Navigating Independence: A Survey of Visually Impaired People's Experiences and Needs

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Abstract— **Independent navigation in unfamiliar environments remains a major challenge for blind and visually impaired individuals, despite the availability of various assistive technologies. Understanding users' real-world experiences, preferences, and unmet needs is essential for guiding the development of effective navigation aids. This paper presents the results of a fully accessible online survey investigating navigation experiences, challenges, and technology preferences of people with visual impairments. The questionnaire consisted of 17 closed-ended and two open-ended questions and was distributed worldwide through 76 individuals and organizations supporting visually impaired communities. The survey results indicate that while smartphone-based applications are the most commonly used digital navigation aids, a substantial proportion of participants do not use any assistive navigation technology, often due to cost, accessibility, or usability barriers. Participants reported persistent difficulties related to obstacle detection, wayfinding, and navigation in crowded or unstructured environments. Wearable and hands-free solutions were generally preferred, along with systems that are affordable, lightweight, easy to use, and able to provide information on demand with low cognitive load. The findings provide an empirical overview of navigation experiences and needs among visually impaired users with varied backgrounds and navigation conditions.**

I. Introduction

Independent navigation in unfamiliar environments is a fundamental requirement for autonomy, safety, and social participation. For blind and visually impaired (BVI) individuals, navigating everyday spaces such as streets, public buildings, or transportation hubs often involves significant challenges related to orientation, obstacle avoidance, and wayfinding. Although a range of assistive technologies has been developed to support navigation, their adoption and effectiveness in real-world settings remain limited.

Limited or occasional use of existing assistive technologies should not be interpreted as a lack of need or willingness among BVI users. Instead, it may reflect mismatches between users' real-world experiences, preferences, and constraints on the one hand, and the accessibility or usability of available solutions on the other. Factors such as cost, ease of use, physical burden, environmental conditions, and regional context can strongly influence whether an assistive system is practical or acceptable in everyday navigation. These considerations highlight the importance of grounding assistive navigation research in an empirical understanding of users' real-world experiences.

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To obtain an overview of the navigation-related needs, challenges, and preferences of BVI individuals, this paper presents a fully accessible online survey targeting people with visual impairments worldwide. The survey was designed to capture self-reported navigation experiences and perspectives on assistive technologies used in daily life. It consists of 17 closed-ended questions and two open-ended questions organized into three parts: (i) personal and sight-related background, (ii) experiences with assistive technologies used for navigation, and (iii) needs and preferences regarding assistive navigation support. The questionnaire was distributed globally through 76 individuals and organizations supporting blind and visually impaired communities.

The contribution of this work lies in providing an empirical overview of navigation experiences and user-reported needs based on survey responses, complementing existing research that often emphasizes technical development over user experience. By systematically collecting and organizing user perspectives, this study aims to inform and contextualize ongoing research on assistive navigation without assuming specific technological solutions or usage scenarios.

The remainder of this paper is organized as follows. Section II reviews related work on assistive navigation for visually impaired users. Section III describes the survey design and methodology. Section IV presents the survey results, followed by a discussion of their implications and limitations in Section V.

II. Related work

Research on navigation for blind and visually impaired (BVI) individuals has explored a wide range of environments and methodological approaches, including outdoor and indoor settings, as well as studies that span both contexts. Prior work has employed surveys, interviews, observational studies, and evaluations of assistive systems to identify navigation challenges, user needs, and potential design directions.

A. Outdoor navigation

A substantial body of work has focused on outdoor navigation, particularly in urban and transportation-related settings [1], [2], [3], [4], [5], [6], [7], [8], [9], [10]. Early survey-based studies, such as [6], examined challenges faced by visually impaired individuals when using public transportation, highlighting the importance of auditory information and environmental awareness. Subsequent work expanded this focus to broader urban navigation issues, including street layout, pedestrian infrastructure, and road-crossing assistance [7], [5], [9].

Other studies investigated strategies and behaviors adopted by visually impaired individuals in complex urban environments. For example, [3] used individual interviews to examine how organizational habits influence navigation strategies, while [1] applied hierarchical cluster analysis to nationwide survey data in Austria to identify distinct user groups with differing mobility needs. Collectively, these studies provide valuable insights into outdoor navigation challenges but are often limited to specific geographic regions or mobility scenarios.

B. Indoor navigation

Indoor navigation has also received considerable attention, particularly in structured environments such as public buildings, healthcare facilities, and campuses. Several studies emphasize the role of environmental design and accessibility features, including contrast, lighting, and visual cues [11], [12]. User-centered investigations have highlighted the importance of incorporating obstacles, barriers, and accessibility-related information into indoor navigation support [13].

