Beyond Navigation: Enabling Inclusive Urban Exploration

Liliana Ardissono[1,†], Angelo Geninatti Cossatin[1,†] and Noemi Mauro[1,†]

[1]*University of Turin, Corso Svizzera 185, Torino, 10149, Italy*

Abstract

This paper presents MAP-ABLE (*Mapping Accessibility for Better Location Exploration*), a project we are developing to support universal map-based geographical exploration. MAP-ABLE aims to develop a web-based platform that enables people with motor, visual, and hearing disabilities to search for accessible places and services using natural language and voice queries, define personal accessibility profiles that persist across sessions, and navigate maps using non-visual modalities. We describe the motivations of this project, how it differs from existing tools, and the design choices we are making.

Keywords

Accessibility, Inclusive design, Personalization, Disability

1. Introduction

The MAP-ABLE project aims to develop universally accessible geographical maps for people with motor, visual, and hearing disabilities. The starting point is a fairly concrete observation: OpenStreetMap[1] (OSM) encodes a surprising amount of accessibility information. There are tags for tactile paving, audio traffic signals, hearing loops, wheelchair-accessible toilets, step-free entrances, Braille signage, and much more [1]. Some of this tagging is quite detailed. For example, the `deaf:description` tag can contain a free-text note like "this cinema regularly offers movies with subtitles." However, this data is almost entirely invisible to end users because the mainstream mapping applications fail to expose it in their user interfaces. For example, Google Maps[2] shows a wheelchair icon for some venues, but this is often based on self-reported data from business owners. Moreover, it overlooks other types of information, such as the presence of hearing loops.

The open-source side is not much better. Most accessibility-focused OSM tools cover wheelchair users or focus on a single type of impairment. The few projects that attempt broader coverage are either proprietary or have not released their source code, which limits community contribution and long-term sustainability. Moreover, Prandi et al. [2] found that most solutions address a single type of disability and that navigation applications frequently become barriers themselves when their interfaces are incompatible with assistive technologies.

The MAP-ABLE project aims to address this issue. Its goal is to give people with motor, visual, and hearing disabilities a usable way to answer questions like *"Where is the nearest step-free café with a hearing loop?"* or *"Which bus stops near me have audible signals?"*, browsing a geographical map. This paper describes the project objectives and the main concepts we are developing to achieve them, building on pioneering work on user adaptation and accessibility to support Universal Access [3].

The remainder of this paper is organized as follows: Section 2 describes the related work. Sections 3 and 4 outline the design and personalization features of the MAP-ABLE platform. Section 5 poses some research questions for the design of the platform, and Section 6 closes the paper.

Joint Proceedings of the ACM UMAP Workshops 2026, UMAP 2026, June 8–11, 2026, Gothenburg, Sweden

[†]These authors contributed equally.

liliana.ardissono@unito.it (L. Ardissono); angelo.geninatticossatin@unito.it (A. Geninatti Cossatin); noemi.mauro@unito.it (N. Mauro)

0000-0002-1339-4243 (L. Ardissono); 0009-0007-5378-7061 (A. Geninatti Cossatin); 0000-0001-8234-3266 (N. Mauro)

[1]https://www.openstreetmap.org

[2]https://www.google.com/maps

2. Related Work

Most tools for supporting people with disabilities in the selection of places to visit focus on a single type of disability. Geospatial web applications provide general navigation support. However, they often lack accessibility information and personalized routing for people with disabilities, who require detailed data about the built environment. Early work on personalized accessibility maps for campus navigation showed that explicit user-defined profiles, encoding parameters such as slope tolerance, surface type, and step height, produce substantially better routing outcomes than generic accessibility layers [4].

