


## PAPER

# Mobile Applications for Cultural Tourism – Past, Present, and Future. Criteria for a Successful Mobile App

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## ABSTRACT

This publication presents a prototype of a mobile application for cultural tourism. Its main goal is to provide information about tourist sites in a city with a rich historical past and deep-rooted traditions, catering to the needs and preferences of contemporary users in terms of functionality and user-friendliness. The paper analyzes contemporary Bulgarian and foreign mobile applications for cultural tourism, emphasizing their advantages over similar applications that were active in the recent past. These advantages include availability, interactivity, and an enhanced user experience. The purpose of the paper is to develop and promote a mobile application that will meet the needs of tourists. The methodology for designing the prototype includes a review and comparative analysis of mobile applications that existed a decade ago, as well as current applications in this field in 2023. Both local applications for Bulgaria and international applications for the Czech Republic, Greece, Italy, Hungary, and Spain were studied. The study focused on usability and other key characteristics that are similar to the functionality of the developed application. Weaknesses of some of the analyzed applications and problems avoided in the proposed prototype are indicated. The paper also presents the primary features of the developed application, such as its user-friendliness, speed of operation, intuitive design, and easy access to tourist and cultural sites. In the future, with the introduction of various mobile applications in this field, it is expected that users will be greatly facilitated in their search for up-to-date information on cultural and historical sites around the world.

## KEYWORDS

cultural tourism, mobile apps, audio guides, augmented reality

## 1 INTRODUCTION

Traditionally, enthusiasts of cultural tourism visit various world attractions to explore them, gain experience and knowledge about the sites, and satisfy their interests or curiosity. Until 15–20 years ago, tourists mostly joined organized groups

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when visiting specific cultural sites and relied on the services of a tourist guide. Preliminary or promotional information about the places in question in the recent past was primarily disseminated through brochures, guidebooks, short educational television programs, and conversations with travel agents.

With the rapid development of Internet services and the widespread use of computing devices, people have been greatly facilitated in accessing a wide range of information. Numerous websites have been developed, including those dedicated to cultural tourism. Blogs and pages dedicated to significant historical places and landmarks on social networks are especially popular. If desired, individuals can share and access information about a chosen website, whether they are at their desktops or laptops, from home or in the office, using the internet. As a result, individuals have the freedom to choose new destinations to visit, whether it be for personal, family, or group travel.

With the widespread use of mobile devices, there has been a growing demand for mobile applications that provide information about specific cultural and tourist attractions in recent years. With these features, users will be able to easily choose their desired destination, no matter where they are—at home, in a vehicle, or in front of a tourist attraction.

A potential challenge to the necessity of mobile apps in the travel industry is globalization and the increasing amount of work and personal travel that comes with it. People prefer to have rich and timely information on their tourist visits available instantly on a small, lightweight, and portable device. With the increased use of mobile devices, the number of mobile applications developed in various fields, including tourism, education, healthcare, and the economy, has been increasing.

Users with mobile devices greatly benefit from accessing relevant cultural tourism apps and installing them from either Google Play or the Apple App Store. In this way, potential tourists are able to explore cultural and historical sites via their phones. Up-to-date tourism mobile apps can be particularly useful for target groups of users who would never otherwise visit the attractions. The reasons for this can be financial or related to a lack of free time. In many cases, these individuals may have special needs or illnesses. These “tourists” have the opportunity to explore the world “from home.”

Applications have also been developed to assist visually impaired tourists in exploring the world more easily. The applications are not intended for mobile devices, but for the white cane that they consistently use. Smart white walking canes are enhanced with electronic aids for travel orientation and location localization, which provide necessary information to the blind through voice assistants [40].

Developers of modern mobile apps aim to fully meet the needs of these users as well, incorporating elements that were not included in the apps years ago. An example is virtual reality and virtual tourism, which became particularly popular during the COVID-19 pandemic. Another useful practice is the “audio guides.” Through these platforms, even tourists facing difficulties in accessing the sights can obtain up-to-date information about the places of interest. The development of IT technologies and the introduction of modern methods for delivering data and services have also played a significant role in the development of cultural tourism [29].

In their publication, Vert and VasIU [44] also point out that augmented reality mobile applications are a suitable way for tourists to explore new lands. Such apps often have limited information available. The authors propose a solution to

integrate linked open data, which has increasing value in terms of quantity and quality. In addition to being open, this data is dynamic and easy to use. In their research, they summarize that this approach would lead to more and better data for tourists [44].

A scientific approach has been applied to prove the presented thesis on modern mobile applications in cultural tourism, and this paper covers the following sections. In the second section, detailed discussions are provided on recent publications by other authors on the topic. The third section analyzes the state and capabilities of mobile applications a decade ago. Their shortcomings and the reasons for their failures are identified. The fourth section is dedicated to discussing the capabilities and unique features of contemporary mobile applications for cultural tourism. In the fifth section, several mobile applications that have an indirect connection to cultural tourism are presented and compared. In the sixth section, the authors synthesize their conclusions on the necessary requirements for a cultural tourism app to be successful in the market and to have sustainable development, based on the shortcomings and advantages of apps found in the last ten years. A working prototype of an application in this area is presented in Section 7. The results of testing the developed application, as well as its key features, are described in the eighth section. The final section summarizes the most significant conclusions that have been drawn from this paper.

## 2 RELATED WORK

Mobile apps for cultural tourism have been attracting interest, as they have been the subject of research and study for more than a decade. Our author team is one of the pioneers who have shown interest in the topic [45]. In our publication from 2013, Stefanov and Stefanova [45] conducted a comprehensive analysis of popular free mobile apps in the field of cultural tourism, comparing their advantages, disadvantages, specific technical features, and challenges of these apps up until 2012. The main thesis ten years ago was that classical offline navigation programs and applications played a leading role in guiding tourists to selected points of interest but were not useful for learning about the cultural and historical values or geographical features of the place. According to the study, the presence of multimedia interactive elements plays a crucial role in enhancing the user's experience when using mobile applications. Another important feature is the ability to share tourists' personal experiences on social networks. This not only promotes the cultural and historical heritage but also enhances the visibility of the mobile application itself, which offers this functionality [45].

Márkus et al. also highlight that interactive multimedia components integrated into mobile applications are notably useful tools for enhancing tourists' knowledge of attractive and significant cultural heritage sites in a country. The authors mention multimedia elements such as personal collections, panoramic views, or custom games [48].

Smart tourism is advancing rapidly and is gaining popularity among tourists and owners of tourist and cultural sites who want to expand their businesses in Europe, America, and Asia. For the sake of convenience, ease, and a seamless experience, users on the go are more likely to choose mobile apps over websites [39].

In their research, the authors emphasize the significance of the logic model in the development of a mobile application using the model, view, and controller

(MVC) design. The template-based design concept leads to greater flexibility and reusability across various applications. Krastev and Voynochowska [33] describe the feasibility of MVC architecture for designing a mobile application for public transport schedules, along with its potential limitations, performance results, and weaknesses.

The object of study in this paper is contemporary Bulgarian and foreign mobile applications for cultural tourism. The research is conducted based on a brief analysis, description of typical functionalities, and design for each of the apps. Their potential benefits have been identified through a comparison of pre-selected criteria, in contrast to mobile applications from ten years ago.

Mobile apps today, unlike those of a decade ago, strive to meet the specific expectations and demands of today's users. In terms of usability, users prefer apps that have easy and simple navigation, a clean design, and require a minimal number of clicks to quickly access the desired information.

