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Benchmarking of Technological Platforms for Accessible Tourism: A Study Resulting in an Innovative Solution—*Access@tour*

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Abstract: Tourism information systems are becoming crucial tools to ensure access to tourism for all people, especially for those with special needs. The aim of this paper is to propose an innovative web platform to increase knowledge transfer among all stakeholders involved in accessible tourism. To achieve this aim, a content analysis of a sample of web platforms responsible for promoting accessible tourism was conducted. With the limitations of the existing platforms as a reference and using a triangulation of methods to identify the requirements that a web platform for accessible tourism should include, a new platform is presented. It is characterized by being innovative and by promoting the collaboration and sharing of information between all the actors involved in accessible tourism—*access@tour by action*. The analysis revealed that there is a lack of this type of platform: only 10 platforms promoting accessible tourism were identified. Moreover, these platforms are limited in scope. Therefore, new tools should be developed to increase the participation of people with special needs in tourism activities, especially people with disabilities.

Keywords: tourism information systems; accessible tourism; people with special needs (PwSN); people with disabilities (PwD); web platforms

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1. Introduction

Accessible tourism seeks to enable people with specific needs (PwSN—people with physical, intellectual, visual and hearing disabilities and people with other special needs, such as seniors, pregnant women, parents with baby strollers, people with respiratory allergies, and people with food allergies) to access tourism products and services with autonomy, equity, and dignity [1]. In this context, information plays an important role [2–4], and information systems can facilitate access to secure and reliable information about tourism products and services, thereby reducing the travel constraints that PwSN face when participating in tourism activities [5,6]. In fact, information systems allow PwSN easy access to a range of tourism activities, contributing to better tourism experiences. However, despite this clear relevance, there is currently an evident lack of web platforms promoting accessible tourism which, at the same time, serve the needs of all stakeholders and contribute to increased stakeholder involvement in the accessibility issue [Sisto et al., 2020]. Taking into account the literature, but also practical applications, the few technological solutions that exist in this area, especially platforms capable of integrating simultaneously the needs of the different stakeholders of the accessible tourism market (demand; supply agents and tourism education institutions) do not meet the needs of all stakeholders, representing standalone solutions. It is also worth mentioning that web applications, when aligned

with the needs of PwSN, may represent adequate solutions to promote information sharing and enhance communication between all stakeholders involved in accessible tourism. Considering the gap reported above and the potential of web platforms, the aim of this study is to understand how a web application for promoting accessible tourism should be developed, starting by mapping and benchmarking applications currently available in the market. However, no study is known that compares these platforms in terms of scope and functionalities. Therefore, the main contribution of this paper is to increase knowledge in this field by analyzing a group of existing platforms for the accessible tourism market and proposing a new platform. Thus, the specific aims of this paper are: (i) to examine the existing accessible tourism platforms, to understand how they work, the users involved and their main functionalities; (ii) to propose a new innovative and collaborative platform—*access@tour by action*.

To accomplish the above-mentioned purposes, this paper is structured in six parts. After this introduction, a literature review is provided about the characteristics of the accessible tourism market and how digital platforms can improve accessibility conditions for people with special needs in tourism activities. In the third section, the methodology used to collect and analyze the data is explained. In the fourth part, the web platforms for the accessible tourism market available on the market are characterized and compared. Afterwards, a brief description of the created platform—*access@tour by action*—is provided, highlighting the most innovative aspects. Lastly, the final section presents the main conclusions and contributions of this study.

2. Literature Review

2.1. Accessible Tourism Market: Relevance, Constraints and Needs

The World Health Organization (WHO) estimates that over 1 billion people worldwide experience some form of disability, a number that will tend to increase with the aging of the population—in 30 years, the number of persons aged 80 years or over is expected to triple [7]. Moreover, some studies related to the relevance of the accessible tourism market in Europe reveal that it represents almost 40% of the total population [8,9]. Thus, accessible tourism has the potential to be a very profitable market, and therefore should not be ignored by the tourism industry [10], not only because it is an excellent business opportunity, but also for reasons of social responsibility.

Since 2006, the right to participate in cultural life and leisure (article 30) has been regulated in the Convention on the Rights of Persons with Disabilities (CRPD) (Resolution 61/2016) and approved by the United Nations [11]. However, PwSN continue to encounter innumerable obstacles when seeking tourism and leisure experiences [3,4,12]. These obstacles could result from the inadequacy of the environment to their specific needs—accessibility to the physical environment, information regarding accessibility [13] and accessible information [14–16]—but also from society's negative attitudes [17–20]. In fact, the absence of suitable information and the negative attitudes of tourism staff appear in the literature as the major barriers that PwSN face in obtaining memorable tourism experiences [21].

Accessible tourism is a solution that seeks to materialize the principles of the CRPD by enabling all people, regardless of their specific needs, to access tourism products and/or services independently [1]. However, the literature highlights that, in most cases, tourism supply agents (TSA) and educational institutions providing training in tourism still do not recognize the relevance and the needs of the accessible tourism market [10,22]. Consequently, a great number of PwSN are excluded from tourism. In fact, the lack of knowledge about the characteristics and needs of PwSN on the part of professionals working in the tourism sector may cause more constraints to visitors with special needs than the existing barriers in terms of physical accessibility [23]. Thus, it is essential for professionals in the sector to have training in accessible tourism so that visitors with special needs can have the tourist experiences they want and deserve. However, the limited literature that analyzes the study programs of higher education courses in tourism, in terms of content related

to accessible tourism [22,24] highlights an almost complete absence of topics related to this area and, in particular, issues related to the needs of people with disabilities (PwD). Consequently, various needs continue to be unaddressed, resulting in huge constraints for PwSN, excluding them from tourism and leisure activities [25]. Information systems (IS) have the potential to be solutions to overcome some of these constraints [2] by providing accurate and reliable information to PwSN in the appropriate format according to their needs [26].

