

IncluSearch: Enhancing Urban Accessibility through a Mobile Platform

Radoslav Karatanev

Sofia University “St. Kliment Ohridski”
Faculty of Mathematics and Informatics
Blvd. “James Bourchier” 5, 1164, g.k. Lozenets, Sofia
rkaratanev@gmail.com

Oprea Iulia Gabriela

University Politehnica of Bucharest
Faculty of Entrepreneurship, Business Engineering and
Management
Corp BN, Bucharest 060042
iulia.oprea11@yahoo.com

Juraj Belajec

University of Zagreb
Faculty of Organization and Informatics
Pavlinska ulica 2, 42000, Varaždin
jurajbelajec@gmail.com

Barbara Krsić

University of Zagreb
Faculty of Organization and Informatics
Pavlinska ulica 2, 42000, Varaždin
krsicbarbara@gmail.com

Abstract. *Currently, about 16% of the world’s population is considered disabled in some way¹. IncluSearch aims to be an innovative platform, designed to enhance urban accessibility for these individuals. Utilizing a user-centred design approach, the platform is planned to feature an interactive city map that users can filter according to specific accessibility requirements, such as wheelchair accessibility or accommodations for mental disabilities. The map will show public places like restaurants, bars, museums, etc. Firstly, the platform would focus on Zagreb, Croatia. But later it would expand according to the needs and growth. The paper discusses the technical challenges encountered, such as integrating real-time data and ensuring accuracy of accessibility information. The results of the case study highlight the platform’s expected effectiveness in improving urban mobility for users with disabilities. Furthermore, the paper explores potential funding avenues, including government support², to sustain and expand the platform’s capabilities. By leveraging technology to bridge accessibility gaps, IncluSearch aims to foster a more inclusive urban environment. This paper contributes to the broader discourse³ on accessible urban development and the role of technology in empowering disabled individuals. Lastly, the tools used in this paper include Figma, Visual Paradigm and MilaNote.*

Keywords. Accessibility, Mobile Application, Disabilities, Urban Mobility, Inclusivity, Wheelchair-accessible, Trip Planner, Government Funding, Technology, User-friendly

1 Introduction

The total population of the world (as of July 2024) is 8.125 billion^[1]. 16%^[2] of that, or about 1.3 billion people worldwide, are considered disabled in some way^[1], either physically or mentally. Despite these statistics, urban environments often present challenges for these individuals, limiting their ability to engage with their communities and access essential services. These challenges can include physical barriers, such as inaccessible public transportation, buildings without ramps or elevators, or inadequate accommodation for individuals with visual impairments. In addition to physical obstacles, individuals with disabilities frequently encounter social and economic barriers. Discrimination and a lack of awareness or understanding from the general public can lead to social isolation and exclusion. In the past, the necessity of changes in urban planning was acknowledged, however, it has since been largely neglected. In response, this paper introduces IncluSearch, a mobile platform with the goal to empower users by revolutionising the way disabled individuals navigate cities. By offering a tool that highlights accessible locations and services, IncluSearch will not only address the immediate needs of individuals with disabilities, but will also foster greater awareness and inclusivity within communities. The platform will allow users to plan their journeys and daily activities with confidence, knowing they can access the services they need without any physical or social barriers. The remainder of this paper goes over the detailed case description and the business model of the platform, after which the reader is presented with the process, service, and application views. The paper then proceeds with the customer journey and the BMC, after

which it discusses the possible future of the platform. Currently, IncluSearch plans to be focused on the city of Bucharest, Romania, where the platform would be developed and tested. The interactive map and its associated services would be fully functional within this city first, allowing users in Bucharest to navigate their surroundings with ease and confidence. However, the long-term vision for IncluSearch is to expand its coverage to include cities across Romania, Europe, and eventually, to provide a global platform that would serve millions of users around the world.

2 Case Overview

Urban environments pose significant challenges for individuals with disabilities, with barriers such as inaccessible public transportation, buildings lacking ramps or elevators, and inadequate accommodations for visual impairments. Additionally, social and economic barriers, including discrimination and limited public awareness, further exacerbate their isolation and exclusion.