Today, the multitude of applications available on the Internet does not indicate a higher level of usability and utility for users. More than 440 tourism mobile applications available on Apple and Google stores were analyzed by Sia et al. [41]. The result of the user survey and usability is that only about 40 of them meet the needs of user interests, based on functionalities such as geolocation services, travel route generators, real-time recommendations, and personalization of information [41].

Application developers adhere to one of the most important requirements of modern users, which is to avoid reading large texts. When exploring a chosen tourist attraction, users prefer to receive information not only in text format but also through audio or video files, as well as multiple images for illustration. These days, mobile applications that focus on cultural tourism provide information in at least two languages. An advantage is when they contain audio and virtual tours, a gallery of high-quality photos, geographical maps, and 3D virtual reality.

Research by Gretzel et al. and Li et al. outlined and emphasized the significant role of mobile technologies in tourism and their inevitable future use [46], [47]. In their study, Gretzel et al. [46] highlight the importance of integrating technologies in a customized manner and adapting them to tourists' expectations and interests.

In their study, Kim and Kim [28] consider the mobile app as a popular method for directly connecting consumers and mobile technology. The authors also emphasize another important aspect of mobile apps: they perceive them as a tool for both users and providers to gather tourism-related information. They emphasize the significance of apps in planning trips and buying travel packages. The mobile application is a strategic interaction platform developed by the providers with the ultimate goal of becoming the preferred information portal for users. Key elements in the development and promotion of apps include the differences in user behavior compared to traditional information channels, as well as the emergence of new types of information environments and technologies, including those anticipated in the future [28].

Using mobile devices and existing apps, tourists are able to enjoy interesting experiences and satisfy their curiosity, while the owners or companies of cultural attractions can effectively manage these experiences [28].

When implementing a timeline view, classified content, which is organized by name, location, and distance, can enhance data visualization. This approach has been applied to create a mobile application that presents and preserves the outlook of historic buildings in chronological sequence [32].

With each passing year, questions such as “*What are the differences between the present and the past in consumer expectations and satisfaction with mobile apps in tourism?*” and “*Is there a need to develop and promote better apps in the future?*” People are becoming increasingly goal-oriented and seeking satisfaction. Responses to these questions are organized in the sixth section of this paper. The paper also presents some modern applications that could be useful to people when traveling and visiting cultural sites. These applications include useful information for location, transportation services, hotels, restaurants, health facilities, shops, weather forecasts, and news.

### 3 MOBILE APPS AND THEIR CAPABILITIES A DECADE AGO

About ten years ago, there were only a few free cultural tourism mobile apps available to mobile phone users, in contrast to the abundance of options available today. Most mobile apps provide information about local and national attractions in Bulgaria and abroad.

Some of the popular apps in 2012–2013 include: Bulgaria: A Tourist Guide, as depicted in Figure 1a; Mobile Bulgaria; Burgas Tourist Guide, as shown in Figure 1b; Bulgaria Tourist Sites, the 100 National Tourist Sites M-tel, as shown in Figure 1c; Visit Burgas, as shown in Figure 1d; Travel Sights Plovdiv; and GUIDE@HAND. Each of the aforementioned applications has its own advantages and disadvantages in terms of design, functionality, and usability.

Many of the mobile apps mentioned that proliferated in the past were developed as additional functionality for existing and already established tourism websites, which was an advantage at the time. They are characterized by a similar approach to promoting tourist attractions—providing a summary of brief information about each attraction, accompanied by a few photos. Many of the travel apps used Google Maps for navigation in the past, and some of the popular ones even had their own maps to display the locations of sites and provide directions to tourists.

The drawbacks include an unfriendly and uncomfortable interface, the absence of a schedule of opening hours for visiting the sights, awkward navigation, the lack of itineraries, and the inability to access some of the photos and texts within the app itself. Instead, users are redirected to the linked tourism website. Some of the apps investigated did not support a multilingual interface.

The factor of calendar time can be pointed out as another important disadvantage. It is common for tourists to visit seaside resorts during the summer months and mountain sites during the winter months. The lack of up-to-date information on prices of goods and services, as well as the opening hours of cultural sites and retail chains, outside the months of the tourist season, is a significant shortcoming of most of the mobile apps being considered. However, none of these applications allow for the direct purchase of tickets for tourist attractions through their own interface. There is often no connection to popular social networks.

Of the mobile apps that were popular from 2012 to 2015, very few are still available today, in 2023. Of those listed above, only GUIDE@HAND is still available for download and installation from Google Play. The last update was on May 5, 2022, ensuring computability with Android 12 [22]. The app is also available through the Apple App Store and was last updated in August 2022 [27].



Fig. 1. Design of applications from a decade ago

The short lifespan of mobile apps for cultural tourism is an example of the lack of long-term economic sustainability, which is an unexpected characteristic for technology projects in the field of tourism innovation. It is noteworthy that even mobile apps sponsored by municipalities and large national companies have not survived the ten-year period we examined. This is a confirmation of the thesis on the significance and relevance of user satisfaction in relation to app usage. This is what underpins the long-term competitiveness and sustainability of a product in its chosen field.

#### 4 MODERN MOBILE APPS–CHARACTERISTICS

The requirement analysis and planning phases that take place prior to the development and deployment of a software application are particularly crucial for mobile applications. The identification of target groups in the requirement analysis phase is crucial for every mobile application and modern software product. This is because they aim to satisfy ever-changing and continuous user requirements to a significant extent. For a mobile app to be relevant and in demand, the analysis and research of its future users are of particular importance.

When determining alternative design solutions for an app, the features and UX/UI design are not only based on the age, gender, and education of users but also on their expectations from the final product [30]. Often, conceptual prototypes are developed and tested with a specific group of respondents in order to incorporate user feedback and perspectives into the release and deployment of the mobile app.

An interesting practice on the part of the developers is to offer a prototype of a mobile application for a specific tourist attraction to a randomly selected group of tourists, typically around 100 people, for testing purposes. As a result of the tourists' feedback, the tested mobile application can be improved based on the users' criteria for easy, convenient, useful, satisfying, and enjoyable interaction with it [31].

These days, users are finding it difficult to choose mobile apps, not only due to the large number of options available but also because of the ratings associated with them. Abulhajja et al. studied the valuation of mobile apps between 2018 and 2022

by analyzing and classifying the research into three categories: predictive modeling, device analysis, and top feature ranking [43].

Every new mobile app developed these days aims to meet the users' needs for fast, easy, and efficient interaction while also providing mobility and interactivity in the specific area it is intended for. Some of the key factors that users prioritize when it comes to design are that mobile apps should be visually appealing, streamlined, user-friendly, and intuitive to navigate. The following is an overview of popular cultural tourism mobile applications that have been available and updated within the past 2–3 years.

#### 4.1 Mobile tourists app GuideAR

The GuideAR mobile tourist app promotes the historical and cultural heritage of Sofia Municipality and the city of Sofia [5]. The app offers the possibility to explore 25 famous cultural and historical sites with the help of an audio guide, an image gallery, and text information.

The idea for the app was presented by its developers while participating in the Hackathon programming competition in 2021. The aim of the app is to allow users to learn about the cultural heritage of tourist sites and their historical significance.

GuideAR provides data in both Bulgarian and English, unlike other similar applications. The information about the attractions is provided by the Regional History Museum in Sofia. After installing the app, tourists can view the sites located near them on the map and obtain information about a selected site by clicking on the corresponding 'spot' through image and text information (see Figure 2a).