The most mature accessibility mapping tools, such as Wheelmap.org[3], the On Wheels App[4], AccessMap Seattle[5], focus on wheelchair and mobility access. Wheelmap has mapped over a million locations using a simple traffic-light system. AccessMap Seattle takes a different angle, focusing on terrain. It routes the user around steep slopes, missing curb cuts, and construction zones. This is useful for wheelchair users, but it says nothing about the accessibility of destinations once you arrive. Li et al. found that mobility impairments induce different perceptions of obstacles in cane users, wheelchair users, etc. [5]. Thus, there is a need for route optimizers that apply custom optimization functions.

Regarding support for blind or low-vision users, MapComplete Blind OSM[6] provides an editing interface to contribute blindness-relevant OSM tags. However, it is a mapping tool, not a search or navigation tool. Commercial applications such as BlindSquare[7] and Lazarillo[8] offer good audio navigation using OSM data, but do not support other disabilities. Moreover, Brock [6] showed that a multimodal prototype pairing tactile overlay with speech output was substantially more effective and satisfying than static maps. This is in line with the results presented by Ducasse et al. in [7], where hybrid maps (that integrate multimodal signals, such as vibrations and voice, with physical map representations) emerge as the most usable alternatives, albeit particularly costly when the most recent technology is adopted.

Some platforms support multiple disability types. For example, Map4Accessibility[9] covers motor, visual, hearing, and cognitive impairments, and allows users to rate and tag venues by disability type. Moreover, AXS Map[10] takes a crowdsourced review approach and includes some hearing-accessibility data. However, these platforms do not allow personalizing search and navigation of places.

In contrast, our project aims to integrate personalization and accessibility to enhance map-based exploration by providing a universal user interface that personalizes layouts and suggestions to specific user needs.

3. The MAP-ABLE Platform

People with disabilities can benefit from digital technologies. However, in a study with elderly users, Johnson and Finn found that design choices influence the usability of applications [8]. We plan to develop MAP-ABLE as a web application, adhering to web accessibility standards (WAI-ARIA [9], WCAG [10]). The platform will pull data from OSM at query time and expose it through a universally accessible search interface, personalized profiles that support adapting information exploration to users, and information-awareness support to make people aware of the reliability of the information presented by the system.

Regarding **accessibility of the user interface**, the premise is that people with different disabilities have different interaction needs, and a single rigid layout cannot suit all of them.

For blind users, the most important requirement is that the map itself should not be the only way

[3] https://wheelmap.org
[4] https://wiki.openstreetmap.org/wiki/On_Wheels_app
[5] https://www.accessmap.app
[6] https://mapcomplete.org/blind_osm.html
[7] https://www.blindsquare.com/
[8] https://lazarillo.app/theapp/
[9] https://map4accessibility.eu
[10] https://github.com/axsmap

to access geographic information. MAP-ABLE will provide list-based and text-based alternatives to map view, audio descriptions of nearby features, and full compatibility with screen readers (VoiceOver, TalkBack, NVDA, and JAWS). Voice input will be supported throughout, so that users who navigate by voice can search and filter without switching interaction modalities.

For deaf and hard-of-hearing users, dense text and complex navigation structures can be difficult to process. We will design a simplified interface mode that reduces visual complexity and avoids long explanatory text in favor of clear icons and concise labels.

For users with motor impairments, which covers a wider range than wheelchair users, including people with tremors, limited grip strength, or walking difficulties, full keyboard navigation will be supported, and touch targets will be sized generously.

Across all of these, the search function will accept natural language. A user should be able to type or say *"accessible restaurant near the Porta Nuova station"* and get results filtered to their accessibility needs, without knowing that the relevant OSM tags are `wheelchair=yes` and `step=0`.

To support **personalized interaction and search**, users will be able to define an accessibility profile that captures their needs. A profile might encode something like "uses a manual wheelchair, has moderate hearing loss, needs step-free access throughout." This will drive the filtering of search results and map overlays across sessions. We will also provide a lighter alternative for users who do not want to create a profile; see Section 4.

