



ACCESS ROADS

Mobile And Social Sensing System
Academic Year 23/24
Computer Engineering, Unipi





The Team

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Today's Agenda

1. Starting Point
2. Project Presentation
3. Accessibility Problems
4. Application Architecture
5. Detection Algorithm
6. Data Collection
7. Application Demo
8. Conclusions



Starting Point

Better off This Way!: Ubiquitous Accessibility Digital Maps via Smartphone-based Crowdsourcing

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SmartWheels: Detecting urban features for wheelchair users' navigation^{*}

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- Significant challenges in navigating for individuals with disabilities.
 - Lack comprehensive accessibility information in existing navigation systems and maps.
 - Necessity to provide accurate accessibility info for indoor/outdoor spaces.



Project Presentation

Project Objectives

- Simplify navigation for users with disabilities by showing points directly on the map.
- Allow users to manually add any accessibility points.
- Create an automatic detection algorithm for accessibility points.



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Accessibility Problems

Elevators

From the old ones (late 80's) to
more modern ones (10's)

Rough Roads

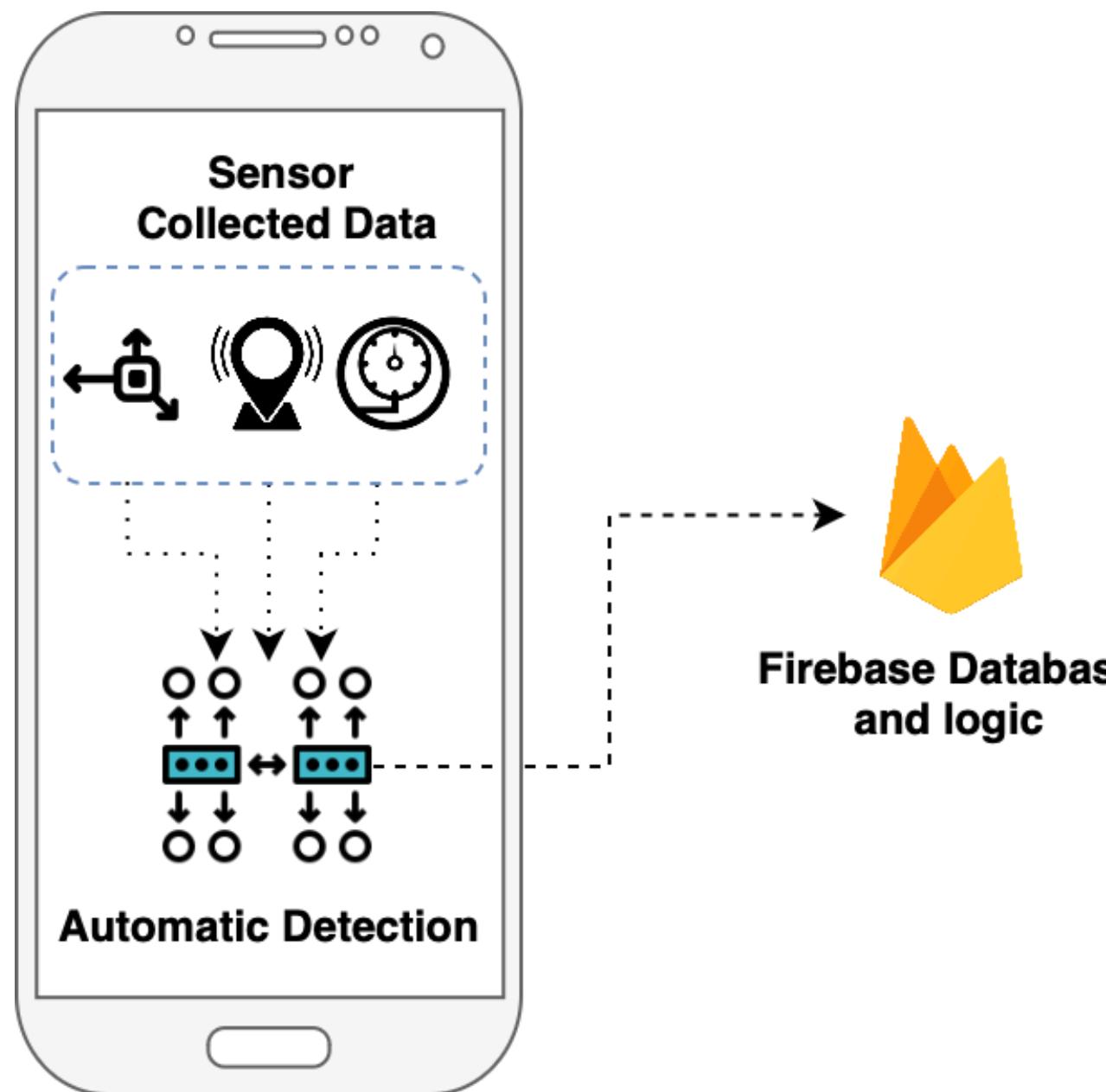
All those surfaces that present
some sort of deformation (e.g.
dirt roads)

Staircases

Standard stairs and steps that
might represent a problem.



