

Article

Evaluating How ‘Smart’ Braşov, Romania Can Be Virtually via a Mobile Application for Cultural Tourism

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Abstract: Global urbanization brings the urge to identify the most intelligent methods to cope with the challenges arising in the modern society. Sustainable and smart cities are the new target for urban development; their representatives are being forced to identify and develop new strategies to increase their city’s performance and ensure that it endures over time. Information and Communication Technology (ICT) contributes to this purpose. Braşov is one of the cities in Romania for which the process of modernization started years ago, and it is currently developing as a smart city. This paper focuses on the development of the city in terms of cultural tourism solutions by presenting a case study on the use of virtual reality with a mobile application and its evaluation on cultural heritage sites. The original contribution of the paper is to describe and analyze the quality of the mobile application by using a proposed analysis grid to identify the main elements of this app. The main findings suggest that the application may bring authenticity of experience through the lens of heritage preservation for further user engagement and participation in real-time, while suggestions are made for future enhancement. Implications are discussed for a) destination managers, b) for developers to improve the general quality of the mobile application in terms of design and features and to implement changes in the near future, and c) for visitors who engage in real-time and co-create experiences.

Keywords: smart city; virtual reality; mobile application; cultural tourism; ICT; real-time; co-creation; Braşov; Corona; Kronstadt

1. Introduction

In recent years, urbanization has seen remarkable growth throughout the world. Nowadays, cities consume between 60% and 80% of the world energy, thus being the main responsible factor for global warming as a result of the emission of greenhouse gases [1]. Because of this, cities need to identify new scenarios to adopt in order to meet the major challenges they face, be they social, economic, political, or environment-related challenges or the like [2]. In order to cope with the urbanization phenomenon, smart cities emerged. The main engine of smart cities is that they try to identify the “balance between social development and economic growth” [2] (p. 1414). This balance is based on the city services and the new technologies that improve people’s lives in that city. Tourism is nowadays an important element of economic growth, and these elements are also fundamental for tourism activities; “as the tourism sector is included in the service area, cities that use smart tourism are, by definition, considered a smart tourism city” [3]. In addition, as Garau observes, “the technologizing of the tourism sector and the spread in recent years of the smart city model appear to be two interrelated processes, which work together in shaping the profile of what we call smart tourism” [4] (p. 74).

One key element that connects the development of smart cities into smart tourism destinations is the use and proliferation of specific user-friendly Information and Communication Technology (ICT) solutions using virtual and mobile applications that may enhance visitors' experiences [5]. Those organizations that employ and reinforce the use of ICT can be competitive [6] and empower value creation [7] by bringing their customers and potential users closer to them.

Users' interaction is facilitated with the implementation of social media and technology tools that may offer interaction in real-time and contribute to the creation of an outstanding and memorable experience [8]. The active participation and engagement of the user is a prerequisite that brings him/her to the front stage; see, for example, the creation of alternative stories with the implementation of virtual reality [9]. More opportunities are offered that can be better implemented. There is further need for research on the subject, and urgent solutions are needed even in pandemic times [10] to avoid congestion and take into consideration the effects of travel restrictions [11].

This paper aims to add new perspectives on the ongoing discussion on the topic by providing details of the "Kronstadt—Virtual Reality" Project that sets Braşov City, Romania as a smart city and tourism destination. It describes and analyzes the quality of the "Virtual Braşov" mobile application to identify the main elements of the app by using a proposed analysis grid and to identify the ways its design and features can be improved and implemented in the near future. All stakeholders involved, such as destination management organizations, visitors, cultural sites, and designers, can benefit from a productive dynamic interaction. The paper also examines how emerging and cutting-edge technologies can contribute to the development of a city in terms of cultural tourism solutions where consumers may interact and engage with these technologies. The "emergence of smart phones that provide powerful and ubiquitous platforms for supporting mobile Augmented Reality" [12] has allowed public and private organizations to develop specific virtual reality (VR) and augmented reality (AR) applications available to everyone. Regarding tourist experience, these technologies "have amply demonstrated how simple cultural fruition is transformed into a dynamic and engaging experience" [4]. However, as they improve tourist experience, the "authenticity of such and other technology-driven experiences from destinations, businesses, and tourists' perspective remain generally unknown" [13]. This study aims to analyze the authenticity of the experience brought by the application through the lens of heritage preservation.

The next section presents the literature review, in which research identifies the gap and considers that, for the development of smart tourism destinations, technology applications, innovative technology, and customer engagement must perform together, and also presents their integration into the initiatives that the management takes regarding the development of a city. Moving from there, Section 3 discusses methodological issues for the overall objective of the project, which was the re-integration of historical monuments into the community space, their promotion, and the development of an application for promoting material heritage. Sections 4 and 5 present the application while also providing a discussion for the facilitation of personalized experiences for further user engagement and participation in real time. This can be implemented in other settings, as is presented in the conclusions in Section 6.

