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Auditing Accessibility of Pavements and Points of Interest in Urban Areas: The 'Seek & Go' Tool †

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Abstract: In recent years, accessibility has become a topic of great interest on a global scale across the scientific, business, and policy sectors. There are two primary reasons for this growing trend. Firstly, accessibility serves as a vital indicator reflecting the social performance of communities, and the public is increasingly aware of critical social issues such as accessibility. Secondly, accessibility is essential for the sustainable development of regions and civil settings, facilitating inclusion and business growth. In this regard, information and communications technologies can play a crucial role in facilitating the accessibility of spaces by disabled people. Numerous digital tools and smart applications are already available to serve this purpose. This study presents a novel digital tool called 'Seek & Go', a comprehensive aid application designed specifically for disabled individuals. The app features a GPS navigation system that caters to pedestrians with disabilities and unique accessibility requirements. The present study documents the models underlying the development of 'Seek & Go', discusses technical aspects of the application, and presents user experience insights.

Keywords: accessibility; disabilities; urban environment; audit; smart application

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1. Introduction

Citizens within a society, regardless of their physical or mental abilities, often encounter social exclusion, with a prominent form being the denial or non-realization of citizenship rights [1]. Territorial factors and especially accessibility (i.e., transport, communications) are fundamental in comprehending social exclusion in modern societies [1]. To this effect, limited accessibility features and amenities, particularly in urban environments, could lead to the marginalization or mobility-related social exclusion of individuals with physical impairment [2–4].

The term "accessibility" denotes the features of an environment that allows all citizens, without any discrimination (e.g., age, gender), to be able to use and access the infrastructures [5] independently, comfortably, and safely. In the latter context, infrastructure refers to digital and physical counterparts (i.e., conventional and electronic installations). Indicatively, accessibility is pertinent to public infrastructure and spaces, transportation means, communication, signage, services, and goods [4,6]. In this vein, accessibility is an overarching concept affecting most aspects of everyday life.

Overall, accessibility implies that physical and digital infrastructure are specially designed and managed so that all society members can access and use it in a safe and comfortable manner [7–9]. Accessibility also implies the proper design and analysis of all structures and facilities so that individuals can autonomously access them, ensuring mobility across infrastructure networks.

Accessibility is fundamental for structured environments, allowing the inclusion of citizens by enabling access and usage of buildings, facilities, and public spaces [5]. Within urban environments, accessibility must ensure an individual's participation in social and economic activities [7], regardless of any form of limited autonomy (e.g., children, older adults, and disabled people). Ensuring that all citizens are provided with the same and equal opportunities to move and access urban environments, public participation can be achieved, and social inclusion for all can be ensured. An individual's participation in society is intimately associated with the human right to social integration and identity, a certain standard of living, and respect [10].

Internationally, communities around the globe have recognized the significance of accessibility for the last three decades. Notably, Article 9 of the UN Convention on the Rights of Persons with Disabilities coins the concept of accessibility, advocating that, "*. . . States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas*" [11]. Specifically, the U.S. Access Board updated the design guidelines that cover access requirements of facilities for people with disabilities under the Americans with Disabilities Act [12]. In Greece, the New Building Code/Regulation (Law 4067/2012) mandates that new building permits are accompanied by an accessibility study, while existing facilities must be modified to ensure accessibility to disabled people [13].

In this regard, most organized communities have introduced standards, necessary provisions, and special design rules on accessible infrastructure. The latter has been recognized as an essential element towards sustainable regional development, as accessibility improves individuals' quality of life and makes urban environments more habitable [14]. Societies' inability to effectively tackle barriers, design effective social policies, and provide training to foster accessibility is inextricably linked to poor urban planning and inadequate infrastructure development strategies [5]. Subsequently, disabled people become vulnerable to escalating inequalities.

2. Accessibility Needs in Urban Environments

2.1. Accessibility Requirements

Urban environments shape the living conditions of people with disabilities and significantly influence the extent of their deprivation and social exclusion [15]. Inaccessible urban environments and poorly designed infrastructure further intensify the accessibility challenges encountered by disabled people, as they create barriers that prevent an individual's integration within society, e.g., by hindering peoples' participation in social, professional, political, and cultural events [16]. Indicatively, people with mild to severe hearing loss who visit creative spaces (e.g., museums) could find translation services helpful; the unavailability of such services limits the participation potential of disabled people, leading to alienation or exclusion. In a similar vein, individuals who use wheelchairs for their mobility within public buildings require accessible elevators or ramps. Furthermore, people with blindness and visual impairment need signage information in healthcare units (e.g., hospitals) or identifiable and comprehensible safety instructions during transportation (e.g., airplanes); however, Braille versions of instructions/leaflets might not be available.

