

Smart Audio Guides: Efficient Digital Solution For Urban Tourism Development

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Abstract—In modern scientific research, the issues of digitalization of tourist services, smartification of the tourist business are becoming more relevance. Even today, aspects of digital transformation are becoming key; it allows achieving the necessary competitive advantages in the market, ensuring the sustainable development of service enterprises. One of the key areas of digitalization is smart audio guides - a technology that provides the ability to create tourist routes with a diverse set of audiovisual effects that ensure a high degree of involvement of tourists as part of their stay in a tourist destination or a single attraction.

Considering the relevance of the research topic, the scientific article identifies and modern areas of digitalization of tourism services, presents a general scheme of the smart concept of tourism, gives a brief description of smart audio guides, and identifies the advantages and disadvantages of their using.

Keywords— digitalization of tourism, smartification, smart audio guides, urban tourism, urban tourist routes, digital transformation of the tourism business, digital technologies, tourist destination.

I. INTRODUCTION

City tourism is becoming one of the promising areas of the industry every year, especially during the period of quarantine restrictions imposed in connection with the COVID-19 pandemic, when there was no opportunity to travel and visit other countries and regions of the world. According to the World Tourism Organization, urban tourism can be a driving force in the development of many cities and countries, contributing to progress in the implementation of the New Urban Agenda and the 17 Sustainable Development Goals, in particular Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable"¹. Tourism is inextricably linked with the development of urban areas, it, including through the active development of infrastructure, the using and implementation of various digital technologies in the life of both local residents and visiting tourists, provides better living conditions².

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¹ <https://www.unwto.org/urban-tourism>

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II. LITERATURE REVIEW

In the context of Industry 4.0 (for a number of countries in transition to the Fifth Industrial Revolution), in which the role of new technologies is increasing every year, providing a high level of competitiveness and sustainability to economic sectors, the tourism business has also undergone a significant digital transformation [1]-[2].

It is important to note that today it is important to talk not only about the digitalization of the industry, but also about smartification, which has become an integral part of it. Highlighting its key areas:

1. using of digital passports and the possibility of almost instant check-in for a flight based on using the molecular scanners and digital baggage tags;

2. popularization of mobile guides and audio guides, created, as a rule, in the form of convenient mobile applications available for download in the AppStore and PlayMarket [3]-[5]; it also may contain Google Maps, Maps me and others as elements, and are also oriented and adapted for the use of specialized accessories (glasses, smart watches, etc.) with virtual guide programs for maximum visualization of routes and tourist sites; at the same time, audio guides can also be interconnected with the transport systems of cities, bike-sharing systems, offering convenient means of moving from tourist object to object [6] - [7];

3. smartification of accommodation facilities through the use of Li-Fi (a high-speed alternative to Wi-Fi) [8]-[9]; gadgets as an electronic room key; interactive digital displays, kiosks, tablets and screens, etc. [10]-[11];

4. using of robotic technology for booking and contactless check-in, services in restaurants, at entertainment facilities [12] - [16]; at the same time, it should be noted the high relevance of this area during the period of quarantine restrictions, as well as the increased number of studies presented in the WoS (Clarivate Analytics) scientometric database: in the period 2015-2021, more than 125 papers were published within this highly specialized scientific field³;

5. automation of passenger transportation, including through the introduction and using by passengers the health check systems through specialized mobile applications and self-service kiosks at airports;

6. independent using by tourists of various services for buying tickets, booking hotels, issuing insurance policies, etc., which indicates a gradual rejection of the services of companies offering package tours [17]-[19];

³ The WoS database was searched for the query "robotics in tourism industry".

7. using the blockchain technology to ensure the security of transactions and the ability to store useful and important information about the trip: tickets, insurance policies, vouchers, etc. [20]-[22];

8. active using by all market participants of various digital tools that allow tourism to actively "join" and become part of the ecosystem of smart cities and tourist destinations.

Through the using of a variety of digital opportunities, it has become possible to customize the provided tourist services (including the development of personalized audio guides), based on the requests and past user experience of potential and real buyers [23] - [25].

In this scientific article, a content analysis of publication activity was carried out within the framework of this scientific direction using the Web of Science database (Clarivate Analytics). The search query was chosen as the search formula: "audio guides" (search mode – "All fields"). As a result, 72 publications were received, of which: articles - 36; papers published in the conference proceedings - 34; sections of books - 4.

