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Effective use of QR Codes in Religious Tourism

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***Abstract*—Quick Response (QR) code is a two dimensional codes that is read and accessed via mobile devices equipped with camera and QR reader. Most smart phones have a camera and the QR reader is easy to install and is available for different platforms. Therefore, the simplicity of this type of code makes it effective in many fields. This paper presents the idea of using QR codes combined with a mobile telephone in religious tourism. Generally, the religious ritual has a set of ordered activities which visitors must follow exactly. QR codes will help the visitors to follow the ordered steps and help them to find information quickly without requiring them to search in any printed brochure. We choose the pilgrimage to the holy city, Mecca in Saudi Arabia, as an example to apply our idea.**

***Keywords*-QR codes; Religious tourism; smart phone; tourist guide;**

I. INTRODUCTION

The use of smart phones is growing quickly and offer wider services to users like, GPS navigation, web navigation, games and more. This encourages the developers to build applications that are tailored for mobile phone specifications. Some technologies such as QR codes [1] are combined with these applications to facilitate the provision of services to mobile users.

QR code technology is widely used and very popular and attractive in most if not all of life aspects. It is a two dimensional barcode carrying different types of information. It can be read and accessed quickly by smart phones. The user requires just a camera and phone software to scan and read QR codes. QR codes encode information in a strange picture consisting of several black and white dots, an example is shown in figure 1. This blind picture is converted into useful information when it is scanned under a QR reader.

QR codes were invented in 1994 and approved in 2000. Their use was limited but, nowadays, as our world becomes digital, the QR code has found its way to all fields and facilitates several types of service. Mobile phones support the spread of QR codes by enabling the reading and accessing of the information stored in this blind code. QR codes are very popular as two dimensional codes in many countries such as Japan, Korea, Canada, Europe, China and other countries [2].

QR codes have different versions which represent the data capacity that they can accommodate. The data encoded in QR codes could be numeric, alphanumeric, binary or Kanji. The highest capacity for data is for the last version 40; it can contain up to 1852 characters [3].

Figure 1. QR code sample

QR codes could be efficient and helpful in religious trips where the order of actions to be taken is prescribed. The journey to the holy city, Mecca in Saudi Arabia, to make the pilgrimage is called “Umrah ”or “Hajj ”consists of several steps. The visitors need to follow the steps according to prescribed ritual.

The traditional way to understand the Omrah or Hajj steps is to have a printed brochure or several brochures that contain instructions explaining what the visitors should do and the locations that the visitors may visit during their residence in Mecca. The visitor must search in the correct brochure to get the desired information. He may never have the chance to get what he wants quickly or can not get what he wants from the material that he has.

QR technology is becoming increasingly accessible to most people, therefore, in this paper we will show how to use QR codes to facilitate and explain the ordered steps in religious tourism, study the flexibility that it offers to visitors and the feasibility of applying it. In the following section we give a brief description of QR codes. Next, section II explores existing tourist guides applications. Section III contains our work and the finally, section IV concludes our paper.

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A. QR codes

A QR code is a matrix of cells arranged in black and white squares. It contains some functional patterns to facilitate storing and reading processes. These functional patterns are: finder patterns, alignment patterns, timing patterns and quiet zone [3]. QR Codes store information in two directions: vertical and horizontal. It can be read in any direction of 360 degree through position detection patterns located at three corners and known as finder patterns. The QR structure is shown in figure 2 [4]. The alignment patterns are used for distortion correction of the QR Code. The timing patterns are arranged in two directions: horizontal and vertical. They are used to identify the central coordinate of each cell in the QR Code.

