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WAR MUSEUM OF NIŠ UNDER THE OPEN SKY

Abstract. This paper shows the usage of information technologies for the improvement of a guided tour through historical war monuments of Niš city. This idea titled The War Museum of Niš Under the Open Sky is realized in the open public spaces such as squares and parks in Niš located in the wider city center. For this purpose, two approaches are used to offer a possibility of getting more detailed information about the persons or events to which monuments are devoted. The first approach is realized as a mobile application that can be freely downloaded from the mobile markets such as Google Play and App Store. Upon downloading the application, the visitor has access to all necessary information about monuments on his mobile device. This enables the visitor to inform himself in advance while using Wi-Fi, as well as store the information after the visit. Another solution is realized as a web application that enables the fast display of information at the monument location. This is realized by scanning a QR code that is the part of specially designed plates located in the front of the monument or at a suitable position nearby.

1. Introduction

Nowadays museums try to offer multimedia content to immerse the visitor into exhibitions in a contemporary way. Usually, this is realized by the application of information technologies to satisfy modern visitor's needs and expectations. Typically, the visitor expects to have information adopted to his interest realized in various multimedia forms like text, image, audio, video, or 3D content. Also, this information should be provided quickly upon request or during the interaction with museum artefacts.

Inside museums, different multimedia solutions are usually provided to increase the interaction and enrich the presentation of cultural heritage exhibition. Therefore, various related systems have been realized that concern the usage of information technologies. For example, different game engines to find the most appropriate solution to immerse visitors in a Roman palace-guided tour are presented in [1]. A Roman tower was reconstructed in 3D space and used for the Augmented Reality (AR) and the Virtual Reality (VR) mobile presentation addressing the needs of the Archaeological Museum in Milan Italy [2]. Testing the usage of Head-mounted Displays as a guiding tool in Egyptian Museum in Cairo is discussed in [3], and [4]. The curators of the Carnegie Museum of Natural History use AR technologies to create dioramas to enhance exhibitions [5]. The Hong Kong Heritage Museum created interactive installations by the usage of various projection systems [6].

Given solutions have been realized for museums that concern concrete cultural heritage topics to engage visitor into the corresponding exhibitions. In this paper, we discuss the mobile solution that guides the visitor through the war history of Niš city across the millennia-long history of the city. The difference compared to the above-mentioned examples is that an actual museum does not exist in the classical sense of this word.

2. Concept of the War Museum

The War Museum of Niš under the Open Sky is realized in the open public space such as the squares and parks of Niš. Locations included in this Museum are in the wider city center at the Park of Heroes and the 7th of July street, the University Square, the King Aleksandar Square, and at the entrance of the concentration camp Red Cross on the 12th of February street. Involved are also a monument near the park Čair, and another in the suburban area Milka Protić.

This virtual museum is aimed at providing information about persons or events to which monuments located across the city are devoted. The realization is done in two different ways. First, an application for mobile devices is developed and offer freely from the Google Play and App Store. Taking into account that not all visitors might like to download and install the application on their mobile devices, a simpler solution is provided. A dedicated Web site is launched with information about the monuments. Each monument is marked by a plate with the title and a QR code, the reading of which leads to the corresponding page on the website.

3. Programming realization

As noticed above, the War Museum of Niš is realized in two ways, as a mobile application and as a Web application related to QR-code reading. In this section, we briefly present the main characteristics of these two approaches.

3.1 ***Mobile application*****.** The mobile application is realized as an electronic guide by using the Unity engine. This multimedia engine is a cross-platform solution that enables generating of applications for both Android and iOS operative systems. The application consists of several multimedia modules:

- Map
- Info
- Gallery
- Audio
- Video
- Language

The map module enables the visitor to locate monuments on the Niš city map provided by the Google Maps service. Navigation to the specific monument is provided by drawing the path from the current location of the user to the selected monument. Also, by choosing the monument of interest on the map by clicking on the corresponding pin, the visitor can get additional information.

