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## **APPLICATION OF AUGMENTED REALITY TECHNOLOGY IN PRESENTING THE DECORATIONS OF THE IRON REGIMENT'S WARRIORS**

**Abstract.** The Iron Regiment was a military unit officially designated as the Second Infantry Regiment “Knjaz Mihailo” of the Serbian Army during the First World War. It was formed in the Toplica region and consisted mainly of first and second call conscripts from this area. The soldiers of the Iron Regiment were awarded with numerous decorations, which can be classified into 17 different orders, including both domestic and foreign. These decorations are exhibited in the Memorial Room in Prokuplje.

This paper presents an application designed for mobile devices such as tablets and smartphones, intended to provide detailed information about these decorations. The application is based on an Augmented Reality (AR) module that enables recognition and provides information about the corresponding decoration. The information is displayed in the form of purposefully prepared multimedia content, including text, audio, and video recordings, as well as interactive 3D models used to illustrate the reverse of each order. The interactive functionality enables image zooming for better observation of decoration details.

### **1. Introduction**

The paper presents a mobile application designed for devices such as tablet PCs and smartphones, aimed at presenting the decorations awarded to the soldiers of the Iron Squad, a famous Serbian military unit from the First World War.

In this context, there are two key concepts that should be highlighted, since they provide the motivation and justification for developing the application and explain the choice of the technology used in its implementation. The first concept, Iron Squad, concerns the contents of the application, and the second, augmented reality (AR), is related to the technical implementation aspects. We start with the simplest to explain, AR.

Augmented reality is a technology that enables inserting digital objects, usually computer-generated, into the image of the real world captured by the camera of a mobile device [1, 2]. The goal of using AR is to provide more detailed information, a better explanation, and, thus, an understanding of certain situations, or simply to illustrate some circumstances. Typically, AR provides for a visually more impressive effect and an immersive experience.

Regarding the contents of the application, it is probably sufficient to say that Iron Squad is the most highly and widely decorated unit in the Serbian army ever. The rationale for the application of AR in the presentation of decorations given to the warriors of the Iron Squad comes directly from the real-life circumstances.

The Memorial Room dedicated to Iron Squad is an annex of the Museum of Toplica in Prokuplje, a city in the south-east of Serbia. The Memorial Room hosts a permanent exhibition about the war history of the Iron Squad. A part of this exhibition consists of display cases where the medals and other decorations are exhibited. For each decoration, there is a legend with its name, but a more detailed description is missing because of space restrictions. Naturally, the cases are locked, and only a single side of the decoration, usually the obverse, is visible. It cannot be expected that every visitor will be offered an opportunity to see the reverse of the decoration, although this side can be very informative and interesting for a better understanding of the situation when the decoration was introduced in practice, and also the circumstances of awarding it. For instance, on many of the decorations, particular years and abbreviations with specific meaning can be read on the reverse.

The main idea is that the mobile application provides an interactive 3D model of the decoration and displays relevant information on the screen of the mobile device. Interactive means that the 3D model can be rotated and zoomed for a better view of particular details. Further, by inserting specific symbols or drawings as arrows or circles, the attention of the user of the application is focused on particular parts of the decoration, and related additional information will be displayed in the form of text and audio record.

The application will be announced at a specially designed and exposed poster near the entrance of the Memorial Room. It is freely accessible to every visitor through QR codes on the poster. Further, the same QR-codes will be on the website of the Museum of Toplica, therefore, the application will be accessible also to those who are not physically present in the vicinity of the Memorial Room. Flyers with the codes will be freely available for the visitors of the Museum of Toplica.

When installed, the contents of the application will be on the mobile device until the users delete it. This offers an opportunity that the details of the exhibited artefacts will also be available after the visit to the Memorial Room and can be studied later in circumstances more convenient for the user and with a longer available time.

## **2. Motivation for the application**

The motivation for the development of this specific application comes directly from the glorious war history of the Iron Regiment.

During the liberation wars from 1912 to 1918, the Kingdom of Serbia mobilized at about 100 infantry, cavalry, and artillery regiments. The Second Infantry Regiment “Knjaz Mihailo” was among these. Conscripts from the age of 21 to 31 from the following municipalities were mobilized into the Regiment: Prokuplje, Blace, Kuršumlija, Žitorađa, Doljevac, Merošina, Bojnik, Lebane, Medveđa, and Zaplanje (nowadays the Municipality of Gadžin Han) [3].

The unit got its famous name, Iron Regiment, from its wartime opponents, specifically the Bulgarians, *Železni puk* in Bulgarian, who were afraid of conflict with this unit.

The Iron Regiment played an important role in numerous battles, first during the Balkan Wars, and then in the First World War. The Regiment suffered enormous losses. From 4655 soldiers and non-commissioned officers and 60 officers at the beginning after mobilization on October 7, 1912, on January 1, 1915, the regiment had only 1793 soldiers and non-commissioned officers and 27 officers. Among those killed in the fighting in the offensive phase of the Battle of Kolubara was the commander of the regiment, Colonel Milivoje Stojanović Brka, in whose honor Stanislav Binicki

composed "March on the Drina". The total losses of the regiment in the wars of 1912-1918 were: 2974 soldiers and non-commissioned officers, and 84 officers [4].