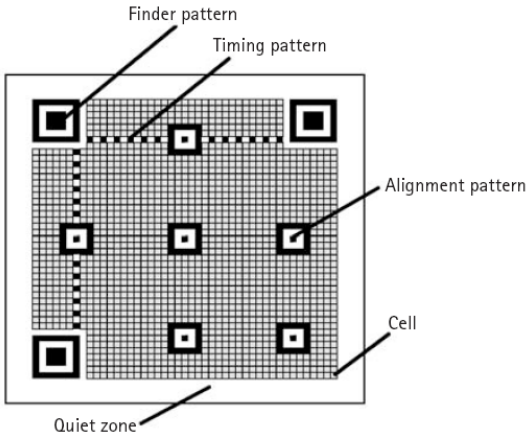

Figure 2. QR code structure

A QR code may contain different forms of data types and when scanning, the user has some options to choose. Some of these types with the options that the user can choose are:

- URL: when the QR code reader scan this type of data a dialog appears to let the user choose to open this URL or to send it as email or as SMS.
- Email message: the QR contains an email address, the subject and the message. When the reader scans this type of code he has to choose either to send this message or to add the contact to the contact list. As an example, we show a screenshot in figure 3.
- Telephone number: when the QR encodes a telephone number, the user can either dial this number or add it to the contact list.
- Text: the text will be recognized and displayed.

QR codes can be used and accessed without any additional charge in cost or time. The advantages of QR code are:

1) It is available in most mobile phones. The QR readers could be installed easily in the mobile phones. It requires a camera which is found now in all smart phones.

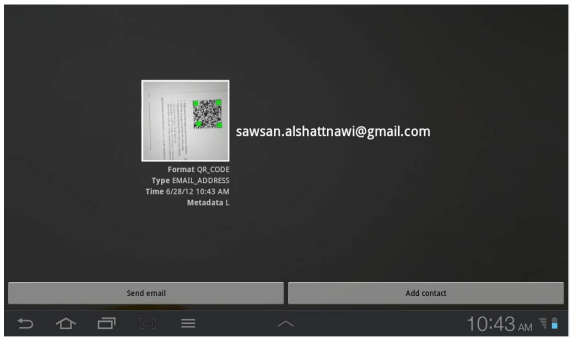

Figure 3. screenshots of scanning an email QR code

2) It is easy to use, fast and accessible to the users. They can save and read the QR easily in their mobiles.
3) it allows to add more information than printed information over papers. The printed area in any panel is very short and it requires to stop and read. With QR codes, additional information may be added and it can be read during follow-up.
4) It is compatible with multiple language alphabets and characters [5].

B. QR Codes Usage

QR is used in many fields. In tourism field, for example, it provides users with the desired information about an attractive area. In addition, it can be used in a museum by attaching a QR code to each artifact containing information about the history or the way in which it made [6]. Bellow are some situations where QR codes are used.

1) Software downloads : the QR codes will open the download page directly without any search for this software through URL′s and layers of pages [5].
2) Patient identification; in Japan, Hong Kong and Singapore, the QR code is printed on the patient′s wristband. It contains information about the patient such as, name, number, date of birth, sex, ward and bed numbers [7]. This makes it easy to ensure that the patient gets the right medicine at the right time.
3) In business, the benefits as mentioned in [8], QR code could increase excitement and make the business unique compared to others. People are curious about what information is hiding behind QR codes. Scanning those codes facilitates a feeling of suspense and instant gratification which makes it stand from the competition.
4) The most attractive usage of QR codes was in education; in schools or universities [9], [10], [11]. For example, a teacher may present a concept and make a QR code containing various links; the students could scan the QR code and access the links directly or save it in their bookmarks [12].

II. Mobile Tourism

Mobile tourism involves using the mobile device as an electronic tourist guide [13]. The electronic tourist guide applications are categorized according to [14] two categories: (1) pre-installed applications: the application must be installed and run on the device. (2) Using the web to browse the tourist information through a thin client on the device. In the first approach, the tourism content is already defined and installed in the user device customized to his preferences. If the user changes one of these preferences, the application must be updated to contain the needed information. The applications Cyberguide presented in [15] and Mytilene E-guide presented in [13] belong to this category.

