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MOBILE ACCESS TO SPECIMENS OF BULGARIAN  
ICONOGRAPHY THROUGH QR CODE IN A GPS-BASED  
INFORMATION SYSTEM \*

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This paper presents an application of QR code marking of digital iconographical collections from the Bulgarian Iconographical Digital Library (BIDL) for their outdoor mobile access and exploring through the GUIDE@HAND audio tourist guide.

**1. Introduction.** In the digital age the mobile devices, the Internet and ICT changed our daily life and routines. They give us information anywhere (work, home, holiday, etc.) and anytime and it is not far from the truth if we say that we couldn't live without these services and devices anymore.

The GUIDE@HAND application is an audio tour guide that helps tourists to discover the city or region with turn-by-turn navigation. It guides them from one interesting sight to the next presenting all information and stories at the right time and at the right place. GUIDE@HAND is developed by the Computer and Automation Research Institute of the Hungarian Academy of Sciences (MTA SZTAKI). It is available on mobile devices (e.g., smartphone, tablet) with Global Positioning System (GPS) exactly determining the location of the traveller. GUIDE@HAND provides *guided walks* with various durations. During the walks, tourists may gain standalone unique knowledge about the sights and attractions of a town or region. The aim is to enable the visitors to change their view on new or familiar locations, objects and motives and explore the past and present of their own neighborhood in an entertaining and informative way.

GUIDE@HAND overcomes the disadvantages of world travel mobile applications as Google Maps (on-line mode) and of classical navigation programs as iGO, Garmin Navigator, etc. (no cultural and historical information for the POI – Points Of Interest objects). Compared to other applications as Geolover – Travel Guide, for example, GUIDE@HAND support correctly the Cyrillic alphabet and in its Global Version it has many advantages over the Bulgarian local mobile applications for cities and events as Sofia, Bulgaria – Free Travel Guide, Burgas Tourist Guide, Visit Burgas, etc. Another one of the most important factors in spreading out GUIDE@HAND is that the application is available on both iOS (iPhone, iPad) and Android based mobile devices. The

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current release of the GUIDE@HAND application supports an extended QR code service for art exploring and learning [1][2]. This service is now applied in churches, monasteries, museums, collections, etc. accessing collections of iconographical objects from the Bulgarian Iconographical Digital Library (BIDL, <http://bidl.math.bas.bg>).

The paper presents an application of QR code-marked digital iconographical collections and its mobile exploring in the GUIDE@HAND Tourist Guide Application.

**2. Functionality for Guided Mobile Access to Iconographical Collections in the BIDL.** Over the last years several initiatives were carried out worldwide towards on-line documentation, exposure, storage and preservation of cultural heritage. In this framework, many valuable masterpieces of Orthodox iconography have been digitalized and appeared in the virtual space. However, rare specimens, private collections, icons from difficult-to-access storages, distant churches, chapels, and monasteries, objects in a risk environment or unstable conditions were almost “untangible” for the e-user. In an attempt to answer these needs of wider accessibility of iconographical objects, a team from the Institute of Mathematics and Informatics has developed a multimedia digital library called Virtual Encyclopaedia of Bulgarian Iconography [3, 4, 5]. Moreover, new functionalities for QR code maintenance and mobile offline BIDL Mode are created. This Internet-based environment is already becoming a place where Orthodox iconographical objects of different kinds and origins were documented, classified, and “exhibited” and its collections could be accessed through mobile devices in guided tours.