This case study focuses on IncluSearch, a mobile platform designed to enhance urban accessibility for individuals with disabilities. IncluSearch aims to address these pressing challenges by providing an interactive tool that enables users to navigate cities more effectively. The platform features a map allowing users to filter locations based on specific accessibility needs, such as wheelchair access and accommodations for visual or mental disabilities. Real-time data integration ensures the information is current and reliable, while a user feedback mechanism helps maintain accuracy and relevancy.

The IncluSearch prototype is designed in Figma, enabling a seamless and visually intuitive experience throughout the design process. The platform is crafted to be user-friendly and accessible, incorporating features like adjustable font sizes, high contrast modes, and screen reader compatibility. These customizations ensure that the app meets the diverse needs of users with various disabilities, promoting ease of use and inclusivity for everyone.

Our research involves a detailed examination of IncluSearch's approach and its impact on improving urban mobility. We explore the technical challenges the platform faces, including the integration of real-time data from various sources, ensuring the accuracy of accessibility information, and fostering ongoing user engagement for platform updates and refinements.

This case study offers a comprehensive overview of IncluSearch's objectives, scope, and the broader context in which it operates. It sets the stage for a detailed analysis of the platform's research methodologies, findings, and the implications of its work. By providing reliable information on accessible

services, IncluSearch aims to enhance community engagement and overall quality of life for individuals with disabilities. Potential funding sources for the platform's sustainability and expansion include government support^[3] and partnerships with non-profit organisations and private sector stakeholders.

3 Methodology

The Case Study Development Model from the DEMO project served as recommendations for the methodologies employed in this case study. As per the guidelines, we conducted an analysis of various scholarly publications and online sources.

Apart from this, we also used the resources we received for the Digital Platform Enterprise Erasmus+ project and a case description template to explore various layers of digital platforms throughout our research. We discovered by dissecting the layers that they consist of data, user, application, and technology layers. We made an effort to comprehend the architecture of the digital platform and how it relates to user base and employee participation in the process. We can comprehend various user viewpoints and how they affect our platform and its surroundings by using this method.

3.1 Data Collection

For this case study, we gathered the data from a range of sources and techniques. Given that the subject at hand is comparatively unexplored in terms of applied informatic technology solutions, it is imperative that we gain as much understanding as possible of the problem. In order to do this, we concentrated on obtaining information in several ways:

- Analysis of available research: With regard to disabled individuals and accessibility, we carefully searched through a number of studies that have been done in a number of different fields. We were able to obtain a great deal of informative data by doing this, which helped us see certain perceived issues from different angles.
- Personal experiences: Project participants who have a family member with a disability provided some of the motivation and logic for addressing this issue and subsequently obtaining additional information of this kind. With the help of this invaluable and intimate experience, we were able to learn even more about these subjects.

4 Results and Discussion

The IncluSearch platform, which was created with the intention of easing the daily problems of individuals with disabilities and increasing their sense of inclusion and welcome, is the subject of a thorough investigation in this part. We begin by discussing the business model and proceed to discuss the viewpoints of processes, services, and applications. We review those before moving on to the business model canvas and customer journey. The next necessary step is to discuss things like necessary technologies and platform overviews, which will help us better identify potential obstacles and possible future developments. Ultimately, a thorough data model can be created using the information above.

4.1 Business Model

Based on each person's unique preferences and circumstances, the IncluSearch business model is intended to provide a dependable and user-friendly means of locating inclusive and welcoming locations. The main features would be centred on providing a simplified experience that would assist those with disabilities, together with their family members or caregivers, in overcoming the daily challenges of navigating public areas and institutions. Working together with privately held recreation and amenity locations as well as government institutions, this achievement would be accomplished. The ability for users to engage with one another on the platform would be another element that would significantly enhance the experience, meaning we would mostly rely on the social computing component of this platform. Some of the key features and value propositions include the following: [5]

