Mobile Exploring of the Bulgarian Iconography through QR Codes in the GUIDE@HAND Tourist Guide Application

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Abstract. The following paper presents an application of QR code marking of digital iconographical collections for their outdoor mobile access and exploring through the GUIDE@HAND audio tourist guide.

Keywords: Mobile Applications, Tourist Guide Application, QR Code, Museum Learning, Exhibition Technologies, Bulgarian Iconography, Digital Library, Digital collection

1   Introduction

Nowadays, ICT applied for tourism overcome cultural and linguistic barriers guaranteeing access to cultural heritage, strengthening a digital market through the provision of better services for tourists. This increases visibility and, as a consequence, competitiveness of tourism destinations.

GUIDE@HAND is an audio tourist guide mobile application providing tools and interactive services for mobile exploring of cultural places and objects. The aim of the GUIDE@HAND's guided walk is to enable the visitors to change their perception of new or familiar locations, objects and motives and explore the past and present of their own area in an entertaining and exploring way. The Global Positioning System (GPS) is used to exactly determine the location of the traveller.

Current release of GUIDE@HAND application maintains extended QR code service for art exploring and learning. This service can be easily applied in churches, monastery, museums, collections, etc. where the GPS signal cannot be relied upon. The iconographical content is stored in the Bulgarian Iconographical Digital Library (BIDL) which provides virtual exhibitions sharing by QR Codes.

The paper presents an application of QR code marked digital cultural heritage collections. The digital contents extended the exhibited arts through the GUIDE@HAND application.

2   GUIDE@HAND Application

The application called GUIDE@HAND developed by the Computer and Automation Research Institute of the Hungarian Academy of Sciences (MTA SZTAKI) runs on several platforms (iOS and Android). GUIDE@HAND is available on mobile devices (e.g. smartphone, tablet) with Global Positioning System (GPS) exactly determining the location of the traveller. The main service provides guided walks with various durations. During the walks, tourists may gain unique knowledge about the sights and attractions of a town or region. The application will help the tourists to discover the city or region with turn-by-turn navigation, guiding them from one interesting sight to the next - they will be presented all information and stories at the right time. During the walks tourists merely need to put the device into their pocket, which then can be used as an audio tourist guide.

Further services offered by the application:

- Offline map with current position of the visitor and the recommended walks of the location
- Explore function for exploring the sights standalone: whenever the tourists approach a point of interest their device will automatically provide them with basic relevant information. They may then choose to listen to additional, related stories.
- Showing services located in the neighbourhood on the map (tourism service providers, events, programs)
- WEB 2.0 services: sharing user experiences and evaluations on Facebook, Twitter, etc.
- Recording user experiences: While using the map, the program will automatically track the route of its user. At any point, the visitors can capture an experience by taking a picture, recording a voicememo or taking a note of something which catches their eyes. When they have finished their sightseeing they can save this track. They can then upload this track to our website. This way, they can share their experiences with their friends and give them a personalized virtual tour of the city.

3   Bulgarian Iconographical Digital Library

The Bulgarian Iconographical Digital Library (available at http://bidl.math.bas.bg) is an Internet-based environment—a place where iconographical objects of different kinds and origins have been documented, classified, and "exhibited" in order to be widely accessible to both professional researchers and the wide audience. The library provides services for registration, documentation, access and exploration of a practically unlimited number of Orthodox iconographical artefacts and knowledge, and end users can use this rich knowledge base through its interactive preview, complex object search, selection, and grouping. BIDL development started eight years ago during the national project "Digital Libraries with Multimedia Content and its Application in Bulgarian Cultural Heritage" of the Institute of Mathematics and Informatics – Bul-

garian Academy of Sciences. BIDL was supported by several international and national projects (viz. FP6 project LOGOS Knowledge-on-Demand for Ubiquitous Learning and national research project SINUS Semantic Technologies for Web Services and Technology Enhanced Learning), mainly using the BIDL content for e-learning purposes (from formal and specialized professional education to self-training or personal cultural investigations). A complete description of the rich BIDL functionality is included in [3][4][5].

4 BIDL-GUIDE@HAND Integration

For the BIDL-GUIDE@HAND integration several issues were considered and appropriate services created:

- Improve the BIDL content editor tool. This tool
  − allows the users to create QR code marked collections of selected iconographical objects,
  − helps the users to save, edit, or delete these collections,
  − can create an export zip file of the selected collection and generate a QR code for its URL.

This export is stored on the BIDL server and can be read by the GUIDE@HAND application.

- The GUIDE@HAND mobile application
  − reads this QR code,
  − recognizes that it is from BIDL,
  − downloads the zip file.
- The GUIDE@HAND mobile application contains all necessary modules to locally
  − store the downloaded collections,
  − manage the collections directory,
  − present these downloaded icons and related descriptions.