For an environment to be considered accessible, it must cater to the unique needs of all disabled individuals. This includes ensuring their ability to move independently, providing equal access, and enhancing their overall quality of life [17–19]. It is important to note that there is no single solution that can meet the needs of everyone, as each person's needs are different and must be accommodated for accordingly [20].

2.2. Mobility Obstacles in Urban Environments

Disabled people often encounter challenges in various aspects of their daily lives, including accessibility to public and private spaces, healthcare services, information and communication, education, employment, culture, leisure, and transportation. Despite progress in recent years, evidence from the literature suggests that people with disabilities still encounter obstacles related to physical infrastructure, technology-based amenities, and architectural elements [16]. Examples of such barriers include inadequate traffic demarcation systems, lack of accessible sanitary facilities, insufficient emergency escape infrastructure, poorly designed ramps with steps at the end, and the misplacement of blind guides and other equipment. Such issues can be further compounded by inaccessible user manuals. First, individuals with mobility-related disabilities require specific accommodations to navigate their surroundings safely and comfortably. For instance, in outer spaces, sidewalks may lack sufficient signs, while barriers such as illegally parked cars and the presence of coffee shop furniture can impede the free movement of people. Moreover, accessing buildings can be a challenge for those who require wheelchair assistance due to narrow entrances. Accessibility barriers are also common in internal spaces. For example, it is necessary for building corridors to have smooth surfaces and sufficient crossing width, with distinct and easily recognizable boundaries. Additionally, smooth, non-slip flooring is essential to prevent accidents [17], and ramps, accessible elevators, and sturdy handrails on stairs are essential for ease of movement. Specifically, elevators may not offer sufficient space, and the control buttons could be inconveniently placed (e.g., at a high height). It is also important to ensure that toilets and bathrooms are equipped with appropriately placed fixtures and handles, and that clear, eye-level markings facilitate easy identification [21]. By prioritizing these accommodations, a more inclusive and accessible environment for all individuals can be created.

Second, people with visual impairments heavily rely on auditory and tactile stimuli to navigate their environment. However, they often encounter significant challenges in communicating, receiving information, and utilizing equipment, devices, and aids [22]. Traditional forms of visual communication, such as printed materials and signage, can significantly limit accessibility for individuals with visual impairments. In particular, signage in Braille format or tactile structures should be present throughout spaces, with large fonts, strong color contrasts, and adequate lighting, while maintaining simplicity and clarity [23]. It is crucial to ensure that communication and information are accessible to all individuals to promote inclusivity and equal access.

Third, individuals with hearing impairments often rely heavily on visual stimuli to supplement their understanding of information, particularly when audio systems are the sole means of communication. This can pose challenges in situations where additional visual information is not readily available. To address the specific needs of those with hearing impairments, environments with optimal acoustics are necessary [24]. Additionally, the use of sound aids and specialized equipment that facilitate alternative communication methods can greatly enhance the daily activities of this population.

From an alternative point of view, a lack of adequate infrastructure and assistive technologies can inhibit the social participation of people with sensory impairments or learning disabilities, such as attaining museum experiences [25]. Notably, exploring a range of clinical, developmental, social, and environmental factors to facilitate the accessibility of disabled children (e.g., with visual impairment) to sports activities, physical exercise, and leisure is important for promoting emotional well-being and social connectivity [26]. Following the Article 30 of the UN Convention on the Rights of Persons with Disabilities that supports the need to ensure accessibility of cultural goods, services, and heritage, barriers and facilitators to cultural participation have been classified under five categories, as follows: (1) lack of effective/adequate legislation, policies and legal standards; (2) lack of funding and/or of adequate services; (3) negative attitudes; (4) lack of accessibility; and (5) lack of consultation with, and involvement of, persons with disabilities in cultural organizations [27].

Overall, accessibility hindrances are associated with deficiencies and weaknesses in elements such as buildings, indoor–outdoor spaces, equipment, and service systems, in both rural and urban areas [21]. Planners need tailored tools and effective guidance to design spaces accessible to all people. In order to achieve optimal results, it is imperative to acknowledge the vital role that information and communications technologies, as well as digital tools, can play in this endeavor [28]. Furthermore, to best support individuals with disabilities, it is important to have specialized and well-trained staff available to accommodate their needs.