1. Search and filter functionality for places and disabilities.
2. The basic functionality for a user of the platform is signing up, after which the user either searches a map for a specific place or writes its name in a search field. Search and filter functionality for places and disabilities.
3. For the places included in IncluSearch, there is no functionality. IncluSearch uses the Google Maps API^[4], so it doesn't need any actions from the places' owner. Businesses would be interested in being included in the platform because that is another way to advertise their business.
4. The platform is free to download and use. The way IncluSearch makes a profit is through ads. The ads appear periodically in a banner-like style to the side of the screen, not obstructing any of the content.
5. Another way for IncluSearch to earn money is by offering the government the option to add information about government institutions. This would also include updating and taking care of that information on our platform. With this, a lot of potential problematic situations for both involved parties would be avoided.
6. While IncluSearch is free to use, it does have an additional premium option. With this payment, users become premium users. Ads are removed for the premium user, and it also unlocks the "Trip Planner" option. With this option, a user can make trip plans for multiple locations at once and check for connectivity between them. In case of some changes with the locations of the trip, the user gets notified about the change. The premium version is at a cost of 6.99€/month.

As was already established in the earlier paragraphs, the majority of the platform's funding will come from advertisements. Additional financing sources could come from government grants and partnerships, or even from joint ventures with various nonprofit groups that support individuals with various types of impairments. The premium version, which eliminates advertisements and grants customers access to a premium feature that improves their entire platform experience, is the last possible source of revenue. The interactive map on IncluSearch displays a variety of essential urban locations, including but not limited to:

- **Restaurants and Cafes:** Users could be able to find dining establishments that offer wheelchair access, braille menus, and other disability-friendly features.
- **Public Transportation Hubs:** The map would highlight accessible metro stations, bus stops, and other public transit points that accommodate individuals with mobility issues or other disabilities.
- **Public Restrooms:** IncluSearch would mark restrooms that are equipped for wheelchair users and others with special needs.
- **Cultural and Recreational Facilities:** Museums, parks, theaters, and sports venues are would be included, with information about their accessibility features.
- **Health and Wellness Centers:** Hospitals, clinics, and pharmacies with accessible entrances and services would be mapped.
- **Government Buildings and Services:** Users could find accessible government offices, libraries, and other public services.

4.2 Process View

Although there is no immediate need for certifications such as ISO, various essential aspects must be standardised and given more attention. Some of these are:

- **User Research and Needs Assessment.** There can be different types of actions, in order to be thorough, such as having extensive user persona development. There can be conducted in-depth interviews and focus groups with a diverse group of individuals with disabilities. This creates detailed user personas. Quantitative and Qualitative Analysis is another useful method. By implementing surveys and data collection methods, there can be multiple quantitative and qualitative data collected. Some statistical analysis tools can be used to identify common pain points and needs.
- **Quality Assurance and Testing.** There should be a comprehensive test plan, where it covers all aspects of the platform. For the quality assurance part, there needs to be conducted accessibility audits to ensure compliance with the current WCAG 2.1 guidelines. (“Web Content Accessibility Guidelines (WCAG) 2.1”)
- **Community Building and Engagement.** It’s important to design a strategic plan for reaching the communities that are targeted for this platform. There can also be interactive features implemented in the platform, such as forums.
- **Inclusive Marketing Strategies.** It is essential to ensure a diverse representation in marketing. There needs to be marketing campaigns targeted for the groups of individuals.
- **Targeted Outreach and Partnership.** It is important to identify and establish partnerships with organisations that are strategic.
- **Regulatory Compliance.** The platform should have a strong strategy that includes regular updates on changes in laws.
- **Accessibility Tools and Resources.** The platform has a dedicated section that helps users understand how to utilise that platform’s accessibility features. Also the platform can offer users the chance to customise and cater to them for their every pain points and needs.