The next figure depicts an UML Use Case Diagram of these new services. Two new extension points for the presentation layer of BIDL were defined:

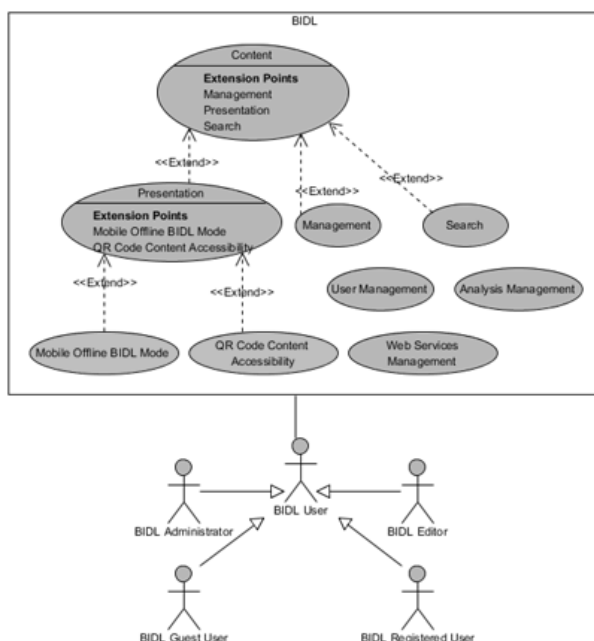


Fig. 1. UML Use Case Diagram

- Offline mobile mode for BIDL collections.
- Content accessibility through QR codes for all of the BIDL collections.

The following main features are implemented:

- QR Code generation, which implements the content accessibility through QR codes, and
- Generation of offline archives (according to the G@H specifications), implementing the offline mobile mode for BIDL collections.

The presentation layer of BIDL was extended by new mobile templates and functionality for automatic bulk creation of web content, based on the mobile templates and the collections data.

The created mobile templates are used as a master page for a collection and as a detailed view of a certain object.

Figure 2 depicts the extension of the current BIDL design architecture. There is a controller responsible for the offline archive creation extending the Collection Management and Presentation services, and a controller for the QR codes generation, which extends the Collection creation service. Main newly developed entities are the mobile templates and the generated QR codes.

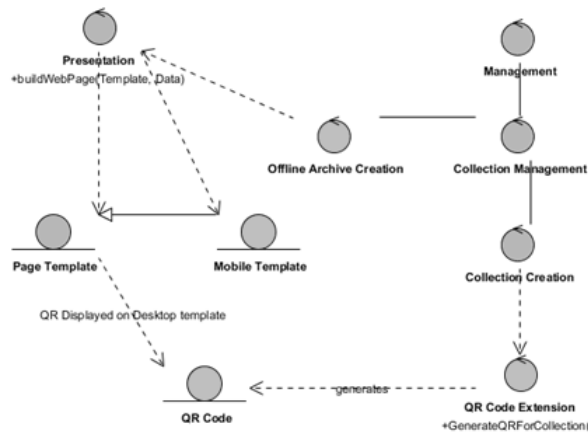


Fig. 2. Design Class Diagram

Figure 3 depicts the QR accessibility point from the BIDL desktop mode web page for an icon collection from the Regional History Museum in Veliko Tarnovo. Figure 4 shows the master and detailed collection mobile template presenting the iconographical content in the GUIDE@HAND application.

A migration process was developed to support the QR creation of the existing collections in BIDL.

The creation of offline archives was developed as a real time process, which builds the collection archive every time a QR mobile request is made. The purpose of this real time archive creation is to preserve the content dynamics, because the BIDL collections are “alive”, not static, and are not dependent on some set of objects, but on some set of characteristics of objects.



