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### **QR codes and libraries: Implementation and usage**

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#### **Abstract**

In this paper we will present a brief history of the QR codes – two-dimensional codes – from their usage in industry to the increasing popularity in cultural institutions. We will show the best practices of their usage in libraries worldwide and give a brief overview of their usage in Serbia. Readers will get acquainted with process of QR code creation as well as with best way for assessing their usage.

#### **What are QR codes?**

The best way to introduce QR codes, if you've never heard of them before, is to say that they represent the fastest connection between physical and virtual world. QR stands for: Quick Response – which means that their content can be quickly decoded. QR codes were developed in 1994 by the Japanese company Denso Wave<sup>1</sup> for tracking production of

car spare parts. They are designed to allow very fast decoding of their content. QR codes represent a type of two dimensional codes which basically means that they store information both horizontally and vertically (they differ from the bar codes in which information can be stored only horizontally – see Figure 1).

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<sup>1</sup> This company produces devices for automatic product identification (bar

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code readers, industrial robots etc.). They are a division of Toyota Company. More information can be found at: <http://www.denso-wave.com/en/index.html>

Because of that, QR codes can hold much more information than standard bar codes.



Picture 1: Differences in coding between the QR code and barcode <sup>2</sup>

Amount of data that can be stored in QR codes depends of the data type, code size and error correction capability. Thus, one code can store:

- Up to 7089 numerical characters
- Up to 4296 alphanumerical characters
- Up to 2953 binary (8 bits) characters
- Up to 1817 Kanji or Kana characters

It is interesting to mention that data from the code can be restored even if the codes are had been damaged or dirty. That is, up to 30% of damaged code content can be restored (see Figure 2). This is possible because data is stored in a specific way, error correction capability of the codes and possibility of 360 degrees high speed reading. There are four error correction levels: L[ow], M[edium], Q[uality], H[igh]. Each of these labels tells us up to wick level of damage codewords can be restored: L – 7%, M – 15%, Q – 25% и H – 30%. Thanks to the error correction level QR codes can be designed in accordance with the needs of their creators. Therefore, many companies insert in their advertising banners QR codes that contain i.e. company’s logo, which look much nicer than ordinary QR codes <sup>3</sup>.

QR codes have one more positive side. There’s no need to have a specific device for their decoding, they can easily be scanned with smart phone cameras. Having all of this in mind, it’s not sur-

prising that QR codes are moving from the use in industry to many segments of modern society.



Figure 2. This code is damaged but its still can be read: Scan this code if you want to find out what it contains!

You can find many websites which offer creation of QR codes for free <sup>4</sup>. Most of these sites have predefined templates for QR codes. It is easy for user to choose purpose of QR code, most common templates are: URL, text, vCard or phone number (which can be easily imported to the phone contacts). Due to increased popularity of QR codes, reading software is available for all operating systems from leading mobile phone manufacturers. This software is free and pre-installed on most new generation phones. Because of the increasing popularity of the QR codes, there is much software for their decoding. This software is available for operating systems of leading mobile device manufactures. Software is usually free, and a new generation mobile phone comes from the factory with already installed software <sup>5</sup>.

We’ve already mentioned that QR codes represent

<sup>2</sup> Picture taken from: <http://www.denso-wave.com/qrcode/aboutqr-e.html>

<sup>3</sup> More information can be found at: <http://mashable.com/2011/04/18/qr-code-design-tips/>

<sup>4</sup> Some examples: <http://www.the2dcode.com/qr-code-generator>, <http://qrcode.kaywa.com/>, <http://goqr.me/>

<sup>5</sup> If you already don’t have the software for your mobile phone, you can download it here: <http://blogchebgb.blogspot.com/2011/08/qr-e-hi-tech.html>

the fastest connection between physical and virtual world, but how does it exactly work? When user scans the code he/she can, only in a few seconds, be redirected to the web page of, for example, local cinema where they can find information about movie projections; they can fill out some online forms; get information about theater or even about history of a building or a monument on which the code is placed. Before QR codes came into use mobile access to Internet had been pretty much the same as desktop access; users of the mobile web had to type long addresses in their web browsers where mistake in only one character would lead them to a dead-end. By scanning the QR code, users are saved from typing the long addresses and the access to information is much faster.

Having in mind that the use of QR codes is totally free <sup>6</sup> it's not surprising that their use is growing, particularly in cultural institutions, especially in libraries.

### **QR codes and libraries**

Despite of the popularity of QR codes in Japan their blooming in the rest of the world is still expected. Number of mobile phone users, on a world level, is growing every year. According to the statistics <sup>7</sup> for 2011, 76% of world population uses mobile phones. If we look by countries, on the very top are United Arab Emirates where 197% of residents have mobile phone (almost two phones per resident). In the United States 104% of residents have mobile phone. Results of the survey which was conducted during 2009 in the USA, show that the number of adult users who use mobile phones for access to Internet (not only for calls and texting) was 40%. Also many reports show that more and more teenag-

ers and young adults are using mobile phones for Internet access. This information clearly shows that access to Internet via mobile phones will continue to grow and by some predictions it will overcome number of desktop Internet users by 2014 <sup>8</sup>. Libraries all over the world are modifying their websites for mobile usage. By entering in the world of culture QR codes created the space for modernization of libraries. In the following paragraph we will show some examples of successful practice and challenges that follow the implementation of QR codes in libraries all over the world.