4.3 Service View

Users of the IncluSearch require:

- **Ease of use** - Since most of the people using this app are expected to be disabled in some way, the app needs to cater to their needs. This means that there needs to be some assurance that there are a lot of accessibility options and tools implemented. This will result in catering to many needs of our users. In case of people with impaired vision, appropriate typography and interface options are needed. Another important thing is having a satisfying feedback loop which will make it clear when a user picks a specific option, action or functionality. This way, conveying all the plausible interactions clearly is doable.
- **Search engine** - A functionality that usually gets overshadowed is greatly important here. While there is a need for multiple different filtering options, like wheelchair accessibility, there is also a need to keep this filtering well conveyed and easy to use.
- **Navigation** through the platform has to be intuitive and simple. This can be achieved by using a straightforward and clear language while also avoiding jargon. Another aspect that can impact navigation is making the design clean and uncluttered.
- **Profile Customizations and Recommendations.** To give users more freedom and ability to express themselves and their needs, there is a requirement for a high level of customization. Users can put all the information about their wants and needs regarding the disability and preferences, with this they can connect with other people so they can receive recommendations for different places from other users. They would also get algorithm generated recommendations based on the information they uploaded on their profile.

Figure 1 shows the profile of the persona Sophie. She is a user of our platform that has been having a difficult time ever since she started using a wheelchair.

4.4 Application View

IncluSearch has multiple use case scenarios for the platform, these include:

- **Profile Management Feature.** Users can utilise this system to create a profile by applying the functionality for creating one. Other than doing this first step, the system is used to log into the platform. When the user

is finished using the platform, this system is operated to log out.

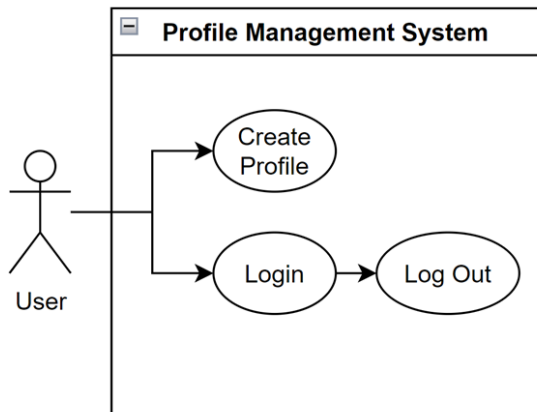


Image 1. Profile management system

- Trip Management Feature.** The user applies this system to search for places that are inclusive to her disability. She can also filter the results to have more accuracy specifically for her needs. The user has multiple features and actions that they can choose from, to do on the platform. She can view the details from the place chosen and decide if it's suitable for her. If not, she can go back in the search step to choose something that is more fitting to her requirements. For the premium account, there is a special feature that helps users plan trips in the selected locations and time frames. The last things that the user can do in this system are to provide feedback on the experience and to post on forums to ask more questions.

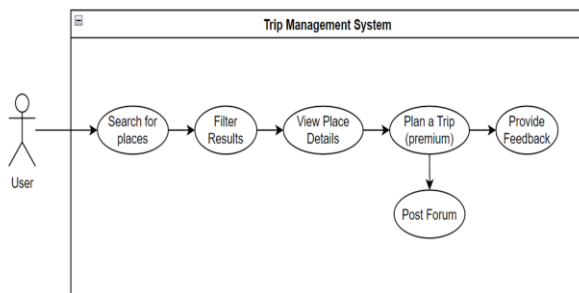


Image 2. Trip management system

- Review Management Feature.** The user is assisted by this system in offering a search function for locating places, as well as filtering results. After using those features, the customer can view more details about the place. The last feature that this system provides the user is to review the place searched, and further offer more information about her experience there.

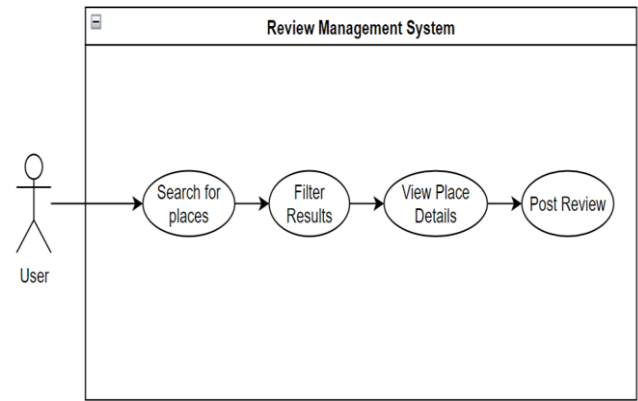


Image 3. Review management system

4.5 Customer Journey

The following customer journey map illustrates Sophie's experience with IncluSearch, showcasing how the platform positively impacts her life at various stages.

