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MOBILE APP FOR SOCIAL ENGAGEMENT TO ASSIST PEOPLE WITH DISABILITIES AT TOURIST SITES[1]

APP MÓVEL DE ENGAJAMENTO SOCIAL PARA AJUDAR PESSOAS COM DEFICIÊNCIA EM LOCAIS TURÍSTICOS

APLICACIÓN MÓVIL DE PARTICIPACIÓN SOCIAL PARA AYUDAR A PERSONAS CON DISCAPACIDAD EN LUGARES TURÍSTICOS

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1 Paper based on Master's Dissertation. Title: Collaborative application with accessibility information about services and tourist sites: case study in Foz do Iguaçu/PR, 2020. Postgraduate Program: Professional Master Degree of Technology, Management and Sustainability. Western Paraná State University – UNIOESTE.

RESUMO

A acessibilidade pode ajudar as pessoas com deficiência a participarem com entusiasmo na sociedade, com acesso equitativo e oportunidades justas. O turismo acessível permite que eles sejam mais incluídos e aproveitem suas experiências. As tecnologias facilitaram as viagens de pessoas com deficiência, bem como um Sistema de Informação Geográfica (SIG) pode fornecer orientação turística, mapas digitais navegáveis e permitir a busca de informações sobre lugares. Para apoiar o planejamento e a locomoção de pessoas com deficiência com mais independência, o objetivo deste artigo é propor um aplicativo para auxiliá-los no fornecimento de informações de acessibilidade a locais turísticos. Para a realização deste trabalho, foi realizada uma pesquisa sobre SIG relacionado à pessoa com deficiência, um projeto piloto para validar a ideia e o desenvolvimento do aplicativo proposto. Como resultado, o aplicativo mapa de locais acessíveis foi desenvolvido, usando tecnologias SIG gratuitas. Este aplicativo irá encorajar as pessoas com deficiência a se moverem com mais segurança e conforto, e aumentar os dados abertos em GIS por engajamento civil.

PALAVRAS-CHAVE

SIG. Aplicativo Móvel. Participação Pública. Pessoas com Deficiência. Turismo Acessível. Mapa de Acessibilidade.

ABSTRACT

Accessibility can aid people with disabilities to participate enthusiastically in society with equitable access and fair opportunities. Accessible tourism enables them to become more included and enjoy their experiences. Technology has facilitated travel for individuals with disabilities, and a Geographic Information System (GIS) can provide tourist guidance, navigable digital maps, and enable the searching of places information. To support people with disabilities planning and moving more independently, the objective of this article is to propose an application to assist them by providing accessibility information about tourist places. To realize this work, research about GIS related to disabled persons was carried out, a pilot project to validate the idea and the app development proposed. As a result, the map of the accessible places was developed using free GIS technologies. This app will encourage people with disabilities to move more safely and comfortably, and increase open data in GIS by civil engagement.

KEYWORDS

GIS; Mobile; Public Participation; People with Disabilities; Accessible Tourism; Accessibility Map.

RESUMEN

La accesibilidad puede ayudar a las personas con discapacidad a participar con entusiasmo en la sociedad con un acceso equitativo y oportunidades justas. El turismo accesible les permite estar más incluidos y disfrutar de sus experiencias. La tecnología ha facilitado los viajes para personas con discapacidades, y un Sistema de Información Geográfica (SIG) puede proporcionar orientación turística, mapas digitales navegables y permitir la búsqueda de información sobre lugares. Para ayudar a las personas con discapacidad a planificar y moverse de forma más autónoma, el objetivo de este artículo es proponer una aplicación que les ayude proporcionando información de accesibilidad sobre lugares turísticos. Para realizar este trabajo se llevó a cabo una investigación sobre SIG relacionados con personas con discapacidad, un proyecto piloto para validar la idea y el desarrollo de la aplicación propuesta. Como resultado, el mapa de los lugares accesibles se desarrolló utilizando tecnologías SIG gratuitas. Esta aplicación alentará a las personas con discapacidades a moverse de manera más segura y cómoda, y aumentará los datos abiertos en SIG mediante la participación civil.