2. Literature Review

2.1. Associated Factors of the Smart City Concept and Smart Tourism Destinations

The European Union has officially recognized the smart city as one of the main development pathways [14]. Smart cities and multinational corporations in the information technology sector have begun to focus their attention on this concept [5,15,16].

Scientific papers attempt to define the smart city concept: Definitions vary according to context, and there is not a consensual definition. Albino et al. [1] account for 23 distinct definitions of the smart city concept. This variety is explained mainly by the fact that a smart city, through the diversity of the domains it applies to, can be considered a subject for "multidisciplinary studies, constantly shaped by

advancements in technology and urban development” [17] (p. 95). However, there is one common aspect to all the accepted meanings: A smart city is a data-driven city [18].

The variety of definitions that have been formulated around the smart city concept outline two directions regarding the areas in which the city operates: (a) A meaning related to technologies and means of communication and information, and (b) a meaning related to people. There are many cities that qualify as “smart” although they have no reference standard, since there are no universal definitions for this concept [19]. Giffinger et al. [20] believe that a smart city can be defined as a city that performs highly in terms of economy, population, leadership, mobility, environment, and living standards, and that is built on a strong base, in combination with the independent activities of its citizens: “A Smart City is furthermore used to discuss the use of modern technology in everyday urban life. This includes not only ICT, but also, and especially, modern transport technologies” [20] (p. 11).

Giffinger et al. [20] propose the Smart City Model, a classification according to which smart cities can be perceived and developed based on six main characteristics: Smart economy, smart people, smart governance, smart mobility, smart environment, and smart living. This model was developed as an assessment tool to be used for medium-sized European cities, in the fields of economy, population, leadership, mobility, environment, and living standards. With this model, a city can check its current state and identify specific niches where development is needed in order for it to be considered a smart city. To Harrison et al. [21], a smart city is a city that has the capacity to connect the physical, technological, social, and business infrastructure in order to increase the collective intelligence of the city. Thus, a smart city is an instrumented, interconnected city that uses devices such as computers, smartphones, the internet, social networks, and various other systems of this kind to allow data collection. Toppeta [22] believes smart cities are seen as such because they have efficiently combined new information and communication technologies with urban planning methods to identify new, intelligent, and effective solutions, thereby contributing to increased sustainability and high living standards for their inhabitants.

The three defining components of smart cities can be divided into three categories, namely technology, people, and institutions. A city can only be considered “smart” when investments in specific development areas help with increasing the quality of life [23]. Leadership, innovation, and social capital supported by human capital are the key components of smartness [24].

A smart city can be considered a city where investments in social and human capital as well as traditional and modern infrastructure support both economic growth and quality of life, with the appropriate management of natural resources through an active leadership of the city. In order to determine the smart city status, we must consider the role of human capital, education, environment, mobility, and social and relational capital in urban development, as well as the role of new information and communication technologies (ICTs) [25].

Hollands [26] believes that given the context of a global race to ensure urban competitiveness, the smart city concept can be considered an urban labeling phenomenon. Creating a city that has advanced technology and a “clean, green, and intelligent city image is in fact useful to attract investments, leading sector professional workers, and tourists” [27] (p. 886). Technology can provide the competitive advantage to a whole ecosystem where humans have a central role for highly individualized services [6,8].

On one hand, a smart city can be considered as a tool used by local entrepreneurial leadership for integration into the investment network, while on the other hand, it can be seen as new space for multinational corporations to grow.

Considering not only technology and knowledge, but humans’ participation as well, the smart city can take into consideration personal preferences that are part of a network, namely: “Investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance” [25] (p. 70).

The smart city is a city model formed as a result of the interactions between different actors, presenting a multitude of different characteristics. A smart city is the result of interactions between citizens, the public, and private actors. Moreover, this is a multidimensional concept with various scopes [23].

The problems that may arise while building the smart city concept inevitably lead us to a point of common interest for all branches of development: Digitization. A prerequisite for this phenomenon is the connectivity that requires network extensions (cable or wireless) and the widespread use of Web-based devices: PCs, portable computers or laptops, tablets, smartphones, and so on. The speed with which such networks are deployed and the number of devices used are increasing worldwide from day to day. The digital growth was tremendous in 2019; it was unique in every sense, through tools, social media, the internet, and mobile applications [28].

Thus, the idea of the digital city emerges, a city that uses ICTs with the aim of providing citizens with high-quality services and creating a virtual community to support the development and participation of democracy [29].

ICT is the very essence of the smart city idea, even if this concept is not limited to the functions of new technologies. Moreover, it is very important to emphasize that the smart city concept is quite broad, integrating both ecological and social dimensions of the city [30]. The use of ICT for various smart projects can be analyzed at the organizational level. This way, the concerned technologies are used for the implementation of organizational, political, and managerial innovations. These technologies are a real driver of change in the social environment. Regardless of how things are interpreted, it is clear that ICT should be considered as a means used to achieve a certain objective, and in no way should it be considered as an end in itself [23]. Technology can facilitate value creation, but the approach needs to be human centric [8]. The interaction of humans and technology is the core element in highly competitive environments. Studies [31,32] use concepts such as intelligent city, information city, connected city, etc. These are all related, and we can identify some common characteristics upon careful observation. These include, first of all, the digital infrastructure for data collection, information and communication, and knowledge sharing. Another common element of these concepts is the connectivity of people who support the facilitation of communication and the strengthening of democracy. Another aspect is the virtualization of the city: A digital city is not only a city with digital infrastructure, but also a virtual representation of people, institutions, and events existing in that city, creating a secondary life parallel to the real one [29].