1. Awareness Stage: Sophie, a young woman with mobility challenges, first becomes aware of IncluSearch through various channels. She encounters an ad for IncluSearch on Facebook, sparking her curiosity. Additionally, she reads an article about accessible travel that highlights IncluSearch as a useful tool. Through conversations with friends and mentions from disability advocacy groups, her interest is piqued. At this stage, Sophie feels curious and hopeful, yet she is sceptical about the accuracy and reliability of the information provided by IncluSearch. Her main concern is whether the platform's data is dependable.

2. Consideration Stage: As Sophie evaluates whether IncluSearch can meet her needs, she delves deeper into its capabilities. She reads testimonials and user reviews, which offer insights into others' experiences. Checking the platform's social media presence, she becomes more familiar with its offerings. During this phase, Sophie feels interested and optimistic but remains cautious. She harbours doubts about the range of listings available on IncluSearch and is concerned about potential accessibility issues within the app itself.

3. Decision Stage: Sophie decides to give IncluSearch a try. She registers on the platform, which is straightforward and user-friendly. Her first search is for accessible cafes in Bucharest, and she is pleased with the initial results. To clarify some features, she contacts customer support and finds them responsive and helpful. This decision-making process leaves her feeling empowered, though she is slightly anxious about her first real-world experience using the platform. Her primary concern is potential technical issues during registration or search.

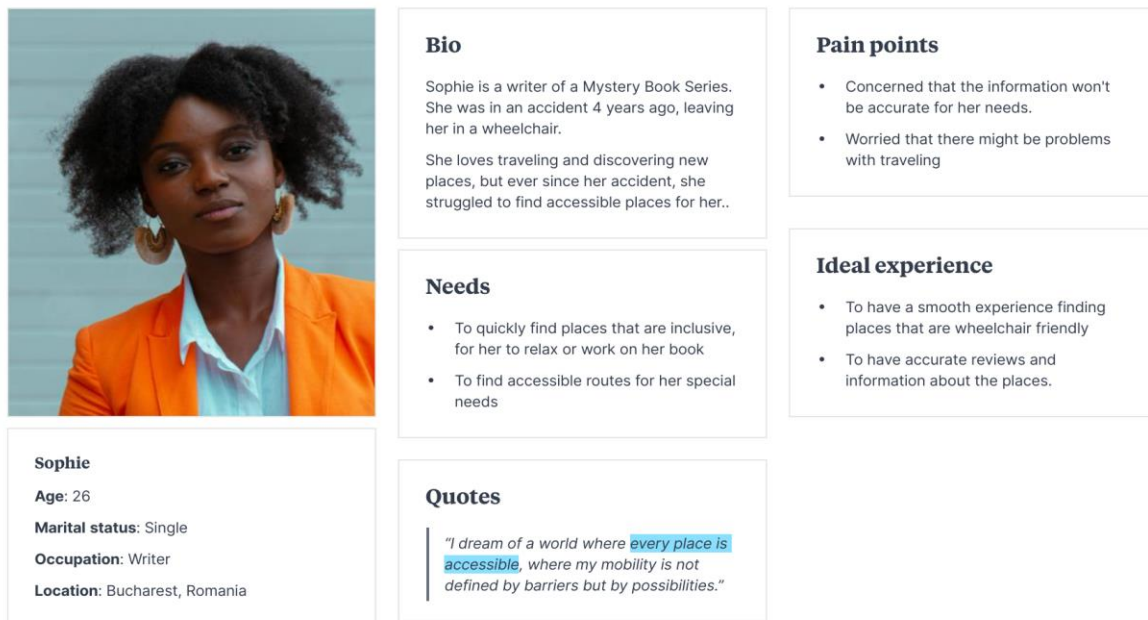


Image 4. Customer persona

4. Usage Stage: Using IncluSearch becomes an integral part of Sophie's daily routine as she searches for and visits accessible places. The mobile app's intuitive design, coupled with effective search filters, makes her experience smooth. Reading detailed reviews and checking ratings of different locations, Sophie feels relieved and confident. The excitement of discovering and visiting new places is palpable. However, she occasionally encounters inconsistent information between various sources and sometimes finds navigating the route planning feature challenging.