PALABRAS CLAVE

SIG; Móvil; Participación pública; Personas con Discapacidad; Turismo Accesible; Mapa de Accesibilidad.

1 INTRODUCTION

According to the World Health Organization, approximately more than a billion people experiences a disability, about 15% of the world population or 785 million individuals, and 15.6% aged 15 or more live with some type of condition (WHO, 2011). The lack of accessibility for the disabled is the principal challenge for people due to architectural obstacles and barriers. People with disabilities include those who have long-term physical, mental, intellectual, or sensory impairments which in interaction with various barriers may hinder their extensive and effective participation in society on an equal basis with others. Of particular importance remain the right of these people to participate in cultural life and access places that offer cultural and tourist services (UN, 2007).

A big step forward for the disabled was The Convention on the Rights of Persons with Disabilities adopted on 13 December 2006 at the United Nations. This convention promotes, protects, and ensures the full and equal enjoyment of all human rights and fundamental freedoms by every person with disabilities, and increases respect for their inherent dignity (UN, 2007).

Almost all of us, at some point in our lives, may acquire a disability, temporary or permanent, as a result of an accident or injury or traveling with a family or friend with restriction conditions. The Accessible Tourism enables people (people including those traveling with children in prams, people with disabilities, and seniors) with access requirements, including mobility, vision, hearing, and cognitive dimensions, to function independently and with equity and dignity through the delivery of universally designed products, services, and environments (DARCY; DICKSON, 2009).

The World Tourism Organization endorses accessible tourism. It is provided in Article 7 that families, youth, students, seniors, and persons with disabilities should be encouraged and facilitated on tourist services (UNWTO, 2021). For this, tourism operators should improve their operations to guarantee access and services for persons with disabilities (DARCY; CAMERON; PEGG, 2010).

Applications directed to disabled tourists with public participation can share information that enables people with disabilities to plan and move more independently. Computational technologies for resolving problems are increasingly present in our quotidian. The use of navigation and orientation maps represents a resource present in the many types of equipment and already assimilated by society.

The geographic data via applications contribute to accessible tourism. People are constantly sharing geographic data through applications on the web, and the term Volunteered Geographic Information (VGI) is defined by the involvement of a substantial number of individuals with no formal qualification, in the creation of geographical knowledge, a function that for centuries has been reserved to official agencies. They are largely untrained, also their actions are almost always voluntary, and the results may or not be accurate, but collectively, they represent a notable innovation that will produce profound impacts on Geographic Information System (GIS) and more generally on the discipline of geography and its relationship to the public (GOODCHILD, 2007).

The GIS applications support accessible tourism allowing guidance, providing navigable digital maps and a database, enabling the search on tourist places information, and assisting people with disabilities to move more comfortably and safely. GIS systems represent computer-based tools for

collecting, storing, processing, analyzing, and visualizing geographic information. These tools improve the efficiency and effectiveness of handling information about objects and events located in geographic space and the six parts of a GIS are hardware, software, data, procedures, people, and network (LONGLEY *et al*., 2015).

In general, many studies about GIS tools of accessibility for people with disabilities can be found, several scientific papers have been published in this field area. For example, a GIS applied to vision impairment tourists is discussed by Rodriguez-Sanchez and contributors (2014) that report the architecture and application development interface for blind users, with screen reading, location, and navigation services. The technologies of Google Maps, Voiceover, Talkback, Blind-Launcher, iOS, and Android devices were used to develop the GIS architecture. The research was conducted at Rey Juan Carlos University, Madrid, Spain. It was described that the application aided people to handle their tasks, and it can be utilized by anyone, with or without disability.