It should be noted that, according to information about the distribution of publications by years, it can be seen that in 2013, as well as 2017-2021, there was a slight surge in publication activity within the scientific area under the research, which is partly due to with the active introduction of audio guides into the systems of smart cities and tourist destinations, as well as their popularization among the local population and tourists, which, in turn, has largely become a driver of increased interest from scientists.

Basically, all publications belong to such WoS categories as: Computer Science Information Systems, Computer Science Theory Methods, Computer Science Cybernetics, Computer Science Artificial Intelligence and Humanities Multidisciplinary, which is largely due to the technical component of audio guides, the specifics of their creation (software product architecture) and subsequent use within digital platforms, smart components of smart cities and tourist areas (Table 1).

TABLE I. DISTRIBUTION OF WORKS BY WOS CATEGORIES

Web of Science Categories	Number of records	% from 72
Computer Science Information Systems	19	26,4
Computer Science Theory Methods	15	20,8
Computer Science Cybernetics	10	13,9
Computer Science Artificial Intelligence	7	9,7
Humanities Multidisciplinary	7	9,7
Computer Science Interdisciplinary Applications	6	8,3
Computer Science Software Engineering	6	8,3
Architecture	5	6,9
Engineering Electrical Electronic	5	6,9
Hospitality Leisure Sport Tourism	5	6,9
Information Science Library Science	5	6,9
Imaging Science Photographic Technology	4	5,6

Archaeology	3	4,2
Computer Science Hardware	3	4,2
Architecture	3	4,2
Education Educational Research	3	4,2
Geography	3	4,2
Physics Applied	3	4,2
Remote Sensing	3	4,2
Telecommunications	3	4,2
Art	2	2,8
Cultural Studies	2	2,8
Ergonomics	2	2,8
Geography Physical	2	2,8
Language Linguistics	2	2,8
Management	2	2,8

Note - obtained by the authors based on the results of the analysis.

The key publishers analyzed are the following: Springer Nature, Association for Computing Machinery, IEEE, Taylor & Francis, and Elsevier; the main sources of publications, in turn, are: Communications In Computer And Information Science, Cultural Tourism, Information Systems Frontiers, International Archives Of The Photogrammetry Remote Sensing And Spatial Information Sciences, IOP Conference Series Materials Science And Engineering and Lecture Notes In Computer Science.

The leading countries in terms of the number of publications within the framework of the scientific issues under consideration are the following: Italy, England, Germany and Spain (Figure 1).

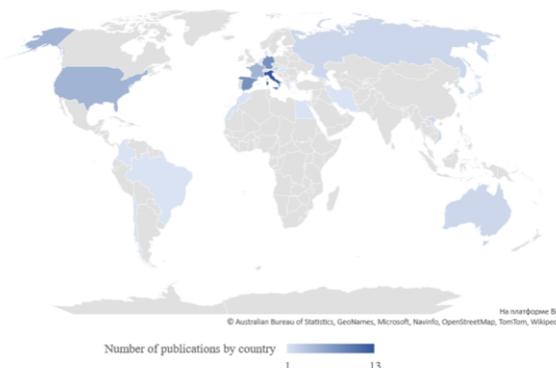


Fig. 1. Distribution of the number of publications for the search query "audio guides" by country

Note - obtained by the authors based on the results of the analysis

The most cited publications are presented in Table 2, which show that the main research areas of scientists, as mentioned above, is the substantiation of the specifics of the creation and using of audio guides in tourism, especially as part of the provision of excursion services in museums.

TABLE II - MOST CITED PUBLICATIONS WITHIN THE SEARCH QUERY "AUDIO GUIDES"

Title of the publication	Number of citations
Miyashita, T., Meier, P., Lieberknecht, S. An Augmented Reality Museum Guide // 7th IEEE International Symposium on Mixed and Augmented Reality 2008 / 7th IEEE International Symposium On Mixed And Augmented Reality, 2008, Proceedings, pp.103-106.	72
Pallud, J and Monod, E. User experience of museum technologies: the phenomenological scales // Oct 2010 / European Journal Of Information System, 19 (5), pp.562-580.	21
Othman, M.K., Petrie, H., Power, C. Engaging Visitors in Museums with Technology: Scales for the Measurement of Visitor and Multimedia Guide Experience // 13th IFIP TC 13 International Conference on Human-Computer Interaction (INTERACT) 2011 / Human-Computer Interaction - Interact 2011, PT IV, 6949, pp.92-99.	19
Jarrier, E., Bourgeon-Renault, D. Impact of Mediation Devices on the Museum Visit Experience and on Visitors' Behavioural Intentions // Fal 2012 / International Journal Of Arts Management, 15 (1), pp.18-29.	18
Seidenari, L, Baccchi, C., Del Bimbo, A. Deep Artwork Detection and Retrieval for Automatic Context-Aware Audio Guides // Aug 2017 / Acm Transactions On Multimedia Computing Communications And Applications, 13 (3).	16
Note - obtained by the authors based on the results of the analysis.	

