QR-CODES APPLIED TO ARCHITECTURE DATA AND TEACHING

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Abstract

The purpose of this paper is to study the use of Quick Response Codes (QR codes) in the architecture framework and propose methods for evaluating future solutions that provide both the visualization of information as the adaptation of this information to the visual environment or to the user profile. Users can use the camera on their mobile device to capture the image of the QR codes and obtain information related to it. This paper reviews available tagging techniques and additionally we present a solution to increase the adaptation of this method taking into account the user profile and the device configuration.

Keywords: Quick response codes (QR code); User Profile, Architecture Data; Dynamic Information; Mobile Tagging.

1. INTRODUCTION

In the recent years, mobile phones with integrated digital cameras and advanced connection tools are prevalent and available to the wide range of users. These users manage a large amount of digital information, they customize their interfaces and applications and exchange their profile constantly with the aim of increasing the transmission speed of the channel and optimizing the receipt time of the message.

One of the most used applications in the last decade, especially in Asian countries, has been the exchange of information using QR codes.

Figure 1.- Some examples of QR Codes (business solutions, marketing, personal information)

According to recent studies (1), barcode scanning applications have been used by 28% of Smartphone users. The highest rate of adoption is among Android users (48%), followed by iPhone users (39%) and BlackBerry users (14%). More than half of these active users scanned a barcode in a store in order to compare the price of the product with other stores and 23% scanned the barcode to bring up more information about the product.

As we can see, mobile phones are now a part of many aspects of everyday life. Modern Smartphones can make calls, but also play music, take and store photographs, browse the Internet and send email (2). Recent studies (3) confirm the increase of these advanced devices: In 2010, the mobile phone sales increased close to 14% respect 2009. The segment of Smartphones (20% of all sales), has been the greatest increase has obtained over 2009 with 50%.

The research community is exploring the different possibilities these devices offer users, ranging from optimizing the presentation of information and creating an augmented reality, to studies more focused on user interaction. Undoubtedly, one of the most researched themes on the use of these new technologies is information visualization (IV). IV is a well-established discipline that proposes graphical approaches to help users better understand and make sense of large volumes of information (4). The small screens of handheld devices provide a clear imperative to designing visual information carefully and presenting it in the most effective way. Limited screen size makes it difficult to display large information spaces as maps (5), web pages or photographs (6).

Hence, the purpose of this paper is to introduce a mobile tagging system which provides the users a customization access to information of digital images, videos, and descriptions related to architecture projects. The user captures a basic QR code of some architecture information and sends this information along with its personal data and device profile to the system. Subsequently the system will return the advanced information features of the project formatted according to the user profile and the characteristics of the device.

2. LITERATURE REVIEW

This section represents a brief explanation of the fundamental technologies of the research background and the justification for the selection of QR Codes in our study.

QR Code

The Quick Response Code (QR Code) is a two-dimensional code developed by Denso Wave in 1994 with the primary aim of being a symbol that is easily interpreted by scanner equipment. The main mission of this code is store information (numeric, alphanumeric or Kanji symbols).

The main advantage of this code in front of other types is that carry meaningful information in the vertical direction as well as the horizontal, for this reason, QR code can carry up to several hundred times the amount of data carried by ordinary bar codes (7).

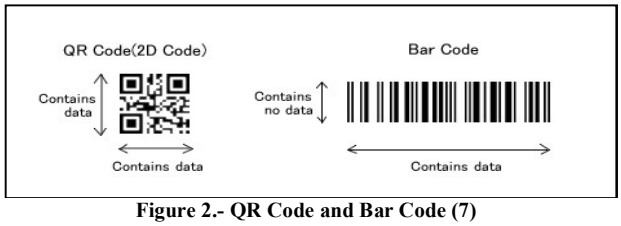

Figure 2.- QR Code and Bar Code (7)

We can find other kinds of 2D Codes (8). The main codes and features are:

		QR Code	PDF417	DataMatrix	Maxi Code
					
Developer(country)		DENSO(Japan)	Symbol Technologies (USA)	RVSI Acuity CiMatrix (USA)	UPS (USA)
Type		Matrix	Stacked Bar Code	Matrix	Matrix
Data capacity	Numeric	7,089	2,710	3,116	138
	Alphanumeric	4,296	1,850	2,355	93
	Binary	2,953	1,018	1,556	
	Kanji	1,817	554	778	
Main features		Large capacity, small printout size High speed scan	Large capacity	Small printout size	High speed scan
Main usages		All categories	OA	FA	Logistics
Standardization		AIM International JIS ISO	AIM International ISO	AIM International ISO	AIM International ISO

Fig 3. Features of 2D Codes (7)

Compared with conventional bar codes, QR Code provides the following main features:

- It is established as a two compatible standards: ISO/IEC 18004 and JIS X0510.
- High capacity encoding of data: with different symbol version to increase the data capacity.
- Configurable print size. (Very interesting the small printout size with high degree of information).
- Kanji and Kana symbols encoding capability.
- Dirt and Damage Resistant. The QR Code also contains its own error correction data (reed Solomon) with capacity to restores 30% of errors (level H).
- Readable from any direction in 360º with an internal orientation calibration and self-alignment markers.
- Structured Append Feature.
- Great number of sites and software for encode information and download readers (9).

The most common data linked to a QR Code are:

- URL: Website, Google maps location, iTunes link, YouTube video, Social media data, etc.
- Text: basic text, SMS, email address or message, vCard, etc.
- Numeric: Phone Number, coordinates, etc.

Figure 4.- Example of QR Code generation (10)

QR Codes in Architecture and Education

Some examples that relate the use of QR codes with the architecture and educational framework are:

1. Basic Web-Link: This QR code links a website related with architectural news:

Figure 5.- http://www.architecturetoday.co.uk/

2. Advanced Design of web-link: The N Building is a commercial structure located near Tachikawa station, Tokio, Japan. Teradadesign + Qosmo decided to use a QR Code as the facade itself. It links a site which includes up to date shop information and has augmented reality applications.

Figure 6.- http://www.teradadesign.com/home.html

3. Advanced Contents: Ubimark has published Jules Verne's classic Around the World in 80 Days enhanced with QR Codes which incorporate additional information such as videos or images that the user can see from the mobile device.

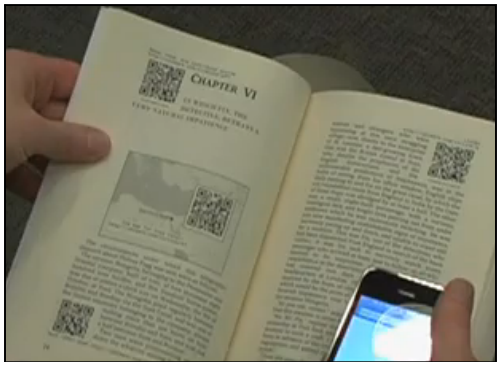

Figure 7.- http://2d-code.co.uk/around-the-world-with-qr-codes/

4. Advanced Data of Architecture Projects: On February 2011, New York City Mayor unveiled a plan to put QR Codes on all NYC building permits by 2013. Users who scan the codes will be able to learn details about ongoing projects, read complaints and violations related to the location, etc. Those information is located in the Buildings Information System which is the Department of Building's main database of New York (11).

Figure 8.- http://www.archdaily.com/115836/quick-response-codes-for-new-york/

5. Tourist information of Architecture Elements: System that allows personal tourist tours around the city of Sevilla (Spain). The user can find QR Codes that have been placed at interesting points where scanning the code the user obtains additional information of the building, street, statue, church, etc.

Figure 9.- http://www.sevillaqr.com/ and quickers

User and Device Profiles

We have seen the main characteristics of QR codes and their basic uses. Now, we need to define information that QR codes has not considered and that can affect the channel of communication: the typology of users and devices.