Survey-based work further underscores the role of user input in identifying relevant environmental information. For instance, [14] surveyed participants with visual impairments across multiple countries to determine the most important elements for audio-tactile campus maps. More recent studies have examined navigation in unfamiliar indoor environments, revealing specific information needs and emphasizing the lack of high-quality indoor maps [15], [16]. While these studies contribute important insights, they typically focus on particular building types or localized settings.

C. Navigation across indoor and outdoor contexts

Several studies have addressed navigation across both indoor and outdoor environments, recognizing the need for continuity between these contexts. [17] explored how individuals with vision impairments use technology to support navigation, highlighting the influence of scenario-dependent and personal factors. Similarly, [18] conducted an observational survey to identify design opportunities for assistive navigation technologies based on user experiences. More recently, [19] evaluated a teleguidance-based navigation assistance system through a usability and user experience study involving blind and visually impaired participants and sighted caretakers, proposing an expanded evaluation model for future research. These studies emphasize the complexity of navigation across environments but are often based on small sample sizes or specific assistive systems.

D. Solution-oriented and technology-focused studies

In addition to needs assessments and surveys, numerous studies have proposed and evaluated novel approaches to enhance navigation for visually impaired individuals, often validating their systems through user studies or questionnaires [20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30], [31]. These investigations have contributed to the development of assistive strategies and interfaces by examining perception, cognition, and interaction during navigation tasks. For example, [29] analyzed differences in how blind and sighted individuals perceive and approach pedestrian navigation tasks, identifying situations in which well-intentioned assistance may be misleading or disruptive. While such solution-oriented studies offer important design insights, they frequently focus on specific technologies or controlled scenarios rather than capturing broader, everyday navigation experiences.

E. Positioning of this work

While existing research provides valuable insights into navigation challenges across different environments and use cases, it is often constrained by geographic scope, specific settings, or a focus on particular assistive solutions. In contrast, the present work adopts a user-centered perspective through a globally distributed, accessible questionnaire, aiming to capture navigation experiences, challenges, and preferences reported by visually impaired individuals across diverse contexts. Rather than evaluating a specific system or technology, this study seeks to provide an empirical overview of everyday navigation needs as reported by BVI users.

III. Survey Methodology

This study investigates the challenges, needs, and experiences of visually impaired individuals when navigating unfamiliar environments through a fully accessible online questionnaire. Accessibility was a central design requirement throughout the survey development process. The questionnaire was rigorously tested, including an evaluation conducted by a blind individual who provided feedback on usability and accessibility. In addition, the WAVE Accessibility browser extension was used to support manual accessibility evaluation. Prior to the main data collection phase, a pilot study involving a small group of visually impaired and sighted individuals was conducted to identify potential usability and accessibility issues.

The questionnaire consisted of 17 closed-ended questions, including 12 single-choice and five multiple-selection items, and two open-ended questions covering personal background, navigation experiences, and preferences.

Conditional branching logic was implemented such that follow-up questions related to usage context, satisfaction, and feedback adequacy were shown only to participants who reported using digital assistive navigation technologies. Participants who indicated that they do not use any digital assistive technology were automatically skipped past these questions.

Eligibility was based on self-identification as blind or visually impaired. Early survey questions collected information on vision status, onset, and severity, which served as screening criteria to verify participant eligibility. All analyzed responses indicated visual impairment.

Before answering the survey questions, participants were presented with an introductory information page describing the purpose of the study and the intended use of the collected data for PhD research purposes. Participation was voluntary, and completion of the questionnaire was taken as implied consent. The survey did not collect personally identifiable information, and responses were analyzed in anonymized form.

Prior to analysis, survey responses underwent basic data cleaning procedures. All test entries created during questionnaire development were removed. Duplicate submissions were identified and excluded, and empty or incomplete responses were discarded. The questionnaire was configured such that all questions were required; if a question was skipped, participants were notified through an accessible message compatible with screen readers. As a result, the final dataset contained no missing responses. No explicit attention-check questions were included; however, all retained responses were reviewed and found to be internally consistent and reasonable.

The survey was disseminated through a combination of organizations, academic institutions, and individual contacts involved in disability support, research, or advocacy. These organizations and individuals were asked to disseminate the questionnaire, without imposing restrictions on participant eligibility. Fig. 1 summarizes the participant recruitment, including recruitment channels, geographic scope, and final sample size. The final sample consisted of N = 42 completed responses.