Cyberguide is built for many different mobile device platforms. It is a context-aware tour guide which means that determining the current user location, as well as a history of past locations, are used to provide more services. The the Global Positioning System (GPS) is used to locate the user outdoors, while for indoor use, the IRDA positioning system is used, But their use is for indoor or outdoor, not both, because there is no positioning system that is used for both. Mytilene E-guide also needs to be installed. It displays tourist information customized to user preferences. Each application is built to a specific platform. The portability from one platform to another requires rebuilding the application from scratch. Over and above this, the application needs a memory size to be installed and run in the mobile device where the resources are very limited. Therefore, applications developers may meet new challenges when taking into account the poverty of mobile resources.

The second approach overcomes some of the disadvantages of the pre-installed applications because web applications can be accessed from any platform and from anywhere, plus there is no need to have mobile resources. But they need constant connectivity to the network. Whenever a user is out of coverage he can not access the service. In addition, internet access is never free. The web application GUIDE [16] represents an example for this type.

The GUIDE application is a web-based application. The system uses mobile computing technologies and wireless infrastructure to help the tourist to get information about the city, adapted to their personal and environmental contexts. It requires continuous connectivity. Tourists can get good information adapted to their locations and preferences. In case of disconnection, GUIDE units cache some of information locally, but during the period of disconnection, as mentioned by the authors of GUIDE, out of date information is presented to tourists. To help alleviate this problem, the user interface to GUIDE has been designed to encourage the user to form a suitable mental model of the system by providing visitors with feedback regarding the current state of connectivity if they are online or offline to associate state with available functionality.

QR code is a new technology that facilitates and overcomes the problems of these tourist guides. There is no need to install the tourism content, no need for Internet connectivity and it is accessible from any platform. A QR reader is available for windows phone, android, Iphones and Nokia etc.

The term Religious Tourism, in general, refers to visits to places for religious duties rather for sightseeing or pleasure alone. Visits to sacred locations may requires a sequence of steps and the visitors must follow the ritual that pertains to each step. Mostly, the visitors like to do what the religious instructions say or what their prophet did in the specified location. For the pilgrimage to Mecca in Saudi Arabia, the visit may take two forms which are called Omrah or Hajj. The number of visitors to Mecca in 2011 was 6.7 million excluding the visitors from the Gulf countries and from KSA [17]. In each visit, the visitors must follow specific instructions and do their efforts to make the visit in a correct way. this means either imitating what Prophet Mohammad did, or, doing what he said to do during the visit. Thus, a ritualistic sequence is imposed.

III. The Proposed Idea: QR and Religious Tourism

As we see in the existing electronic tourist guide, there are some restrictions and limitations. Therefore, we present in this section another way which exploits a new technology, QR codes, to provide users with specific information in a specific location, using their mobile devices.

The work is done in two phases: the first step is building the web site that contains all the necessary information and the desired videos that explain the steps of the pilgrimage and how to use QR codes. The web site is shown in figure 4. The information in the web site is collected from several sites.

The user can navigate the site before visiting, read the information, capture the QR codes, save them in his mobile and use them when required. The web site is necessary for guiding the users on how QR codes will serve them. When the user registers to go, the registration office provides him with the link to this web site and, if necessary, a printed brochure explaining the importance or QR codes and how to use them.

The second step is determining the QR code contents, generating them and determining where to post each one.

The general steps that we follow after the content of each QR code is specified are:

- use the QR code generator. Many sites allow anyone to generate a QR code. It just needs the user to determine the content type and enter the information. (Not all of these site support Arabic language.) QR codes here are generated using http://goqr.me/
- print out the QR codes

Figure 4. The main page of the web site

- place it in the specified locations.

The last step must be studied well. The QR code must be accessible to all. The information must be good enough to help the visitor to understand it quickly.

Here, is an example. To make the Omrah, it is preferable to enter from the gate called Alsalam , there are 79 gates. Therefore, the QR at each gate advices the visitor to go to Alsalam gate. Next, brief information must be given about how to go to that gate from his location, and additional information if the user does not wish really to change the gate. The QR at Alsalam gate contains what the visitor must do, what he has to say before entering this gate and what the next step is.