In general, the analysis of the key areas of digitalization and smartification in tourism makes it possible to identify the common components of a smart concept in tourism: interactive visualization of tourist sites, active using of audiovisual technologies, digital involvement of the subject in the process, which results are obtaining a unique tourist experience and the formation of tourist interest (Figure 2).

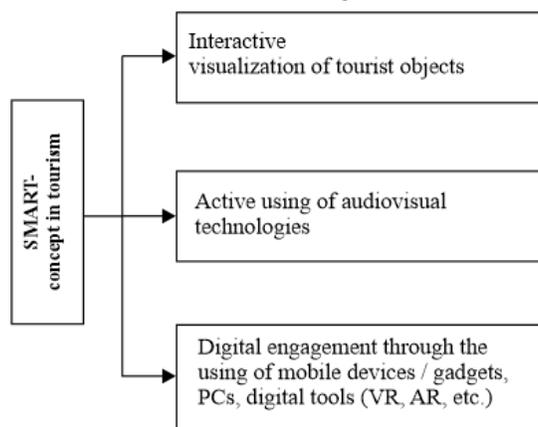


Fig. 2. SMART concept in tourism

Note – developed by the authors.

The objectives of the presented concept are fully consistent with the capabilities of audio guides, which are an effective digital solution in terms of developing the tourist and digital potential of cities and tourist destinations today, including the

territory of which the smart component is being actively implemented; in this regard, we consider it expedient in the conditions of modern digital transformation to consider this tool as a new category – “smart audio guides”, the analysis of the advantages and disadvantages of it using is the key goal of the research conducted in the present article.

III. METHODS

Within the framework of this scientific article, the following research methods were used:

1. *the content analysis method* that made it possible to outline current digitalization trends in the tourism services market based on a study of data (articles, sections of monographs and books) presented in the Thomson Reuters scientometric database (Clarivate Analytics) for 2015-2021;

2. *the method of graphical interpretation* to systematize the most important aspects that form the smart concept of tourism;

3. *the comparison method*, which made it possible to study and characterize smart audio guides in terms of such indicators as: year of creation, geography of coverage, number of downloads, a general brief description, including issues of content quality and its cost;

4. *the generalization method*, the using of which made it possible to highlight the advantages and disadvantages of using smart audio guides in practice.

IV. RESULTS

Currently there are more than 100 different smart audio guides in the AppStore and PlayMarket platforms, which are both *complex applications* covering several countries and regions of the world at once, as well as *fragmented ones*, reflecting the information and audiovisual content on a specific object, city or country.

Within the framework of this article, the authors analyzed the 7 most popular (in terms of their number of downloads) applications: izi.Travel, Qwixi Tour, PocketGuide audio travel guide, Guides by Lonely Planet, Audio Tour Azbo – Travel guide, Rick Steves Audio Europe and DETOUR (Table 3).

TABLE III. BRIEF DESCRIPTION OF SMART TOURIST GUIDES

Name, year of creation	Geography of coverage	Number of Play Market downloads*	Short description
izi.Travel, 2011	121 countries covered; about 15,000 audio guides are presented in three categories (museums, tours, quests) and in more than 150 languages and dialects of the world.	1000000+. The application is also available for download in the AppStore	The service positions itself as a “storytelling platform”; it is free; the authors have the right to set the price for the audio guides they have created. Like most open and free platforms, the application has quite a lot of ads that the client can disable by paying for it, thereby supporting the project. The quality of the content provided varies depending on the involvement of the author in the process of creating an audio guide, his experience and technical capabilities. The cost of paid products varies in the range: 0.7 -41 USD (depending on the tourist site).