Recruitment summary

Target population: Blind and visually impaired individuals across a broad age range

Recruitment period: 12 September – 11 October 2022

Recruitment channels:
- Disability-related organizations and associations
- Online communities and mailing lists
- Direct outreach to individuals

Geographic coverage: Worldwide

Data collection method: Online accessible questionnaire

Final sample: 42 completed survey responses from participants with varying degrees of visual impairment

Fig. 1: Summary of participant recruitment

Inclusivity was a deliberate aspect of the study design. The survey aimed to collect responses from visually impaired individuals with diverse backgrounds, encompassing a wide range of ages, geographic regions, and socioeconomic contexts. Ethical considerations were addressed throughout the study, including participant confidentiality and adherence to data security practices.

Survey responses were analyzed using a combination of quantitative methods for closed-ended questions and qualitative analysis for open-ended responses. For key proportions, 95% confidence intervals were computed using the Wilson score interval [32] to account for uncertainty associated with the sample size. Open-ended responses were analyzed using an inductive thematic analysis approach [33], with themes derived directly from the data. The analysis was conducted by a single researcher. Codes were developed through iterative reading of the responses and refined into a final set of themes.

Complete response distributions, including all questionnaire options and aggregated counts, are available in the project repository at: `https://github.com/banafshebamdad/PhD-Survey-Visually-Impaired`.

IV. Results

This section presents the results of the survey, summarizing participant demographics, reported experiences with assistive navigation technologies, and stated preferences.

A. Participant background

Survey respondents represented a range of geographic regions. Participants from Western Europe and North America accounted for 40.48% (n=17) of responses, followed by Africa (26.19%, n=11) and Eastern Europe (21.43%, n=9). The age distribution spanned multiple groups, with the largest proportions falling within the 30-45 and 45-60 age ranges (33.33%, n=14 each).

Regarding gender, 59.52% (n=25) of respondents identified as male, 38.10% (n=16) as female, and 2.38% (n=1) as non-binary. Slightly more than half of the participants (57.14%, n=24) were not born with visual impairment, while the remainder reported congenital visual impairment. The reported severity of vision loss varied, with 40.48% (n=17) indicating severe visual impairment and 35.71% (n=15) reporting total blindness. Table I summarizes the demographic characteristics and visual impairment profiles of the survey participants.

TABLE I: Participant demographics and visual impairment characteristics

Category	n (%)
Gender	
Male	25 (59.52%)
Female	16 (38.10%)
Non-binary	1 (2.38%)
Age group	
15-30	9 (21.43%)
30-45	14 (33.33%)
45-60	14 (33.33%)
60+	5 (11.9%)
Visual impairment onset	
Congenital	18 (42.86%)
Acquired	24 (57.14%)
Severity of vision loss	
Mild	4 (9.52%)
Moderate	6 (14.29%)
Severe	17 (40.48%)
Total blindness	15 (35.71%)

B. Experiences with assistive navigation technologies

Among respondents, smartphone-based navigation applications were the most commonly used assistive technologies,

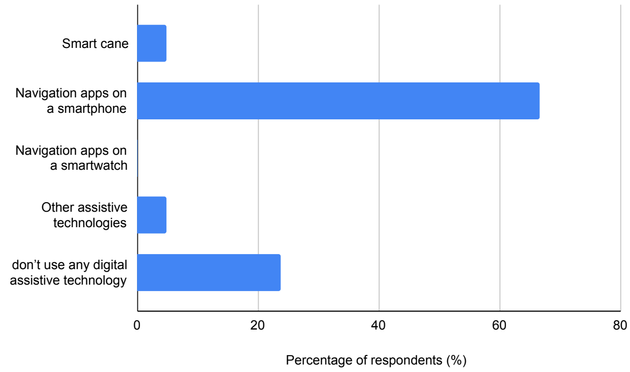


Fig. 2: Use of digital assistive navigation technologies among participants. While smartphone-based applications are most common, a substantial proportion of respondents report not using any assistive navigation technology.

