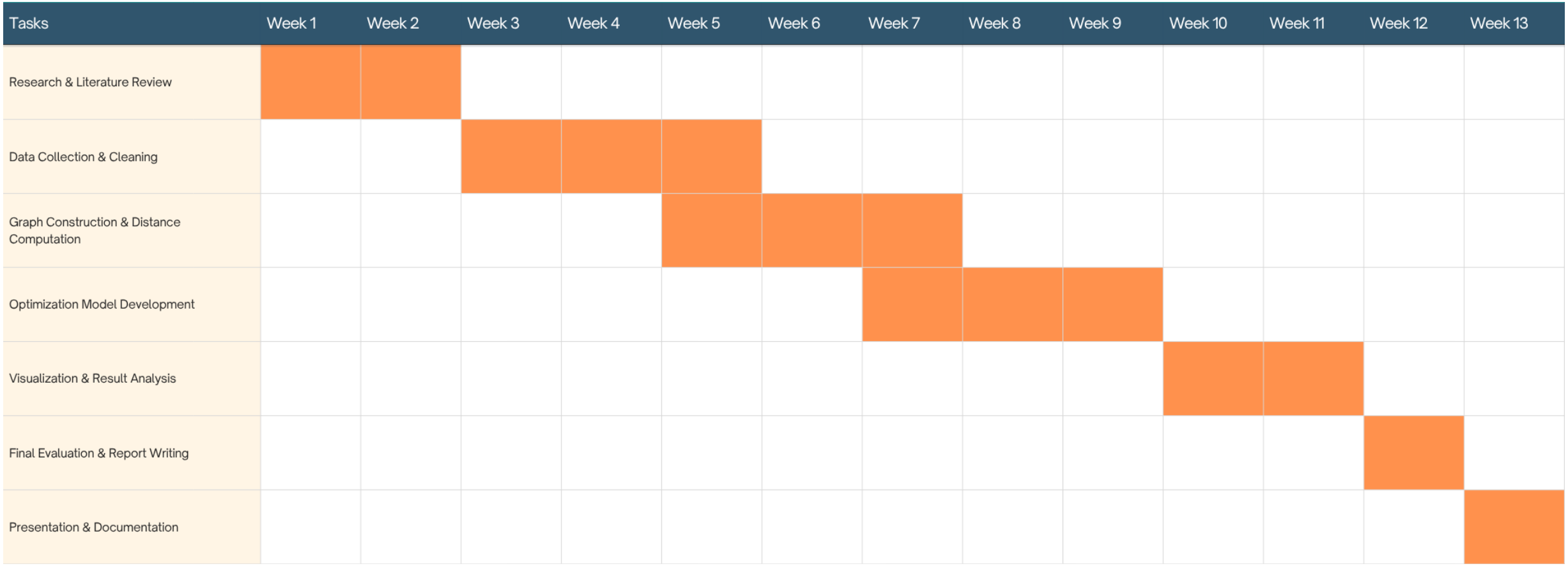
- **Python** (not final call) will be used for data processing, algorithm implementation (MILP, CP, Greedy), model implementation (WALKOPT), and visualization.
- Data will be stored and managed in a **PostgreSQL** (not final call) database.
- **OpenStreetMap** will be the main data source for amenities, 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 **70%** 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.

Project Timeline



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