3. Accessibility Measures for Disabled People

The identification and accommodation of accessibility issues can be a complex and nuanced process, often requiring a profound understanding of the relevant considerations. As such, it is imperative that planners possess the requisite knowledge and expertise to effectively recognize and address these challenges in a thoughtful and comprehensive manner. This research delves into the topic of facilitating access for disabled individuals to urban spaces, with a specific emphasis on measures documented in the literature. A critical taxonomy of this literature revealed a comprehensive list of thirty-one measures, which can be categorized into three distinct clusters based on their scope. These clusters include the following: (i) space infrastructure, (ii) building infrastructure, and (iii) awareness initiatives. Table 1 provides a comprehensive list of these measures and initiatives that have been recognized.

Table 1. Measures/initiatives for ensuring accessibility to people with disabilities.

Scope	Measure/Initiative	Source(s)
Space Infrastructure	1. Outdoor areas and sidewalks accessible for disabled people	[29–31]
	2. Outdoor ramps	[29–32]
	3. Accessible public sanitary facilities	[30,32]
	4. Signage and markings with accessibility information	[30,33]
	5. Routes with integrated blind guide	[34]
	6. Absence of temporary obstacles from sidewalks	[30,32,34–37]
	7. Public parking spaces for disabled people	[29–31]
	8. Walking routes for disabled people	[38]
	9. Audible signals on pedestrian crossings	[34,39]
	10. Public transport accessible by disabled people	[34,37,40]
Building Infrastructure	1. Parking spaces exclusively for disabled people	[29–31]
	2. Communication systems for disabled people (e.g., SMS, e-mail, subtitles, audio systems)	[33]
	3. Accessible signage inside buildings and in surrounding areas	[30,32]
	4. Accessible entrance	[31,41]
	5. Accessible route and escape (e.g., blind guide, touch paths)	[33,36,42]
	6. Accessible sanitary facilities	[30]
	7. Accessible services	[43]
	8. Accessible fixed equipment (e.g., reception and transaction counters)	[31,32]
	9. Accessible means for covering altitude differences (e.g., elevators)	[32]
	10. Proper lighting for disabled people	[44]
	11. Proper coloring of selected building points for disabled people	[42,44]
Awareness Initiatives	1. Public awareness campaigns	[45]
	2. Staff training	[37,40,45]
	3. Accessible web portals in organizations	[30,46]
	4. Tourist guides for disabled people	[39,46]
	5. Smart applications for disabled people	[39,45]
	6. Public events for raising disability awareness	[40]
	7. Maps with accessible facilities and points of interest in each regional setting/authority	[34]
	8. Information office for the disabled people in each in each regional setting/authority	[34]
	9. Multimedia for disabled people (e.g., videos in sign language)	[39]
	10. Accessible information material and forms	[37,40]

4. Tool Development for Auditing Accessibility

A multitude of digital applications exist that have been created to aid disabled individuals. Due to the importance of accessibility in smart cities, the market for such applications continues to expand. As part of our research on accessibility in urban areas, we have developed the 'Seek & Go' application.

'Seek & Go' aims to be a comprehensive assistive application to aid individuals with disabilities. Towards this goal, collecting information regarding accessibility is a primary concern. The collection of data to identify potential accessibility issues is carried out by a dedicated experts' team which is trained on using the application developed as part of this research. The prospective goal is to allow citizens, store owners, volunteers, and other interest groups, to add their own data directly. The collected data could be used by third-party applications (e.g., mobile apps offering routing features focusing on accessibility), and end users (e.g., people with disabilities, wheelchair users, users with baby carriage). The 'Seek & Go' application was developed as part of the "Digital Products and Services for Accessible and Safe Mobility of Senior and Disabled Tourists and Citizens in Greece" project (acronym: 'Seek & Go'), funded by the European Regional Development Fund of the European Union and Greek national funds via the Operational Program Competitiveness, Entrepreneurship and Innovation, under the "Research—Create—Innovate" call. The project was a collaborative effort between the following parties: (i) MLS Multimedia S.A., a software company based in Thessaloniki, Greece; (ii) the Department of Informatics & Telecommunications at the University of Ioannina; and (iii) the Department of Supply Chain Management at the International Hellenic University.

It is important to note that the consortium worked closely with the National Confederation of Disabled People, a leading umbrella organization representing the disability and chronic disease patients' movement in Greece. This collaboration helped the research team better understand the unique needs and requirements of individuals with disabilities.