Application Architecture



The architecture of the application consists of:

- Collect data from the sensors (GPS, barometer and accelerometer).
- This data is analyzed by an automatic detection algorithm.
- In case the algorithm confirms the presence of an accessibility point, an insertion or update logic is implemented via Firebase.



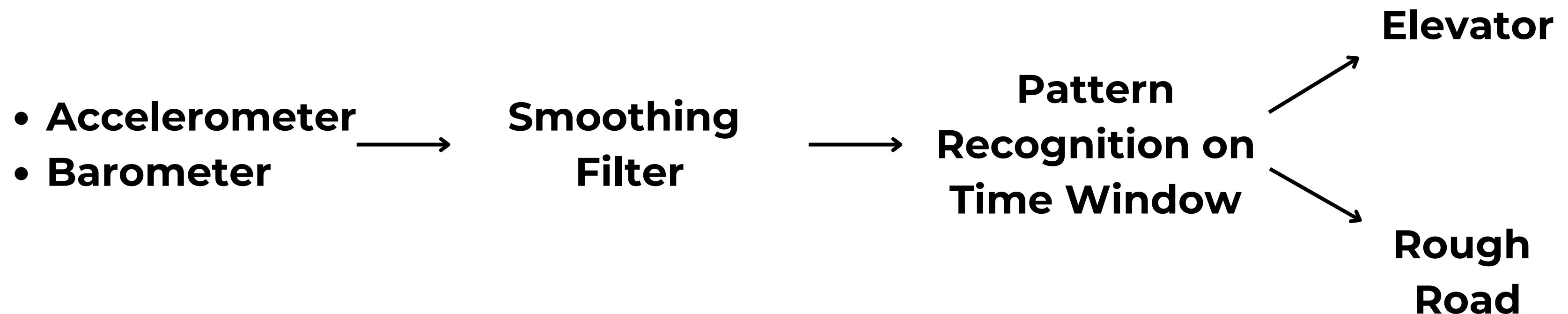
Data Fetching



When a user opens the application, a map is provided via the Maps SDK in which accessibility points are highlighted relative to their current location

Detection Algorithm

The detection algorithm relies on **two** sensors present on the smartphone:



The class responsible for this detection is **SemanticDetector.kt**

The smartphone used to test this algorithm **Xiaomi 11T PRO (Android 14 API 34)**