Particularly useful is the navigation functionality that includes a choice of route—either longer or shorter—for users to navigate around relevant facilities (see Figure 2b). Another intriguing feature is the enhanced augmented virtual reality, which allows users to visualize how a chosen architectural landmark would have appeared in the past using the camera on their mobile device. Users don't have to be near the facilities to use the app; they can be anywhere. The app can be used on both Android and iOS or accessed through its official website: <https://guidear.eu> [6].

Only time would impose restrictions on visiting all 25 sights on day trips. It would be beneficial to propose a priority list for their visit based on importance or, alternatively, suggest priority for important sights that are located near the users' current location. It is possible to use e-scooters or bicycles for faster travel, which can be rented through mobile applications (see Table 3). These services are used by young people willingly.

#### 4.2 Mobile cultural app Audio Guide to Tryavna

The mobile application "Audio Guide to Tryavna" has been available to users since 2022 and offers language support in two languages: Bulgarian and English [21]. The app was developed under the motto "Listen while you walk" and offers audio-guided tours of landmark sites in the city, such as the Old School, Renaissance Square, Raikov's House, Slaveykov's House, the Clock Tower, and others (see Figure 2c). Photos are also provided for each of the selected locations. Each cultural

site is marked with a special ‘tag’. Using the app on their mobile phones, tourists do not need the services of tour guides or group tours for the respective attractions.

The design of the app emphasizes the orange and white color scheme and features a convenient vertical navigation menu on the left. The app was developed as part of the project “Tryavna’s Past in the Digital Future.” The app can be used on the Android OS and is available for free on Google Play.

A significant drawback is that the app cannot be used by elderly users who have hearing impairments or are completely unable to hear. It is recommended to include short descriptions of the sights or provide links to existing information about them on the Internet.

### 4.3 Mobile app Plovdiv City Card

The “Plovdiv City Card” is a free app that offers a catalog of the top attractions in the city. With the help of the app, it is possible to create a list of reserved places for pre-planned trips. Users have easy navigation and quick access to information, as well as useful travel tips [17].

There are two versions of the card available for purchase: a 24-hour card and a 72-hour card. Additionally, there is a choice between the ‘Adult’ or ‘Adult and Child’ (see Figure 2d).

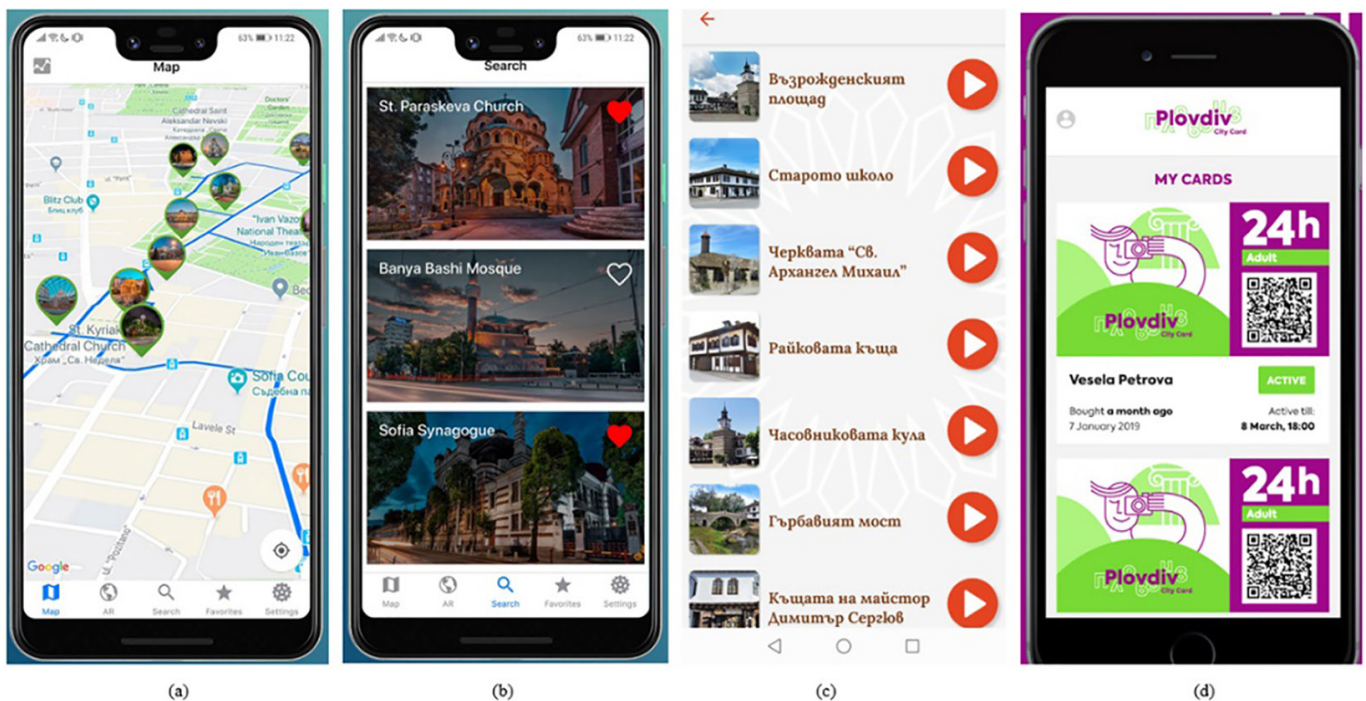


Fig. 2. Modern mobile apps for tourist attractions in Bulgaria

Through the card, users have the opportunity to access the services of restaurants, bars, and entertainment venues. They can also visit the city’s best museums and galleries or indulge in wine tasting. This way, they can visit more attractions and save money. The mobile app has its own navigation map and works optimally only when the location is turned on [13].



#### 4.4 Mobile app Budapest Guide Tickets and Map

This mobile app has been developed for Android and iOS. Both versions support seven languages: Italian, German, French, Spanish, Polish, Russian, and English [2], [25]. It is updated frequently (on average, once a month), which indicates its quality and ensures that the content is up-to-date. Versions for iOS and Android have small design variations but significant differences in pricing policies. The iOS app is priced at BGN 24.99, while the Android app is priced at BGN 7.79, as shown in Figure 3a.

The app provides details of tourist sites, tours, hotels, restaurants, and attractions. Detailed maps are included that can be used offline and without roaming, which is advantageous for foreign tourists. Another benefit is the ability to purchase travel tickets directly using the user's currency. Detailed information about a specific trip is also beneficial for users. Provides recommendations and feedback from users who have already visited the attractions and utilized the app's services.

#### 4.5 Mobile app Vienna Travel Guide

This modern mobile "guide" app is available in both free and paid versions on Google Play. It can be used by different age groups of users [23]. The advantage of this is that it can be accessed even when users are in 'offline' mode and offers the possibility to access Wikipedia. Brief and useful information from the Wiki is provided for each of the selected sites.

In terms of usability, users find the app quick and easy to navigate, even when on the move, such as walking or traveling. Users are provided with up-to-date and comprehensive information on hotels, restaurants, shopping venues, well-known stores and malls, nightlife, and medical centers.

The app contains useful information about popular tourist attractions and cultural sites in Vienna; see Figure 3b. The maps provided and the available transport routes are extremely helpful for navigating and getting around the city. The app enables users to share an inspiring experience. It is available in both German and English and has been downloaded over 100,000 times. The last updates were made at the end of 2022 [23].