Milunka Savić and Flora Sands, the only two women who were decorated with the Karadjordje star with swords, fought in the regiment.

The regiment's war flag was the most decorated flag in the Serbian army, with the following decorations: Karadjordje's star with swords of the second order, Karadjordje's star with swords of the third order, Karadjordje's star with swords of the fourth order, Decoration of the White Eagle IV order, Gold Medal for Bravery and the French War Cross with Palm.

The Iron Regiment is the most decorated unit in the Serbian army. The regiment has 229 KZm bearers (36 double KZm bearers). In 1918 alone, a total of 982 privates and non-commissioned officers were awarded the Medal for Bravery (556 gold medals and 426 silver medals).

The list of national decorations consists of

- Order of Karađorđe's Star with Swords
- Order of the White Eagle with Swords
- Medal for Bravery "Miloš Obilić"
- Medal for Zealous Service
- Medal for Military Virtues
- Commemorative Medal for the War of 1912
- Commemorative Medal for the Second Balkan War
- Commemorative Medal for Loyalty to the Fatherland 1915 – Albanian Commemorative Medal
- Commemorative Medal for the War of Liberation and Unification 1914–1918

The list of foreign decorations consists of

- Legion of Honour of the French Republic
- War Cross with Golden Palm of the French Republic
- War Cross with Gold Star of the French Republic
- War Cross with Bronze Star of the French Republic
- Order of St. George of Imperial Russia
- Russian Order of St. Stanislaus with Swords, 4th Class
- Bravery Medal "George V" of the Kingdom of England
- Polish Order of St. Anna
- Polish Military Cross, 5th Class
- Bulgarian Order of Bravery of St. Alexander

### **3. Realization of the application**

The application dedicated to the Iron Regiment is realized using the Unity engine as a cross-platform tool. This enables visitors to the Memorial Room in Prokuplje to install the application on mobile devices running on both Android and iOS platforms. Furthermore, this tool enabled the development of multiple modules designed to provide multimedia information to the visitors.

When a visitor scans the QR code located in the Memorial Room, he is directed to download the application from the Google Play or App Store. Following the download and installation process, the initial screen of the application is displayed as shown in Figure 1. This screen contains interactive parts that enable the visitor to select

the preferred language, and interactive buttons that serve as a navigational menu to the other parts of the application. The first button provides the basic information about Iron Regiment, the second button links to the information about the war trajectory, while the third and fourth button offer details regarding awards and decorations. The fifth button in the menu provides access to the augmented reality (AR) module.



Figure 1. Initial screen of the application.

The augmented reality module is implemented using the EasyAR SDK, and the development and implementation of it is based on image tracking. Accordingly, when an image captured with the camera of the device is matched with an image that is stored in the application database, the virtual overlay is shown over the image. A virtual overlay that is shown during tracking has embedded interaction and links to the content that concerns a recognized image.

An illustrative example of augmented reality usage in this application is given in Figure 2. The camera of the device is enabled to capture an image of the real world when the AR module starts. The virtual button appears as an overlay while recognizing and tracking the decoration. Also, this button symbolizes to the visitor that information about this decoration is available in the database. This information can be accessed by interaction with the virtual button.



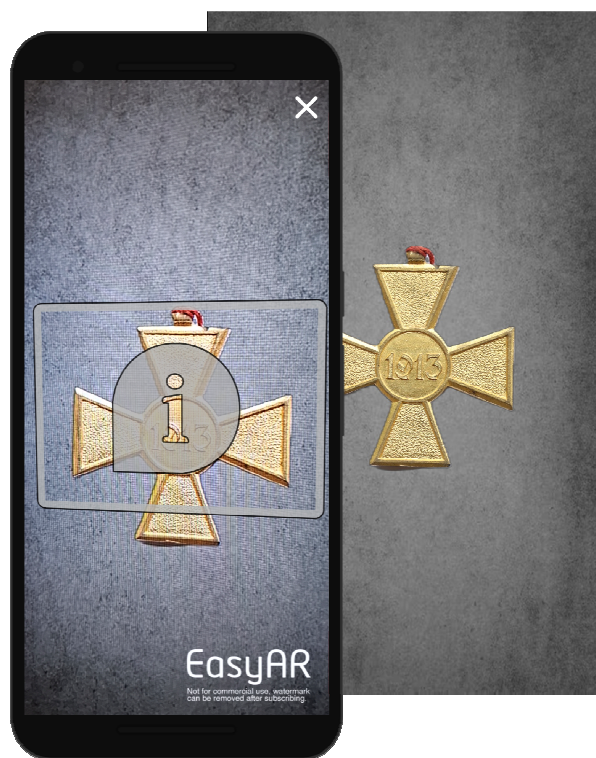


Figure 2. Augmented reality tracking of the decoration

Figure 3a illustrates information provided after interaction with the virtual button. This information is given in the form of text or audio. Also, thumbnails are implemented as a link to the image gallery, where larger images of decoration are provided. According to this, visitors may zoom in on images, and explore the reverse and obverse of decoration as in Figure 3b. Moreover, enhanced interaction and a higher level of detail can be achieved through interaction with the 3D model, allowing visitors to observe decoration from various angles while using the rotation and zooming functionalities given in Figure 3c.