Applications directed to physical disability tourists in Russia are described by Kulakov and contributors (2014, 2015), the architecture of an application web and mobile with accessibility information and the route planning services. The infrastructure related to these projects involved Geo2Tag, MySQL, JSON, HTML 5, JavaScript, CSS3, JQuery, JQuery Mobile, AngularJS, PhoneGap, ASP.NET MVC4, OpenStreetMap, Google Maps, and Open Source Routing Machine technologies. The accessibility map application was put in operation in the Ministry of Healthcare and Social Development of Karelia, Russia. The application displays a list of obstacles for the selected route with difficulty level, and the user can decide which course should be used, and the service allows the following main functions: Data collection, Route planning and sharing, and Audio-assistance. The Route planning function is based on OpenStreetMap on its storage of maps, and the service is provided to volunteers and disabled people.

An application for elderly tourists is presented by Signoretti *et al*. (2015) that consists of a gamified app to provide a new way for elderly people to travel. The application makes the tourist interact with the game, with historical information, text, sound, image, and video, as well as related to challenges. The technologies Windows Phone 8.1, Visual Studio 2013 IDE, HTML 5, CSS3, JavaScript were used in this project. The app was tested on the campus map of the University of Aveiro, Portugal.

Participation in GIS via mobile is described by Brovelli *et al*. (2016). Apps like GeoPaparazzi, Kort, OSMTracker, OpenStreetMap, Mapillary, EpiCollect, Decoro Urbano, NoiseTube, Noise Battle, Skywatch Windoo, Mappiness, ODK Collect, GeoODK, were designed for a geo-crowdsourcing. The technologies Geoserver, PostgreSQL, PostGIS, Apache Tomcat, OpenLayers, GeoExt, ExtJS, Leaflet, ODK Collect, Enketo Web framework, can be used for public participation application development. This study reports three projects involving the public into participatory sensing activities: the citizens' report of potholes in response to the generally adverse conditions of roads pavement in Como (northern Italy); mapping and evaluation of architectural barriers in Como; and the mapping of touristic points of interest, implementation of the architecture addressed the field of tourism valorization in a cross-border area between Italy and Switzerland.

The WheelMap app is presented by Mobasheri *et al*. (2017). A collaborative accessibility map for wheelchair users based on OpenStreetMap. The technologies Ruby on Rails, Rosemary, OpenStreet-

Map API, Maki, MapBox, ArcGIS, Android, and iOS devices were used to develop this application. The app contains the following technical features: home screen with a map with points of places; search function; filters by types of location; color symbology to identify the levels of accessibility (accessible, partially accessible, not accessible); items for evaluating (entrance, toilet); available in 32 languages; operating systems are Android, iOS and the web.

The Brazilian app Wheelguide (GUIADERODAS, 2021) is also focused on wheelchair users. This is a free and collaborative app for consulting and rating accessibility with +10,000 downloads from Google Play Store. The main technical aspects of this app are: simplified interface; search function; filters by types and nearby places according to the user's location; color symbology to identify the levels of accessibility (accessible, partially accessible, not accessible); items for evaluating (parking, entrance, internal circulation, counter, table, toilet); places from the foursquare database; map display by Google Map; available in English, Portuguese and Spanish languages; operating systems are Android and iOS.

As can be seen, these kinds of examples are developed using free software, and the accessibility information is generally provided by volunteers users. The focus of these tools is a physical disability, a condition that affects a person's mobility. The mobile application has a great impact on sustainability and Sustainable Development Goals (SDG), related to reduced inequalities and sustainable cities and communities.

The use of these applications improves life better for people with disabilities by planning for eventual obstacles that people can face. Technology can increase their well-being by providing resources to facilitate the right to come and go as they wish within a trip. According to World Health Organization, Quality of Life is related to an individual's perception of their position in life in the context of the culture and their values concerning their objectives, beliefs, principles, and interests (WHO, 2021).

Following these goals of accessible tourism applications, the objective of this present research is to propose an application to assist people with disabilities by providing accessibility information about tourist places. The application will bring geographic information data associated with accessibility metadata created by volunteered users. This tool will help people to plan and move more independently during a trip.