Accessibility is also related to inclusive tourism, responsible tourism and sustainable tourism. The adoption of accessible tourism principles contributes to reducing non-participation and exclusion in tourism [4]. Moreover, removing barriers, i.e., promoting responsible tourism, will improve places for people to live and visit, and consequently the inclusion of PwSN in tourism and in society will increase. Thus, accessibility represents a relevant precondition to promoting inclusive tourism, which is a crucial component of sustainable tourism. In this line of thought, considering that "inclusive tourism can be understood as transformative tourism in which marginalized groups are engaged in ethical production or consumption of tourism and the sharing of its benefits" [27], p. 592, accessible tourism, which contributes to overcoming barriers that PwSN face to participation in tourism activities, is an important element to achieve inclusive tourism [28,29]. In turn, inclusive tourism represents an integral part of sustainable tourism. To develop more inclusive tourism through the adoption of accessible tourism principles, it is crucial to promote participatory approaches involving all relevant stakeholders. The adoption of these participative approaches can be facilitated through the development of IS that promote the exchange of information and communication among all stakeholders involved in accessible tourism.

2.2. Web Platforms and the Creation of Accessible Conditions in Tourism

According to Gonçalves et al. [30], information represents a crucial factor for accessible tourism, and the use of information and communication technologies (ICTs) can facilitate access to this information in an accessible way, mainly by people that have some disability [5]. This type of system allows PwSN easy access to information on the accessibility of tourist activities, contributing to better tourism experiences and delivering more value to customers. Nowadays, with the help of different ICTs, all information related to accessibility can be more easily obtained, especially about specific requirements that PwSN need in order to make a tourism experience truly accessible [31].

ICTs are capable of helping PwSN during different stages of a tourism trip. As studied by Cohen et al. [32], the behavior model of tourists regarding the consumption of tourism products can be divided into three different stages: (i) pre-visit (planning stage, recognition of needs, search for information, evaluation of alternatives and actual purchase), (ii) on-site (consumption and purchase of tourism products) and (iii) post-visit (evaluation of tourism products). ICTs [5] can provide the very important function of helping tourists during all of these three phases. For example, mobile apps, as suggested by Emrouzeh et al. [33], can assist in navigation processes (wayfinding), social interactions (sharing experiences and communicating), emergency situations (health and weather alerts), transactional (purchase of tickets, accommodation booking and shopping), entertainment (movies and games) and most importantly, searching for information about tourism activities.

With the development of a more digital era, there are new ICTs emerging from concepts such as Tourism 4.0 [34]. For that reason, it will be important to study how emerging technological concepts such as cloud computing, voice/motion recognition and advanced robotics can change the creation of accessible tourism platforms.

Nevertheless, during the building process of a platform, it is very important to consider the potential users and their needs in terms of functional and non-functional requirements, which in turn include accessibility requirements. Functional requirements can be defined as what the system can do, and provide the responses and actions to specific inputs and conditions of the system [35]. The non-functional requirements define how the functional

requirements should be executed [36] and are related to functionalities that ensure that the system is usable, flexible, accessible, and efficient. Non-functional requirements are responsible for providing accessible content on web platforms. According to the European Standard-EN 301 549 [9], a web platform is accessible if it allows access to the broadest range of users, including PwSN. In order to evaluate the level of web accessibility, software is generally used [37], i.e., automatic evaluation tools capable of determining if the content of a website meets the Web Content Accessibility Guidelines (WCAG), such as WCAG 2.0 [38], which has been developed by the World Wide Web Consortium (W3C).

The evaluation based on WCAG 2.0 considers the following four principles: (i) perceivable (product perceivable by users); (ii) operable (interface components and navigation are operable); (iii) understandable (content and information are understandable); and (iv) robust (content can be interpreted by user agents, including assistive technologies) [39]. These principles have different guidelines, based on three available conformance levels: (i) A—basic accessibility; (ii) AA—intermediate accessibility; and (iii) AAA—high accessibility [38]. Some studies concerning the evaluation of web platform accessibility reveal that in many cases these platforms present several problems in terms of accessibility [40]. Subsequently, it is of major importance to understand the relevance of each WCAG 2.0 guideline on tourism platforms, to make sure these systems are truly accessible to everyone.

3. Materials and Methods

3.1. Contextualization of the Problem

This study was developed within the ACTION (Accessible tourism: Co-creation of tourism experience through web-based intelligent systems) research project. It is an ongoing project conducted in Portugal, financed by European and national funds, involving 12 researchers from three Portuguese educational institutions and from several areas of knowledge (tourism, management, sociology and information systems). In the scope of this research project, an accessible tourism platform named *access@tour by action* [41] was developed. The goal is to provide support for information management in accessible tourism, by facilitating communication and information sharing between the three principal stakeholders of this market: (i) people with special needs (PwSN); (ii) tourism supply agents (e.g., accommodation, museums and monuments, travel agencies and tour operators), and (iii) institutions responsible for training in tourism (students and professors) [42]. During the development process of a platform with complex characteristics such as this, it is crucial to analyze the available platforms on the market in order to understand what has been done in this area. Accordingly, this study attempts to characterize the available accessible tourism platforms, their users and functionalities and, consequently, propose a new web platform with some innovative features.

For this purpose, the data collection procedure may be categorized into two stages: (i) methods used to identify and characterize the available platforms for accessible tourism (Section 3.2), and (ii) methods used to develop the new platform proposed in this research (Section 3.3).