The spread of the two key concepts, smart city and digital city, allowed the spread of technological advances. Moreover, smart cities developed more and more in countries where economic and scientific development is considerable. The size of a city plays an important role in defining it as a smart city—the larger the city, the more environmental impact it needs to reduce through this program. However, if the city is large, there are numerous advantages related to data, knowledge, and services [33]. The smart city concept is spreading forcefully and rapidly on all continents, and specialists believe it can be considered a key strategy to improve the quality of social life in the urban environment [29].

The smart city concept is now linked to other tourist-related aspects, such as “city branding”, “tourism destinations”, and “country brand image” [34,35], and is more and more related to virtual and mobile applications as tools that are needed in order to implement smartness.

The abovementioned components provide a framework for the development of smart tourism destinations that not only employ ICT, but bring customer solutions to the service logic domain [24]. Technology applications are enablers that contribute to and facilitate a city’s becoming smart and, furthermore, a smart destination [36]. Tourists, destination managers, cultural managers, and city residents can employ various computing technologies that enable the machines to interact with humans [18]. In that way, instant value can be created, as can highly personalized services [8]. Mehraliyev et al. [13] identified the thematic research trends and the most and least researched areas of smart tourism research found in 86 relevant articles, indexed in the Web of Science, Scopus, and EBSCOhost databases. According to them, the five most predominant themes are: “Effects of

smart tourism on consumers”, “development of applications or technologies”, “consumers’ adoption of smart tourism”, “conceptual development of smart tourism”, and “smart tourism planning and management” (p. 80).

Buhalis and Amaranggana [5] propose a new model based on three dimensions of smart tourism that may help the overall tourism experience, defined by “Smart City” (through Smart Mobility, Environment, People, Living, Government, and Economy), “Smart Tourism Destination” (through Amenities, Accessibility, Attractions, Available Packages, and Ancillary Services), and the outcome of “Tourism Experience Enhanced”. Using almost the same attributes (Accommodation, Amenity, Attraction, Access, and Ancillary Services) on studying how the smart tourism satisfaction and service satisfaction affect the overall satisfaction with smart tourism cities in three South Korean cities, Um and Chung [3] found that satisfaction with smart tourism had “a positive significant influence on service satisfaction and overall satisfaction of visiting a smart tourism city” in all three cities. The future perspective of blending the concepts of smart cities, applying the ICT technologies in the development of eTourism and smart tourism strategies, is foreseen by Buhalis [18] as the new ambient intelligence (AmI) tourism. The last concerning idea related to the smart city concept allows for the definition of open data [37] as a key that enables citizens to feel more integrated in the initiatives that the management takes regarding the development of the city, as the cultural touristic projects or different initiatives use internet platforms to facilitate access to all private or public data in order to provide some transparency, but also to create new business opportunities [38].

Based on the abovementioned, the context in which the Smart Tourism Destinations are defined is closely associated with technology, individuals, and different institutions; then, perceiving this as the “hardware” of the smart city, the next section discusses the issue of virtual and mobile applications—metaphorically speaking, the “software”.

2.2. Virtual and Mobile Applications

Discussions about the smart characteristics of cities that use different mobile applications or other smart solutions have been employed, such as on-line problem-solving tools, intelligent shopping, services ordered electronically, telemedicine monitoring, virtual exhibitions or lectures, smart grid applications, on-line information about consumption, or cameras around town [39].

Jasrotia and Gangotia [40] (p. 48) discuss the necessity “to be smart in order to survive in the tourism industry. Smartness is required at each step, from generation of information to the communication of the information.” Buhalis and Amaranggana [5,41] identified the models or the types of tourism applications in Smart Tourism Destinations: VR and AR that help to experience digital environments of tourism sites; vehicle tracking and monitoring systems for getting real-time information and locations of vehicles; energy-efficient green hotels for reducing consumption of electricity and pollution; applications for showing available tour packages, translation of languages, and providing guidance to the tourists on the visit; access to information about nearby attractions to visit and visiting hours through mobile devices; generating direct and quick feedback from tourists through ICTs regarding service quality.

Regarding this conceptualization, it was proved that VR is enhancing the connection between new technologies and empathy, envisioning how sensors could help us understand users’ emotions; VR enriches users’ experience of the world [42]. Countries and sectors, but also research disciplines, can benefit from the provision of excellence in services where a customer service approach is initiated with the implementation of technology [43]. Virtual humans, for example, which are software-generated human-like animated artificial characters [44], can provide virtual experiences to users. This can be the case in different fields. Sylaiou et al. [45] argue on the role of virtual experiences with technological toolsets that bring forth the dynamics of interaction between real humans and virtual reality in museums. Applications of virtual reality for educational purposes can also foster the accessibility of culture and provide interaction with heritage [46].