Qwixi Tour, 2017	The geography of the audio guide covers 36 countries (mainly European). Audio tours are presented in 2 categories: tours and quests.	10000+ The application is also available for download in the AppStore	Free audio guide, but there is paid content, the cost of which is determined by the developer of the guide. The quality of the content provided varies depending on the involvement of the author in the process of creating an audio guide, his experience and technical capabilities. The cost of paid products varies in the range: 0.8 – 17 USD (depending on the tourist site).
PocketG uide audio travel guide, 2011	165 cities are presented in the application.	500000+ The application is also available for download in the AppStore	Positions itself as a personal guide. The cost for the content varies depending on the number of tours purchased (1.3 - 15 USD). The quality of the audio recording in the trial version is usually not high; photo resolution - average, the information corresponds to the declared objects.
Guides by Lonely Planet, 2016	Geography of the guide: on all continents; 8368 guides to cities and regions, more than 1000 panoramic videos; there are 19 phrasebooks in different languages.	1000000+ The application is also available for download in the AppStore	It positioned itself as a free guide, in the latest versions - a paid subscription and several free previews (periodically promotions: any city can be free). Subscription cost: 1 month – 4.99 USD; 6 months – 21.99 USD; 1 year – 39.99 USD. High quality content; availability of videos (interesting facts and introductory fragments), collections of places (top, markets, historical places, cathedrals, restaurants, etc.), AR-currency converter.
Audio Tour Azbo – Travel guide, 2014	The geography of the application covers 35 countries (mainly European countries) and 70 cities.	The application is available for download in AppStore, but not available in PlayMarket	This app is a world city guide with offline maps. Audio tours are presented in Russian and English. The application has several free tours, but most of the audio can only be listened to by paying a certain amount of money (2 USD). All excursions are created by experienced guides and voiced by professional announcers.
Rick Steves Audio Europe, 2011	Mostly European countries (about 30 countries).	100000+ The application is also available for download in the AppStore	The application is completely free, all audio recordings are in English only. There is no GPS, the user himself chooses the destination, objects and listens. The content in the application has not been updated for a long time, the photo resolution is low; the audio recordings presented are generally informative.

DETOUR, 2016	Currently available in 17 cities including: San Francisco, New York, Chicago, Los Angeles, Austin, London, Paris, Rome, Berlin, Barcelona, Marrakech and others.	50000+ (PlayMarket)	It has free and paid content. The cost of paid products varies in the range: 4.0 – 19 USD (depending on the tourist site).
Note - compiled by the authors. *At the time of information collection (01/26/2022). Viewing the number of downloads is not available in the AppStore.			

It should be noted that all smart audio guides were shown in Table 3 are leaders in popularity on various tourist sites and forums, including: Viator, KUDAGO, TripAdvisor and many others.

The analysis showed that the most popular in terms of downloads are izi.Travel, Guides by Lonely Planet: more than 1 million downloads in PlayMarket. Unfortunately, it is impossible to track the analyzed indicator in the AppStore, since this statistics is not available to an ordinary user. No less famous are PocketGuide audio travel guide, Qwixi Tour and Rick Steves Audio Europe.

Each of the presented applications, as a rule, contains both free content and paid content, the cost of which may vary depending on the region, subscription type, route duration and a set of audiovisual effects in its composition.

The geography of coverage is also heterogeneous: some of the smart audio guides are focused, for example, mainly on European countries (Qwixi Tour, Audio Tour Azbo - Travel guide, Rick Steves Audio Europe), the other part covers a large pool of countries and regions of the world (PocketGuide audio travel guide, izi.Travel, Guides by Lonely Planet), and some contain content only for individual cities (DETOUR).

Highlighting the advantages of using SMART audio guides by tourists and sightseers⁴:

1. simultaneous using of visual, motor and auditory memory, which for many people is an important factor for the development of personality and communication skills;
2. more active involvement in the process of cognition of the objects of display and story (as opposed to the standard classical excursion);
3. automation (through the using of specially created and well adapted mobile applications for different devices) of tactile perception of text, graphic and audio material (in the process of moving along the excursion route from point A to points B, C, etc. and acquaintance with the created and presented content in the application);
4. formation of sustainable interest among tourists to further study of tourist attractions in the place of stay, and, as a result, the creation of a favorable image of the tourist destination, increasing its level of recognition;

⁴ All conclusions are based on the results of the research conducted by the authors.

