Mobile Presentation of the War History of the City of Niš

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Abstract. Contemporary visitors of a historical and tourist site expect access to quick information about different subjects according to their interests. Unfortunately, billboards and plates near monuments usually do not provide enough information that can satisfy the visitors' needs. However, mobile devices such as tablets and smartphones with appropriate software solutions can help visitors get the information in an appropriate manner. In this paper, we present two ways of providing information such as a web application with the usage of QR codes, and a purposely developed application for mobile devices implemented by using augmented reality technologies. We compare both these solutions and discuss their advantages and possible drawbacks. The application of these two approaches of using information technologies in representing national historical heritage are illustrated by concrete examples of their implementation in the city of Niš. By using these applications, visitors are informed about the war history of Niš, a city that was occupied many times and by many conquerors in its millennia-long history.

Keywords: Mobile Application, QR Code, Augmented Reality, Cultural Heritage.

1 Introduction

The advancement of information technologies has led to their application becoming ubiquitous in each segment of our daily lives. Due to the advancement in software and hardware, along with a faster internet connection, people can quickly access the information they require. The rapid improvement of mobile devices enabled them to become search engines and communication tools for every need. Accordingly, various cultural institutions and organizations tend to adapt their historical presentations to the trends that come along with mobile technology. Also, the modern visitor expects to see more educational and multimedia content through interaction with historical heritage presentations. Hence, information should be provided quickly and accurately in accordance with the visitors' interests.

Cultural heritage presentations, except the usage of classical billboards which have limited space for text and images, incorporate multimedia solutions to enrich the cultural heritage content and attract and immerse visitors (Argyriou, Economou, & Bouki,

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2020). This can be seen in the installation of touch screen panels placed inside museums that provide interactive content by using simple motion gestures on their surface (Barbieri, Bruno, & Muzzupappa, 2018). Also, multimedia projection implemented in the form of interactive projection mapping can be used to immerse visitors into the historical presentation (Nikolakopoulou, et al., 2022). In particular, mobile applications realized as user guides can be used for indoor or outdoor historical presentations. Oftentimes, indoor mobile applications are used as multimedia guides, which have replaced classical audio guides (Roussou & Katifori, 2018).

Examples of applications devoted to the presentation of historical heritage are presented in (Solima & Izzo, 2018), (Koo, Kim, Kim, Kim, & Cha, 2019). Typically, these applications follow a particular approach, while the present paper describes a combination of approaches based on QR codes and AR technology.

In this paper, we present two mobile device solutions developed for outdoor usage for monuments in the city of Niš. This is a part of continued work being done on the digitization process of cultural heritage presented in previous papers (Tatić, Gajić, & Stanković, 2015), (Tatić, Stanković, Stojanović, & Jovanović, 2019). Accordingly, the content of these mobile solutions concerns the history of the city of Niš and its war monuments located in the city centre. The first solution was made as an application for mobile devices for the Monument to the Liberators, where important years for the liberation of the city are inscribed on the monument and recognized by the augmented reality module in the application we developed. The second solution was aimed at labelling the historical place where the First World War began with a QR code through which information is received from a web application. These two applications, realised as different solutions for the presentation of cultural heritage, are intended to introduce contemporary tourists, but also younger generations familiar with mobile technology, to the history of the city of Niš.

2 Mobile and QR Code Solutions

Visitors of historical sites expect to be well and in an attractive way informed about the historical heritage related to the location they are visiting. It is a common practice to read the printed panels in front of monuments. These panels have limited areas for presenting information in the form of text, photos, diagrams, etc. If visitors want to acquire more details about a monument, they usually consult tourist guides, read tourist leaflets, or search the Internet for more information. Due to the advent of mobile devices, mobile applications could lead to solutions that allow visitors to be better informed about the historical content of tourist sites. Moreover, AR technology or QR codes can help contemporary visitors quickly find information of interest by using mobile devices in tourist locations. In this chapter, we present how these technologies are used for presenting the historical heritage related to the monuments in the city of Niš. Also, we provide a comparison between these approaches in the sense of usage and data processing (provided content, information retrieval).

2.1 Mobile Applications and QR Codes

Mobile applications are in general published on well-known mobile application stores such as Google Play or the App Store. Depending on their device type, visitors must find and install the application from one of these stores. Accordingly, visitors should be informed by the tourist organisation where these applications can be found. Typically, a QR code is provided to the visitors for installation of the application in advance, using their home or hotel Wi-Fi. The installed application serves as a digital catalogue and digital guide on the mobile device which might store more historical information than classical catalogues and travel guides. Also, the provided application has multimedia content that can be used in the way that the visitors prefer, such as reading the text or listening to the audio content about a certain topic.