A. System Functionality

The way of accessing the information depends on the visitor requirements or the connection status. This accessing can be done in two possible ways:

1) The visitor at each location can scan the posted QR code and read or save it during the visit as shown in figure 5 (a). This represents our original system idea. Also, to facilitate the saving of QR codes on the mobile device, the visitor can choose a number of QR codes from a big list on the web site to be downloaded as a package on the mobile device. Therefore, the visitor can read the information in the QR codes as required, at anytime and anywhere.
2) A link to the site is appended on each QR code, if the connection to the internet is possible, the visitor can access more information on the web site as shown in figure 5 (b).

B. System Testing

Testing and studying the effectiveness of such a method in field will be very hard. So, we simulated the situation in a big square on the university campus. It was hard work, but large number of students helped me in the simulation process and in fixing of QR code panels.

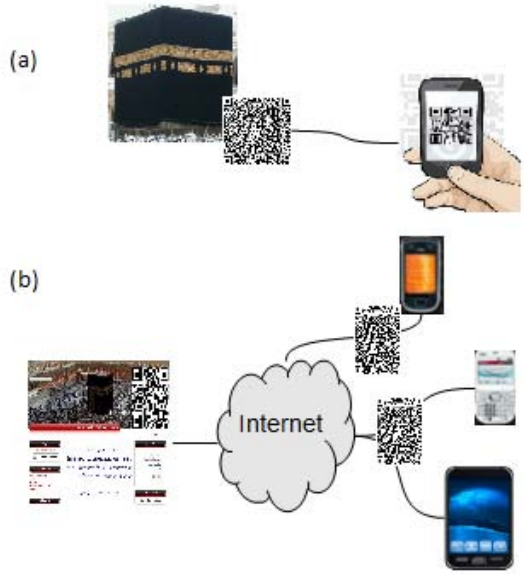

Figure 5. The system functionality

The test is done by two groups of people. The first group consists of four people of different ages who was already made this pilgrimage. Some of them were familiar with the use of smart phones. One was 12 years of age and familiar with smart phones, two were 32 years of age and the third one was 56 and use the mobile phones only for making calls. The second group consisted of the same number of people of the same ages, who they had never made the pilgrimage.

Each group did the test at different times, i.e group one did it one day and the second group did it another day. We explain to each group how to use QR codes but not the visit steps.

After finishing, each person is demanded to answer a questionnaire form. As a result we see that the QR code help the persons who did the visit for the first time, second group. They have not any information about the steps and the QR codes help them to make the correct steps according to an observer we choose to observe the groups reaction. The first group were familiar with the steps but they forgot for example what we must say at each location, QR codes help them to remember and all of them confirm that QR codes are easier than having a printed brochure.

For the persons that are not familiar with smart phone, they had not any problem because the QR code scanner and reader need not any user process. Finally the first group advise to post the the QR in a location where all can see it and the picture must be big enough to be captured from a far distant because nearly all time the location is crowded.

IV. Conclusion

We have presented in this paper the benefits of QR codes and how they could be used in religious tourism. This simple

technology is very useful and should enter our world to facilitate the process of getting information.

The main problem that we may encounter while applying this work is that people are not familiar with seeing and using this code. Therefore, the registration office′s stuff must be well trained about the importance of these codes and how they will serve the people during their visits. They must also facilitate the using of these code by installing the QR reader in the visitors mobile devices when they register.

From the simple testing, QR codes have proved their efficiency and usefulness in this area. The QR codes can be posted, not just in the visit location, on transport media and at any point of interest before reaching the desired location.

As a future work, we aim to build an application that combines the QR code with Mobile Cloud Computing to overcome the limitations of the device's resources. The QR in this application will act as an interface between the user and the application. The QR will contain a special unique code which helps to determine the user's location. The information will be displayed according to user preferences such as language, visit type (Omrah or Hajj) and tourism content format.

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