3.2. Data Collection and Analysis Methods

To understand how existing accessible tourism platforms work, and the main requirements for users they presented, a qualitative analysis of 10 platforms was conducted. First, we sought to study the state of the art of existing platforms. To do so, platforms were identified through extensive web research in platform marketplaces (e.g., Google Play Store, Microsoft Store, and Apple Store) between June and July 2021. It should be noted that the research was carried out within the Portuguese geographical context, therefore using the Portuguese versions of the mentioned platform's marketplaces. Platforms were selected based on the following keywords: "tourism," "accessibility," and "people with disabilities." Only platforms providing information related to accessible tourism were selected, excluding others that, although may help people with disabilities during their tourism and leisure practices, were not developed specifically for the tourism context (e.g., *Be My Eyes*;

Wheelmap). Next, the selected platforms were reviewed through a strict content analysis process, searching for the characteristics of each system and its functionalities, with the data being organized in the following groups: (i) objectives of the platform; (ii) country where the platform was developed; and (iii) the target market. Then, a more detailed analysis of these platforms was done, and the main information requirements were identified and categorized into two groups: "functional" and "non-functional." While a content analysis was used to study functional requirements, a web accessibility analysis, using the automatic tools *AccessMonitor* [43] and "*Test de accesibilidad Web*" [44] (TAW), was performed for a detailed perception of non-functional requirements related to accessibility, available on the tourism platforms analyzed.

3.3. Procedure to Attain Access@tour by Action

The methodological process illustrated in Figure 1 was used to obtain a new tourism platform—*access@tour by action*. This process combines six stages, within an iterative development procedure (see Figure 1), with a more detailed explanation of the whole methodological process in the study by Teixeira et al. [45]. The diversity of the accessible tourism market generates the need to characterize every single type of consumer (PwSN) and other identified stakeholders (supply agents and tourism higher education institutions). Given the characteristics and complexity of the accessible tourism market, a triangulation of methods and approaches was used to study the problem and propose a solution. This triangulation approach included the analysis of existing platforms, which is the main goal of the current paper, and other approaches to collecting requirements. So, in addition, to understand how every type of user can be best served, a participatory design process (interviews, questionnaires, focus group) based on Alves et al. [12] was applied to retrieve user requirements. To study accessibility requirements, software tools such as *AccessMonitor* were used to evaluate what accessibility standards should be allocated to the platform. With the inputs obtained, the user-centered design (UCD) was followed through cycles of requirement gathering and validation, with the focus on ensuring accessibility. To help in the process, a horizontal prototype was developed and a testing procedure was conducted to identify improvements needed.

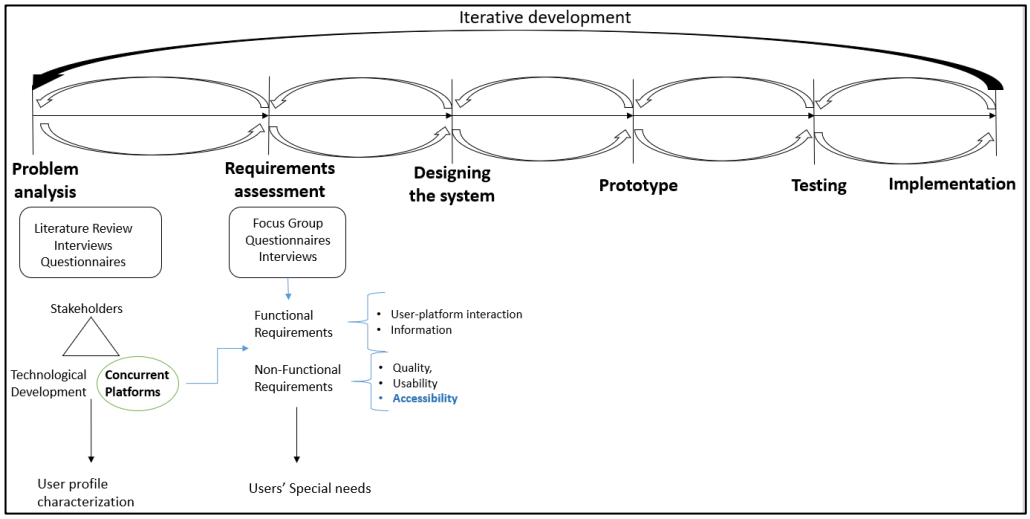

Figure 1. Methodological process for attaining *access@tour by action.* Source: Own elaboration.

4. Results

4.1. Characterization of the Platforms Analyzed

Table 1 characterizes the analyzed platforms. The majority of the platforms were developed for all segments of the accessible tourism market (six out of ten) and provide information about European countries (eight out of ten). Considering the objectives of these

platforms, most of them share information about accessible tourism products, promoting the interaction between tourism demand (PwSN) and tourism supply agents (TSA). However, none of them include education institutions providing training in tourism according to the needs of this market. Moreover, although there is some diversity in terms of the countries involved, Portugal is one of the most represented countries in this group of platforms, followed by Spain. The fact that the data collection was made using the Portuguese versions of Google Play Store, Microsoft Store, and Apple Store may help explain this fact. In addition, Portugal has been investing in accessible tourism [46], and the emergence of these types of the platform may be a possible consequence.

Table 1. Characteristics of the analyzed platforms.