5. Post-Experience Stage: After using IncluSearch, Sophie reflects on her experience and provides valuable feedback. She receives a follow-up email inviting her to share her thoughts. Sophie fills out a feedback form, rating her overall experience, and posts a positive review on social media. She also contacts customer support to suggest potential improvements to the platform. At this stage, Sophie feels satisfied, valued, and grateful for the positive impact IncluSearch has had on her ability to navigate the city. Nonetheless, she experiences minor frustrations with potential technical glitches while submitting feedback and wishes for a more immediate response to her suggestions. [6]

4.6 Business Model Canvas

IncluSearch operates on a comprehensive business model designed to enhance urban accessibility for individuals with disabilities. The BMC is described in Figure 2.

Key partners include disability organisations, government agencies, public facility managers, private business owners, technology providers, and marketing and PR agencies. These partnerships are essential for ensuring the platform's content is reliable and up-to-

date, and for promoting the app to a broad audience. The platform's key activities revolve around development and maintenance, database management, marketing campaigns, and ongoing research and feedback collection. These activities ensure the app remains functional, accurate, and user-centric. IncluSearch's key resources include a skilled development team, an extensive database of accessible locations, marketing resources, funding, and user feedback mechanisms. These resources are critical for sustaining operations and growth.

The value propositions of IncluSearch centre on providing centralised and reliable information about accessible facilities, offering a user-friendly platform tailored for people with disabilities, and fostering a community with trusted reviews and ratings. This enhances mobility and independence for users. Customer relationships are maintained through personalised user profiles, a community forum, active user support, feedback loops, and regular updates. These elements help build a loyal and engaged user base.

The platform targets several customer segments: individuals with disabilities seeking accessible services, their caregivers and family members, public facilities aiming to improve accessibility, and government agencies focused on accessibility initiatives. These segments are chosen based on their direct need for reliable accessibility information and their role in promoting inclusivity.

IncluSearch reaches its customers through various channels, including a mobile app, social media, partnerships with disability organisations, email newsletters, community events, and collaborations with both public and private sector entities. These

<p>Key Partners</p> <ul style="list-style-type: none"> Disability organizations Government agencies Public facility managers (police stations, hospitals) Private business owners (cafes, restaurants, hotels) Technology providers (mobile app development) Marketing and PR agencies 	<p>Key Activities</p> <ul style="list-style-type: none"> Platform development and maintenance Database management and updates Marketing and outreach campaigns Research and feedback collection for improvement 	<p>Value Propositions</p> <ul style="list-style-type: none"> Centralized and reliable information on accessible public and private facilities User-friendly platform tailored for people with disabilities Trusted community reviews and ratings Enhanced mobility and independence for users 	<p>Customer Relationships</p> <ul style="list-style-type: none"> Personalized user profiles Community forum Active user support Customer feedback and improvement loops Regular updates and newsletters 	<p>Customer Segments</p> <ul style="list-style-type: none"> Individuals with disabilities seeking accessible services Caregivers and family members of individuals with disabilities Public facilities aiming to improve accessibility Government agencies focused on accessibility initiatives
<p>Key Resources</p> <ul style="list-style-type: none"> Skilled development team Database of accessible locations Marketing and PR resources Funding and financial resources User feedback mechanisms 		<p>Channels</p> <ul style="list-style-type: none"> Mobile app Social media platforms Partnerships with disability organizations Email newsletters Community events and workshops Collaborations with public and private sector entities 		
<p>Cost Structure</p> <ul style="list-style-type: none"> Platform development and maintenance costs Marketing and advertising expenses Salaries for development, support, and management teams Database management and updates Research and user feedback collection 		<p>Revenue Streams</p> <ul style="list-style-type: none"> Subscription fees for premium services (businesses and users) Advertising fees from inclusive businesses Sponsored content and featured listings Grants and funding from government and non-profit organizations Partnership and collaboration fees Donations and crowdfunding campaigns 		

Image 5. BMC

channels ensure widespread awareness and adoption of the platform. The cost structure includes expenses related to platform development and maintenance, marketing and advertising, salaries for the team, database management, and research.