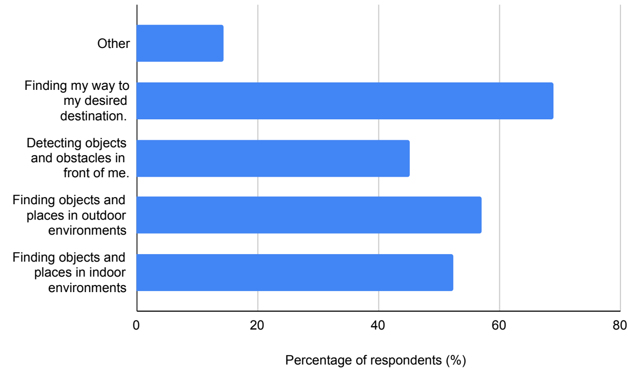


Fig. 3: Reported navigation challenges in unfamiliar environments. Participants most frequently reported difficulties related to route finding and obstacle detection.

reported by 66.7% (n=28, 95% CI [51.6%, 79.0%]) of participants. Notably, 23.8% (n=10, 95% CI [13.5%, 38.5%]) indicated that they did not use any digital assistive navigation technology (Fig. 2).

Levels of satisfaction with assistive technologies varied. The largest proportion of respondents (46.9%, n=15; 95% CI [30.9%, 63.6%]) reported being satisfied, while 15.6% (n=5, 95% CI [6.9%, 31.8%]) expressed dissatisfaction and 6.2% (n=2, 95% CI [1.7%, 20.1%]) reported uncertainty.

Among respondents who reported using assistive navigation technologies, only 18.8% (n=6, 95% CI [8.9%, 35.3%]) indicated that the feedback provided was sufficient to guide them in unfamiliar environments. The majority reported context-dependent limitations, including insufficient feedback in environments with many obstacles (31.2%, n=10; 95% CI [18.0%, 48.6%]), outdoor environments (25.0%, n=8; 95% CI [13.3%, 42.1%]), and indoor environments (12.5%, n=4; 95% CI [5.0%, 28.1%]). Perceived adequacy of reaction time to obstacles was mixed. Among respondents, 40.6% (n=13, 95% CI [25.5%, 57.7%]) reported having sufficient time to react either always or most of the time, while 37.5% (n=12, 95% CI [22.9%, 54.7%]) indicated that this was only sometimes the case. A further 18.8% (n=6, 95% CI [8.9%, 35.3%]) reported rarely or never having sufficient time to react, and 3.1% (n=1, 95% CI [0.6%, 15.7%]) were unsure.

As shown in Fig. 3, participants reported encountering challenges when navigating unfamiliar environments, with difficulties related to finding routes to destinations (69.0%, n=29; 95% CI [54.0%, 80.9%]) and locating objects in outdoor settings (57.1%, n=24; 95% CI [42.2%, 70.9%]).

Concerns about collisions were also reported. Head-level obstacles were identified as a challenge by 76.2% (n=32, 95% CI [61.5%, 86.5%]) of participants. Difficulties related to both chest-level and ground-level hazards were each reported by 40.45% (n=17, 95% CI [27.0%, 55.5%]). Among respondents who used assistive technologies, 93.8% (n=30, 95% CI [79.9%, 98.3%]) reported using them for outdoor navigation or for both outdoor and indoor navigation.

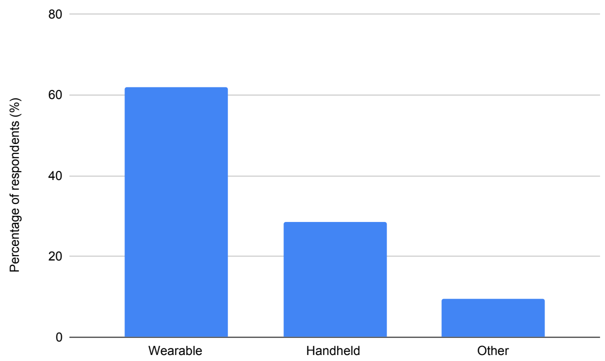
C. Preferences and expectations

Preferences for assistive navigation technologies varied across participants. As shown in Fig. 4(a), participants preferred wearable devices, while Fig. 4(b) indicates a strong preference for audio and multimodal feedback. Wearable devices, such as smart glasses or smartwatches, were preferred by 61.9% (n=26, 95% CI [46.8%, 75.0%]) of respondents, while 28.6% (n=12, 95% CI [17.2%, 43.6%]) favored handheld devices, including smart canes. With the exception of one participant with mild visual impairment, those expressing a preference for handheld devices reported severe or total visual impairment. A further 9.5% (n=4, 95% CI [3.8%, 22.1%]) indicated openness to alternative forms of assistive devices.