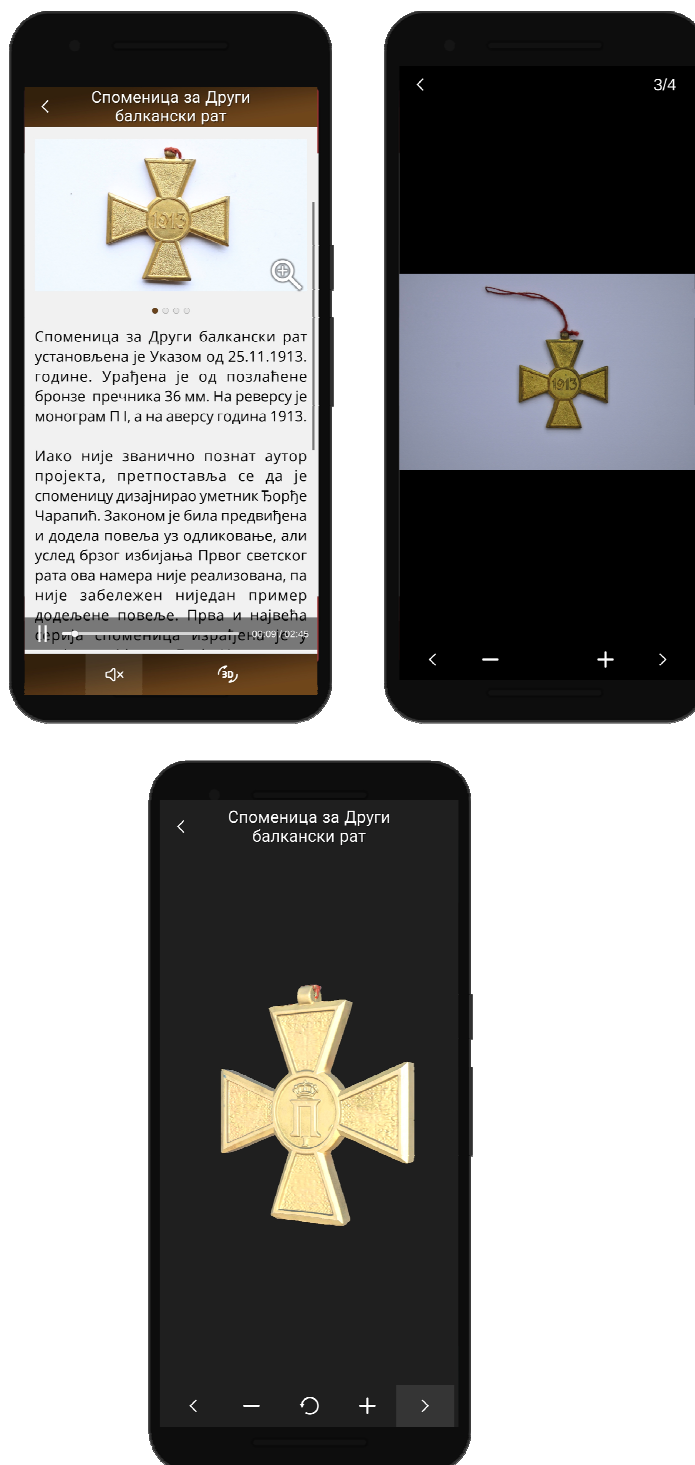


Figure 3. a) Information about decoration in form of text, audio and thumbnail b) image gallery c) 3D model

#### 4. Closing Remarks

The paper presents a mobile application for the representation of decorations awarded to warriors of the Iron Regiment from the First World War. The application is aimed to provide enriched information about the decorations exhibited in the Memorial Room of the Iron Regiment, a part of the Museum of Toplica in Prokuplje.

Through the recognition of each decoration by the augmented reality technology, visitors can access embedded multimedia material in the form of text, audio, and video. Additionally, an integrated image gallery and interactive 3D models enable users to examine the reverse side of the decorations, while zoom functionality supports detailed visual inspection. These features enhance both the interactivity of the system and the level of visitor engagement throughout the exhibition.

The application will be freely available on Google Play and App Store platforms, ensuring broad accessibility to the public. Visitors will be able to download the application by searching for its title or by scanning the QR code displayed on a poster located at the entrance to the Memorial Room. QR codes will also be accessible on the official website of the Toplica Museum. Furthermore, the Museum will print posters featuring images of the decorations, intended to function as interactive souvenirs.

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