Platform *	Objectives	Countries	Demand Agents (Special Need)
Tourism for All [47] www.tourism-for-all.com	Promote information about accessible tourism	Portugal	Mobility Impairments
Hands to discover [48] www.handstodiscover.com	Communication mediator	Portugal	Deaf
ENAT [49] www.accessibletourism.org	Make European tourism destinations accessible to all travelers	Several countries	All accessible market segments
Tur4all Portugal [50] www.tur4all.pt	Promote information about accessible tourism	Portugal and Spain	All accessible market segments
PREDIF [51] www.predif.org	Promote accessible tourism offers	Spain	Mobility impairments
Reisen für Alle [52] www.reisen-fuer-alle.de	Present accessible tourism offers	Germany	All accessible market segments
Jaccede [53] https://www.jaccede.com/en	Find and share information about the accessibility conditions of tourism places	France	All accessible market segments
Euans [54] www.euansguide.com/	Review, share, and discover accessible places to go	Several countries	All accessible market segments
Autism Travel [55] www.autismtravel.com/	Work as database of autism-friendly tourism offers	United States of America	People with autism syndrome
Getaboutable [56] www.getaboutable.com/	Connect the inclusive travel and leisure sector with demand	Australia	All accessible market segments

* All the Pltforms were Accessed on 4 February 2022. Source: Own elaboration based on information available at [43–52].

4.2. Functionalities: Stakeholders Involved, Types of Services, and Types of Information

Although all 10 platforms were selected because they share information related to accessible tourism, in practice, they presented some different features (see Table 2).

Table 2. Stakeholders involved, type of service and type of information provided.

Platforms	Stakeholders Involved	Type of Services	Type of Information
Tourism for All	Tourism demand Tourism suppliers	Accommodation Tourism activities Cultural attractions Transportation Beaches	Accessibility characteristics of the offer. Services available. Location and address. Distances to airports/health facilities.

Table 2. *Cont.*

Platforms	Stakeholders Involved	Type of Services	Type of Information
Hands to discover	Tourism demand Tourism suppliers	Accommodation Restaurants and bars Cultural attractions Activities Shopping	Information about places, scheduling, points of interest in sign language.
ENAT	Tourism demand	Events Projects	Information about projects, events and good practices in AT.
Tur4all Portugal	Tourism demand Tourism suppliers	Accommodation Restaurants and bars Cultural attractions Natural attractions Tourism activities Transportation	Accessibility characteristics of the offer. Accessibility report.
PREDIF	Tourism demand	Events Projects	Information, namely legal information, in AT.
Reisen für Alle	Tourism demand Tourism suppliers	Accommodation Restaurants and bars Cultural attractions Natural attractions Transportation Other tourism activities	Accessibility characteristics of the offer.
Jaccede	Tourism demand Tourism suppliers	Accommodation Restaurants and bars Medical facilities	Accessibility characteristics of the offer.
Euans	Tourism demand Tourism suppliers	Cultural attractions Natural attractions Accommodation Restaurants and bars	Accessibility characteristics of the offer.
Autism Travel	Tourism demand Tourism suppliers	Accommodation Restaurants and bars Cultural attractions Natural attractions Other tourism activities	Accessibility characteristics of the offer.
Getaboutable	Tourism demand Tourism suppliers	Accommodation Restaurants and bars Cultural attractions Natural attractions Transportation Other tourism activities	Accessibility characteristics of the offer.

Source: Own elaboration based on information available at [43–52].

In general, the analyzed platforms share information about the accessibility characteristics of the tourism supply (seven out of ten). Therefore, the scope of action is limited, since only tourism demand and tourism supply agents are involved in these platforms This ends up limiting the action, as it leaves out educational institutions which, as has been emphasized by the literature [22–24], have a fundamental role in accessible tourism.

Regarding the type of tourism supply agents involved, accommodation (nine out of ten), restaurants and bars (seven out of ten) and cultural attractions (seven out of ten) stand out. This has implications on the type of information available on the different platforms,

with information about the characteristics of the offer in terms of physical accessibility being the most presented.

Concerning the functionalities of the analyzed platforms, all the platforms share common principles regarding what is ideal for the promotion of accessible tourism. The list of potential characteristics of functional requirements is presented in Table 3. Most of the platforms allow users to search for accessible tourism offers (eight out of ten) and obtain detailed information/communication about accessibility conditions in the offers (six out of ten). In contrast, only two platforms (*ENAT* and *PREDIF*) grant access to information related to upcoming accessible tourism events (e.g., webinars and workshops).

Table 3. Functional characteristics of analyzed platforms.

Platform	Functional Characteristics
Tourism for All	• Search for accessible tourism offers • Search for accessible tourism information/communication • Ask for support or request more information about accessible tourism offers
Hands to discover	• Search for accessible tourism information/communication • View explaining videos about system functionalities
ENAT	• Search for accessible tourism information/communication • Search for upcoming events about accessible tourism
Tur4all Portugal	• Search for accessible tourism offers • Search for accessible tourism information/communication • Create an individual profile, stating accessibility requirements/special needs • Search for upcoming events about accessible tourism • Interact with other users • Evaluation of tourism offers
PREDIF	• Search for accessible tourism information/communication • Search for upcoming events about accessible tourism • Explore accessible tourism resources with an interactive map
Reisen für Alle	• Search for accessible tourism offers • Search for accessible tourism information communication • Create an individual profile, stating accessibility requirements/special needs • Explore accessible tourism resources with an interactive map • Evaluation of tourism offers
Jaccede	• Search for accessible tourism offers • Create an individual profile, stating accessibility requirements /special needs • Interact with other users • Evaluation of tourism offers
Euans	• Search for accessible tourism offers • Create an individual profile, stating accessibility requirements/special needs • Interact with other users • Evaluation of tourism offers
Autism Travel	• Search for accessible tourism offers • Search for accessible tourism information/communication • Ask for support or request more information about accessible tourism offers • Interact with other users
Getaboutable	• Search for accessible tourism offers • Interact with other users • Explore accessible tourism resources with an interactive map

Source: Own elaboration based on information available at [43–52].