#### 4.6 Mobile app Italy Travel Guide Offline

The app was added to Google Play in October 2013, and the latest update was released in April 2019. It has been downloaded more than 50,000 times over the years and is available in seven languages: English, Russian, Spanish, French, Portuguese, Italian, and Chinese. It offers information on attractions, maps, and guides [10]. The app is also available for Apple iOS users, with one almost unnoticeable difference in the name: "Italy: Travel Guide Offline" [26].

Under the header on the home screen, as shown in Figure 3c, there is a picture that also functions as a button. This button links to detailed information about Italy, including its population, time zone, history, and emergency numbers. On this screen, you can view the country by region. After the picture, there is a section with useful tools, such as a glossary and a metro map. The next section includes the destinations available in the app. Each item on the list has a button that links to more information.

The site provides details, including photos of the town and a description. After the informational text, there are lists that provide suggestions for visiting sites, shops, restaurants, and more. Most of these options are locked and require purchasing the complete guide. For \$2, one can unlock all of the app’s features, including maps, information, and ad removal. The app offers its users an interesting option: to learn how to pronounce words and phrases in Italian. The side menu contains buttons for the home screen, the dictionary, the user’s favorite sites, the metro map, the ability to create a travel plan, and settings.

### 4.7 Spain Travel Guide

The app was launched on Google Play in October 2022 and has received over five thousand downloads from the store since then. The latest update is from March 2023, indicating that it is still in production. Spain Travel Guide focuses on introducing tourists to attractions in Spain as well as local food and drink. No location information is required upon first launch, and the app does not need to access user data. Currently, the only available language is English [18]. The home screen features a header displaying the name of the application. Below the header, there are categories, followed by a list of relevant attractions, as depicted in Figure 3d. In the app, users can explore popular cities in the country, such as Barcelona, Madrid, and Valencia. There is information about several famous sites in a separate category, and it is also possible to learn about the country’s iconic dishes and beverages.

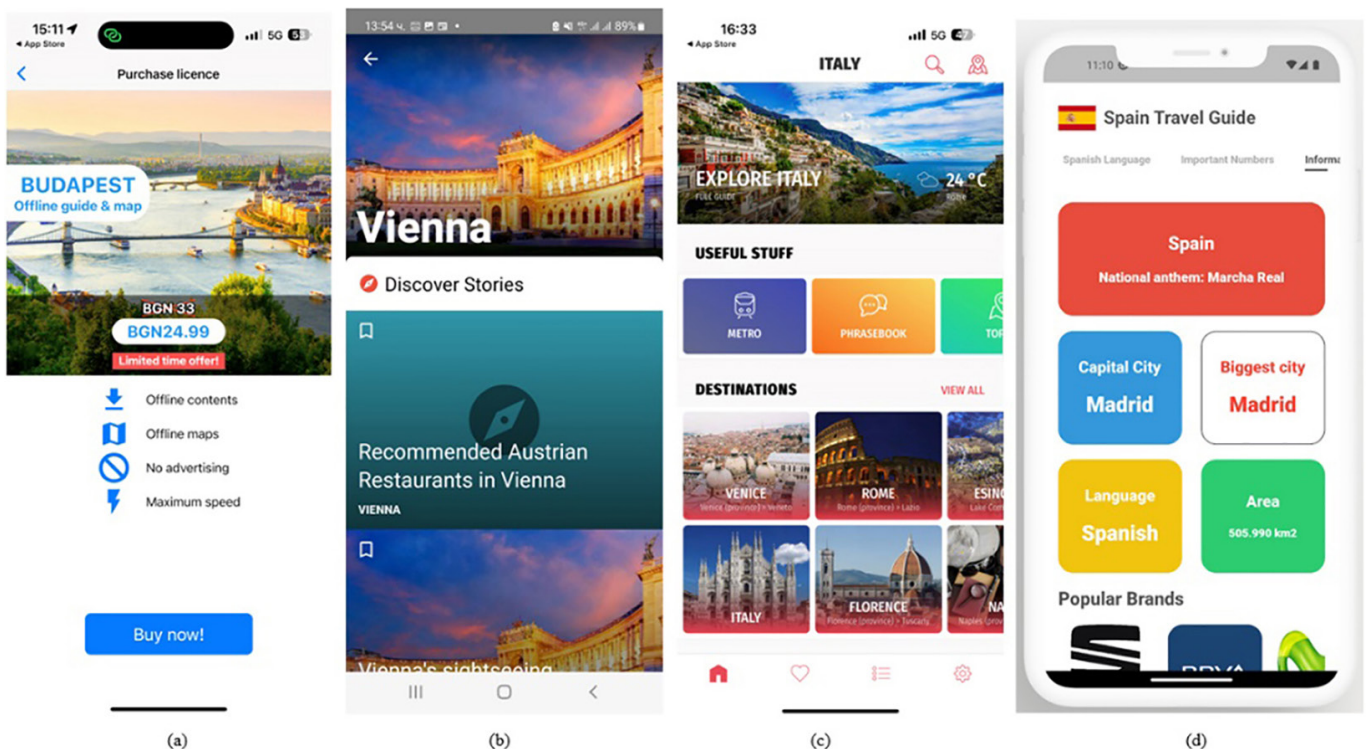


Fig. 3. Actual applications for cities and countries in Europe

Each item in the list leads to a screen displaying its details. There, you can see a picture with text below it. In the categories of cities and landmarks, there is a button

that displays the attraction on a map in Google Maps. If the user has another map application, they can choose which one to use to open the location. Short advertisements also appear when changing screens.

### 4.8 Other modern mobile applications focused on cultural tourism

There are other well-known applications related to cultural tourism for historic cities in Bulgaria and abroad. A brief analysis of some of them is made and can be seen in Tables 1 and 2.

**Table 1.** A few mobile applications in Bulgaria, focused on cultural tourism

iLoveBulgaria	Pleven Live	Hisarya TourWalk	Kavarna Guide
			
Description			
<p><b>iLoveBulgaria</b> is an app providing information about important cultural sites through photos, video, text and navigation to reach them. The app is available in 13 languages [9]. If interested, after a visit the users can scan the given signage of the place and thus it can be promoted.</p>	<p><b>PlevenLive</b> is a mobile tourist guide, providing information about cultural attractions and current news about the city. The app also presents information about health facilities, hotels, restaurants, sports and cultural activities [16].</p>	<p>The <b>HisaryaTourWalk</b> application uses augmented reality and gives information about Diocletianopolis Thermae. The app is available in three languages [8].</p>	<p>The aim of the <b>Kavarna Guide</b> app is to provide visitors to Kavarna with information about the cultural and fishing heritage of the town. The app offers information about opening hours, contacts of hotels and restaurants, shops and pharmacies, car service stations [12]. The information about the respective facilities includes current location, photos, contacts and short text.</p>

The presented applications are designed to cater to the specific needs of visitors to these places. However, they need to be promoted in order to be used more frequently and by a larger number of users.