The Info module provides the textual information about the specific monument followed by the thumbnail images. Images can be seen in the full-screen mode by using the Gallery module. This module enables pinch to zoom or incremental zoom of each image. Also, navigation through other images in the image gallery is provided. For each image, a short description and order number in the gallery are presented.

Instead of reading the textual information visitor can use the Audio module to listen to the corresponding story while exploring the location of the monument. Accordingly, specific historical information could be provided in the video format by using the Video module. The video record about the monument is streamed from the server, therefore, an internet connection is necessary. This solution is selected in order to keep the size of the application small and reduce the downloading time.

The Language module gives the ability to get historical information about the monument in the preferred language. Currently, built-in languages are Serbian, and English. For 7 monuments, the option in Russian is also provided.

3.2 ***Web application*****.** The web application for the War Museum is realized to provide fast information about each monument. This is realized by using specially designed plates with the name of the monument and a QR code. It is assumed that the visitor will read the QR code by an ordinary QR-code reader which is presently a standard part of the software on mobile devices.

Upon scanning the QR code with the QR reader, a specified link is provided to the browser. In this way, the HTTP request is sent to the external server in order to retrieve the information about the monument of interest. The server processes the data to find the information stored in the MySQL database and creates the corresponding response. The response is shown in the mobile device browser as an HTML5 responsive page adaptable to the screen size. This page is organized to display various multimedia information such as text, images, video, and audio content. The visitor can choose the preferred language between Serbian and English and for some monuments also Russian. Translation in Russian and other languages such as French and German are planned as a part of the further development of this War Museum.

4. Physical realization

Providing the information through QR-codes requires some activities related to the assignment of QR-codes to the monuments. Assignment of QR-codes to monuments is done by using specially designed plates. Since these plates are aimed for outdoor usage, they have metallic support and the printing is protected by an especially selected transparent foil. Plates are positioned on the flat surface in front of the monument and are resistant to different weather conditions. The QR code can be viewed as a bridge between the mobile device of the user and the remote information stored on the server.

The special design of the plates is created in cooperation with the institutions responsible for cultural monuments in Niš city and by appreciating requirements issued by them. Each plate has printed the monument title and a QR code. It is positioned at an appropriate distance from the monument, and dimensions are selected such that the plate is easily noticeable by visitors and simply readable by the camera of the mobile device during the scanning.

5. Illustrative examples

Figure 1 shows the monument with the plate placed in front with the title Monument to the National Hero Đurđelina Đuka Dinić and a correspondingly created QR code. After the QR code is scanned by a QR code reader, the visitor gets multimedia content information about this Second World War National Heroine. The content is opened in the default browser of the mobile device and visitor has options to choose between two languages, Serbian and English. Multimedia information is given in the form of text and photos. If the visitor prefers to listen to written text, he can choose the audio option while exploring the monument.