The paper is organized as follows: Section 2 describes the steps to develop the mobile app using free technologies. These results are present in Section 3, the operation of the mobile app. Section 4 describes the Discussions. Finally, the main conclusions are drawn in Section 5.

2 METHODS

2.1 THE PILOT PROJECT

To get a better understanding of the project implementation, a pilot mobile app was developed in a Brazilian University. An Android mobile app was built using Google Android, Maps, and Drive technologies (GOOGLE, 2021). The pilot app brings accessibility information about the campus, in which any student could consult the metadata about points of interest, using a smartphone connected to the Internet.

During the pilot project, a building survey at the university provided information for a listing of eleven accessibility issues. These items contain questions about the following items: sidewalk, parking, building access, internal circulation, doors, adapted toilet, furniture, library, auditorium, restaurants, lighting, signs, and services. Based on the Brazilian Association of Technical Standards NBR 9050/2015 standard we could get a better understand of criteria and technical parameters to be observed when designing, building, and proceeding with installation and adjustment of urban constructions to the conditions of accessibility (ABNT, 2015).

According to the research analysis of related apps and the pilot, we understand the following activities should be performed for the development of the proposed app, such as requirements gathering, designing, and app development architecture, coding, testing, and publishing. These steps are fundamental for the development of an application GIS to disabled tourists, in whom the specifics needs regarding people with disabilities and reduced mobility must be present.

2.2 SYSTEM REQUIREMENTS SPECIFICATION

The requirements of the mobile app were elicited and the documentation describes the features and behavior. The Software Requirements (SR) includes requirements as follows:

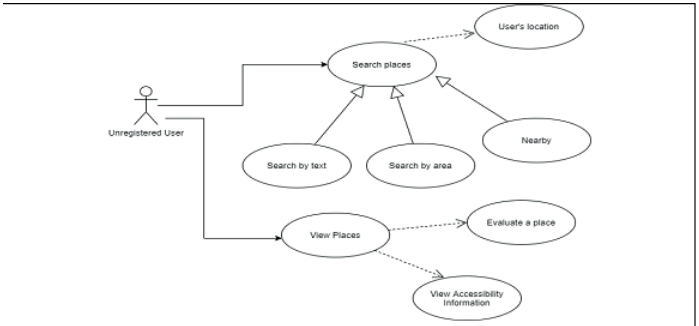
- SR1. The mobile app shall show display the information about a place: name, address, GPS coordinates, category, accessibility items;
- SR2. The places are organized into groups of categories. These categories are defined according to the Standard International Classification of Tourism Activities for grouping tourism-related places (UN, 2010). Possible categories and establishments are:
  - SR2.1. Food and Drink: bar, bbq, biergarten, cafe, fast food, food court, ice cream, pub, restaurant;
  - SR2.2. Shop: general store, department store, mall, clothing, shoes, accessories, food, beverages, discount store, charity, health and beauty, do-it-yourself, household, building materials, gardening, furniture and interior, electronics, outdoors and sport, vehicles, art, music, hobbies, stationery, gifts, books, newspapers, others;
  - SR2.3. Accommodation: apartment, chalet, guest house, hostel, hotel, motel;
  - SR2.4. Health: clinic, dentist, doctors, hospital, pharmacy;
  - SR2.5. Attractions: aquarium, attraction, gallery, museum, theme park, viewpoint, zoo;
- SR3. The accessibility evaluation of the places is categorized into items. Accessibility items for buildings and facilities must be considering the infrastructure of the place and its surroundings, barriers frequently faced by people with disabilities. These are prerequisites for the inclusion of all people, with means, items that must be observed for an accessible place. The accessibility items and the questions are about:
  - SR3.1. Sidewalk: items must be observed are about the conditions and width of the pathway, tactile surfaces, and adequately ramped;
  - SR3.2. Parking: verifying if an establishment has accessible parking spaces;
  - SR3.3. Entry Building: conditions about entry and exiting the building, which means, how easy is the entrance for people with disabilities and reduced mobility;