Placed somewhere in the middle of the so-called “real world” and VR, AR has been acknowledged as one of the innovations that could engage users when exploring, for example, heritage sites [47] or historical events [42]. Virtual experiences that employ technological toolsets allow for interaction to take place between users and heritage [45]. Chung et al. [48] observe that while AR technology provides better experiences while preserving the integrity of the sites, its aesthetic and the “satisfaction of the users with the application at cultural heritage sites affect attitudes toward a destination, which, in turn, has an effect on the intention to revisit cultural heritage sites” (p. 11).

As Shehade and Stylianou-Lambert [49] (p. 4) argue: “One of the biggest challenges faced by VR/AR applications is the authenticity of the offered experience”, as there must be a connection between the immersive experience and the heritage preservation. In addition, Garau [4] presents three solutions for the cultural fruition provided by the technological developments: “Virtual reconstruction” according to the historical and cultural context, “the geolocation of the user”, and “the presence of tags, cameras, and sensors for guidance” (p. 71).

Bec et al. [50] propose a four-stage conceptual model to guide applications of AR and VR, which presents how these immersive technologies can be used for heritage preservation within the tourism experience. Thus, the main concept of heritage presentation can be categorized in four approaches: “Historical Facts”, “Contested Heritage”, “Integrated Historical Facts and Contested Heritage”, and “Alternate Scenarios”. These four approaches are detailed by Bec et al. [50] as follows:

- The “Known Facts” approach draws on heritage information that has been substantiated or validated and can be used in the tourism experience to present near-accurate accounts of history; for example, virtual reconstructions of artefacts and cities that visitors can use to obtain information or virtually explore.
- The “Contested Heritage” approach utilizes the unverified stories of local heritage to present a subjective or imaginative interpretation. AR and VR can use this approach to communicate and present cultural stories, myths, or legends that may lack scientific validation.
- The “Combination of Known Facts and Contested Heritage” approach draws on both substantiated and unsubstantiated information to present actual and personalized interpretations or versions of history. For example, virtual recreations of significant events can be developed according to the known facts while incorporating personalized stories or anecdotes of the event.
- The “Alternate Scenarios” approach can draw on the known facts and contested heritage to present alternate realities that may have occurred if certain events in history had resulted in different outcomes.

In evaluating a new application, it must be taken into account that it must respond to or meet the needs of the target group and, from the quality point of view, that it will be appropriate for the base criteria that enhance the excellent functioning of the application. By studying the types of mobile applications and their quality [51], the authors proposed a guide that establishes seven important characteristics that determine the quality of mobile applications: (1) The generality of the application is represented by the size of the target group for which the mobile app is intended; (2) reliability is the feature that highlights its tolerance for errors and its continued operation without affecting the user’s activity; (3) the correctness aims to highlight the correct results in the app after different database inputs; (4) the user-friendly character highlights that the form and content of the app can be easily understood and used by the user; (5) the continuity is characterized by the elements known by the user and taken from other apps to make it easier for people to use that application; (6) portability is the feature by which applications offer the possibility to run in an appropriate way on any type of device and export data from one device to another; (7) security is the ability to conserve all resources according to the parameters defined by the developer and the user [51].

Mobile applications are also vital when discussing about smart cities, urban development, and smart tourism destinations, as they are “software applications that are specifically designed to be used on the small computing devices or wireless computing devices rather than laptops or

desktops” [52] (p. 36), and are on the app market, which is one of the most dynamic segments of the software industry [53].

This is the context in which the Municipality of Braşov and the Braşov Metropolitan Agency (AMB) developed the “Kronstadt—Virtual Reality” Project for the Virtual Presentation of Heritage, which is the subject of the following discussion.

3. Materials and Methods

3.1. Research Settings—Braşov City Facts and the Romanian Internet Access Analytics

The destination under study—Braşov City of Romania, on the grounds of Braşov County—was the second Romanian destination for foreign tourists in 2017 [54], and “although it is placed on the no. 1 Romanian tourist axis, Braşov is, still, only perceived and promoted as a winter sports center and the historic city” [55] (p. 5), as an important number of foreign tourists were officially registered [56,57]. Four hundred objects are on the “List of Historical Monuments of Romania”, with the Middle Ages, the Renaissance, the Baroque, Classicism, and the modern period leaving their marks on the city [58].

The future vision for Braşov is to be defined as a “compact city”—the polycentric development support of the cultural and creative sectors offers to increase the quality of life and to combat social exclusion, a “mobile city”—the optimization of urban mobility, a “touristic city”—for the development of the cultural and creative industries as a pillar of sustainable development, a “protective city”—improving the quality of healthcare, education, and social services, an “innovative city”—includes, as of now, the cultural and creative industries, and as a “cultural city”—potentiating the capacity of the cultural and creative sectors to contribute to and to effectively support the socio-economic development of the city of Braşov and, at the same time, to provide residents of the city and of the metropolitan area the satisfaction of their cultural needs and aspirations by generating the strengthening of the sense of belonging and of identity and increasing their participation in the cultural life that promotes diversity in the European context [55].