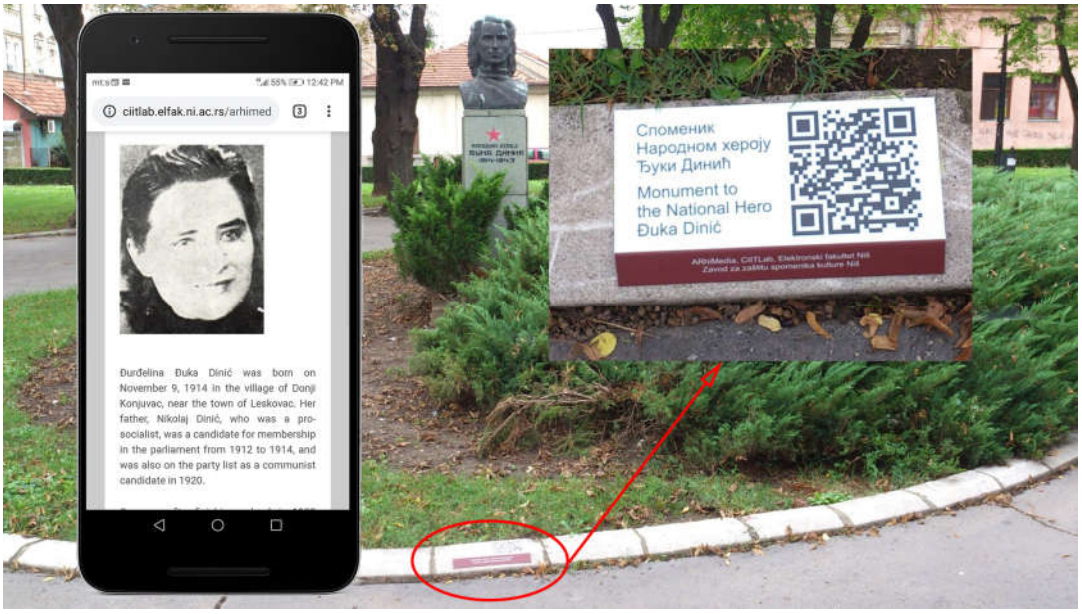

Figure 1. Monument to the National Hero Đurđelina Đuka Dinić marked with a QR code

Mobile application is aimed to be installed from the mobile stores via QR placed on touristic booklets, billboards near the entrance of the parks, and other touristic locations in the Niš city. It can be also found by retrieving Google Play and App Store with the name of the application. Once installed the application enables the visitor to have a complete tourist guide through the War Museum of Niš under the Open Sky.

Figure 2 represents the installed application where the menu is shown on the screen. The visitor can decide how to get information whether through list items or by the map. Choosing the list items all monuments are shown with an associated icon and the title. Opening one item in the list, the corresponding text and thumbnail photos are projected on the screen. If detailed photos of the monument are preferred, they can be retrieved from the image gallery. Also, instead of reading the text, the audio player can produce the sound recorded by a professional speaker reading the text.