The 'Seek & Go' partnership boasts a wealth of multi-disciplinary expertise and extensive experience in its field. Through this project, the partnership envisions to develop innovative solutions that will enhance the capacity of both private and public entities to better serve disabled people in a more effective and competitive manner. Specifically, the 'Seek & Go' project focused on addressing the unique requirements of persons with disabilities or limited mobility, including senior citizens and expectant mothers [47].

A key result of the project was the 'Seek & Go' application that features a GPS navigation system specially designed for disabled pedestrians with special accessibility requirements [40]. The project at hand was centered around promoting mobility while adhering to the "Design for All" principles and the widely acknowledged accessibility standards. A key component of the initiative involved gathering georeferenced accessibility data in the two largest urban centers in Greece, i.e., Athens and Thessaloniki. Moreover, the project consortium committed to laying the groundwork for achieving nationwide coverage in Greece post project.

Through meticulous on-site inspections, experienced evaluators and consultants conducted assessments of streets and landmarks within the designated study area [47]. Upon completion, the 'Seek & Go' application could act as a catalyst for enhancing the mobility of citizens with disabilities in Greece, while simultaneously elevating the country's global branding as a distinctive, accessible destination. The auditing process plays a crucial role in ensuring the efficient and seamless operation of the application. With this objective in mind, the development of the 'Seek & Go' application was accompanied by the implementation of a specialized auditing tool, which was specifically designed to support this initiative [48].

5. Technical Approach

In the subsequent sections, we present the technical aspects of the 'Seek & Go' digital application in terms of architecture and functionality.

5.1. Architecture

The development of the 'Seek & Go' application followed the microservices' design approach, comprising three distinct and independent layers. This approach ensured that each layer could be deployed and scaled independently, with fewer dependencies, resulting in simpler maintenance, quicker updates, and a more transparent communication interface. In addition, the application was implemented as a Progressive Web App, utilizing Service Workers as a virtual proxy between the browser and the network in order to support offline use. This feature is particularly essential since the application is primarily intended to be used while on the move. The 'Seek & Go' conceptual architecture is illustrated in Figure 1, demonstrating the three separate layers that make up the overall application, i.e., front-end, back-end, and storage layers.

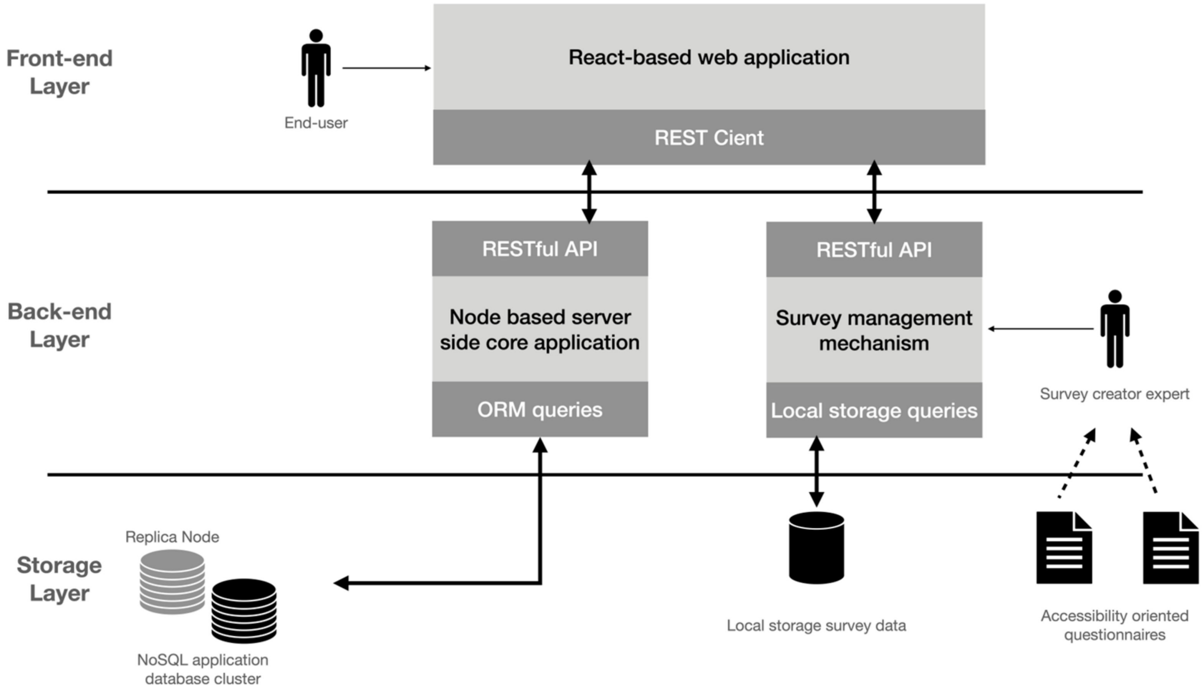

Figure 1. 'Seek & Go' architecture.