Fig. 3. Collection of icons from Regional History Museum in Veliko Turnovo

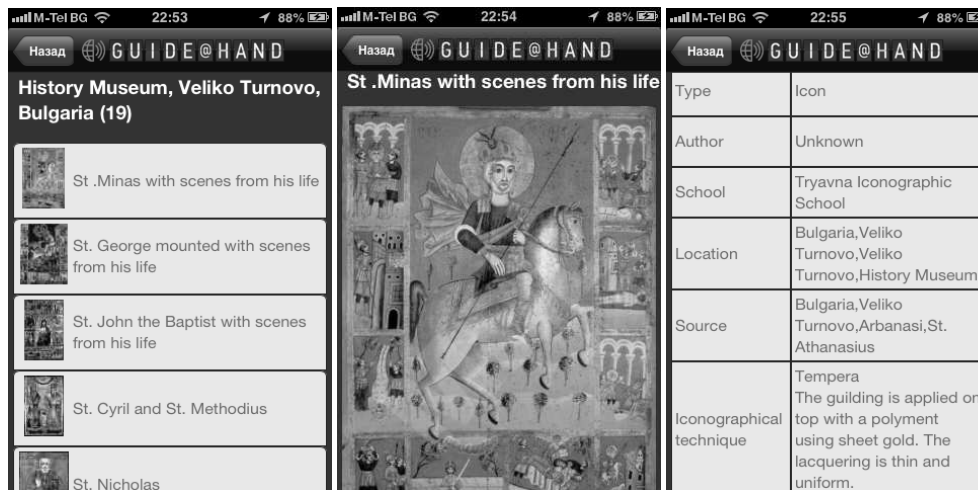


Fig. 4. Master and detailed collection mobile template

**3. GUIDE@HAND presentation of the iconographical content.** To view a BIDL collection in GUIDE@HAND, the user has to use the built-in QR code reader functionality of the mobile application. This functionality has already been implemented before the BIDL-GUIDE@HAND integration. The result of scanning the BIDL QR code (Fig. 5) is an URL pointing to the BIDL archive file which can be downloaded from the BIDL web server. The GUIDE@HAND application analyses whether or not the URL points to the BIDL web server and if a match is detected the application will start to download the archive file. Once the file is fully downloaded the application will extract the archive's content into a predefined directory structure.

There is a screen in the GUIDE@HAND application called My collections which is available from the main menu of the application. Opening this screen will read up the



Fig. 5. QR code for the icons collection of Museum of wood-carving and iconography art, Tryavna, Bulgaria

directory where the downloaded collections are stored. It will find the BIDL collection the user has just downloaded. The application will read the collection's name from the `collection.name.txt` file for every downloaded collection and display those for the user in a full screen list. When the user selects the BIDL collection from the list, the application will open a web browser and display the content of the offline `index.html` file.

This will result in displaying the content of the collection for the user on the screen of the mobile device. The `bidle.css` and `bidle.js` files will ensure that the content is displayed in a mobile optimized manner.

The GUIDE@HAND header never disappears while browsing the content. On the left side of the header there is a Back button. Pressing this button will take the user back to the My collections list.

The user can use the QR code reader any time to rescan the BIDL QR code. This will actualize the offline content by deleting the directory of the collection and downloading the BIDL archive file again.

For each row in the My collections list there is a Delete button which the user can press to delete the directory for that collection, thus removing the collection from the list as well. These buttons are invisible by default to prevent accidental deletion. The user has to either swipe their finger on the desired row in the list (iOS) or press the main Delete button in the upper right corner of the My collections screen to display the Delete buttons in all the rows in the list. Once displayed the Delete button can be pressed which will show first a deletion confirmation message to the user. The collection will be deleted from the device only after the user confirms this request.

In case there is no collection in the My collections list the GUIDE@HAND application will display information to the user about where to find the BIDL website and how to start to create collections.

**4. Conclusion.** The presented development attempts to encompass the opportunities for applying QR codes for iconographical art exhibitions. GUIDE@HAND application is 184

now in process of inclusion of a complete tour of Arbanassi churches, preserving valuable artefacts of the Bulgarian iconography. A demo of short tour showing 3 churches is prepared. The GUIDE@HAND Bulgarian interface is already prepared.

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## МОБИЛЕН ДОСТЪП ДО ОБРАЗЦИ НА БЪЛГАРСКАТА ИКОНОГРАФИЯ ЧРЕЗ QR КОД В GPS-БАЗИРАНА ИНФОРМАЦИОННА СИСТЕМА

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Докладът представя приложението на маркирането на цифрови иконографски колекции от „Виртуална енциклопедия на българската иконография“ чрез QR код за тяхното мобилно използване и достъп посредством GPS-базиран туристически аудио пътеводител GUIDE@HAND.