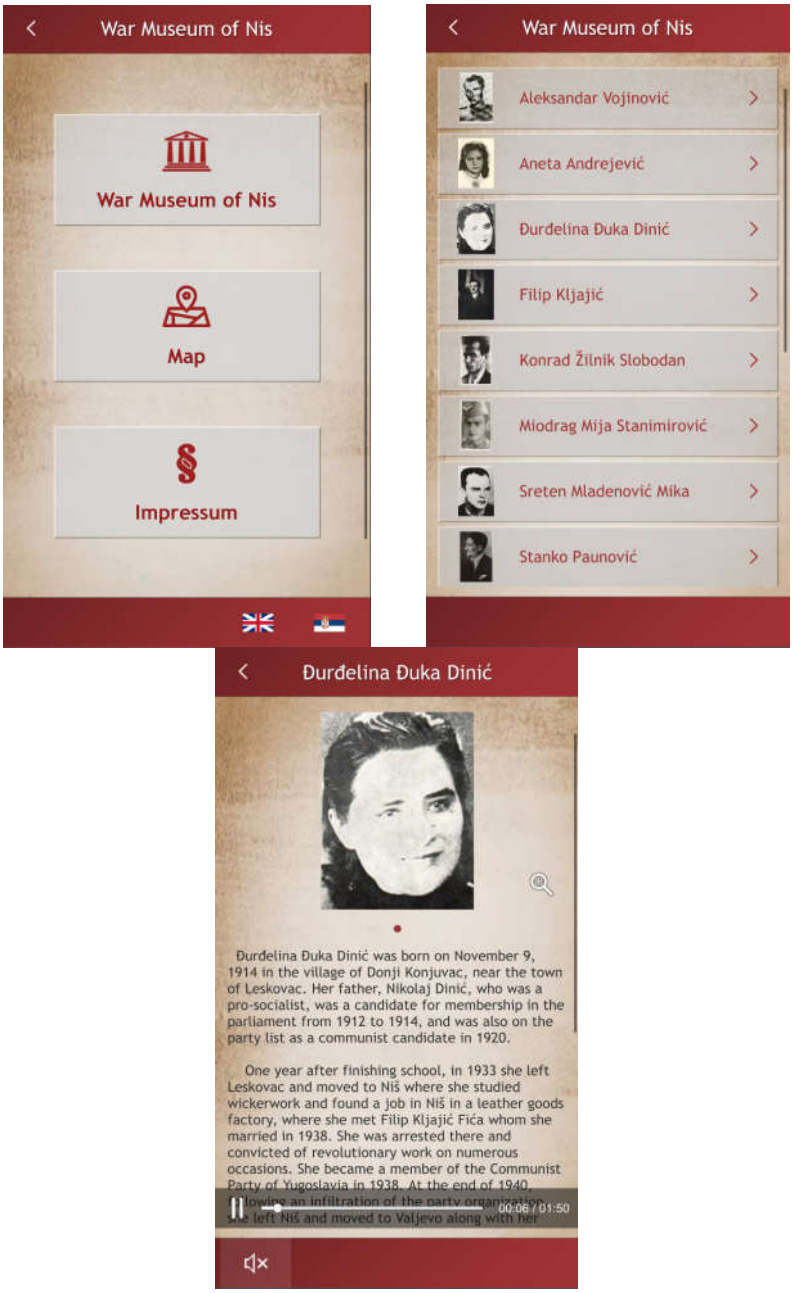

Figure 2. Mobile application a) left image application menu b) list items of war heroes and c) detailed information in form of text, photos, and sound.

Choosing the map option, shown in Figure 3, the Google map opens with interactive pins, where each pin represents one monument. More detailed information about the monument will be shown if the visitor touches the pin. The visitor can select the navigation option for each monument of interest and then the path from the user's current location to the selected monument will be drowned.