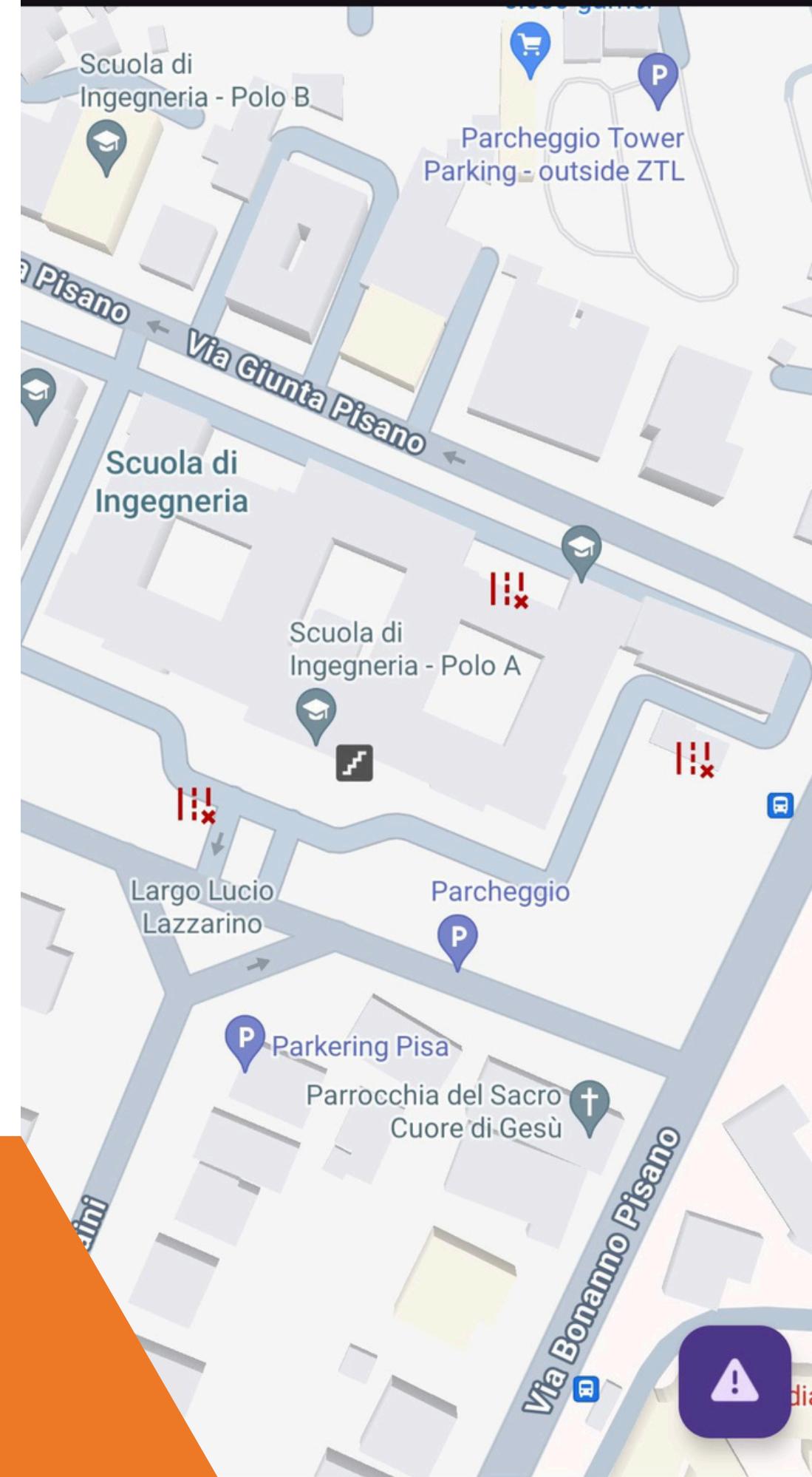


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Data Collection

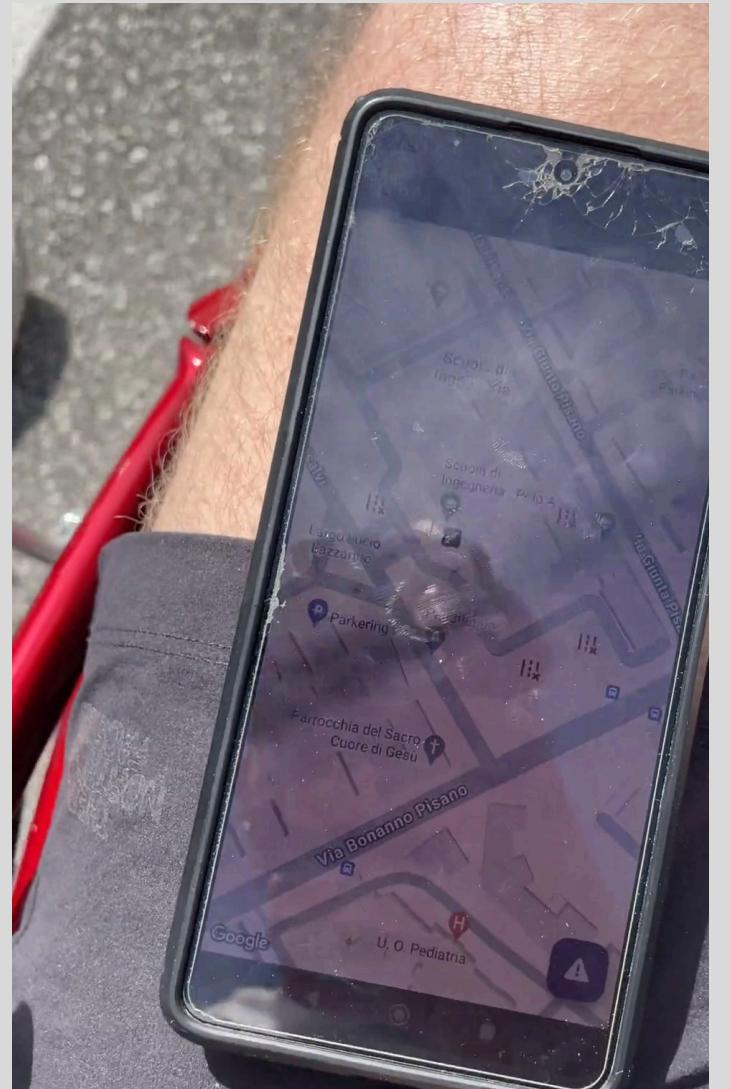
Experiments were developed in the university area to collect data. Using a wheelchair, we tested and updated our algorithms for creating a map of accessibility points from the station to the university building.