According to the Internet World Statistics site [59], at the end of 2017, out of a total of over 19.5 million inhabitants of Romania, 14.3 million were internet users. Following a study conducted in 2015 [60], using the Computer-Assisted Web Interviewing (CAWI) method, with relevant sampling by age segment at the population level and with 1040 responses, which came mainly from respondents from the urban area between the ages of 18 and 55+, the results showed that over 87% of Romanians have a smartphone, 58% have a tablet, and 75% of them they access the Internet daily or almost daily through these devices. Young people between the ages of 18 and 25 use more than 10 applications on their personal mobile device. Thus, we expect that residents can have a good use of mobile applications.

3.2. Case Studies: “Kronstadt—Virtual Reality” Project and “Virtual Braşov” Application

At the EU level, there are a number of projects that support and finance smart city initiatives. The largest projects of this kind based on size, budget, number of members, and geographical area are the “European Innovation Partnership on Smart Cities and Communities” (EIP-SCC) [14] and the “Smart Cities Project” [61]. Braşov City received local and European Commission support to become a smart city with the idea to introduce integrated, innovative, and efficient technologies for the city. Research conducted in Braşov in 2015 indicated that general leisure activities are much more present in Braşov citizens’ life than those specific to cultural consumption [62].

The decrease in public participation in activities related to performing arts can be explained by the fact that, during times of economic difficulties, citizens tried to organize their expenses according to priorities, and the preferred carrying out leisure activities with their friends instead of going to see various performances. The same consumer study shows that, regarding the types of activities for which the population in the metropolitan area of Braşov would like public money to be directed, the highest percentages were registered for activities aimed at protecting and enhancing the cultural heritage. Thus, 73% of respondents claimed that money should be spent on educational programs

for students on the protection of the built heritage. In addition, most of the population in Braşov perceives the impact of artistic activities as having positive effects at the individual level (the personal development and cultural education of individuals).

The data collected and the above results were decisive for local government authorities in promoting the material heritage, and an augmented reality application was developed. The general project, entitled “Kronstadt—Virtual Reality” [63,64], aimed at enhancing the value of the material and cultural heritage through innovative promotional solutions. It also aimed at the improvement of the public’s accessibility to information and historical monuments, as well as heritage education to stimulate artistic creativity. Accessibility to culture with applications of virtual reality for educational purposes [9] can bring active participation and engagement of the user [46].

The overall objective of the project was the re-integration of historical monuments into the community space and their promotion through unconventional methods. Additionally, an application for promoting material heritage was developed: “Virtual Braşov”, which uses Google’s Arcore technology for augmented reality and is available for free on the Play Store [65]. The application can be used on smartphones that support this technology. For the promotion of historical monuments and sites in Braşov, six representative areas of the Historical Center (Council Square, Modarom, Poarta Schei, Livada Postei, the Rectorate of the Transilvania University of Braşov, and the Aro Palace Hotel) were selected, as the spatial patterns of tourist activity in Braşov were discussed and proved by using geotagged photos, which may reflect “the way tourists perceive the host culture and influence destination images” [66] (p. 46), or collected from Flickr analysis [54,58], which provides geo-referencing for location landmarks; they all have a section in the Augmented Reality (AR) application menu (see Figure 1).

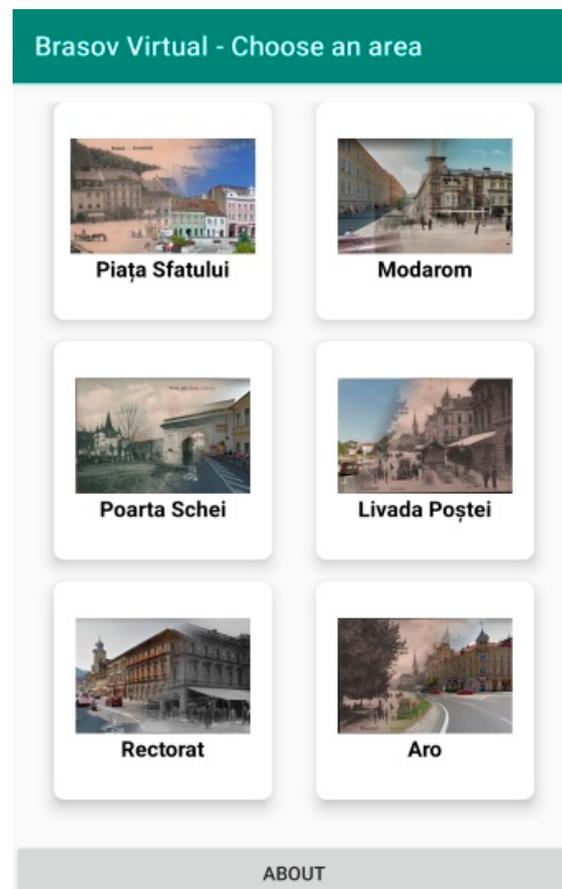


Figure 1. Details from the “Virtual Braşov” application menu.