Revenue streams are diversified, comprising subscription fees for premium services, advertising fees, sponsored content, grants and funding from government and non-profit organisations, partnership fees, and donations. This mix ensures financial sustainability and allows for continuous improvement and expansion of the platform. [7]

4.7 Platform Overview

The three figures under “Application View” above illustrate the IncluSearch system using UML Use Case diagrams, highlighting the various options available to users of the platform. The system is designed with a single type of actor: the End User. Access to the platform is restricted to registered users, making account creation the initial step in the process. Once an account is created, users are directed to the Home Screen, which features a detailed map of their immediate surroundings, enriched with data that identifies accessible locations and services. From the Home Screen, users have two primary options: they can either select a highlighted feature directly on the map to view its reviews and characteristics, or apply filters to the map based on their personal preferences. If users choose to filter the map, a popup window appears, allowing them to select specific accessibility features they wish to highlight. When a user selects a highlighted location on the map, detailed information about the place, including reviews, is displayed. This approach ensures that users receive only the most important information about each location, while maintaining the platform’s intended ease of use. By focusing on essential details, IncluSearch offers a

streamlined experience that empowers users to navigate their urban environment effectively. The Home Screen is also the place where the user can view the “Trip Planner” feature. This feature, which will be available only on the “Premium” version of the platform, will not only show the accessibility features of a location, but also the fastest way to get there from the user’s current location. The “Trip Planner” will take into account the selections in the disability filter mentioned above, while selecting the most effective route.

4.8 Challenges and Future

IncluSearch is aimed at improving accessibility and inclusivity for people with various disabilities. Even though it is promising, there are still certain challenges that there might come across in developing and using the platform. Here is an analysis regarding what are some challenges, as well as the future of the platform.

4.8.1. Challenges

- Accessibility and Usability.** Designing an interface that caters to a wide range of individuals with disabilities requires a considerable large amount of test and research. It is a significant challenge to ensure that the platform is easy to use for people that have visual, auditory, cognitive, and physical impairments. There is a constant change in the technology for accessibility and assistive needs. This results in constant updates and improvements to maintain inclusivity.
- Data Accuracy and Quality.** It is crucial to maintain the accuracy of the information about public places and to make sure that it is up to date. This challenge requires verification processes and updates that are consistent. It is important avoid

misinformation, by filtering and handling user reviews and contributions

- **Privacy and Security.** It is extremely important to safeguard personal data and ensure compliance with data protection regulations. Since there will be sensitive user information, it is essential to protect the platform from potential security breaches.
- **Market Growth.** It can be difficult, especially in the beginning, to attract users, so there needs to be an effective marketing strategy and a strong value proposition. After more users are interested and keep using the app, to scale the infrastructure in order to handle the increased traffic and data.
- **Financial Sustainability.** Relying only on ads, and then on the premium subscriptions for revenue might become complicated, if it is not managed well. It might become a challenge to manage operational costs, staff salaries, and server maintenance, while ensuring profitability. It is important to balance profitability with user experience.

4.8.2. Future

- **Expanding Geographic Reach.** Even though the platform will start only in one location, it is a goal to expand largely. The vision is to become the main assistant for 70% of the population that struggles with disabilities in Europe. Because of this expansion, there can also be updates in the features, such as having languages to choose from and to translate.
- **Enhancing Accessibility Features.** In the future there can be more accessible features that cater to each individual. Every user can have more complex options to choose from. Because of the upgrades in technology the platform can have new features, such as voice control, screen readers, and more.
- **Improving Data and Analytics.** Based on the user experience, there is a lot of data to work with. It is important to gain insight from the data collected, in order to offer targeted features and upgrade the platform.
- **Community Support.** The support system needs to be thorough to help the users and quickly address problems. By having a strong support system there will also be a strong community built. It is important to foster this community and help users feel safe. By doing these, it will encourage them to engage on the platform and offer them a comfortable user experience.
- **Technology and Innovation.** In the future, after there is a lot of growth on the platform, there can be a development on a mobile application. Based on analysing user data, it

can be easy to see if the users want an update or a change.