The front-end layer is composed of the following elements: (i) the user interface (UI), (ii) the application programming interface (API) for fetching data from the server and the local storage, and (iii) the survey dispatcher for handling data synchronization among the local storage and the remote database. The survey dispatcher is based on the following:

- React, a JavaScript library for building user interfaces [49].
- Google Maps JavaScript API [50].
- Turf, an advanced geospatial analysis library [51].
- Chakra-UI, a simple, modular, and accessible component library that provides accessible building blocks to build React applications [52].
- Survey.js, a set of open-source JavaScript libraries to dynamically build surveys and forms dynamically [53].

The back-end layer is a server-side application that handles the business logic, including the following: (i) user management, (ii) authentication, (iii) handling of privileges and rights, (iv) database communication, and (v) defining API endpoints following the Open API 3.0 specification for describing, producing, consuming, and visualizing RESTful web services [54]. The underlying technologies of this layer are as follows: (i) Node.js, a JavaScript runtime [55], and (ii) Feathers.js, a robust framework designed for the creation of both real-time applications and REST APIs [56]. Additionally, Survey Creator, which is a component of Survey.js, is an excellent tool for the assembly of various questionnaires.

These questionnaires can be linked to graphical entities such as obstacles, pavements, crosswalks, points of interest (POIs), and others on the map, providing a comprehensive overview of the area under investigation.

The 'Seek & Go' application has a storage layer that utilizes MongoDB [57], a cross-platform document-oriented database, which is classified as a NoSQL DB. All data produced by the application are in the form of JSON documents with the appropriate schemas. These documents are validated by the Mongoose [58] object model library in the back end. The implementation of this layer relies on MongoDB Atlas Clusters hosted in Amazon Web Services, which ensures maximum scalability and expandability. Additionally, automated DB replicas guarantee zero downtime service.

5.2. Handling Offline Content

The 'Seek & Go' application is designed and implemented to facilitate concurrent usage by multiple users who have installed it on their tablet or smartphone with the appropriate screen size. Notably, the implementation of the 'Seek & Go' application takes into account the possibility of unstable internet connectivity, such as when users enter underground parking lots, buildings, or elevators. Moreover, such a design feature ensures access to users who may encounter internet connection issues due to economic or other social complications, thus enabling them to engage in the process and upload to the system when they obtain access to free or unlimited Wi-Fi.

In this light, the 'Seek & Go' application has been engineered to function even without internet access, utilizing a progressive web app approach, which employs smart caching and the browser's local storage to maintain collected data. Additionally, a mechanism for continuously monitoring content updates was introduced to ensure that local data remain in synchronization with the central database.

In the event of connectivity issues, users may experience a lack of synchronization of their collected data. However, through the use of the 'Seek & Go' application, users can store and take photos offline, with the ability to upload them to the server either as a batch selection or per survey on demand. It is important to note that special management is required for the handling of photos locally and offline. To comply with local storage limitations, photos are encoded to a Base64 sequence on the fly. Upon upload to the server, the photos are decoded to their original binary form and stored as JPG image files. This transformation process also helps to reduce the actual size of the photos in terms of bytes on the server. Additionally, public links to the uploaded images are available in various resolutions, including thumbnail, medium, and original.

One limitation of the current version of the application implementation approach is the challenge of supporting high-resolution images generated by advanced mobile cameras, which is predominantly determined by device specifications. To mitigate the issue of handling extremely large photos without encountering memory errors, particularly on low-end devices, users may opt to choose a lower resolution in their camera settings or frequently synchronize and then clear the local storage of their devices after each synchronization. Experienced users can only delete local storage through the front-end UI as an additional security layer against unintended data loss.