Monuments labelled with QR codes, which are scanned by a default QR scanner, enable visitors to get information about the monument instantaneously and without preparation in advance, such as downloading and installation. An internet connection is necessary because the content is provided as a web application from an external server. After scanning, multimedia information about the monument is opened in a web browser, but it is not stored on the mobile device and cannot be accessed later.

In the next sections, we present examples of the practical realizations of both approaches applied to presenting the war history of the city of Niš, Serbia.

2.2 Mobile Application for the Monument to the Liberators of Niš

The mobile application has been made for the Monument to the Liberators of Niš to provide information about events over the years and related scenes represented by reliefs on the monument.

Fig. 1. Location of the Monument to the Liberators of Niš.

The monument is located in the city centre and is dedicated to important periods of liberation wars (Fig. 1). The four reliefs that symbolize the years of liberation are located on the bottom part of the monument (Fig. 2). In the middle part of the monument, there are sculptures that represent important battles for liberty, while at the top there is a horseman popularly called *Moravac* by the people of Niš, which symbolises freedom.

Fig. 2. Relief for AR recognition on the Monument to the Liberators of Niš.

The event when the priest Petar Ikonomović and a group of rebels took the solemn oath to fight against Ottoman occupation is inscribed in one of the reliefs. By recognizing the relief, the story about the beginning of the resistance against Ottoman occupation in 1874 is projected onto the screen of a mobile device. Similarly, recognising the monument relief depicting King Milan Obrenović entering the newly liberated Niš with his army, detailed information regarding the liberation of Niš city from the Ottoman occupation in 1877 is provided (Fig. 3).

Fig. 3. Mobile application: left - main screen, middle – AR module, right – provided information.

At the beginning of the First World War, Niš was the war capital of Serbia since the government and the National Assembly retreated there from Belgrade, which at that time was on the border of Serbia and the Austro-Hungarian Empire. The relief showing King Aleksandar Karađorđević signing the Niš Declaration that defined the aims of the war, such as the liberation and unification of the South Slavs, is shown on the third relief. Recognition of that relief provides information about this and other events that symbolize 1915, the year in which Niš was occupied. Niš was liberated on October 12, 1918, when King Aleksandar Karađorđević entered the liberated city of Niš with his army. Therefore, the fourth relief was inscribed for this particular occasion. The monument relief recognition provides information regarding the liberation of Niš in 1918.

2.3 Programming Implementation

A Unity Engine was used as a cross-platform solution for the realisation of the applications. The application was designed for both Android and iOS mobile devices. It is offered for free from the corresponding markets.

The aim of the application is to use augmented reality to recognize the reliefs at the bottom of the monument dedicated to events that took place in particular years, which are inscribed on the bottom of the reliefs and which provide the related information for each year. The information is provided in the form of multimedia content and relates to the reliefs on the monument depicting the Ottoman occupation of Niš and the First World War. Image tracking is used for relief recognition, and it is implemented as an augmented reality module realized by the EasyAR SDK.

2.4 QR Codes in the War Museum of Niš

The War museum under the open sky was realised by placing special plates with QR-codes near the busts of monuments related to war heroes and sculptures symbolising the fight for liberty. These monuments are found at different locations across the city, but most of them are in the city centre or at a walking distance from it. The majority of busts and sculptures are located at the Park of Heroes and the Univerzitetski Square, both of which are in the city centre and near the Fortress of Niš.

A few other monuments are located at various places with marked war busts and sculptures, such as monuments at the Red Cross Concentration camp and two monuments in the Kralj Aleksandar Ujedinitelj Square.

A purposely designed plate was made to label the place where the First World War began (Fig. 4). Recognizing the QR-code on it provides information about the historical happenings on these important days. At this location, the President of the Council of Ministers of the Serbian government, Nikola Pašić, received a telegram sent by the government of the Austro-Hungarian Empire with the official declaration of war on Serbia (Fig. 5). This event marks the beginning of the Great War. The telegram was sent from Vienna on July 28, 1914, at 11.10 am, by regular post, and was routed to Serbia via Romania. There are notices about two possible and mutually close locations where the telegram may have been delivered to Nikola Pašić. These are the Hotel Orient, in the official version, where the plate is located, and the Hotel Europe, a hundred meters away. These hotels no longer exist, but images of what they looked like in the past are provided on the web link.

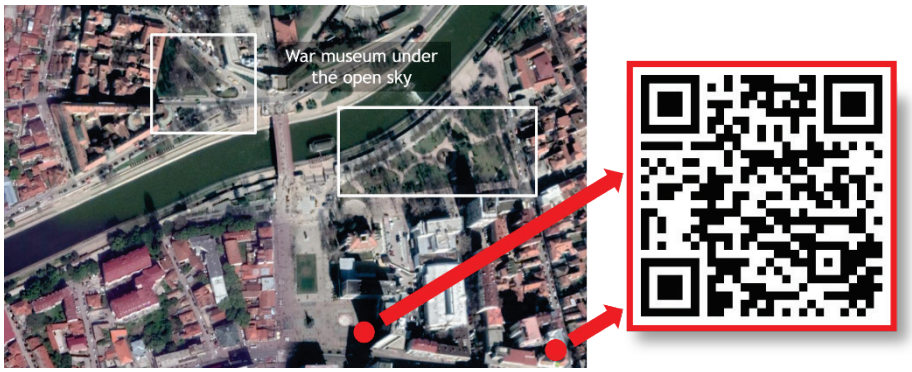

Fig. 4. Location of War Museum in the city centre and the QR code that provides information when First World War began.