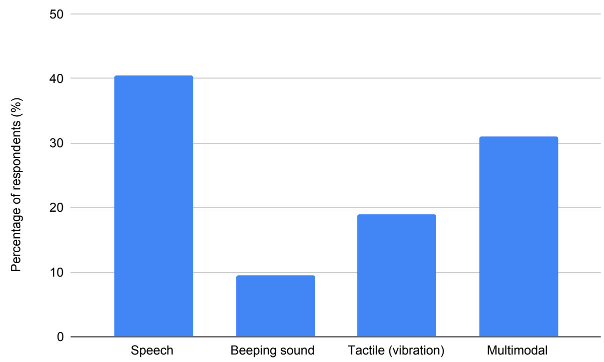
Regarding information delivery, speech-based feedback was preferred by 40.5% (n=17, 95% CI [27.0%, 55.5%]) of respondents. Combined feedback modalities were selected by 31.0% (n=13, 95% CI [19.1%, 46.0%]), and tactile feedback by 19.0% (n=8, 95% CI [10.0%, 33.3%]). Among participants who favored tactile feedback, the hands and arms were the most commonly preferred locations for receiving sensory information (57.1%, n=24; 95% CI [42.2%, 70.9%]).

Participants also identified factors influencing route selection during navigation. Obstacle-free paths were the most frequently selected criterion (61.9%, n=26; 95% CI [46.8%, 75.0%]), followed by the availability of route information (54.8%, n=23; 95% CI [39.9%, 68.8%]). Constant navigational assistance was selected by 47.6% (n=20; 95% CI [33.4%, 62.3%]) of participants, while shortest-distance routing and rapid re-routing after obstacle detection were each reported by 38.1% (n=16, 95% CI [25.0%, 53.2%]).

When asked about important characteristics of assistive navigation technologies, respondents most frequently selected ease of use (81.0%, n=34; 95% CI [66.7%, 90.0%]) and low cost (66.7%, n=28; 95% CI [51.6%, 79.0%]). A second tier of priorities included low mental load and low device weight (each 52.4%, n=22; 95% CI [37.7%,



(a) Device form factor preference



(b) Feedback modality preference

Fig. 4: Preferences for assistive navigation systems. (a) Preferred device form factors for navigation assistance. (b) Preferred feedback modalities for receiving information about the surrounding environment.

66.6%]), followed by low physical effort and identification and avoidance of obstacles (each 47.6%, n=20; 95% CI [33.4%, 62.3%]).

D. Insights from open-ended responses

In addition to structured questions, participants provided open-ended feedback on what their ideal assistive navigation technology should look like and offered additional comments or suggestions. The responses indicate several recurring design considerations, which are summarized below.

A frequently stated requirement was simplicity and low-effort use, where participants explicitly asked for solutions that are "easy to use," "minimal effort," or provide a "clear walking route" rather than excessive information. Relatedly, participants expressed preferences for everyday and familiar form factors, such as smartphone-, smartwatch-, or watch-like solutions, and for systems that integrate with existing mainstream products rather than requiring bespoke devices.

Another recurring requirement concerned unobtrusive and discreet use, including devices that "blend in" with the cane, are "discreet," or are non-obvious to others. Participants also described compatibility with existing mobility aids, describing the system as an addition to the cane or explicitly expressing interest in smart-cane concepts.

Participants further pointed to the importance of actionable guidance and obstacle-related information, such as feedback about the distance and nature of obstacles or clear route instructions. Multiple respondents also referenced interaction modalities, including audio and tactile feedback options and voice-based operation. In terms of audio delivery, one respondent explicitly mentioned bone-conduction headphones in combination with smartphone-based navigation, while another referred to being able to notice sound quickly.

Reliability and accuracy were explicitly emphasized by participants who requested reliable operation and accuracy. Practical considerations were also present, particularly affordability and accessibility across regions, with multiple respondents requesting low-cost devices and noting constraints in developing contexts. Some participants further mentioned power and operating constraints, such as solar powering or offline functionality.

Overall, the open-ended responses highlight that participants value assistive navigation technologies that are easy to use, unobtrusive, compatible with existing aids, and practically accessible, while still providing reliable, actionable guidance.

V. Discussion

The survey results provide an empirical view of how visually impaired individuals experience navigation in unfamiliar environments and how they perceive existing assistive navigation technologies. Rather than evaluating specific systems, the findings highlight recurring challenges and preferences that emerge across participant backgrounds, environments, and levels of visual impairment.