6. User Experience

One of the primary challenges in completing surveys that require geolocation information is matching questions with identifiable entities on a map correctly. This can be a particularly arduous task when using traditional paper-based surveys. Even with electronic surveys that offer maps, the geolocation capabilities are typically limited to a single point, marked by a pin or, at best, an area defined by a polygon on the map. 'Seek & Go', however, offers a unique solution that significantly improves the user experience and provides increased functionality [48]. Based on usability testing and cognitive walkthrough, the development team identified, in the early stages of the implementation, usability issues that mainly concerned difficulties in handling the UI from small tablets. For this reason, the application focused on a tablet-first design, meaning higher tolerance on tap precision, smart drag and drop of the graphical elements on a map (e.g., pedestrian crossings, obstacles), which allows automatic placement to the correct position (sticky elements), introducing serializable actions for connecting segments only by tapping consequently buttons or graphical elements (such as sockets and plugs) and connecting entrances to segments via a single tap as the application calculates the nearest point and finds the closest element (i.e., pavement or pedestrian road) automatically.

Users are provided with clear guidance on selecting the appropriate entity from a range of options, including street segments, POIs, segment connections, and POI/entrance connections. Upon making a selection, users are presented with simplified steps on the screen that facilitate the drawing of the area of interest by tapping on the map. To optimize the user experience, the application utilizes simple trigonometric calculations, leveraging the Turf library to restrict the movement of the drawing elements. This is particularly useful when users are interacting with the UI from a touch screen. The UI is thoughtfully designed to display relevant, simplified information based on the selected entity. To ensure that users adhere to appropriate rules, the application imposes additional restrictions to prevent undesirable actions, such as adding a pedestrian crossing where no two opposite pavements are defined in the working segment. An indicative screenshot of the application is shown in Figure 2 displaying a selected segment entity. The screenshot shows the currently unanswered surveys that correspond to the selected entity on the map, helping users to better identify missing input. In this specific example, the user has to complete surveys for two sidewalks, four obstacles, and three pedestrian crossings.

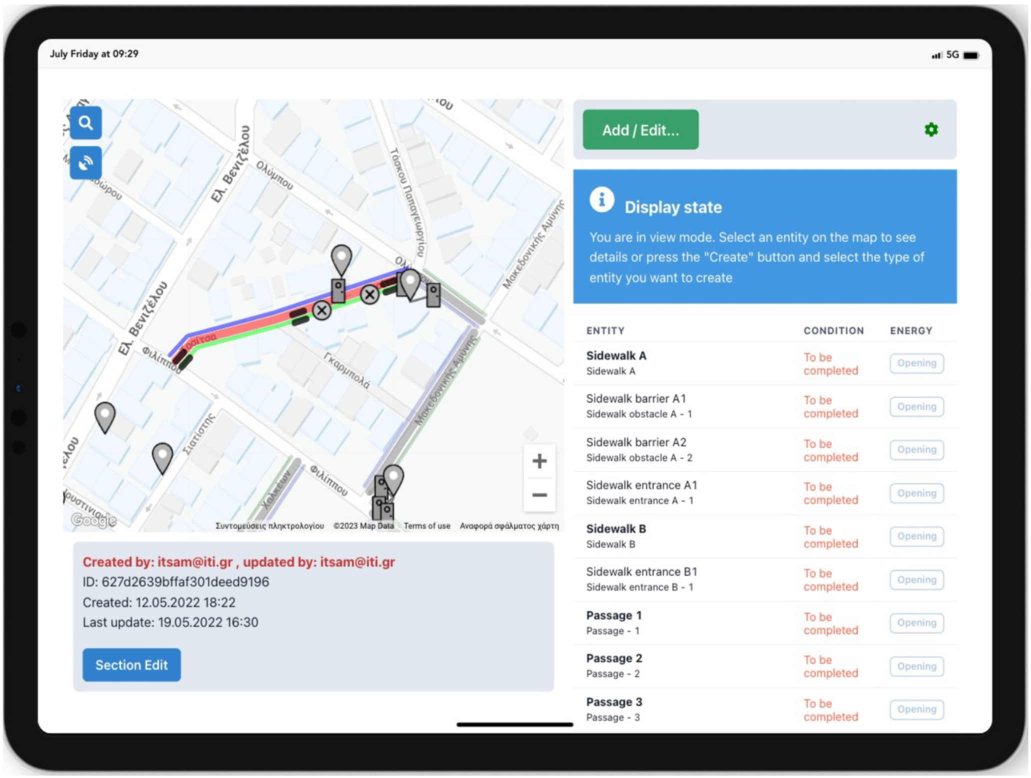

Figure 2. Screenshot of the 'Seek & Go' application highlighting a selected segment with its corresponding list of surveys remaining to be completed (marked in red). For better understanding, the text is auto-translated from Greek (except names of the streets which are shown in Greek as provided by Google Maps), and it might contain inconsistencies and grammatical and/or syntactical errors.