In the context of interaction between users and platforms, the registration process is not available on all platforms. *Tur4all Portugal*, *Reisen für Alle*, *Jaccede* and *Euans* allow users to create a profile, where accessibility requirements can be stated. These platforms

also enable registered users to interact with them. Similarly, *Autism Travel* also permits registered users to communicate with each other. It is important to point out that registered users can be either part of the demand or supply. Finally, in relation to the evaluation, only a small number of the platforms (four out of ten) let users evaluate tourism offers. More specifically, while one of them only permits a more general evaluation, the others allow users to evaluate offers, taking into consideration more specific accessibility criteria (e.g., ramps, customer service, environment accessibility, facilities, parking, etc.).

4.3. Evaluation of Platform Characteristics: Non-Functional Requirements

Regarding non-functional characteristics, the most important aspect to consider is whether or not the platforms are accessible to users with disabilities. To fully understand accessibility standards available in current tourism platforms, two online automatic tools—*AccessMonitor* and "*Test de Accesibilidad Web*" (TAW)—were used to examine the 10 websites, which host the before mentioned tourism web applications. The two tools were used to take into consideration WCAG 2.0 guidelines and the A, AA and AAA conformance levels. *AccessMonitor* indicates a global index, which is a quantitative scale (ranging from 1—very poor web accessibility practices to 10—excellent web accessibility practices), and errors found by the degree of compliance (A, AA and AAA). On the other hand, TAW presents the results divided into three categories: (i) "problems" (corrections required); (ii) "warnings" (review is required); and (iii) "not reviewed" (manual review is necessary). In both tools, the only input needed is the URL of the tourism platforms.

The results presented in Table 4 were obtained with *AccessMonitor*. The global index varies between 4.5 and 8.6, with half of the websites being classified as having regular accessibility practices (index between 4 and 5). However, there are two websites with very good accessibility practices (index between 8 and 9). Errors of type A are the most critical but also the most common, ranging from a minimum of six to a maximum of 16 detected errors. This indicates that every site has at least one type A error. Regarding the AA and AAA levels, some minor errors were also found, which influences the totality of errors. Comparatively, the platforms *Jaccede* is the one with fewer reporting errors and *Tur4All Portugal* is the one which obtained the best global index score. On the other hand, the *Getaboutable* is the platform with the most detected errors, and *Tourism for All* is the one that registered the lowest global index score.

Table 4. Global index scores and errors in web accessibility of accessible tourism platforms.

AccessMonitor Standards	Platforms									
	Tourism for All	Hands to Discover	ENAT	Tur4all Portugal	PREDIF	Reisen für Alle	Jaccede	Euans	Autism Travel	Getaboutable
Global Index	4.5	8.2	6.9	8.6	5.7	6.4	4.6	7.8	5.7	5.0
Errors type A	11	10	11	12	15	14	6	11	14	16
Errors type AA	2	2	3	0	4	3	2	3	6	7
Errors type AAA	1	2	2	1	3	2	0	2	3	3
Total errors (A + AA + AAA)	14	14	16	13	22	19	8	16	23	26

Source: Own elaboration.

Table 5 illustrates the results obtained with the *TAW*. The outcomes of this evaluation summarize the number of problems detected, categorized within the four principles (perceivable, operable, understandable, and robust) and the 12 guidelines of the *WCAG 2.0*. All platforms seem to have more problems of the perceivable type, especially guideline '1.1 Text Alternatives'. Additionally, the robust and operable principles also displayed a substantial number of problems in all tourism platforms. In contrast, the lowest number of problems was registered in the understandable principle.

Table 5. Web accessibility results obtained with TAW.

	Platforms									
	Tourism for All	**Hands to Discover**	**ENAT**	**Tur4all Portugal**	**PREDIF**	**Reisen für Alle**	**Jaccede**	**Euans**	**Autism Travel**	**Getaboutable**
WCAG 2.0 Principles and Guidelines	**Number of Problems**	**Number of Problems**	**Number of Problems**	**Number of Problems**	**Number of Problems**	**Number of Problems**	**Number of Problems**	**Number of Problems**	**Number of Problems**	**Number of Problems**
1.1 Text alternatives	73	29	1	0	2	5	2	4	18	8
1.2 Time-based media	0	0	0	0	0	0	0	0	0	0
1.3 Adaptable	15	2	2	2	2	3	13	2	7	6
1.4 Distinguishable	0	0	0	0	0	0	0	0	0	0
Total Perceivable	88	31	3	2	4	8	15	6	25	14
2.1 Keyboard accessible	0	0	0	0	0	0	0	0	0	0
2.2 Enough time	0	0	0	0	0	0	0	0	0	0
2.3 Seizures	0	0	0	0	0	0	0	0	0	0
2.4 Navigable	9	37	0	3	2	18	8	0	29	38
Total Operable	9	37	0	3	2	18	8	0	29	38
3.1 Readable	0	0	0	0	0	0	0	0	0	0
3.2 Predictable	1	0	0	0	2	0	0	0	0	1
3.3 Input assistance	11	1	1	4	0	0	2	0	5	4
Total Understandable	12	1	1	4	2	0	2	0	5	5
4.1 Compatible	25	1	72	1	6	12	16	3	29	54
Total Robust	25	1	72	1	6	12	16	3	29	54

Source: Own elaboration.

It should be pointed out that there are guidelines with no detected errors. These guidelines are 1.2 Time-based media; 1.4 Distinguishable; 2.1 Keyboard accessible; 2.2 Enough time; 2.3 Seizures; and 3.1 Readable. This means that platforms tend to provide alternatives to time-based media, content is distinguishable, all functionalities are available from a keyboard, enough time is provided to read and use content, the content does not cause seizures and the majority of content tends to be readable.