Library of the Huddersfield University (United Kingdom) was the pioneer of QR codes usage. Librarians have noticed that students, when browsing through an electronic catalog, write down notes about book location, availability etc. on a piece of paper, and afterwards look at that paper while browsing the book shelves in search for a specific title. Lately students started to take pictures of electronic records with their mobile phones and then browse the shelves for the desired title. Having this in mind, librarians decided to put QR codes with a link to the mobile version of the same record at the bottom of the electronic record. Codes were also placed in printed books which have electronic equivalent so users can choose between two forms. They have also placed codes on the shelves with periodicals to link current periodicals with electronic version. Creation of QR codes is easy task for the librarians; harder part is to inform the users about their usefulness. Library of the Huddersfield University promotes their codes on the library blog and by printing the posters which explain their use.

The most advanced use of QR codes can be seen in the public library of Contra Costa County, CA. They have perceived a great potential for use of QR codes on physical locations outside the library. Library management created part-

<sup>6</sup> Denso Wave is the patent right owner for the QR codes, but codes can be freely used by users: <http://www.denso-wave.com/qrcode/qrstandard-e.html>

<sup>7</sup> [http://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_number\\_of\\_mobile\\_phones\\_in\\_use](http://en.wikipedia.org/wiki/List_of_countries_by_number_of_mobile_phones_in_use)

<sup>8</sup> <http://www.digitalbuzzblog.com/2011-mobile-statistics-stats-facts-marketing-infographic/>

nership with local public bus transportation and QR codes with links to library audio books were placed on the public bus transportation. Ideal way to shorten the bus ride!

Libraries use QR codes in various interesting ways. Some decided to promote authors of exhibitions by putting the codes next to the exhibited object which will direct you to the author's website or to detailed description of the exhibited item. Thus users can be informed about the author, creation of the object, or price if the object is for sale. Larger libraries use QR codes to enable users the reservation of the study rooms. They simply stick the code containing the link to the reservation form, on the door of study room enabling fast reservation for users. QR codes with links to audio/video library tour can be often seen in the libraries. Many libraries use QR codes to promote their electronic collections. QR codes are stuck on cardboard book imitation and placed on the shelves where printed books should be placed.

Promoting of QR codes differs from library to library. Librarians are trying to promote QR codes on both physical and virtual users meeting places. Bookmarks with a small QR code and instruction about its usage are printed and at the same time libraries offer on their websites downloadable software for QR code reading. By increased usage of smart phones number of mobile application users is also growing.

Beside the promotion of QR codes librarians are trying to track their usage. There are numerous web applications for URL shortening. Shortened URL is very useful for QR codes because regular URL can often be too long<sup>9</sup>. Shortened URL can offer numerous statistic data about its access. For example, the address from the shortened URL can be placed in only one QR code making the tracking of its usage much easier.

<sup>9</sup> Shortened URL are very useful for web sites like Twitter where you can enter limited number of characters.

Websites which have applications for URL shortening do not always provide desired statistic so libraries are forced to combine data from several websites. The most popular free websites for URL shortening are: <http://goo.gl/>; <https://bitly.com/>; <http://delivr.com/>. There are also commercial websites, and a really good one is: <http://www1.qr-reactor.com/>.

### QR codes in Serbian Libraries

Research conducted by the National Institute for Statistics in 2010 tells us that the number of households with some kind of Internet access was 39%<sup>10</sup> and 22% of them access Internet through mobile phones (83% of Serbian residents have a mobile phone). With this data, it is not surprising that QR codes are becoming more popular in Serbia. Nowadays you can notice them on advertising posters for movies, banks, websites, etc. They are located on various places, from the huge billboards to the advertising posters in city buses. Authors of these papers are not fully familiar with their usage in cultural institutions, but it is useful to mention that National Library of Serbia has presented the link to the mobile version of KoBSON web page with the QR code on the occasion of 10th Anniversary of KoBSON project.

In 2010, the Belgrade City Library had started the pilot project for promotion of the codes. Numerous codes (mostly with quotes from famous literary works) were placed on the bookshelves and other transparent places in the library (reading room entrance, gallery, near the registration desk, etc.). The aim of this project was to familiarize users with QR codes and their usage. At that time Belgrade City Library was lacking the Wi-Fi Internet access so we decided not to put links in the codes because we would put users in an unfavorable situation to pay to access to the code content. We are planning to implement

<sup>10</sup> <http://webrzs.stat.gov.rs/WebSite/repository/documents/00/00/43/62/PressICT2011.pdf>

codes which will lead users to the website of most popular book titles, authors of exhibitions from our gallery, etc. We are also planning to use QR codes for promotion of our digital collection. In the Belgrade City Library, QR codes were promoted through library blog and social networks <sup>11</sup>. For the next phase we are planning to print posters with funny explanation about QR code usage.

### Conclusion

Libraries are changing in accordance with users' needs. Libraries, traditionally very passive institutions, cannot always keep up the pace with changes. Unlike other innovations, QR codes have been amazingly well accepted in the library world. Being aware of their potential, librarians discuss more and more about their usage. Many technological innovations which first found their use in the industrial sector moved slowly towards the libraries and other cultural institutions. It is interesting to say that QR codes are perhaps the first innovation to which advantages the librarians were hooked on before the library users. Librarians are now faced with the situation where they have to show all the benefits of QR codes to the library users. It might sound like a paradox but it is a fact that we, librarians, have to follow the technological progress of the society if we want to stay relevant sources of information for future generations of users.



Figure 3: QR codes in the Belgrade City Library

<sup>11</sup> <http://blogchebgb.blogspot.com/2011/08/qr-e-hi-tech.html>

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