**Table 2.** A few mobile applications oriented towards cultural tourism in Europe


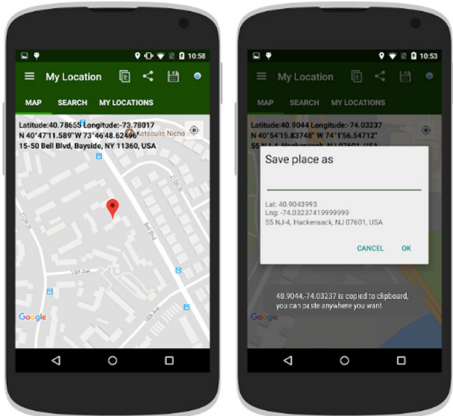

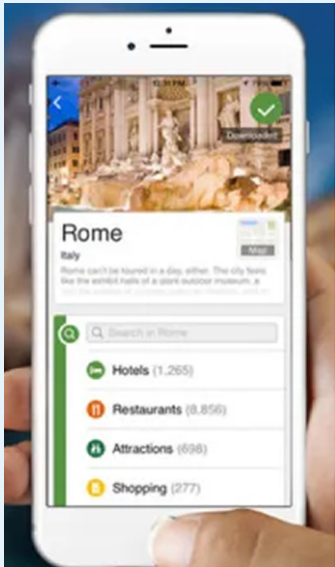
Culture is Athens	Hike and Bike in Malashevija, Berovo	Tips for Trips Czech Republic
		
Description		
<p>The app provides information about the capital Athens as a cultural center [3]. The cultural attractions are grouped into itineraries for optimal visits, and updated information is offered for ancient and modern monuments.</p>	<p>The <i>Hike and Bike</i> in Malashevija mobile app is aimed at people who love hiking and cycling in Macedonia [7]. It includes information on how to safely navigate and move along the main trails of Malashevija, near the town of Berovo. Directions are given through photos and a description of Malashevija, as well as information on accommodation and places to eat.</p>	<p>The app features up-to-date information on cultural and natural attractions, sporting events and activities in the Czech Republic during each of the seasons [19]. It contains information on the number of visitors to the sites, car parks, toilets and ATMs in four languages.</p>

## 5 OTHER MOBILE APPS FOR CULTURAL TOURISM

After choosing to visit cultural places and tourist sites, users would like to be provided with convenient access to accompanying activities and services. Thus, they also need applications containing information on location and directions, alternative modes of travel and transportation services, planned events, media appearances, accommodations, and shopping options, weather forecasts, and language recognition translators. The developers of these mobile apps rely on valuable information related to trip selection, hotel booking, noting visited places, cultural events, and more. This way, tourists who have the desire to visit the sites in person can obtain reliable information to plan their trips accordingly. Thanks to these applications, tourists are introduced to cultural sites that may have limited or lacking information when visiting a place.

This would serve as background and provide possible ideas for developing future applications for these locations. More prominent mobile applications in this category are presented in Table 3.

**Table 3.** Mobile applications that are complementing those specialized in cultural tourism

Mobile Apps	Screenshots	Description of Apps
<p><b>My location – Where Am I</b></p> 		<p>By using the <b>“My location – Where Am I”</b> app and pinpointing their location, mobile users can obtain meaningful information about their current whereabouts. They obtain address data, altitude, and scale—whether it be a close-up or a bird’s-eye view. Users can choose between map, hybrid, or satellite view [14].</p>
<p><b>Tripadvisor Mobile App</b></p> 		<p>The <b>Tripadvisor Mobile App</b> is designed to provide people with information on hotel and restaurant bookings, as well as nearby tourist sites and restaurants. When planning their trip, everyone can gather information about bookings and then embark on a journey around the world [20].</p>

(Continued)

**Table 3.** Mobile applications that are complementing those specialized in cultural tourism (Continued)

Mobile Apps	Screenshots	Description of Apps
<p><b>Google Translate</b></p> 		<p>The <b>Google Translate</b> application is designed for users who struggle with learning foreign languages, with the goal of making communication easier. Translation is available in over 100 languages by entering text. It is possible to translate without an internet connection into more than 50 languages. It offers translation from camera images in over 90 languages and translation in more than 70 languages for conversations [4].</p>
<p><b>Bird – Ride Electric</b></p> 		<p>For a more convenient and eco-friendly mode of transportation in congested urban areas, electric scooters are increasingly being utilized in major cities worldwide, including Vienna. With the <b>Bird – Ride Electric</b> app, one can rent a scooter and not only sightsee while traveling, but also make connections such as other means of transport, to the metro or the airport. Payment is per minute, electronically [1].</p>
<p><b>Journi Blog – Travel Journal</b></p> 		<p>The <b>Journi Blog – Travel Journal</b> app could be referred to as a “travel journal”. The application allows users to record photos as photo archives, maps, short descriptions of the visited attractions, and to keep notes and comments. While on the go, tourists have the opportunity to share information about the sights they have visited with friends and family. By using the app, they could also help determine future itineraries on Google Earth [11].</p>
<p><b>NextBike</b></p> 		<p>The <b>NextBike</b> app is designed for visitors and residents of Austria. You can rent a bike through it. Using this mode of transportation, workers and tourists would greatly benefit from easier navigation of streets and boulevards. After selecting a bicycle from a station or flexzone, the QR code of the bicycle is scanned or its number is entered. Payment is done electronically and based on the time of use [15].</p>

The applications presented in Table 3 feature simplified logos. Logos, which are easily recognizable and memorable, serve to evoke emotions within users and intentionally impact them with visual messages. In terms of design, the developers adhere to modern requirements for simple color schemes and visually appealing color shades. In terms of typography, including font choice, font size, and layout, the developers apply modern principles and metrics to create a better, intuitive, recognizable, and clutter-free UX/UI design.

## 6 CHARACTERISTICS OF A SUCCESSFUL MOBILE APPLICATION

For the long-term utilization of mobile applications in tourism, it is crucial to establish appropriate criteria that address user needs, current technological trends, reliable suppliers, and support. For smart tourism applications available in the recent past (2012–2017), Dorčić et al. [35] conducted a comprehensive review of over 120 articles describing their functionalities.

A significant indicator that remains in the background for users of travel mobile applications is their security. From our perspective, this indicator is of utmost importance for both educational mobile applications aimed at school children [37] and any mobile application aiming to succeed and prosper by satisfying one of the leading factors: security and privacy.

Garcia and Casas [24] identified quality-of-experience indicators. They considered thirteen quality of experience metrics. Some of the objective indicators, for example, include latency, signal instability, signal strength, bandwidth throughput, power consumption, memory consumption, and CPU consumption. Additionally, a subjective metric such as user opinion is also considered. The authors also describe various tools for analyzing the quality of experience on mobile devices. These tools automatically collect and calculate data, combining both objective and subjective metrics, and present a limited range of approaches. Even with the tools studied, conducting a comprehensive app analysis is still challenging. According to the survey, there is a gap in the development of tools that integrate and combine mobile quality of experience (QoE) metrics [24].

In order for a mobile application for cultural tourism to be successful, it needs to satisfy the following features and functionalities:

- Regular addition of new tourist attractions. For each tourist attraction, it is desirable to provide the following additional information: opening hours, price for admission, public transportation opinions, parking availability nearby restroom facilities, availability of free Wi-Fi, and information about nearby hotels and ATMs. In addition, it is important to consider whether the tourist attraction is accessible for people with disabilities, if pets are allowed, and if photography is permitted on the premises.
- Provide detailed information about the tourist sites through useful, up-to-date, and varied content.
- Regular updates are available on Google Play and the Apple Store.
- Bug fixing.
- User data security and safety.
- Multimedia information.
- Audio guide, notwithstanding that it is associated with additional maintenance and update costs.
- User-friendly interface and user experience.
- Information on possible ways to purchase tickets for transport and tourist sites (as an appendix).
- Users to be able to deliver comments about tourist sites.

- Possibility of online chat between all users of the application.
- Possibility for users to add personal photos about the sites.
- Connection to social networks.
- Ability to link the user account to the pages (profiles) of the visited site.
- Connection to emergency medical services and other health facilities.
- Be adaptable and geared towards supporting people with special needs.
- To combine features with the applications of GPS navigation usable by the disadvantaged.