- SR3.4. Circulation: about this item, questions are related to autonomy for the disabled person's movements;
- SR3.5. Adapted Toilet: for toilets or bathrooms, issues are about both general and specifically accessible facilities;
- SR3.6. Furniture: discussions about furniture are comprehended appropriate counters and tables for wheelchair users and short-statured people;
- SR3.7. Signs and Labels. these questions are related to access signs, labels, and tactile Braille signs;

- SR4. During the evaluation process, people can choose between a set of options for each question. The set of responses are: Yes, No, Not Sure;
- SR5. The mobile app shall show the average scale for grade a place. A scale composed of the following items and weights were: Poor (1); Fair (2); Average (3); Good (4); and Excellent (5);
- SR6. For visualization of geographical data, icons symbology, and colors on the map make it easier for users to identify how accessible are the places. The markers vector layer represents the points and perceived accessibility by the app users. The icons representations are:
  - SR6.1. A gray diamond represents the places that have not yet been evaluated;
  - SR6.2. The green circular icon represents evaluated places, where the evaluation score is between 4 and 5 (Good and Excellent);
  - SR6.3. The yellow hexagonal icon represents evaluated places, where the evaluation score is 3 (Average);
  - SR6.4. The red rectangular icon represents evaluated places, where the evaluation score is between 1 and 2 (Poor and Fair).

The Use Case Diagram (UCD) describes and illustrates the interactions between the user and the system. The use case presented in Figure 1, showed the activities that the user can perform in the mobile app.

Figure 1 – Application Use Case Diagram



UCD1. Search for accessible places and evaluate

Description: This Use Case Diagram describes how the user can search for accessible places and evaluate a place.

Actor: Unregistered User

Steps:

- The Unregistered User starts the mobile application. The application requests a user's location.
- The application shows places nearby the user's location.
- The application shows the search fields available.
- Places are displayed on the map screen in different colors to visually indicate the accessibility level.
- The Unregistered User selects one of the results.
- The application shows all the accessibility information about the place.
- The Unregistered User can add the accessibility evaluation for a place.

Source: The authors (2021).

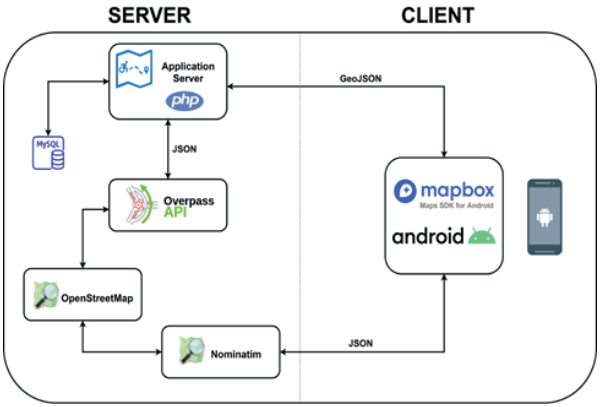
2.3 SYSTEM STRUCTURE

The Architecture of the System describes the behavior of technologies, how they interact with each other, and their internal structure. This facilitates the understanding for development and demonstrates how the components are set to work together. The architecture of the application is presented in Figure 2.

The mobile app was build using the collection of technologies, Application Programming Interfaces (API), and a Software Development Kit (SDK). Free software and services were properly used in the proposed app, in which the Android, OpenStreetMap, Overpass API, Nominatim API, and MapBox SDK were carefully selected. Android is an operating system based on Linux, designed primarily for touchscreen mobile devices like smartphones and tablets (WIKIPEDIA, 2021). OpenStreetMap (OSM) is a collaborative project to create a world-free editable map (OPENSTREETMAP, 2019).

To query custom selected parts of OSM, the Overpass API was selected, this API provides a copy of the OSM main database up to date and delivers them for easy search (OVERPASS API, 2021). Nominatim API is a tool to search OSM data to generate synthetic addresses of OSM points (reverse geocoding), and this service was utilized for searching places (NOMINATIM, 2021).