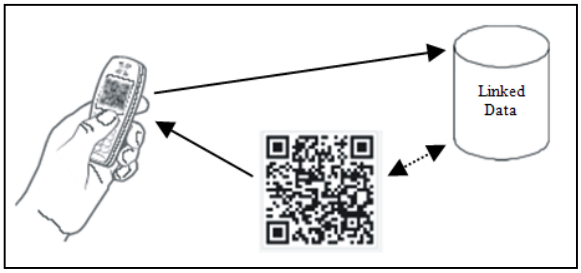

Figure 10.- Work cycle using QR Codes

On the one hand, we can find a lot of studies and research works that tell us about the differences of the users (12). Basic differences are related to physiological and culture factors such as age, gender, language or disability (13), (14), (15), (16). In a psychological area, we find works that would allow us to evaluate the differences between users based on the perception, the emotions and subjective cultural differences (17), (18), (15) .

A QR code can be a good option to store user information. There are applications that allow quickly and easy generate QR codes from the personal data of the user (stored in text or in a vCard).

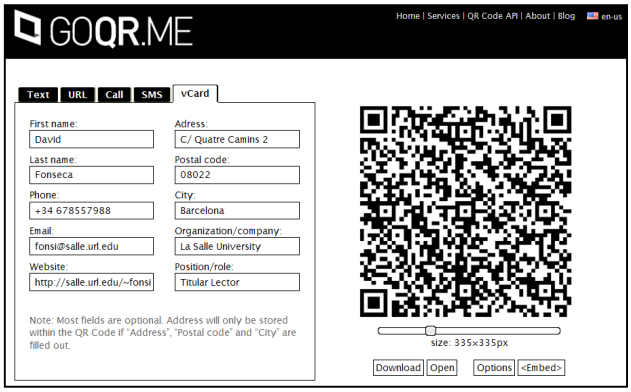

Figure 11.- User ID encoded as QR code. http://goqr.me/

But there are other data related to users that are not public or they are interesting that not being visibles. Those data, such as main language, any visual or hearing disabilities and other subjective preferences, can be very important to achieve a more optimal communication.

Also, several studies (12), (19) reveal the need of taking into account the characteristics of the device where the user is visualizing the information. If we are able to adapt content according to the device we will get a better communication and increased usability and user satisfaction.

3. PROBLEM DESCRIPTION AND NEW DYNAMIC METHODOLOGY

As we have seen, QR codes are able to link the users to information related to them, but otherwise do not taken into account either the user or the device profiles.

The information linked to the code, either text or a dynamic "url" with capability to update its contents, is received by users and devices but it can be some times that the final user and their device have problems to understand or process the information. For example: the language of the data or the possible disabilities of an user that needs that the message will be encoded.

In this paper, and based on the current state of this technology, we propose to create a dynamic cannel able to update the information associated with a QR code in terms of three main points:

- Initial data associated to the QR Code.
- User profile data, information that the user needs to have updated.
- Device information (software, O.S., model, resolution of the screen, operator, etc.

Instead of generating static codes as shown in section 2 of this paper, the proposed system is based on the following schedule:

- Dynamic screen devices to show the QR codes.
- Specific software installed in the portable device. This software
- The software will bring together three types of datum:
    - The data decoded and linked to original QR code.
    - The parameters that the user has saved in their profile.
    - The device characteristics to be considered for an optimized model of the final information associated to the QR code.

With all data processed, the software sends them to the server of the system which generates the QR codes. The server generates the new information taking into account all data and specially the user profile.

- The system can choose between two models for updating the initial information associated to the QR code:
    - Without cost for the user: The system updates the QR code displayed in a dynamic screen linking a new address where the user can access the extended data modeled according their profile and their device.
    - Payment system: The QR code is static and the user receives by SMS the new information modeled according their profile and their device or a new link with the same information or additional ones.

4. CONCLUSIONS

The proposed system is currently under design in order to be implemented at an early stage during the first quarter of 2012.

This new model will allow increased access to all type of information and digital contents. Especially useful it will be for information based on the user's language and for the users with audio or visual impairments. The increased accessibility of the system will lead to a more satisfying user experience.

A weakness of the proposal is the introduction of dynamic screens to display the QR codes because it would raise the budget for implementation of the system. This weakness can be overcome by choosing the mode of static codes and SMS communication between the service and the end-user.

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