Mobile applications containing augmented reality are particularly popular today. Tourism, along with other fields such as medicine, education, and economics, also benefits from this technology. In this regard, interesting applications have been implemented for renowned cultural attractions using augmented reality. This technology has demonstrated significant benefits in the field of cultural tourism and is therefore being promoted to users. Hence, mobile applications contribute to the development of a country's tourism sector [38].

Applications that include gamification are considered successful. A growing number of mobile tourism apps are utilizing gamification as a strategy to promote tourist destinations and highlight their unique features. As a result of using these applications, we expect increased visitor levels and promotion of the attractions, allowing disadvantaged individuals who are unable to visit to explore them [36].

Information communication between tourists visiting an attraction is also important. Cultural tourism has been developing over the years and can be considered a form of intelligent tourism. Modern technologies and devices, along with industrial innovations, are contributing to the development of culturally smart tourism. Through these platforms, consumers are facilitated in making travel choices and decisions [34].

Another key challenge in deploying a mobile app is adhering to industry-leading standards. The development of usability standards for various types of technology is further complicated by the absence of a precise definition of usability. There are standards defined by the International Organization for Standardization (ISO), and other international organizations are also working in this direction. Nacheva [42] conducts a review of these standards and their current status, specifically identifying those that define the usability of mobile applications.

In accordance with the aforementioned criteria, the objective is to develop a mobile application for cultural tourism, specifically targeting visitors to Veliko Tarnovo, Bulgaria. The target groups include both tourists and owners of well-known local attractions.

The primary idea of the future mobile application is to be up-to-date and widely used, with included functionalities that satisfy both groups of users—participants in tourism. With the mobile application, visiting the Old Capital could become easier, more enjoyable, and more fulfilling. The mobile app is a convenient and practical assistant that allows tourists to be independent while enjoying and learning more about the history, culture, and beauty of Veliko Tarnovo, the Old Capital of Bulgaria. It also allows attraction owners to present the advantages of their site and offer easy access to potential visitors.

## 7 PROTOTYPE OF MOBILE APP FOR CULTURAL TOURISM

Like many other countries around the world, Bulgaria possesses an incredibly valuable natural and cultural heritage that should be appreciated not only by locals but also by foreign visitors.



This paper presents the *Your VT Guide* mobile application, which has been developed for the purposes of cultural tourism. The application offers an enticing and convenient interface. It is aimed at tourists and visitors to the former capital city of Veliko Tarnovo in Bulgaria, providing them with the chance to familiarize themselves with the renowned historical sites in the city. The information is currently presented in two languages: Bulgarian and English, with plans to add other languages in a future update.

The distinctive features mentioned in the previous section have been observed during the development of the application. The aim of the app is to make it easier and more user-friendly for both visitors and owners of cultural attractions and organizations. Both types of users are given the opportunity to independently manage their profiles, browse the content of other users, and have a direct link to the places.

On the home screen of the application, all available sights are presented in a list. Brief information is visible for each of the sights, including the name, a short description, and a photo. Clicking on the given site opens a screen with complete information about it. At the bottom of the screen is the menu. A menu is displayed depending on the type of user involved.

The app provides two types of menus: one for tourists and one for attraction owners. Each of them allows for different permissions and access to various pages and functions. According to the parameter passed, the navigation determines which menu to display. Users have access to the following screens: ‘Home’, ‘Profile,’ ‘Requests,’ ‘Map,’ and ‘Exit.’

### 7.1 Tourist profile

Tourists who use the app with a user role can manage their profiles, view other users’ content, and have a direct connection to the attractions.

For users, there are two ways to access the app: through email or with a Google account. Users can browse all the attractions and perform the following actions with them: add to favorites, mark as visited, and request a visit, as shown in Figure 4a.

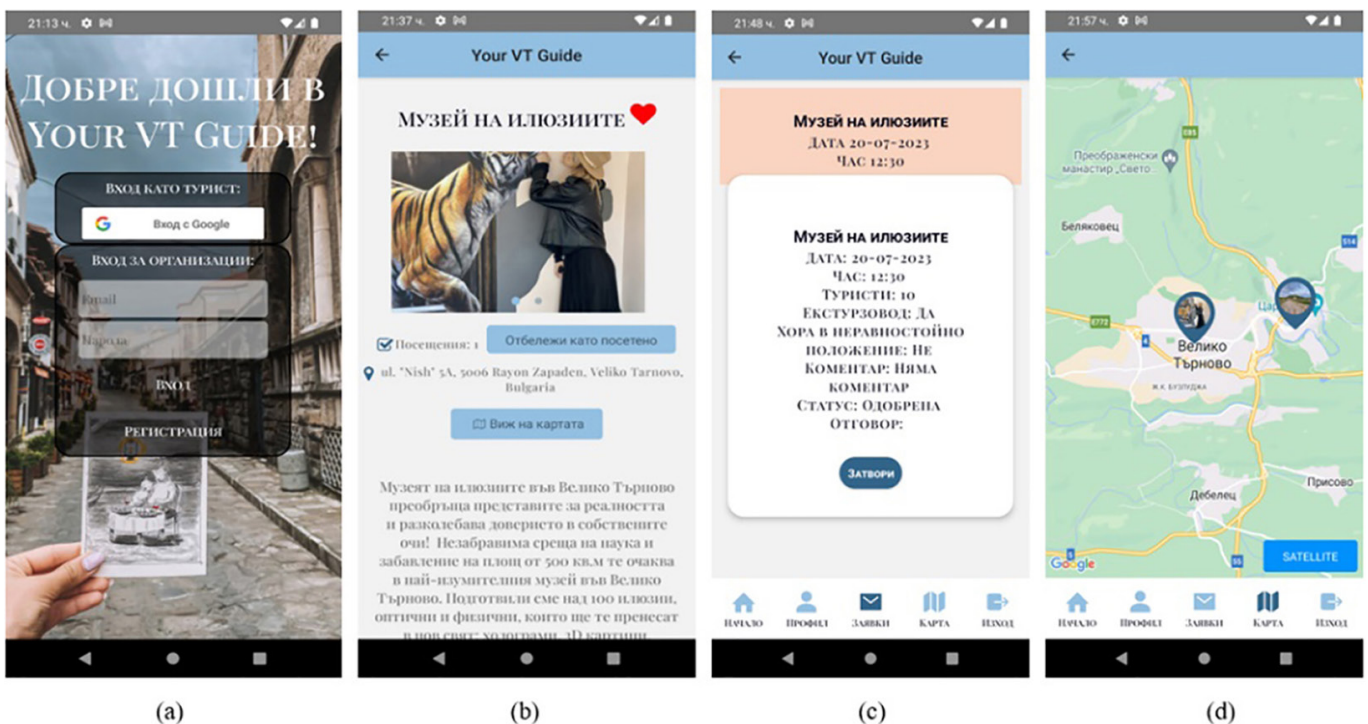


Fig. 4. Design of the application for users’ profile as tourist

### – **Data about the attractions**

The attraction's details screen provides information about a specific target. The name of the attraction is displayed at the top of the screen, and a heart icon is next to it to indicate that the attraction is a favorite for the user, as shown in Figure 4b. Each time this button is pressed, the user can add or remove an attraction repeatedly.