The best results were again obtained by *Tur4All Portugal*. Overall, this platform had the lowest total number of problems identified and in two of the four principles. Similarly, the platform *Euans* also obtained a very good result, with no problems identified in operable and understandable principles. In a similar fashion, *ENAT* does report any problems related to the operable principle. Finally, consistent with the results of *AccessMonitor*, *Tourism for All* and *Getaboutable* are the poorest performing platforms, registering the biggest share of *TAW* problems. The most critical guidelines seem to be '1.1 Text Alternatives' and '4.1 Compatible'. This could indicate that non-text content does not always have a text alternative that serves the same purpose, and compatibility with assistive technologies is not ensured.

Taking into consideration the evaluations provided by *AccessMonitor* and *TAW*, it was possible to make a detailed analysis of the accessibility of the content on accessible tourism platforms. Thanks to this accessibility analysis, it was possible to retrieve several requirements for conceptualizing our own web application for accessible tourism. The list of potential characteristics of non-functional requirements is presented in Table 6.

Table 6. Non-functional characteristics of the analyzed platforms.

Platform	Non-Functional Characteristics
Tourism for All	• Every offer page has a simple design • Simple text • Clear return button
Hands to discover	• The upper search bar stays identical in every page • Textual elements serve equal information as images • Compatibility with assistive technologies

Table 6. *Cont.*

Platform	Non-Functional Characteristics
ENAT	• Every page has a button that allows the user to listen to what is written • Compatibility with assistive technologies • Simple text • Content organized in an order that ensures meaning and operability
Tur4all Portugal	• Compatibility with assistive technologies • Interoperability with other systems • Structured browsing system • Simple text • Textual elements provide the same information as images
PREDIF	• Textual elements provide the same information as images • Compatibility with assistive technologies • The <link> elements that exist are an appropriated resource.
Reisen für Alle	• The purpose of each link is explained. • Textual elements provide the same information as images • There are no obsolete elements used to control the visual presentation • Compatibility with assistive technologies
Jaccede	• There are no obsolete elements used to control the visual presentation • Changes of context are initiated only by user request • Labels or instructions are provided when content requires user input
Euans	• Textual elements provide the same information as images • Compatibility with assistive technologies • There are no obsolete elements used to control the visual presentation
Autism Travel	• There are no obsolete elements used to control the visual presentation • The <title> element only appears once in the web page • Textual elements provide the same information as images
Getaboutable	• Every offer page has a simple design • Simple text

Source: Own elaboration.

5. Access@tour by Action

After analyzing tourism platforms that already exist and extracting the functional (Table 3) and non-functional (Table 6) requirements, it was possible to continue the methodological process, illustrated in Figure 1, and obtain our own tourism information system named *access@tour by action* (Figure 2). A first prototype of this new tourism platform was designed using Adobe XD.

This section depicts the aims of *access@tour by action* and how it works, highlighting the main functional and non-functional characteristics of the platform and demonstrating some interfaces. Notwithstanding, only the main interfaces will be exhibited in an effort to convey a general view of this newly developed accessible tourism platform.

The *access@tour by action* platform intends to support knowledge transfer in the context of accessible tourism. However, it is hoped that the platform will integrate new concepts that help make tourism more accessible. As a result, in addition to this platform incorporating the requirements that the previous platforms have, it is intended to be more than just a tourism information aggregator.

Figure 2. Interface of the *access@tour by action* home screen. Source: Own elaboration.

5.1. Functional Characteristics of Access@tour by Action

The analysis of the main functionalities in other tourism platforms allowed an understanding of how a potential platform should work and what information should be displayed. However, the research clearly showed that there is a lack of integration among everyone involved in the accessible tourism market. Therefore, to overcome this limitation, *access@tour by action* incorporates all stakeholders involved in the accessible tourism market. Thus, the users of this platform can be: (i) demand agents (visitors with special needs, social institutions and caregivers); (ii) supply agents (entities responsible for creating accessible tourism offers); or (iii) education institutions (teachers and students that take part in training courses in tourism).

Based on the previous recoiled requirements but also taking into consideration the other requirements sources (questionnaires and focus groups with all users), the different functionalities were designed and implemented. Essentially, the *access@tour by action* platform strives to promote information sharing and exchange between the aforementioned key players in accessible tourism. This was implemented taking into consideration a logical process incorporating both inputs (information that users can insert into the platform) and outputs (information that users can retrieve from the platform). According to the type of user, *access@tour by action* offers different functionalities, as displayed in Table 7.

Table 7. High-level functionalities available for users in *access@tour by action.*

	Types of Users			
	Demand Agents	Supply Agents	Teaching Institutions	
			Tourism Students	Tourism Teachers
Inputs (Insert into *access@tour by action* information about)	• Accessibility requirements • Evaluating the accessibility of a tourism offer	• Accessible tourism offers • Job offers *	• Work experience in accessible tourism * • Curriculum vitae *	• Academic research in accessible Tourism * • Training opportunities related to accessible tourism * • Curriculum vitae *
Outputs (Retrieve from *access@tour by action* information about)	• Accessible tourism offers • Tourism support services • Legislation on accessible tourism	• Visitors' accessibility requirements • Evaluations performed by visitors of tourism offers • Human resources with training in accessible tourism *	• Job opportunities * • Academic research in accessible Tourism * • Training courses in accessible tourism *	• Characteristics of accessible tourism • Market needs • Training courses in accessible tourism * • Academic research in accessible Tourism *

* Functionalities not found in the previous platforms analyzed. Source: Own elaboration.