Each entity featured on the map corresponds to a distinct survey, which has been designed to gather pertinent accessibility information. Specifically tailored questionnaires have been developed for each of the four major entities, namely street segments, POIs, segment connections, and POI entrances. The questionnaires capture all requisite accessibility details, including information for obstacles and ramps on pavements, accessibility infrastructure in buildings, slope angles, opening widths, and unique signaling for the visually impaired.

From the UI perspective, selecting a survey highlights its corresponding element on the map while emphasizing their relationship. Additionally, dynamic rules are applied within the surveys based on user responses. For example, when a wheelchair ramp is available, supplementary questions relating to the ramp are added. To enhance the user experience, individuals can directly insert specific questions and photos from their camera or photo library, eliminating the need to switch between screens. The survey provides a comprehensive map overview, highlighting the selected entity for ease of reference. This allows users to quickly locate the relevant element among segments, pedestrian roads, crossings, pavements, obstacles, entrances, and POIs.

From the UX perspective, the filled surveys are stored locally, enabling instantaneous saves without waiting times for uploading everything on the server. Uploading is triggered on demand when users have fast internet access. This offline-first design allows for better flexibility as it enables users to identify missing input, provides better performance, and promotes data resiliency because it reduces the risk of data loss.

Additionally, the 'Seek & Go' application offers a key feature whereby the various entities are interconnected, forming a graph for calculating alternative accessible routes from point X to point Y on a map (Figure 3). Users can define multiple entrances to POIs and connect different segments by pavement or pedestrian road through an intuitive and user-friendly UI, utilizing icons and visual aids. This enables the calculation of alternative paths, such as utilizing a nearby pedestrian crossing when an obstacle blocks the entrance of a POI for wheelchair users on one side of the road.

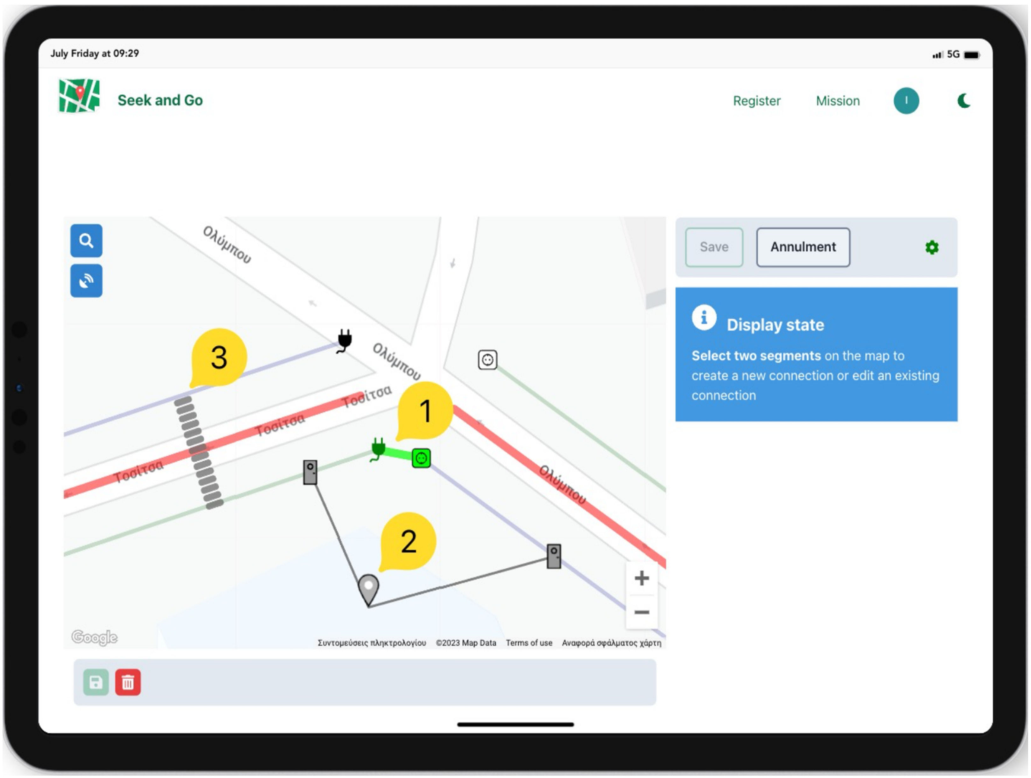

Figure 3. Tap-friendly UI interaction for connecting segments using self-explanatory icons such as sockets and plugs (map pin #1). POI containing two entrances connected to different segments (map pin #2) and pedestrian crossing connecting two opposite pavements (map pin #3) are also displayed graphically on the screenshot.