A. Navigation challenges in unfamiliar environments

Participants reported multiple difficulties related to wayfinding, obstacle avoidance, and spatial awareness, particularly in unfamiliar settings. Challenges such as identifying routes to destinations, detecting obstacles at different body levels, and navigating outdoor environments were frequently reported. These findings are consistent with prior work emphasizing that navigation difficulties extend beyond simple orientation tasks and often involve dynamic, cluttered, or unpredictable environments. The reported concerns about head-level and ground-level obstacles further illustrate the complexity of real-world navigation, where hazards may not be confined to a single spatial plane.

The prominence of outdoor navigation in reported technology use suggests that outdoor environments remain a critical context for assistive navigation. While indoor navigation has received increasing attention in recent research, the survey responses indicate that participants continue to face substantial challenges outdoors, where environmental variability and infrastructure differences may increase navigation difficulties.

B. Use and perception of assistive navigation technologies

The results indicate that smartphone-based applications are the most commonly used digital assistive tools, reflecting their widespread availability and integration into everyday devices. At the same time, a substantial proportion of participants reported not using any digital assistive navigation technology. This observation suggests that the existence of assistive tools does not necessarily translate into universal adoption and points to potential barriers related to accessibility, usability, or contextual suitability.

Reported satisfaction levels varied among participants, indicating that current solutions may meet the needs of some users while falling short for others. Difficulties in providing effective feedback in environments with numerous obstacles or high ambient noise further underscore the challenges faced by assistive technologies in real-world conditions. These findings reinforce the importance of considering environmental context and user diversity when evaluating navigation support systems.

C. Diversity of preferences and interaction modalities

Preferences regarding device form factors and feedback modalities varied considerably among participants. While wearable solutions were favored by many respondents, a notable proportion preferred handheld devices, particularly among those with severe or total visual impairment. This variation suggests that no single form factor can accommodate all users and highlights the importance of flexibility in assistive navigation design.

Similarly, preferences for information delivery differed across participants. Speech-based feedback was most commonly selected, but combined and tactile feedback modalities were also frequently preferred. The selection of hands and arms as preferred locations for tactile feedback reflects practical considerations related to perception, comfort, and ease of interaction during navigation. Together, these findings indicate that assistive navigation support must accommodate multiple interaction modalities to align with diverse user preferences and situational demands.

D. Implications for understanding user needs

Participants prioritized ease of use, affordability, and effective obstacle identification when considering important characteristics of assistive navigation technologies. Additionally, route selection preferences emphasized obstacle avoidance and access to route information over purely efficiency-based criteria such as shortest distance. These priorities suggest that navigation support is evaluated not only in terms of performance but also in terms of cognitive effort, safety, and practicality during everyday use.

Taken together, the survey results highlight the heterogeneity of navigation experiences and expectations among visually impaired individuals. Rather than pointing toward a single optimal solution, the findings emphasize the need to account for differences in impairment severity, environmental context, and personal preferences. This demonstrates the importance of incorporating user perspectives into navigation research.

VI. Limitations

This study has several limitations that should be considered when interpreting the results. First, the survey relied on online recruitment, which may introduce sampling bias toward individuals with internet access and experience with digital tools. As a result, visually impaired individuals with limited access to online resources may be underrepresented. In addition, although the survey was designed to be accessible, online participation may still pose challenges for individuals who primarily rely on alternative communication methods such as Braille.

The survey was conducted exclusively in English, which may have excluded non-English speakers and limited the representation of perspectives from certain regions. Furthermore, the study was based on a relatively small subset of the broader BVI population, and the data collection period was constrained by time limitations. While efforts were made to reach a diverse group of participants within this timeframe, these factors may have influenced the overall sample size and distribution. Future studies addressing these limitations could contribute to a more comprehensive understanding of navigation challenges and needs among visually impaired individuals.

VII. Conclusion

This paper presented the results of a fully accessible online survey examining navigation experiences, challenges, and preferences reported by visually impaired individuals. By capturing user-reported perspectives across diverse environments and backgrounds, the study provides an empirical view of everyday navigation needs that complements existing research on assistive navigation.

The findings highlight the diversity of navigation experiences and preferences, underscoring that visually impaired users do not form a homogeneous group with uniform requirements. Rather than supporting a single approach to navigation assistance, the results emphasize the importance of considering variability in impairment severity, environmental context, and interaction preferences.

While the study has acknowledged limitations related to sampling and scope, the survey offers a structured account of challenges and expectations reported by visually impaired individuals. As such, it contributes user-centered evidence that can help contextualize ongoing research and inform future studies on navigation support.

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