As mentioned before, the system functionalities were already implemented in a functional prototype. Figure 3 illustrates how the system functionalities represented in Table 7 gave rise to actual platform interfaces. The main goal is to portray the three navigation paths available, according to the type of user engaging with the platform at a given moment.

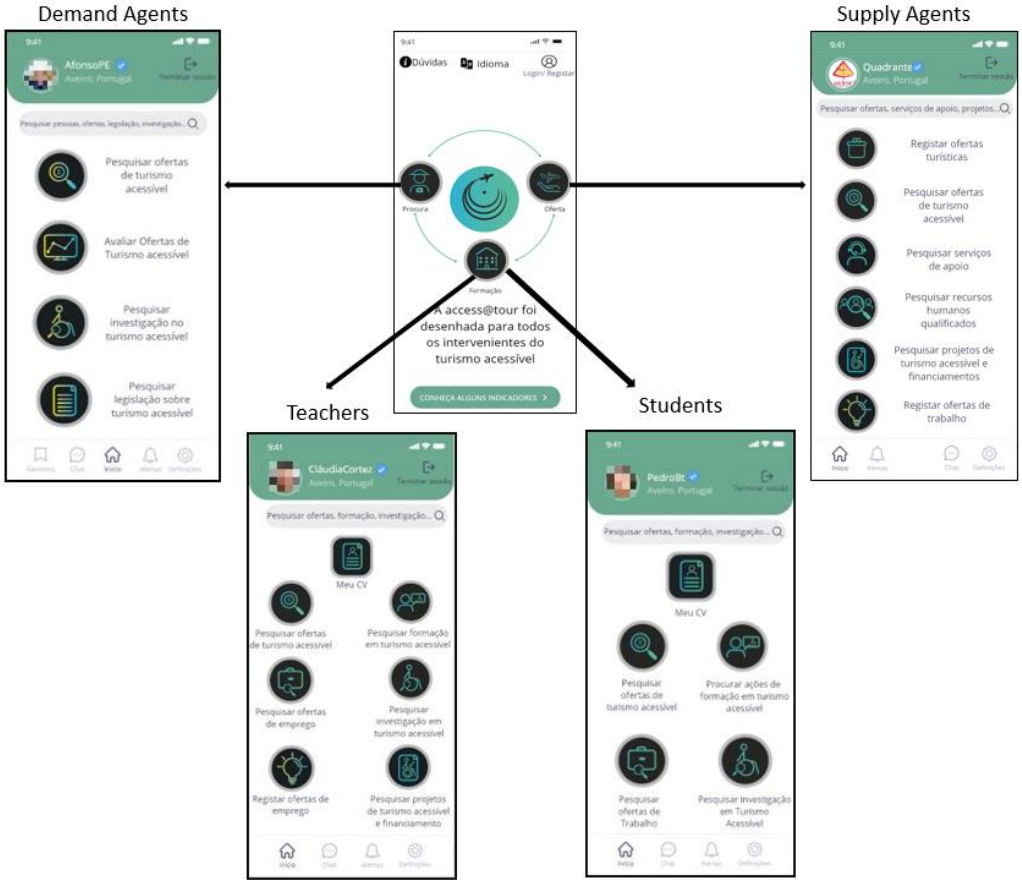

Figure 3. Interfaces representing navigation paths within *access@tour by action* (interfaces in Portuguese). Source: Own elaboration.

It should be noted that several functionalities that *access@tour by action* provides are not currently available on the previously characterized platforms which are available for the accessible tourism market. In the same manner, most of these innovative characteristics are related to the incorporation of tourism teaching institutions on the platform. This integration aimed at promoting more accessible tourism by integrating training courses and job opportunities related to the accessible tourism market. Consequently, the involvement of these users' profiles can be considered one of the most important innovative aspects of this system. Besides this, *access@tour by action* also integrates location and real-time information features to help navigate in an unfamiliar environment, creating more accessibility conditions in tourism activities.

5.2. Non-Functional Characteristics of Access@tour by Action

Concerning non-functional characteristics, *access@tour by action* is intended to be accessible to all PwSN. To this end, the development of the platform was based on the WCAG. Taking into consideration all the non-functional requirements obtained during the assessment procedure, especially those found in other tourism platforms, five essential components were identified. The five main non-functional characteristics of *access@tour by action* that ensure overall accessibility are: (i) presence of alternatives to content that contains text/videos/images; (ii) simple navigation system; (iii) content presented in a simple and understandable format; (iv) straightforward layout; and (v) compatibility with assistive technologies.

Due to the nature of non-functional characteristics, it is not a simple task to illustrate interfaces incorporating all of these types of platform features. This is mainly due to the fact that these mechanics are linked to the human–computer interaction between the platform and users. In spite of this, in Figure 4 an attempt is made to demonstrate some non-functional characteristics of *access@tour by action*. The tourism platform has an initial screen greeting the user with a video containing sign language. Likewise, there is an option to change the size of the text. When input from the users is needed, the platform provides input assistance, through labels and instructions. Moreover, *access@tour by action* offers simple and intuitive content, making sure accessibility is present whenever users are using the system.