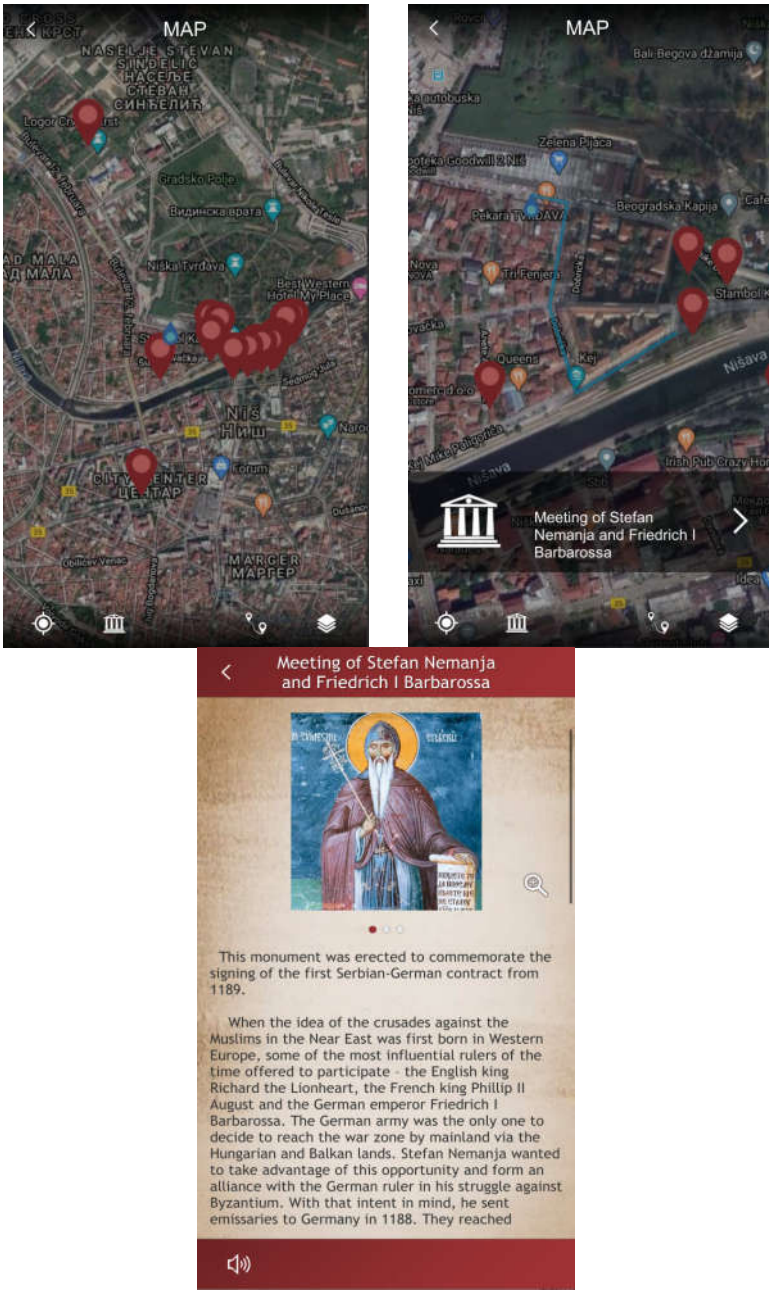

Figure 3. (a) Connection to the Google Map with active pins, (b) the route from the visitor's current location to the selected monument drown on the map, and (c) the multimedia content concerning the selected monument.

6. Conclusion

In this paper, we presented the system titled War Museum of Niš Under the Open Sky realized with two approaches to improve the presentation of historical heritage that concerns the past wars in the city of Niš from the earlier past to the events in 1999 related to the bombing of Niš. The first created solution is a mobile application that gives the opportunity to the visitor to have the application installed on his mobile device. In this way, the visitor can be informed about the monuments of Niš before the actual visit and later get the related information during the tour without a need for additional internet usage. Another implemented solution is the Web application that gives the ability to the visitor to rich information at the monument location via the QR code. A drawback is that the visitor cannot access the same information later. Further,

some activity related to the assignment of QR-codes to monuments is required. A good feature is that no additional software should be downloaded or installed on the mobile device. Recall that the QR-code readers are a standard part of the mobile device software package.

Multimedia information provided by this system is in the form of text, images audio, and video format. The visitor can choose between Serbian, English, and for 7 monuments also in Russian.

Future work will concern the involvement of some other monuments and historical buildings that will expand this tour through various events or historical periods. Also, preparing the multimedia content to be projected in different languages including German, French, Chinese, as well as Greek, and Bulgarian is planned among further activities.

References

1. Smith, M., Walford, N.S., Jimenez-Bescos, C., "Using 3D modelling and game engine technologies for interactive exploration of cultural heritage: An evaluation of four game engines in relation to roman archaeological heritage", *Digital Applications in Archaeology and Cultural Heritage*, 14(2019), e00113.
2. Morandi, S., Tremari, M., "Virtual Representation of Archaeological Stratigraphy. 3D Modeling and Interactive Presentation of the Late Roman Towers (Archaeological Museum, Milan Italy)", In *Digital Cultural Heritage*, Springer, 2020, 389–400.
3. Hammady, R., Ma, M., "Designing Spatial UI as a Solution of the Narrow FOV of Microsoft HoloLens: Prototype of Virtual Museum Guide", In *Augmented Reality and Virtual Reality*, Springer, 2019, 217–231.
4. Hammady, R., Ma, M., Strathern, C., Mohamad, M., "Design and development of a spatial mixed reality touring guide to the Egyptian museum", *Multimedia Tools and Applications*, 79:5(2020), 3465–3494.
5. Harrington, M.C., Tatzgern, M., Langer, T., Wenzel, J.W., "Augmented Reality Brings the Real World into Natural History Dioramas with Data Visualizations and Bioacoustics at the Carnegie Museum of Natural History", *The Museum Journal*, 62:2,(2019), 177–193.
6. Tso, A.W.B., Lau, J.M.Y., "Visitors' Perception of a Multimodal Exhibition: A Case Study at the Hong Kong Heritage Museum", In *Digital Humanities and New Ways of Teaching*, Springer, 2019, 177–193.

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