The app includes a useful feature related to an automatic photo slider. Clicking on any of the images opens a full-screen slideshow, and each photo can be zoomed in or out. Below the photos is a visitor counter, which is integrated within the app and indicates the number of users who have marked the site as visited. The button can only be pressed once, and then it disappears. Tourists are not allowed to undo this action. Several tabs have also been added to the application to provide information on the entity's opening hours and prices. A list of additional benefits is provided to address several of the most important questions that may arise when planning a visit, which are presented in Figure 4c.

### – **Create a request to visit a location**

A request to visit a specific attraction is made by filling out a form. It is mandatory to indicate the date and time of the visit. It is necessary to specify the number of people who will be attending and whether any of them have disabilities. The user can also add a comment containing a question or specific information. Once the request is sent, the tourist can track the status and, if the organization has responded, see Figure 5a.

### – **Map of Veliko Tarnovo Municipality**

The screen displays a map with markers indicating all the attractions, each accompanied by a picture. When multiple attractions are gathered, clustering is performed, and a single marker is displayed indicating the number of sights. On clicking a marker, the user is taken to the details of the attraction. The map has two views: standard and satellite. Switching between the views is done by clicking a button located in the bottom corner.

### – **Tourist attraction map**

The map of a tourist attraction can be accessed from the record details. A map will open on a new screen, indicating only the given facility.

There is also a button that opens the address in Google Maps and creates an itinerary using the user's location. In this way, tourists will be able to navigate easily and quickly to their chosen locations from any point (see Figure 4d).

## 7.2 Owners of a tourist attraction

Users with an ownership role can utilize the "login with email and password" feature in the application.

### – **Tourist attraction: owner registration**

If the organization does not have a profile, it can create one by using a form. Please refer to Figure 6a. It is necessary to fill in all three fields: name, email, and password. The only requirement for name validation is that the field is not empty. The email must be structured correctly because, when the request is sent, Firebase monitors its authenticity, but it does not necessarily have to exist. The password must also be at least six characters; otherwise, an error message is returned. After clicking the "register" button, a record is created.

### – **Attraction owner: home screen**

The home screen displays a list of all attractions, similar to what tourists would see. At the bottom of the page, there is the owner's menu. Organizations have access to the following screens: "Home," "My Profile," "Requests," "Map," and "Exit." These screens are similar to the user menu, but they lead to different pages.

### – **My profile**

The page provides organizations with easy access to their own information. The screen starts with a picture that is the same for everyone. The organization's name and email are displayed after a request to the database. Below them is a section featuring all the attractions of the specified profile. There is brief information about the attractions, a photo, and a button that leads to the editing screen, as shown in Figure 6b. The page ends with a button that allows the creation of a new attraction.

```

const createRequest = async (request) => {
  console.log(request);
  const newId = uuid.v4();
  firestore()
    .collection('requests')
    .doc(newId)
    .set({
      date: request.date,
      hour: request.hour,
      tourists: request.tourists,
      disablePeople: request.disablePeople,
      guide: request.guide,
      orgId: request.orgId,
      userId: request.userId,
      objName: request.objName,
      comment: request.comment,
      status: '',
      respond: '',
      id: newId,
    })
    .then(() => {
      console.log('Request added!');
    });
  firestore()
    .collection('organizations')
    .doc(request.orgId)
    .update({
      requests: firestore.FieldValue.arrayUnion(newId),
    });
  firestore()
    .collection('users')
    .doc(request.userId)
    .update({
      requests: firestore.FieldValue.arrayUnion(newId),
    });
};

```

(a)

```

const createObject = async (orgId, object) => {
  const location = await getCoordinatesByLocationString(object.address);
  const newId = uuid.v4();
  console.log(newId);
  firestore()
    .collection('objects')
    .doc(newId)
    .set({
      name: object.name,
      address: object.address,
      location: {
        lat: location.lat,
        lon: location.lng
      },
      description: object.description,
      photos: object.photos,
      openHours: object.openHours,
      prices: object.prices,
      visits: 0,
      rating: object.rating,
      pronos: object.pronos,
      orgId: orgId,
      id: newId,
    })
    .then(() => {
      console.log('Object added!');
    });
  firestore()
    .collection('organizations')
    .doc(orgId)
    .update({
      objects: firestore.FieldValue.arrayUnion(newId),
    });
};

```

(b)

**Fig. 5.** Facilities visit request from tourist and request to the database for attraction creation

### – **Create a tourists attraction object – steps**

Attraction creation occurs by filling out a form that is sent to the database, and a new record is added there (see Figure 5b).

For the query to pass successfully, all fields must be filled in. The information that needs to be filled in includes the name of the facility, a description, the exact address, up to 15 images, opening hours and breaks, prices, and whether the facility offers additional amenities. When an address is added, a new screen opens, allowing the user to select the location by swiping on the map or using the search engine (see Figure 6c).

Organizations can also view the details of an attraction, both their own and others'. If the attraction is owned by the listed profile, then they have the right to view the details and edit the information by clicking on a button at the bottom of the page (see Figure 6d). In the other case, users are only allowed to view the page without being able to perform any actions.

Organizations are not allowed to add attractions to their favorites or mark them as visited, nor are they able to make requests.

– **Editing a tourist attraction**

The editing screen is similar to the screen for creating attractions. However, in this case, when navigating to the page, the previously created one is passed as a parameter, and the fields are filled with the data. The user has the option to modify all the attraction data. When the ‘Create’ button is clicked, the query is processed by the database, which updates the required information in the record. To enable owners of tourist sites to publish multimedia files, including audio and video, in order to assist disadvantaged individuals.