Figure 2 – The architecture of the application



Source: The authors (2021).

The Mapbox Maps SDK for Android is an open-source toolset for displaying maps inside of Android app, this SDK was implemented in the app as a base map (streets, satellite, outdoor, traffic, light, dark, building 3D), for vector features into layers, and advanced functions (MAPBOX, 2021). Finally, for the exchange of data between the web server and the app, the open standard format designed for representing simple geographical features GeoJSON notation was implemented.

The app's web server functions were developed in PHP language and MySQL database. The server functions are: getting places by distance; getting places by area; and registering an evaluation. When the app is started, the user is requested to enable the location, and then the nearby places are loaded, within a radius of 500 meters around. During the process of obtaining a place, the web server receives the request and calls the Overpass API, passing latitude and longitude parameters to get places by distance, or bounding boxes to get places by area. The response is a JSON object (a collection of name/value pairs in data-interchange format) that contains the places from Overpass API, and then the web server selects match data from a database, processes the information, and returns to the app a GeoJSON object (format for geographic data structures).

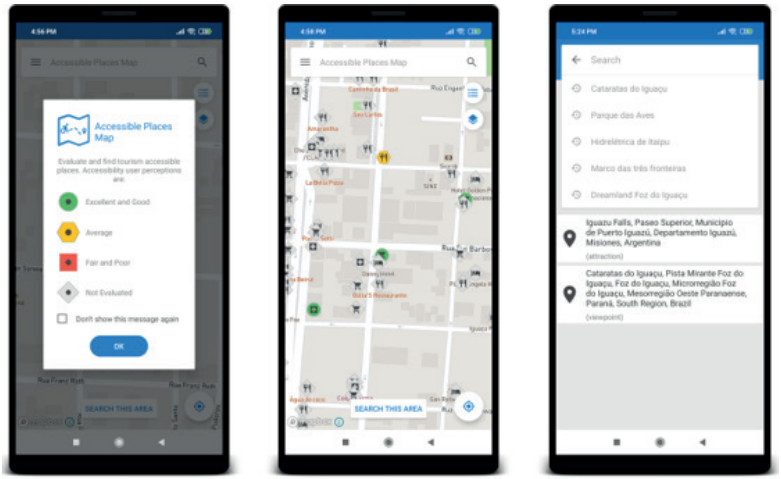
3 RESULTS

3.1 RUNNING EXAMPLE: PLACES SEARCH

This section presents the implementation of the place searching operation of the mobile app. Figure 3a presents a Quick Tutorial Window, which displays brief information about the legends of the app, icons colors, and formats content. This guidance helps beginner users to recognize how the information will be displayed.

The mobile app presents a minimalist design, in which the map involves the whole screen, and the functions are accessed by buttons. The places are presented in a layer over the base map. The textual search box is presented at the top of the map and the floating buttons giving access to the place list. There are functions to change the base layer, get the user's location, and search places by area. These are presented in Figure 3b.

Figure 3 – Place Search Functions



(a) (b) (c)

Source: The authors (2021).

After the process for obtaining places around the user's location, the places nearby are displayed on the map. The function "SEARCH THIS AREA" gets the bounding boxes, a particular area of a map expressed as an array of coordinate pairs (the minimum longitude and latitude, the maximum longitude and latitude), and requests places that are contained in this specific area.