Thus, using a camera-equipped device (phone, tablet, digital camera), one can change what is being filmed in real time. The smart application runs algorithms that identify areas with representative buildings in Braşov (in the historical area) and displays an image that has been added to buildings from another historical period on the screen of the device, thus creating a combination of the real world and the virtual one, as in Figure 2.

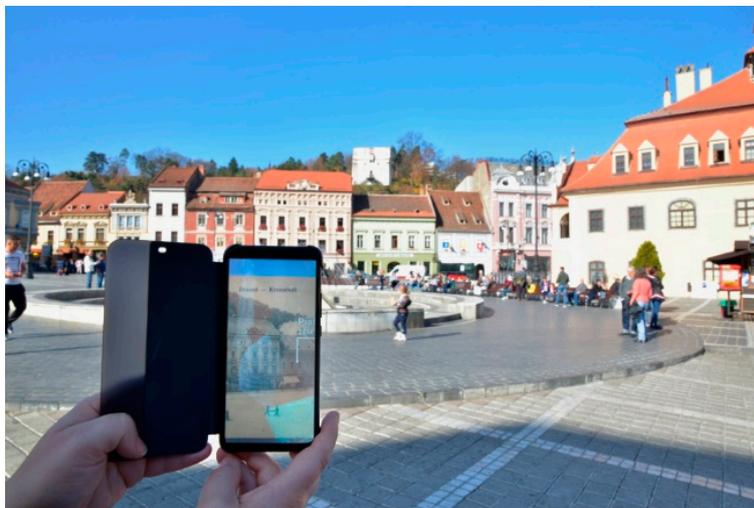


Figure 2. Detail regarding the use of the “Virtual Braşov” application in the historical center of Braşov.

3.3. Research Design and Data Instruments for Evaluating the “Virtual Braşov” Application’s Quality

Bec et al. [50] proposed a four-stage conceptual model that presents how immersive technologies can be used for heritage preservation within the tourism experience, which was categorized in four approaches: “Historical Facts”, “Contested Heritage”, “Integrated Historical Facts and Contested Heritage”, and “Alternate Scenarios”; this model was the first step for analyzing the “Virtual Braşov” application quality dimensions.

After reviewing the second proposed model for assuring the app’s quality [51] and comparing with the ten best practices for designing mobile applications proposed by Lică [67], a research design for analyzing the “Virtual Braşov” application was developed using a descriptive–explanatory type of research; as an interrogation imposed on reality, it will answer the natural questions that occur from here: “What is it?” and “how is this reality?”, meaning “what is the quality of the application?”. Online tourism destination research is an expanding field [68,69], where there is no need for unanimously accepted models in the academic community or by practitioners; therefore, “when a new field is being explored, existent analysis methods are frequently adopted, which have already been used in different fields, and a technology transfer is realized” [70] (p. 179).

In this study, the authors agreed with the ideas on the determinant role of content analysis as a way to examine the manifest content of messages, while being an ideal tool for examining the quality of the mobile applications. In addition, we have to accept that “traditionally, content analysis is considered, first of all, a quantitative method, which requires, however, a qualitative assessment” [71] (p. 13). In the light of the latter clarifications, we considered content analysis as a research method, as it is a quantitative and qualitative variant of communication content analysis. As a working technique, we selected to use a frequency analysis, and as an instrument, we used a categorical coding system and a quantitative grid of the collected data. Content analysis determines the specification of categories, focusing on what can be seen and counted [72].

The aim of this descriptive analysis is to identify which elements are the main ones of the application, as it is necessary to compare concepts and methodologies from other scientific fields because a calibrated, well-rounded methodology from one scientific field regarding these characteristics

does not exist [73]; it is also necessary to determine if they can be improved to create a design application that could be implemented in the near future.

The “quality of the application” concept was operationalized by seven dimensions with several indicators and variables: (1) Generality—(1.1) target audience—(1.1.1) inhabitants and (1.1.2) visitors or tourists; (2) reliability—(2.1) errors—(2.1.1) lack of functioning errors and (2.1.2) lack of reading errors; (3) correctness—(3.1) correct information—(3.1.1) search section, (3.1.2) simple search option, and (3.1.3) advanced search option; (4) user-friendly character—(4.1) form—(4.1.1) logo, (4.1.2) slogan, (4.1.3) home or menu icon, (4.1.4) calendar icon, (4.1.5) map icon, and (4.1.6) personal account icon, as well as (4.2) content—(4.2.1) general information, (4.2.2) contact information, (4.2.3) news or events, (4.2.4) notifications, (4.2.5) internal links, (4.2.6) external links, (4.2.7) representative images, (4.2.8) creating new account options, and (4.2.9) feedback and FAQs; (5) continuity—(5.1) known elements—(5.1.1) similarity with other applications; (6) portability—(6.1) correct functionality—(6.1.1) adaptation to accessibility standards, as well as (6.2) export data—(6.2.1) saved data and (6.2.2) export data; (7) security—(7.1) security parameters—(7.1.1) terms and conditions, (7.1.2) logging in with personal data, and (7.1.3) securing the application with a password.