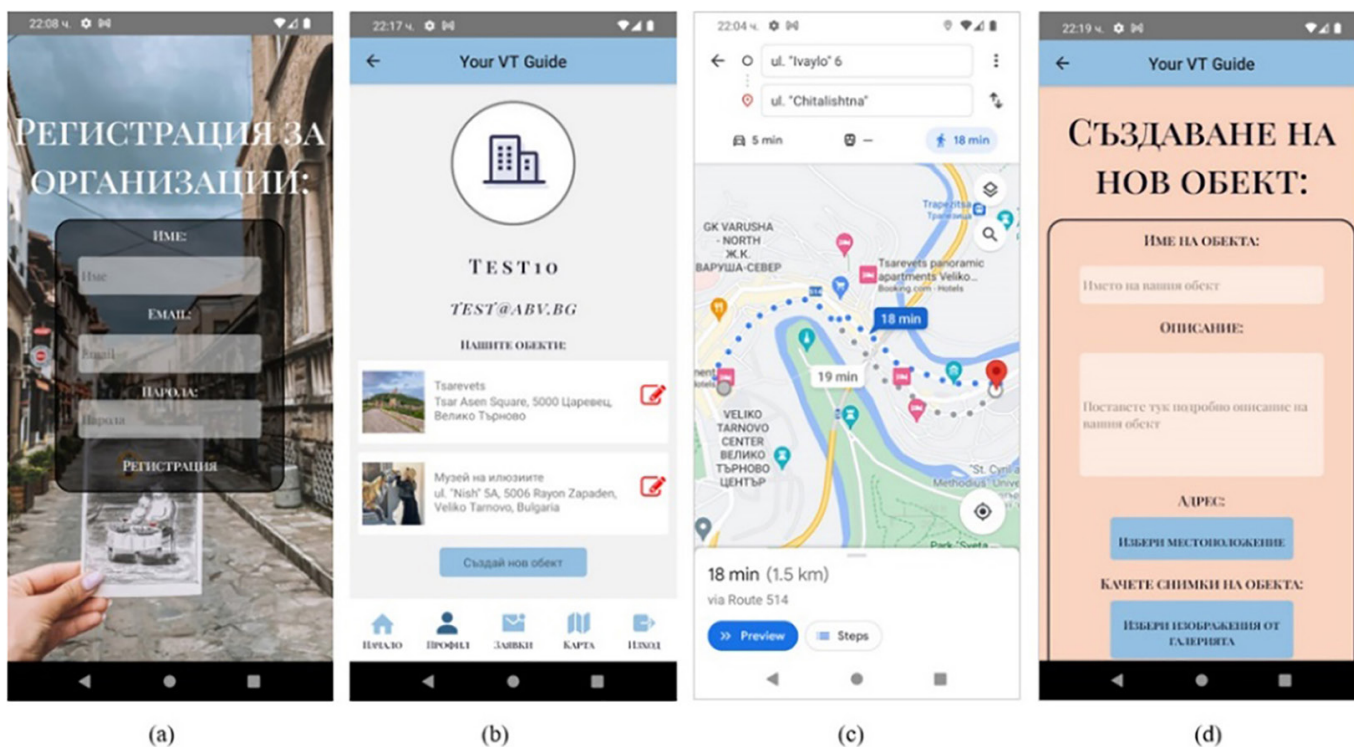


Fig. 6. Capabilities of the app at the service of tourist attraction owners

**7.3 Testing the app ‘Your VT Guide’ and future app improvements**

The test results of the developed app, *Your VT Guide*, are presented and summarized below. Testers between the ages of 22 and 32 participated in the app testing process for a period of 2 weeks. The application considers both roles: attraction owner and tourist. Testing was done in two phases: during development and after project completion. Minor inconsistencies were addressed during the process, and changes were made to enhance the user experience. On all tested devices, the app works without any problems. There are also no design inconsistencies across different resolutions and screen sizes. On phones with older versions of Android and less RAM, no bugs or slowdowns were noticed.

As a result of the testing, the project has several advantages that can be highlighted, including: an intuitive interface, a user-friendly and clean design, low memory usage on devices, text-to-speech functionality for blind users, and the ability to make requests and receive responses from organizations. As disadvantages of the testing process, the following can be noted: the inability to purchase tickets for attractions through the application, the lack of access via social networks for tourists,

the application being developed solely for Android, and the app not being available on Google Play.

Future versions of *Your VT Guide* will focus on adding new features and enhancing existing ones. The findings from testing will also be taken into account, with user feedback being of utmost importance. *Future enhancements* include improving security, enhancing the user interface (UI) and user experience (UX), and adding new features such as deleting attractions, removing a profile, and editing a profile. Additionally, we plan to incorporate login options with Facebook or other social networks, integrate payment systems, and develop an iOS version.

## 8 DISCUSSION

One of the key challenges for the research has been identifying mobile apps for cultural tourism that can be explored in detail. The main objective is to cover both local and global destinations, including European capitals that are rich in significant cultural and historical sites. The decision to only use free versions, due to their affordability and popularity, presents another obstacle.

The main achievement in overcoming the mentioned challenges is the synthesis and generalization of a system of criteria for classifying a mobile application as economically sustainable and successful in the long term. The proposed system is the initial effort to provide a comprehensive description of the criteria for classifying a mobile application as effective, utilized, and preferred, with the potential for ongoing updates.

The results of the current study show that the primary reason for using a mobile application is the interactivity and personalization opportunities it offers. Furthermore, similar to other studies, these results confirm that only about 10 percent of the applications studied meet user interests based on functionalities such as route generators, geolocation services, or real-time recommendations [41]. There is also evidence to support the proposition that the success of mobile applications in smart tourism is dependent on user requirements and the quality of their experience [24]. Interactive multimedia elements, such as favorite attractions, author's photos, panoramic views, or personalized games, are the key factors in this indicator [48]. A successful and efficient mobile application is also directly dependent on the latest trends in technological innovation, the selection of a trustworthy supplier, and timely support [35].

Smart tourism, aimed at promoting business growth, is not only preferred by tourists worldwide [39], but also by the owners of tourist and cultural attractions. These owners are the primary target group for the prototype of the mobile application for Veliko Tarnovo, as presented in Section 7. Contemporary mobile applications for cultural tourism not only guide and support their users but also serve as a tool for collecting tourism-related information from the users themselves. In addition to emphasizing the mobile app as a strategic interaction point, with the guiding idea of being a preferred information portal for users, the role of the app in purchasing tourism packages or in travel planning is also emphasized [28]. However, this aspect is beyond the scope of the present study.

Another key point in the publication is the authors' development of a prototype mobile application that meets the specified criteria. The application is aimed not only at tourists but also at the owners of cultural and historical attractions. It is currently undergoing upgrades, publication, and promotion. Additional applications have been analyzed to assist tourists in utilizing mobile applications for cultural tourism. Auxiliary applications are summarized in Table 3 and enrich the user experience by complementing the functionality of a tourism mobile application, satisfying a set of criteria.

Although the present study is based on a thorough comparative analysis using a set of criteria, it is not without limitations. These limitations arise from the need to confirm the conclusions by applying statistically proven results. First, the applications were not randomly selected. The focus was on popular applications from over a decade ago, specifically free applications that were analyzed by the author's team in a publication from 2013 [45]. On the other hand, the finding that almost none of them are accessible and will not exist in 2023 motivates the need to select currently relevant mobile applications in the field of cultural tourism. The intent is to cover not only local but also global free-to-download mobile applications. They are selected based on their popularity on Google Play and the Apple Store. The framework, although important, is influenced by the presence of numerous mobile applications that claim to be leaders in this field. Even the paid ones often do not last more than three years.

## 9 CONCLUSION

Cultural tourism has been and will continue to be satisfying for tourists and their spirit of exploration. Cultural tourism provides people with the opportunity to learn not only about the historical and cultural heritage of a place but also about the traditions and customs of different nations. The information available at historical sites is important. In the past, people primarily relied on guidebooks, geographical maps, and tour guides for their tours. Today, people prefer using the internet and their mobile devices. To be more informed, tourists need apps that provide information about cultural sites and landmarks, historical and ethnographic museums, as well as various interesting events.

Using mobile devices anywhere and without any time constraints, users have instant access to the information they desire. In today's digital age, mobile apps and devices have become an indispensable part of many people's daily lives. Mobile apps play a vital role in how people interact with technology, from social networking and entertainment to productivity and business. Cultural and heritage tourism will always be preferred. It can be summarized that the mobile applications developed for this type of tourism aim to enhance the user experience by integrating various technologies. Especially for places and heritage sites with limited access, great historical value, and diverse information to share.

The paper presents and analyzes the potential of contemporary mobile applications for cultural tourism. The advantages of their applications over those used ten years ago are pointed out. The research question is: "*What features are necessary for a mobile application to be successful in the long run?*" The main contribution of this paper is to summarize the specific criteria that modern mobile applications need to meet in order to satisfy increased user expectations and be successful, preferred, and sustainable over time. The proposed system of criteria is comprehensive and aligned with the trends of the digital society. Satisfying the listed characteristics when developing a mobile application can lead to quality assurance, financial sustainability, and the promotion of tourist attractions, ultimately guaranteeing a higher quality of tourist services.

As a topic for future work, the team plans to improve the proposed prototype in the following areas: enhancing security, adding new functionalities for interactive user interaction, incorporating additional payment systems, and promoting the product on social networks. The next big challenge is to develop an iOS version.

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