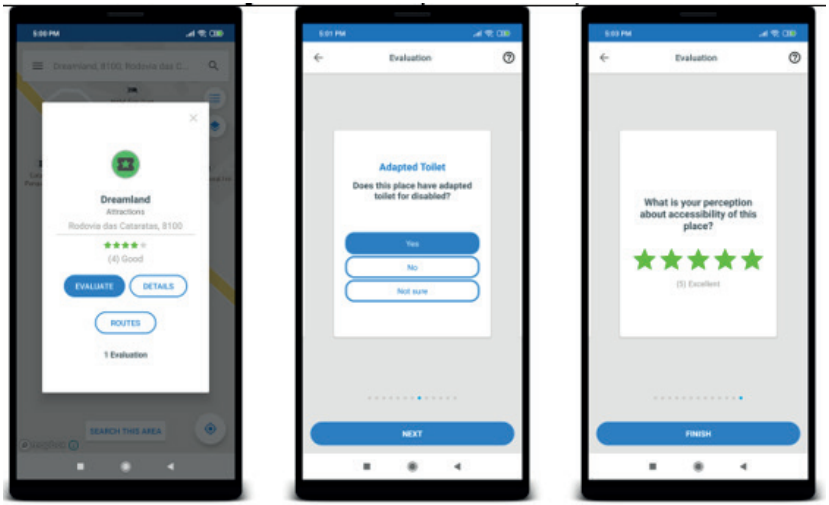
For searching places by text, this function returns information about a set of places based on a string. This process was implemented by Nominatim API as a search engine. The results are presented in a list, and the app function maintains a history of the last five terms searched. These functions are presented in Figure 3a.

3.2 RUNNING EXAMPLE: ACCESSIBILITY EVALUATION FOR A PLACE

This section presents the most important function of the mobile app, which is the process of accessibility evaluation for a place. When the user selects a place over the map, the app displays a pop-up window with some pieces of information. Figure 4a presents a brief information window that displays the category icon with the color representing the level of accessibility, the place name, tour-

ism category, address, star rating system, the description of the rating, number of evaluations, and function buttons. The button "EVALUATE" is used for the accessibility evaluation. The button "DETAILS" displays information about the place including the answered questions about accessibility. The button "ROUTES" draws a route on the map to the selected location.

Figure 4 – Accessibility evaluation for a place



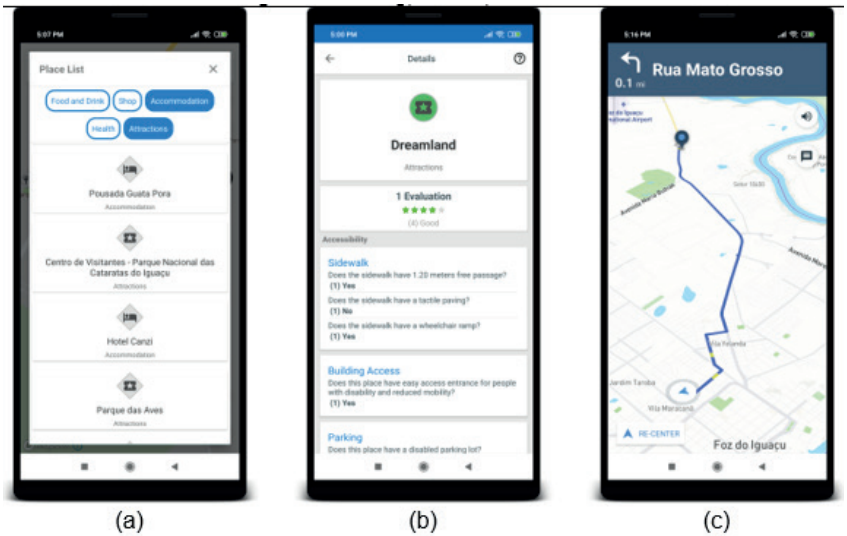
Source: The authors (2021).

The accessibility evaluation for a place is started when the user selects the button "EVALUATE". During the process, the user needs to answer the questions about accessibility items. Figure 4b presents a card with the question about the adapted toilet. For each question, there are "YES", "NO" and "NOT SURE" options. To this end, the last card asks to rate the accessibility perception of the place being evaluated. Figure 4c presents the rate stars and scores, for example, one star for poor conditions (red color); two for fair (red color); three for average (yellow color); four for good (green color); and five for excellent (green color). Finally, the button "FINISH" sends the form.