Concerning **information awareness support,** Table 1 lists a sample of the OSM tags MAP-ABLE will integrate to support map exploration. One persistent challenge is that OSM coverage of accessibility features is highly uneven. In many cities, even well-known venues have no accessibility tags. We will handle this through explicit gap warnings in the interface. When a place has incomplete accessibility data, the platform will alert the user rather than silently omitting it or showing it as inaccessible. We will also employ digital nudging techniques [11] to encourage users to add missing tags via the OSM website, under the premise that MAP-ABLE users will be motivated contributors.

Table 1
A selection of OSM accessibility tags used by MAP-ABLE.

Tag	Disability type
`wheelchair=yes/limited/no`	Motor
`barrier=kerb`, `ramp=yes`	Motor
`tactile_paving=yes/no/incorrect`	Visual
`acoustic=voice_description`	Visual
`tactile_writing:braille:XX=yes`	Visual
`traffic_signals:sound=yes`	Visual
`hearing_loop=yes`	Hearing
`deaf:description:en=*`	Hearing
`amenity=parking + capacity:disabled=*`	Motor

4. Personalization and Adaptation in MAP-ABLE

In most personalized information retrieval systems, the user model captures preferences, interests, past behavior, and the system uses these to rank or filter content. The underlying assumption is that relevance is subjective and that two users looking at the same query might want different results. In MAP-ABLE, the situation is different. Accessibility requirements are not preferences in the usual sense. A person who uses a wheelchair does not "prefer" step-free entrances the way someone might prefer thriller novels to romance. They need such features. This shifts the role of personalization from optimizing for satisfaction to filtering for feasibility.

To handle both user preferences and requirements representing feasibility constraints, we will support two distinct (but not mutually exclusive) modes of personalization, which reflect different user needs and interaction contexts.

- The first is *long-term profile-based personalization.* Users who interact with the platform regularly will be able to define a persistent accessibility profile encoding their specific requirements, disability types, constraints (e.g., maximum step height, need for hearing loop), and preferred information formats (e.g., audio descriptions, simplified text). This profile will be applied across all searches and map views, reducing interaction overhead for each session. The user model here is explicit and user-controlled.
- The second mode is *session-level filter-based adaptation.* For users who do not want to create a profile (perhaps they are using the platform for the first time or on behalf of someone else), a set of prominently placed filter widgets will enable them to adjust the map in real time. This is closer to faceted search than to personalization, but serves a similar function: it lets users express their current context without committing to a persistent representation.

Beyond filtering search results, MAP-ABLE will adapt its own interface to the user's profile. We plan adaptations such as switching between full map view and list mode as the default view, enabling or disabling voice output, adjusting text density, and activating keyboard navigation mode. We will deliberately avoid more aggressive adaptations, such as restructuring navigation menus or automatically hiding features, because these might disorient users who have learned where things are.

We concur that adaptation should *augment* the interface, not restrict it. A blind user's profile will trigger audio descriptions and screen-reader optimizations, but it will not hide the map view.

5. Research Questions and Open Problems

MAP-ABLE is under development. In the following, we report the open design decisions.

Should one interface serve everyone? Features that help blind users (audio descriptions, screen reader support, list views) are different from features that help deaf users (visual simplicity, icon-led design) and different again from features that help users with motor impairments (keyboard navigation, large touch targets). We have taken the position that a unified platform with adaptive modes is better than separate specialized tools, both because it is more sustainable to maintain and because many users have more than one disability. However, MAP-ABLE's evaluation will need to address it directly.

How accurate does the NLP translation need to be? The quality of our natural language interface depends on how reliably we can map user queries to OSM tags. OSM's tagging schema is large, sometimes inconsistent, and evolving. A query like *"somewhere quiet"* has no direct OSM equivalent. We are planning to evaluate translation accuracy across a range of query types.

Crowdsourced data and trust. When someone with a disability relies on our platform to navigate a new city, incorrect accessibility data is not merely an inconvenience. We need to communicate uncertainty clearly to give users some sense of how reliable a given data point is. OSM lacks a built-in reputation system for accessibility tags, and we are considering how to build lightweight trust signals into the interface.