- **Regulatory Compliance and Ethical Standards.** It is crucial to stay updated with the regulations regarding data protection and accessibility to ensure that there is legal compliance. There needs to be high ethical standards in user interactions, no matter the changes and upgrades that the platform will face.

By facing these challenges and more and focusing on future advancements, the platform IncluSearch can grow effectively in all plans. It can provide valuable services to the individuals targeted, this will increase inclusivity and accessibility for them.

4.9 Data Model (Figure 3)

Based on our prior research and the models we created, the following factors emerged as the most significant and ought to be included in the data model: [8]

- The comprehensive data of users and businesses
- User data includes: user id, full name, username, date of birth, description, their user role, and premium user id.
- Business data includes: business id, business name, address, working hours, and business type.
- Review data includes: review id, rating, date posted, and content. This is directly connected to users and business'.
- Planner data includes: plan id, plan name, start date, end date, description, and premium user that's the organiser of the plan. It's connected to the businesses and users.

5 Conclusion

In conclusion, this paper has introduced IncluSearch, an innovative platform designed to improve urban accessibility for individuals with disabilities. Unlike traditional methods that depend on establishment owners to disclose their accessibility features, IncluSearch empowers people with disabilities to share and exchange this vital information directly with one another, ultimately leading to more precise and often more up-to-date information. This paper aims to give the reader an insight into the missing elements of modern infrastructure, and how the side effects of it can be minimised. Looking forward, our long-term goal is for IncluSearch to be used globally by millions of people worldwide, allowing them to live easier, and feel more included in modern society.

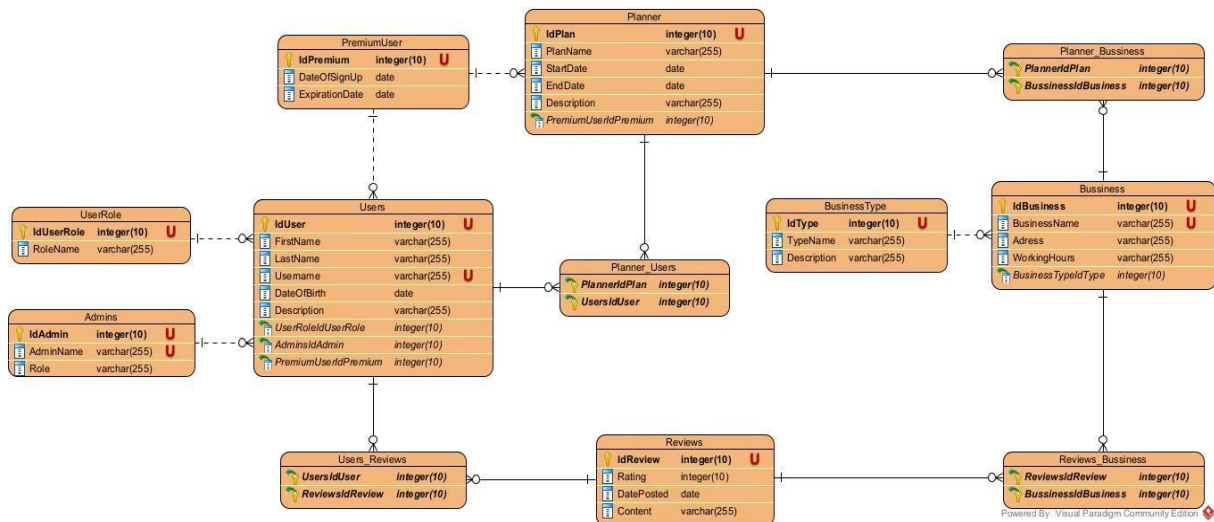


Image 6. Data model

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