Map

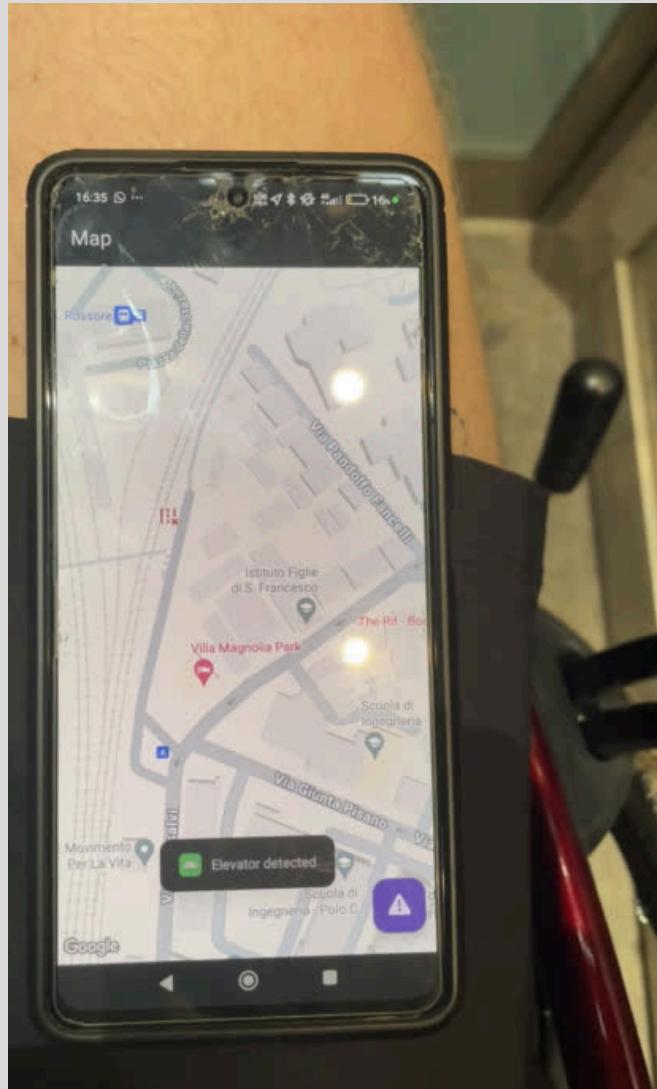




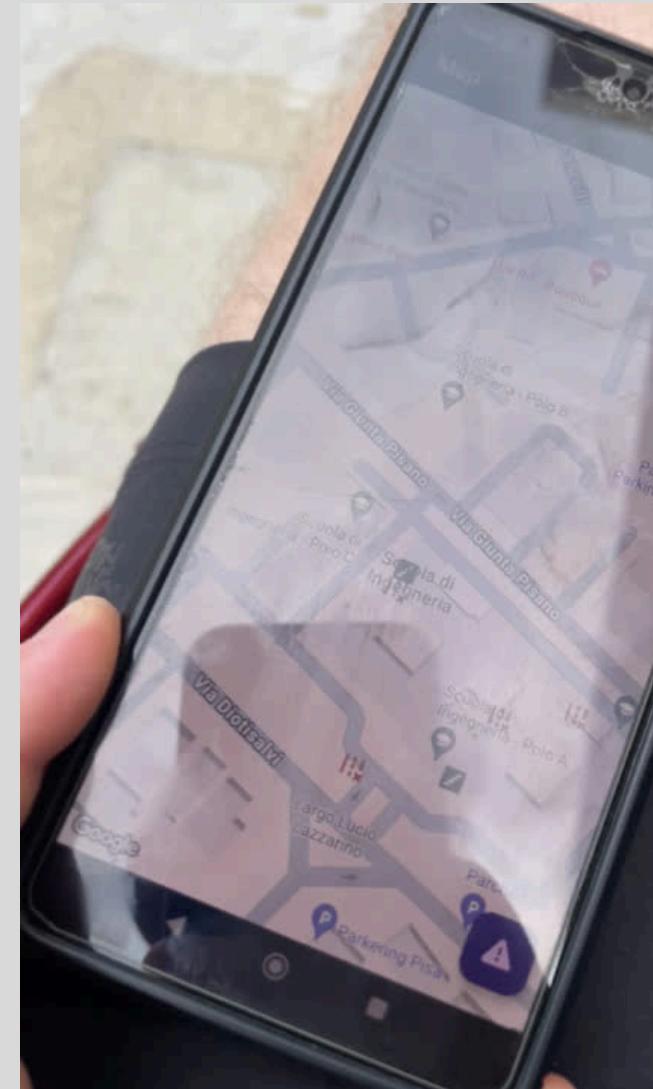
Application Demo



Plain Road,
No Detection



Elevator,
Detection



Rough Road,
Detection



Reporting a
Semantic



Conclusions

AccessRoads represents a significant step towards digital accessibility, **providing crucial accessibility information** for individuals with mobility impairments.

The **passive crowdsourcing** approach adopted by AccessRoads, along with the use of **multi-modal sensors**, has shown promise in enriching digital maps with accessibility data.