What counts as "accessible enough"? Unfortunately, accessibility is not binary. A venue might be technically wheelchair-accessible, but have a heavy door that challenges some users. An OSM `wheelchair=limited` tag exists for cases like this, but the threshold for "limited" versus "yes" is inconsistently applied. For users with specific physical profiles, the difference matters. This intersects with a broader question about the granularity of accessibility data that crowdsourcing platforms can realistically collect and maintain.

6. Conclusions

MAP-ABLE is, at its core, an attempt to make useful data actually useful. Accessibility information already exists in OSM; the problem is the gap between what is tagged and what people with disabilities can actually find and use. We plan to develop a platform to close that gap, working directly with the communities it is meant to serve.

The questions MAP-ABLE raises are how to design inclusive interfaces for different disabilities, how to personalize without compromising privacy, and how to build trust in crowdsourced data.

Acknowledgments

Our University has partially funded this work through the project "Grant for Internationalization".

Declaration on Generative AI

During the preparation of this work, the authors used Claude[11], and Grammarly[12] for the execution of the following tasks: Paraphrase and reword, Grammar and spelling check. After using these tools, the authors reviewed and edited the content as needed. The authors assume complete responsibility for the content of the publication.

References

[1] OpenStreetMap Wiki, Disabilities — openstreetmap wiki, 2024. URL: https://wiki.openstreetmap.org/wiki/Disabilities.

[2] C. Prandi, B. R. Barricelli, S. Mirri, D. Fogli, Accessible wayfinding and navigation: a systematic mapping study, Universal Access in the Information Society 22 (2023) 185–212. doi:10.1007/s10209-021-00843-x.

[3] C. Stephanidis, Adaptive techniques for universal access, User Modeling and User-Adapted Interaction 11 (2001) 159–179. URL: https://doi.org/10.1023/A:1011144232235.

[4] H. Karimi, L. Zhang, J. Benner, Personalized accessibility map (PAM): a novel assisted wayfinding approach for people with disabilities, Annals of GIS 20 (2014) 99–108. URL: https://doi.org/10.1080/19475683.2014.904438. doi:10.1080/19475683.2014.904438.

[5] C. Li, R. Y. Pang, D. Labbé, Y. Eisenberg, M. Hosseini, J. E. Froehlich, Accessibility for whom? perceptions of mobility barriers across disability groups and implications for designing personalized maps, in: Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems, CHI '25, Association for Computing Machinery, New York, NY, USA, 2025. URL: https://doi.org/10.1145/3706598.3713421. doi:10.1145/3706598.3713421.

[6] A. M. Brock, Touch the map! designing interactive maps for visually impaired people, SIGACCESS Access. Comput. (2013) 9–14. URL: https://doi.org/10.1145/2444800.2444802. doi:10.1145/2444800.2444802.

[7] J. Ducasse, A. M. Brock, C. Jouffrais, Accessible Interactive Maps for Visually Impaired Users, Springer International Publishing, Cham, 2018, pp. 537–584. URL: https://doi.org/10.1007/978-3-319-54446-5_17. doi:10.1007/978-3-319-54446-5_17.

[8] J. Johnson, K. Finn, Designing User Interfaces for an Aging Population - Towards Universal Design, Communications of the ACM, 2017. doi:10.1016/C2015-0-01451-4.

[9] W3C, Accessible rich internet applications (WAI-ARIA) 1.2, https://www.w3.org/TR/wai-aria/, 2023. Accessed: April 2026.

[10] W3C, WCAG 2 overview, https://www.w3.org/WAI/standards-guidelines/wcag/, 2023. Accessed: April 2026.

[11] M. Jesse, D. Jannach, Digital nudging with recommender systems: Survey and future directions, Computers in Human Behavior Reports 3 (2021) 100052. URL: https://www.sciencedirect.com/science/article/pii/S245195882030052X. doi:https://doi.org/10.1016/j.chbr.2020.100052.

[11] https://claude.ai/

[12] https://app.grammarly.com/