5. independence: there is no need to purchase sightseeing tours on the spot (or in advance, depending on the type of tourist package), which in different countries of the world can be very expensive (for example, in the TOP-3 countries in terms of tourist arrivals - France (90 million people), Spain (83,7 million people) and the USA (79,3 million people)⁵, the cost of classic excursions related to getting to know the most famous sights in the pre-pandemic period varied, on average, from 40 to 170 US dollars)⁶ and follow the group along a strictly agreed route for a limited period of time (the average duration of a standard study tour is 1.5-2 hours);

6. the ability of using almost anywhere in the world where there is an Internet connection; at the same time, some applications allow the tourists to download content in advance and using the audio guide for the object / objects offline;

7. the ability to continue listening to the audio guide and sightseeing at any convenient time, which is almost impossible to do when using a standard excursion purchased from specialized companies (travel agents, tour operators, tour agencies, etc.);

8. effective planning of hiking routes and their distribution according to the time of stay, choosing for yourself the most interesting and attractive objects, places and attractions.

At the same time, an indisputable advantage is the ability to create for tourists their own routes, upload them to the platform, thereby making them immediately available to a wide range of users. This solution also solves the problem of promoting tourist sites and places that are less "advertised" in standard tourist guides, which most often popularize the most famous tourist attractions, but usually do not tell about interesting streets, courtyards, art objects, etc., having, perhaps, no less interesting history of creation or appearance.

As for the disadvantages of using SMART audio guides, there are largely fewer than advantages:

1. lack of internet connection can be a problem for listening to audio content and watching videos, which can be solved by preloading media materials on the gadget (which allows most applications to do); as for the route itself, in most programs it is implemented using maps that can work offline using satellite communications;

2. the capacity of gadget batteries, which limits their battery life, and, in some cases, the inability to charge the device; the most popular solution today is carrying a powerbank; it should also be noted that most tourist information centers, attractions in different countries and regions of the world have charging stations for phones and tablets;

3. not very high-quality content created by amateur guides or tourists themselves; most audio guides allow any interested person to download their material, some of which may to some extent not meet the requirements of those who use or purchase it, while today a number of software products prescribe minimum requirements and develop recommendations regarding the creation of high-quality and interesting materials and their downloads (for example, the desktop version of the izi.Travel program contains special sections with

recommendations for creating audio tours around the city and in museums; also provides answers to questions regarding the technical capabilities of the platform and requirements for content (graphic, audio-visual), which is loaded);

4. the likelihood of going off the route in an unfamiliar area: this situation is possible, but it is thought out by the developers, since when creating and laying a route, as a rule, navigation stories (sound stories) are used that allow the tourist not to stray from the route; another important element that solves this problem is virtual borders (the so-called "trigger zones"), crossing which the tourist will immediately receive a hint where he should go next.

The research shows that, of course, the advantages of using smart audio guides in the development of urban tourism and the development of interesting and attractive urban tourist routes are much greater than the disadvantages, especially since the latter can be prevented and, in most cases, solved.

Smart audio guides today have become not just interesting software products, but also a convenient tool for planning a tourist's stay abroad, an effective tool for creating a stable positive image of tourist areas, as well as an effective object for promoting and popularizing objects of tourist interest.

V. DISCUSSIONS

To date, despite the existing works of the authors, reflecting aspects of the digitalization of tourism, the classification of smart technologies, the peculiarities of their application directly in the service sector (including the tourism market), there are still questions that are debatable regarding the specifics of the relationship smart tourism and smart cities, determining the level of digital potential of tourism enterprises in the context of active smartification, developing a methodology for evaluating the effectiveness of audio guides in terms of attracting more tourists to certain objects, creating a set of criteria, the using of which would allow creating unique routes.

Further research by the authors will be aimed at identifying the features of the using the smart technologies in the structure of tourist and excursion services and conducting a content analysis of the filling of smart audio guides in the world's leading tourist centers, as well as in the cities of Central Kazakhstan - Karaganda, Temirtau, Zhezkazgan; in addition, the members of the research group during 2022-2023 will be aimed at creating urban tourist routes "Geometry of the city" (sightseeing tours of the display objects of the cities of Karaganda, Temirtau, Zhezkazgan), "Murals and graffiti of Karaganda", "Where? Where? In Karaganda!" (a walk through the famous and unusual monuments of Karaganda) and others and uploading them to the izi.Travel platform (in the form of high-quality audiovisual content) for subsequent widespread using by residents and non-residents of the region and country.

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⁶ According to the website: <https://www.viator.com>

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