The plates used to mark the monuments are made from special material that is resistant to different weather conditions. The plates are designed and placed on the locations following the requirements of the local institution in charge of the protection of monuments in Niš. The QR code on these plates is linked to the multimedia information about the corresponding monuments.

Information is presented to the visitors by scanning the QR code with their mobile devices. Typically, mobile phones have a QR code reader application by default. Scanning the QR code from the plates with this application leads to the multimedia information on the dedicated web page.

The material presented to the user is realised as a web application optimized for mobile devices. Therefore, various multimedia material such as text, images, and videos are embedded into the webpage accessible via the QR code. This page supports multilingual content and thus the provided information can be seen in Serbian, English, and Russian.

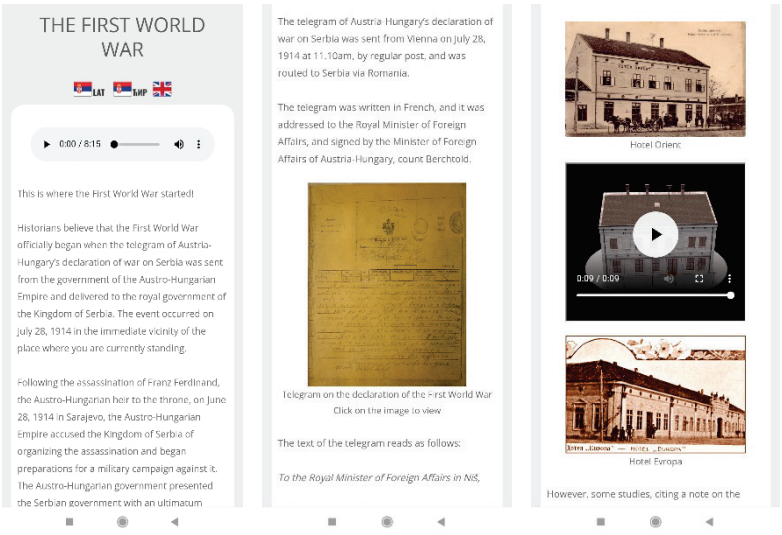

Fig. 5. Information about the beginning of the First World War.

2.5 Comparison of Approaches

In the presented approaches for the presentation of historical heritage, the first solution is used to recognise monument reliefs with augmented reality and provide information about the events presented on the reliefs of interest to the visitor. The second solution uses custom labels in form of plates with QR codes placed near the monuments to provide information about them.

The first solution requires downloading an application from an online store and its installation on a mobile device. During the installation, the visitor must have free storage space available on their mobile device. In that sense, mobile applications require more space than does the information retrieved from a web server by a QR code. Also, the installation process of the mobile application and gathering information about the monument requires more time than downloading information from a web page using a QR code.

Once the application is installed, data about the monument are stored in the device memory and are available at any time. As a result, the mobile application has embedded content, making it easier to navigate through the information about the monuments.

The advantage is that the information content is accessible at any time and offline, with the exception of the video material that is streamed from the server, which requires a Wi-Fi connection to view. This way of realization was selected to minimize the size of the application and reduce the download time. The advantage of this approach to the presentation of historical heritage is that no additional activities are required at the locations of the monuments. Periodic upgrading and maintaining the application is required, as dictated by the rules of application markets such as Google Play and the App Store.

The second approach, based on QR codes, does not require downloading and installing specific software, since an ordinary QR code reader is sufficient. Therefore, many visitors prefer it from that point of view. The information can be viewed after scanning the QR code, but it is not stored on the mobile device for later retrieval. This can be viewed as a bottleneck. Also, attaching physical plates or other appropriate labels near the monuments is necessary, which increases the cost of realization and implies maintenance of the labels.

3 Conclusion

The rapid development of information technologies and the advent of hardware solutions such as mobile devices have opened new trends in the presentation of historical heritage. A contemporary visitor at a tourist destination expects to receive more information, and in a more attractive way, provided by new technologies, rather than information which is usually inscribed on billboards and plates near monuments.

In this paper, we present, discuss, and compare the realisation of two types of mobile solutions that can satisfy the needs of contemporary tourists. The first solution was designed as a mobile application based on augmented reality for the Monument to the Liberators of Niš. The second solution was implemented for the War Museum by the usage of QR codes on specially designed plates.

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