The main advantage of this conceptual scheme is that it provides the framework for a standardized and flexible tool, so that as web and app innovations or new features are developed, they find their way into the scheme [74].

In conducting this analysis, as an observational research method that aims to systematically evaluate the symbolic content of all communication forms [75], the focus was defined on the technique of analyzing the frequencies to identify how many times the counting unit appeared, i.e., the symbols were determined in the recording unit according to the criteria established in the analysis grid presented above.

We followed the methodological rigors considering that the grid and the categories should be: “Comprehensive (to capture all variants of the occurrence of the characteristic, the theme), exclusive (a unit registered in a category may no longer appear in another), objective (to allow a classification of the material that depends as little as possible on the analyst), and relevant (appropriate to the objective pursued by the research and the content of the documents)” [76] (p. 137).

4. Results

The proposed dimensions of Bec et al. [50]—“Historical Facts”, “Contested Heritage”, “Integrated Historical Facts and Contested Heritage”, and “Alternate Scenarios”—must all generate this connection of the digital tourism experience.

First, we took into consideration the historical facts. The Braşov Metropolitan Agency selected six of the most visited attraction sites of Braşov. Each of them was affected more or less through history by natural or human interventions. The app materializes some of the historical buildings as they were a few hundred years ago, and also some that were destroyed during the Communist regime, like the Vila Kertsch and Reformed Church. In addition, the app presents the major historical facts about the buildings from each selected area, but all of them are presented more like disparate pieces of a very big puzzle of “Kronstadt” City. The other three dimensions—“Contested Heritage”, “Integrated Historical Facts and Contested Heritage”, and “Alternate Scenarios”—are not found in the storytelling of the app. In other words, the app presents the users an older version of the area or the attraction site from an old postcard and describes the setting, as presented in Figure 3.

Proceeding with the established criteria, the analysis grid contains 29 units of analysis in which the counting unit could appear. In the case of the application “Virtual Braşov”, of the 29 categories, the counting unit appears 10 times, so we can deduce that the predominantly small number of content elements of the application “Virtual Braşov” (34%), from a qualitative perspective, is not appropriate, and it requires improvements to get more people to use this app.

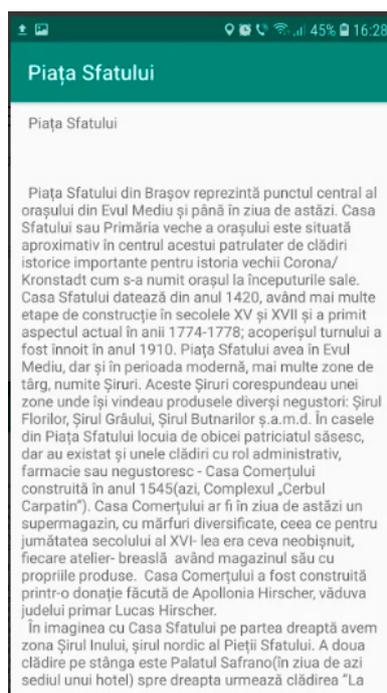


Figure 3. Sample description of the “Piața Sfatului” (Council Square) attraction area from the “Virtual Brașov” application menu (see Appendix A for the translation into English of Figure 3).

Information applications [51] are divided into two categories: Those that have a stable content (the virtual museum, such as the “Virtual Brașov” or the maps), and those that have a dynamic content (probable time or road traffic). The quality of these applications is given by the accuracy of the data and the ease of updating for those with dynamic content.

5. Discussion

The paper adds to the discussion and contributes by filling a gap in our understanding of how consumers interact and engage with emerging technologies in a particular and very specific type of service area. Emerging technologies are needed for the realization of a smart city. While mobile AR hardware has become commonplace, there is a need for more research on how to use this hardware to deliver a compelling mobile AR experience [4]. App implementation and adequate promotion of cultural heritage landmarks of a city can determine the user engagement, which is also necessary for the acceptance and adoption of these cutting-edge technologies.

The abovementioned categories are suitable for a critical analysis of the “Virtual Brașov” app that will generate some proposals for the improvement of both the immersive experience and the heritage preservation. However, this evaluation is not based on user experience. This argument is based on the idea that authenticity from the users’ experiences can have different acceptations. An older citizen, for example, could interpret it from a historical perspective, a younger from the immersive experience, and a tourist from a cultural perspective.

So, in this light, virtual information applications must retain or have certain features, such as:

- **Comprehensiveness**—in a virtual medium such as the “Virtual Brașov” application, all the touristic objectives, landmarks, and cultural heritage artifacts must be stored, presented, and accessed in one place in relation to the audience’s expectations. In addition, the app should include or use links to places or official websites where one can find more information.
- **Accessibility and filtering**—data can be filtered by users according to certain criteria, such as name, interest, theme, etc.