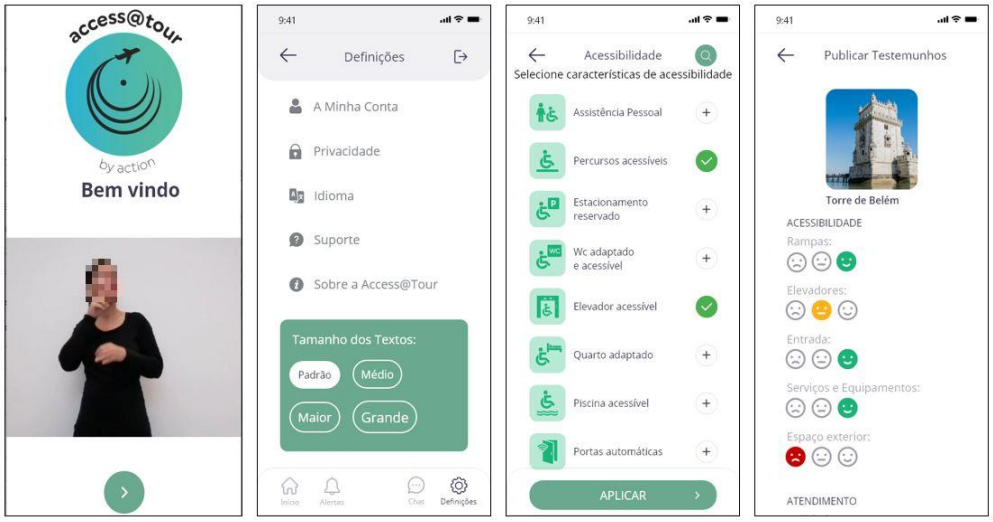

Figure 4. Interfaces representing different features of access@tour (interfaces in Portuguese). Source: Own elaboration.

In addition to the already described non-functional characteristics, the wish is for the platform to work within new emerging technologies in an advanced implementation phase, namely Tourism 4.0 concepts. By integrating technologies such as virtual reality, image

recognition software, adaptive learning and cloud technologies, it is possible to provide more accessibility features while PwSN navigate in *access@tour by action*.

From the same perspective, it is also necessary to foster the integration of content from the largest range of valid sources, addressing the diverse needs of users. Ultimately, it would also be crucial for the platform to become independent of the use of assistive technologies, and start integrating accessibility features by themselves, such as alternative keyboards, zoom support and reading assistance.

6. Conclusions

Web platforms are important tools to facilitate access to reliable information about the accessibility of tourism products. Overall, these systems play a very powerful role in creating accessible tourism experiences and also promoting the involvement of all stakeholders in the development of accessible and inclusive tourism. They are capable of involving all accessible tourism stakeholders in a dynamic process of sharing and creating knowledge. However, this study reveals that only a small number of web platforms aimed at accessible tourism currently exist and, besides this, they present some limitations. Moreover, the scope of these platforms in terms of stakeholders involved and functionalities is also limited. To overcome these restrictions, this study proposed an innovative and collaborative web platform for accessible tourism—*access@tour by action*.

The platform was developed by following a specific methodological process that included gathering requirements from different sources, including functionalities available on tourism platforms. The principal functional and non-functional characteristics of *access@tour by action* were briefly described in an attempt to demonstrate how it is distinct from what already exists. The main innovation is the integration of diverse stakeholders of the accessible tourism market and making sure accessibility is the main concern during the interaction between users and the platform.

By creating the platform and mainly focusing on retrieving both functional and non-functional requirements, the insights provided relevant theoretical and practical contributions. From a theoretical point of view, this paper provides relevant insights concerning accessible tourism, and how web platforms can overcome the travel constraints of PwSN, mainly in the case of information constraints. Furthermore, concerning methodological approaches, this paper explains how tourism platforms should be developed to surpass both information and accessibility issues. On the other hand, the practical aspects of this research highlight the need to provide more accessibility functionalities in tourism platforms and integrate all the stakeholders involved in accessible tourism: demand, tourism supply agents, and education institutions. As the role of every stakeholder is crucial but very diverse, the requirements obtained allow knowledge to be expanded about features that should be available on future tourism platforms for the accessible tourism market. Moreover, this kind of platform may facilitate communication among all the actors involved in the definition of public policies that contribute to developing accessible tourism. Moreover, these platforms facilitate the engagement of PwSN, supply agents (private and public) and education institutions in the policy-making process. Thus, the policy design, implementation, monitoring and evaluation of results (Biachi et al., 2020) can be facilitated through the use of platforms that promote the involvement of all accessible tourism stakeholders in information sharing and communication.

Despite the relevant contributions of this study, some issues and limitations can be pointed out. Thus, this kind of technological solution may also have some issues regarding, for example, the security and vulnerability of data that may be exposed to third parties. In this respect, such a solution should have an associated security protocol that ensures not only the general data protection regulation, but also uses encrypted data exchange with secure access by authorized users. In this study, only platforms built especially for accessible tourism were selected to be analyzed. There are several other platforms that can contribute to more accessible conditions, for example, platforms that identify places that are wheelchair friendly (*Wheelmap*). However, their main goal is not to promote

accessible tourism products, and therefore, they were not included in the analysis process. Furthermore, due to the limitations of the prototype version of *access@tour by action*, the interaction between the different interfaces could not be displayed.

Another limitation is that the process of retrieving non-functional requirements was heavily based on the result of automatic tools. The evaluation of web accessibility was only possible on the homepages. As some platforms have a large number of interfaces, not all aspects could be properly studied. Since web accessibility analysis involves computational efforts, it would be important to perform investigation studies that compare the levels of accessibility across different interfaces of a single tourism platform. Furthermore, the WCAG is being constantly updated. This study used WCAG 2.0 because that is the level currently supported by the assessment tools used. In future web accessibility analysis on tourism platforms, investigations could be complemented with the use of other tools that support more recent versions of the WCAG.

The increasing digitalization of tourism offers new challenges regarding communication with tourists with special needs. With the rise of the accessible tourism sector and digitalization, tourists have other demands and higher expectations. Moreover, Tourism 4.0 concepts such as cloud computing and adaptive learning are expected to become increasingly present in tourism information systems. Due to these factors, adaptation to new technological environments will be fundamental to the future of the accessible tourism market and the success of *access@tour by action*.

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