3.3 RUNNING EXAMPLE: LISTING, DETAILS, AND ROUTES.

There is another method to listing places that over the map. Pressing the floating button below the textual search box will be displayed the place list window. Figure 5a presents this function that contains a filter by touristic categories: Food and Dring, Shop, Accommodation, Heath, and Attractions. After clicking in one or more categories the list will be shown the resulting places. This function helps users to view places in a textual format.

Figure 5 – Listing, Details, and Routes



Source: The authors (2021).

Viewing accessibility information is important to people with disabilities planning and getting details for a place. Figure 5b presents a Details Windows that displays all accessibility data. The first field is rating, then the next data displays the answered questions grouped by items. The number of the answers indicates how is the accessibility figured out by users.

Completing the mobile app's main functions, one of the important activities is drawing routes on the map. This function can provide directions from the user's location to the selected place address. The guiding assistant is initiated by clicking the navigation button. This function is implemented by the MapBox Navigation SDK. The user is assisted by the voice instructions, location snapping, and progress along the route. These functions are presented in Figure 5c.

4 DISCUSSION

The mobile app developed by this work is called Accessible Places Map, a collaborative guide to accessible tourism for people with disabilities. Pre-requisites are the minimal Android 5.1 smartphone and the internet connection. No registration is required for accessibility evaluation, and it is available in English, Spanish, and Portuguese languages.

Compared to the similar apps of these categories, this app also displays the map as an initial screen, and when it is started the user can view nearby places represented by the vector point's layer. The first base map style displayed is Mapbox Streets because this design emphasizes roadways,

places, built features, administrative boundaries, and transit networks. Clicking on a marker icon represented a place, the mobile app will show a pop-up window displaying information about the accessibility data. If one place has not yet been accessibility evaluated, the user will be encouraged to register the data. All accessibility data displayed from the app is based on collaborative evaluations.

During coding and testing, we selected a touristic site to perform analysis. The Iguazu Falls are one of the New 7 Wonders of Nature, this place became an international touristic destination, the third on the list of ten most visited in Brazil for a leisure trip, according to the Brazilian Ministry of Tourism in 2018. We verified that many locations of this site were not present at OpenStreetMap and some of them were inconsistent. To obtain more data for testing and to correct the existing places, an update was performed at the OpenStreetMap database, using the iD Web Editor and the Vespucci application for Android applications. More than one hundred places have been improved during this process.

5 CONCLUSIONS

This work aims to propose a collaborative mobile app with accessibility information to assist people with disabilities in planning and moving when them visiting tourist sites. These individuals are capable to perform their activities, with some limitations, and knowing the accessibility information about a place previously is important to improve their quality of life. They want to effectively participate in cultural life and access places that offer tourist services. Enabling people with disabilities to move independently is the priority topic of this mobile app.

The proposed mobile app delivers the following contributions: increasing civil engagement by volunteer participation; disability awareness and inclusion; public policy-oriented urban planning; quality of life-related to accessibility and mobility issues due to architectural obstacles and barriers. Supporting people with disabilities to move more safely and comfortably is increasing social participation. The citizens' participation implies in public contribution to overcoming the current problems of the society. Progressively apps are addressed exclusively designed to assist people with disabilities to experience their best lives.

Contributions for the use of free GIS technologies, and how to designing the client/server application architecture are present in this work. The benefits of using free technologies are related to a minimal cost, providing full freedom, being part of social movement, and collaboration with larger projects that handle the same data source. The use of the OpenStreetMap database is reliable, and the frequent updates contribute to many projects around the world.

The research was limited to propose an Android mobile app applied to disabled tourists. All accessibility information displayed by this app is related to buildings and furniture, and the data depends on free users' contributions. This work provides possibilities for new studies related to delivering accessibility data through technologies applications.

Regarding the future improvement of this project, we look at several tasks with could be: get the usability evaluation by uses experience to upgrade the app functions; access the accessibility data by the other platforms such as website; creating an OpenStreetMap local cache to increase performance in the app.

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