- Organization—the data provided in the applications can be organized by the users in their own collections.

Overall, this paper makes a theoretical contribution in terms of the necessity of actively engaging citizens in emerging technologies' implementation with regard to a smart city framework. Taking into account the results of the analysis, the "Virtual Braşov" application will have to contain several elements of qualitative content to satisfy the needs of individuals. In addition, the app should include other settings, such as a timeline feature, not just disparate historical facts with links between all the puzzle pieces and Braşov's history through time (an interactive map). The other three dimensions—"Contested Heritage", "Integrated Historical Facts and Contested Heritage", and "Alternate Scenarios"—were not found in the storytelling of the app. In addition, it should contain some "Contested Facts" about some of the places, relevant people, and happenings. According to Bec et al. [50], in the last stage, the app could use "Alternate Scenarios"; for example, how the Vila Kertsch would look nowadays had it not have been destroyed to make space for the new Aro Palace Hotel, or if the workers' revolt against communism (in 1987) would have succeeded.

Furthermore, alternative stories can be created by profiling people based on their interests, preferences, and needs. Citizens, for example, may interpret heritage with ICT that can facilitate personalized experiences [8]. The active participation and engagement of the user is a prerequisite that can create alternative stories with the implementation of virtual reality [9]. This can happen in real time and results in the co-creation of an experience that engages the user.

From a deterministic point of view, technology (as a goal, not as an enabler) still has a central position in most smart city projects and the development of different sectorial markets, such as the use of new methods of communication for heritage management [77,78]. While technology creates various new opportunities, it is dangerous to believe that technology alone is enough to create a smart city. "This potential can only be harnessed if it is embedded in a social context. Technology can support urban innovations, but to think of it as the main driver of social change is an only one-dimensional point of view. In order to overcome the short-term nature of Smart City projects and have an impact over a longer period of time, the social context should be central to Smart City projects" [78] (p. 9).

The smart city concept involves the use of cutting-edge technology to deliver the best living conditions to the inhabitants of the respective city. This trend has continuously evolved over the last 20 years and is now spreading worldwide, but especially in developed countries across continents [29]. ICT was first used for the digitization of cities many years ago, but it continues to help cities become "modern" and to benefit from the various advantages of this status.

6. Conclusions

This paper illustrated that innovative technologies can contribute to the promotion of a destination (i.e., Braşov City), its cultural landmarks, and involvement of citizens.

Apps have expanded rapidly in number in the last years, with considerable investment and increased attention from researchers, including in the field of cultural tourism. There is an opportunity for AR and VR that will also help preserve cultural heritage sites. However, there may be implications for the conservation and management of cultural heritage when creating virtual tourism experiences, so destination managers and cultural and administrative representatives must properly balance the heritage with the accuracy of the information or known facts. To guide the presentation of cultural heritage in tourism experiences, the present research presented a four-stage conceptual model to guide applications of AR and VR that presents how these immersive technologies can be used for heritage preservation within the tourism experience [50].

Opportunities are numerous and can be better implemented; future research should test the development of prototypes of digital tourism experiences across the four approaches analyzed. Further research should explore 3D-scanning techniques to increase the accuracy of virtual recreations of cultural heritage sites; we also propose that the future development of research needs to better incorporate users' points of view in the app interactions by offering different "readings" of the same

buildings based on people's interests (e.g., older and younger citizens may "read" the cultural heritage landmark differently using VR equipment).

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Appendix A Translation into English of Figure 3. Sample Description of the "Piața Sfatului" (Council Square) Attraction Area from the "Brașov Virtual" Application Menu

Council Square—The Council Square in Brașov has been the central point of the city from the Middle Ages to the present day. The Council House, or the old Town Hall, is located approximately in the center of this quadrangle of historical buildings, which are important for the history of the old Corona/Kronstadt, as the city was called in its beginnings. The Council Square dates from 1420, had several stages of construction in the 15th and 17th centuries, and received its current appearance in 1774–1778; the roof of the tower was renewed in 1910. The Council Square had several trade or sale areas, called Rows, in the Middle Ages, but also in the modern period. These Rows corresponded to an area where various merchants sold their products: The Row of Flowers, the Row of Wheat, the Row of Carpenters, etc. The houses in the Council Square were usually inhabited by the Saxon patricians, but there were also some buildings with an administrative, pharmaceutical, or merchant role—for example, the House of Commerce, built in 1545 (today, the "Carpathian Stag" Complex). Today, the House of Commerce would be similar to a supermarket with diversified goods, which, for the middle of the 16th century, was something unusual; each guild manufactory had its own shop with its own products. The House of Commerce was built using a donation made by Apollonia Hirscher, the widow of Mayor Lucas Hirscher. In the image with the Council House on the right, we see the Linen Row area, the northern row of the Council Square. The second building on the left is the Safrano Palace (nowadays serving as a hotel), to the right follows the building...

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