5 QR Codes in BIDL for the Exhibitions Sharing

Based on the presented in Section 4 assignment new functionalities for QR code maintenance and mobile offline BIDL Mode are created. The next figure depicts UML Use Case Diagram of new services.

Two new extension points for the presentation layer of BIDL were defined:

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

The following main features are implemented:

- QR Code generation, which implements the content accessibility trough 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 two new mobile templates and functionality for automatic bulk creation of web content, based on the mobile templates and the collections data.

The mobile templates created - one as master page for a collection, and the other – as a detailed view of a certain object.
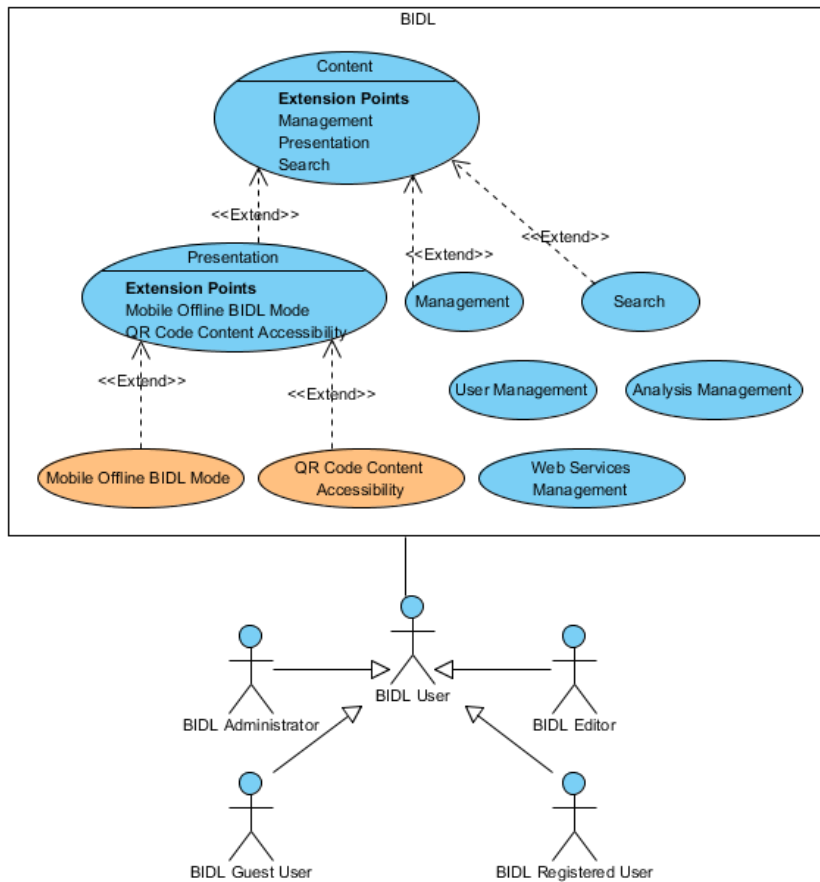
Fig. 1. UML Use Case Diagram

Figure 2 shows the extension of the current BIDL design architecture (classes in orange present the new features). 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.
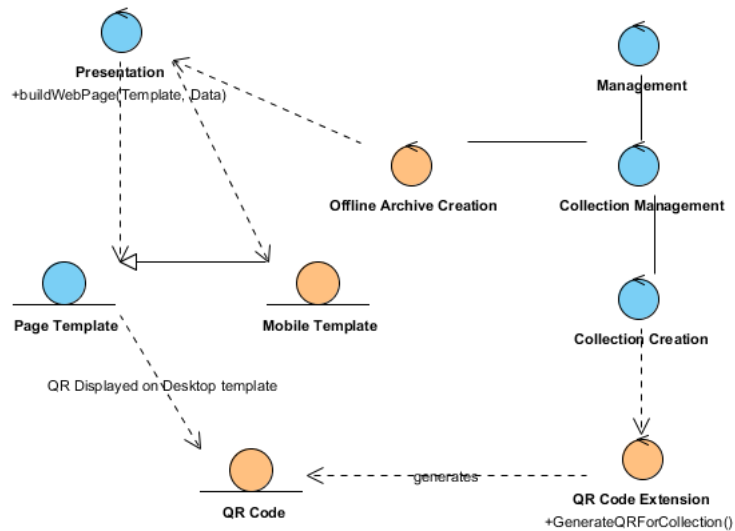