The 'Seek & Go' application does not incorporate routing calculations in its functions. However, it enables data sharing through its API to third-party systems, which can utilize the collected information to propose alternative access routes and determine the most optimal one based on the user's specific requirements, priorities, or preferences. Furthermore, ongoing application developments encompass advanced analysis and programming methods for creating maps with higher spatial resolution [59].

7. Models and Document Schemas

The 'Seek & Go' application facilitates two primary types of JSON-driven models. The first model pertains to survey schemas, which are generated using the Survey Creator—a visual designer that enables experts to devise surveys and forms. The Survey Creator produces a survey configuration in JSON format, which can subsequently be used by the SurveyJS library to exhibit the survey within the application. While it is not possible to integrate the Survey Creator into the 'Seek & Go' application, its results (JSON configurations) can be utilized with the open-source SurveyJS library. Initially, the application provided support for eighteen surveys, encompassing restrooms, staircases, bus stops, obstacles, pedestrian crossings, and pavements, among others. Across the various survey types, more than four hundred questions could be defined. Each JSON configuration is converted into a contemporary form that supports rules based on user responses. The application corresponds to the graphical element (e.g., pedestrian crossing with the corresponding survey). Example surveys are featured in Figure 4.

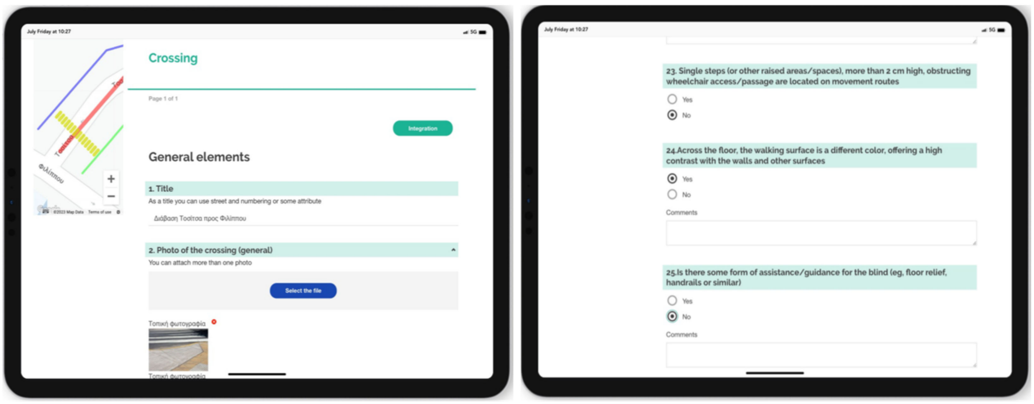

Figure 4. Every survey is the rendered output of a JSON configuration and is related to a graphical representation on the map (**left**). Questions are mainly accessibility oriented (**right**).

The second model pertains to the various schemas established to facilitate the application's underlying business logic. This includes seven distinct MongoDB collections, as follows:

i. Connections' collection, which houses documents detailing the interrelationships among different map elements, resulting in a linked graph.
ii. Entrances' collection, which retains data concerning the entry POIs.
iii. POIs' collection, which encompasses several distinct categories, such as museums and churches.
iv. Segments' collection, which serves as the central collection and comprises the requisite nested configurations for obstacles and pedestrian crossings.
v. Surveys' collection, where all responses to completed surveys are stored.
vi. Templates' collection, which houses the configuration documents from the Survey Creator.
vii. Users' collection, which contains documents relating to the system's users (e.g., credentials, privileges).

8. Conclusions

This research paper introduces the 'Seek & Go' application, which serves as an auditing tool designed to systematically gather georeferenced accessibility data for streets and POIs in urban conurbations. Its primary purpose is to supply the developed database with accessibility data, which, in turn, can be used to guide and inform disabled users, ultimately enhancing the mobility of citizens within the study areas.

Potential areas for future research could involve an examination of policy-making processes at the municipal level, with a focus on incorporating the 'Seek & Go' mobile application into a comprehensive framework that can serve as a guide for stakeholders seeking to establish accessible-for-all services [60]. This approach can play a critical role in promoting sustainable urban communities, a priority identified in the United Nations' Sustainable Development Goal #11 [61].

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