Fig. 2. Design Class Diagram

The following picture depicts the QR accessibility point from BIDL desktop mode web page for an icons collection from the Regional History Museum in Veliko Tarnovo.
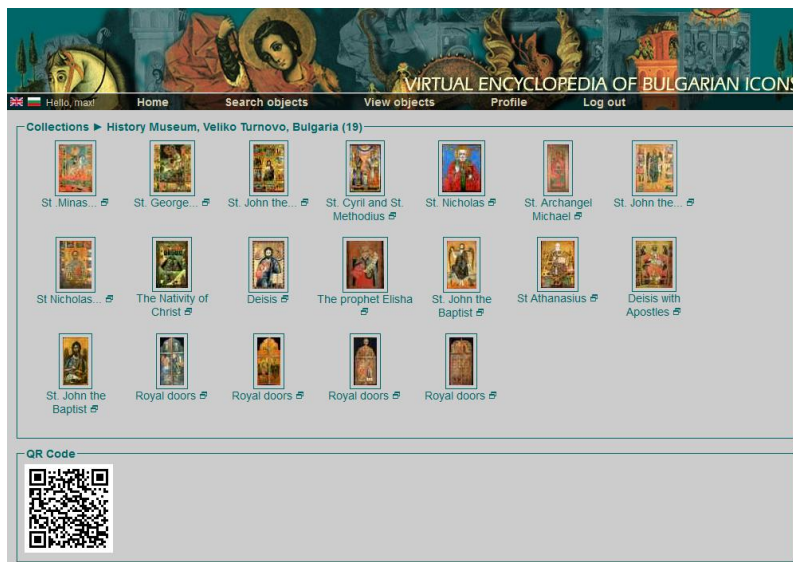

Fig. 3. Collection of icons from Regional History Museum in Veliko Tarnovo

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

The offline archives creation 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.

The created archives have the following structure:

`index.html` – the master page for a collection

`collection_name.txt` – metadata for the collection, currently contains only the name of the collection

`bidl.css` – cascading style sheet for the presentation of the mobile page

`bidl.js` – custom JavaScript code

`jquery.js` – JQuery code for reusing common JavaScript functionality

`page_1.html` – detailed view of an object

`page_2.html`

`page_....html`

`Images/` - folder containing the objects images (the images are watermarked)

`Images/1-view.jpg` (the big one for the detailed view of the object)

`Images/1-thumb.jpg` (and the smallest for the master page of the collection)

`Images/2-view.jpg`

`Images/2-thumb.jpg`

`Images/…-view.jpg`

`Images/…-thumb.jpg`

QR Code Extension implements the functionality for creating QR codes immediately after creating a collection.
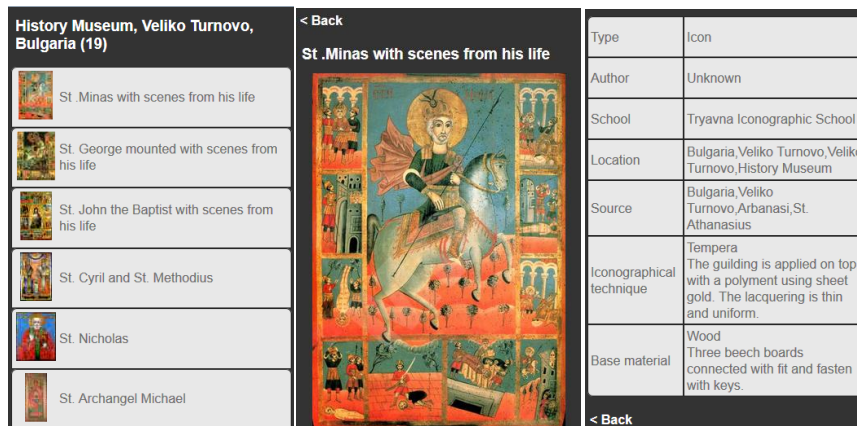

Fig. 4. Master and detailed collection mobile template

6   Work in GUIDE@HAND for BIDL Collection

To view the 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 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. After this the application will delete the archive file from the device [1][2].

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 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.

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

7   Conclusions and Future Work

The presented development attempts to encompass the opportunities for applying QR codes for iconographical art exhibitions. The next step is the BIDL extension for providing QR Code generation service for each icon stored in the BIDL archives. The exhibit sites hosting the icons can use this service to assign the printed codes to the exhibited objects. Visitors using the extended BIDL-GUIDE@HAND system offline can identify these QR Codes and present the related information for each icon in the downloaded collection.

GUIDE@HAND application is now in process of inclusion of complete tour of Arbanassi churches, keeping valuable artefacts of the Bulgarian iconography. GUIDE@HAND Bulgarian interface is prepared. This work is under a joint IMI-BAS – MTA SZTAKI cooperation project *Development of Software Systems for Multimedia and Language Technologies*.

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