

Usage of QR Codes in Web Based System for the Electronic Market Research

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Abstract— this paper describes the usage of QR codes in a web based system that was developed for the needs of promotion and electronic market research. QR codes can be used in several ways and they provide an opportunity to make various researches that emphasize people’s reactions or people’s answers. The greatest dilemma is how to present QR codes in order to attract the users’ attention. For the needs of this research, a pilot version of the web based multiplatform application was made to detect users of mobile devices and collect data from their scans. This paper describes the functionality of the system and the results of the research. Based on the results of the initial research guidelines for the second version of the web based system are defined and the new target population is chosen.

Keywords – QR code, web, electronic market research, promotion

I. INTRODUCTION

The usage of mobile devices has rapidly increased in the last years. Everyone has a smart device in their pockets, always near and at hand. That is a great opportunity for marketing companies, one they can and must use. Sometimes promotional campaigns are offensive and they produce a counter effect. If the consumer is given a way to decide what to choose, the effects of promotion could be better. QR codes are useful in sharing information in curious and interesting ways. They are used on magazine pages, product boxes, billboards, advertisement flyers and papers, cd/dvd covers, books, beverages and other mediums that are suitable for QR codes. A qualitative focus group study conducted in Japan found that loyal customers would use QR codes in order to access promotional information and discounted items [1].

According to Sago (2011), the integration of QR codes into ads allows consumers to connect to web sites that provide additional information, enabling them to download coupons, enter sweepstakes, link to a firm's social media sites, and access information while shopping.

People use social networks every day. These networks bring the new platform to collect and research the consumers’ feedback that can be used in future promotion of the product or brand. Some social networks have options where the owner of the page can set the targeting population for their promotion. It is sometimes enough to post a small amount of information on these networks, that is attractive and interesting for people. These things could be rapidly shared with other people.

In cooperation with an ICT company from Subotica, the authors conducted a small-scale research was done to determine how users react to various representations of QR code.

The second section offers some information about QR codes. The third section presents the first part of the research, as well as the schema and functionality of system. In the fourth section the results of research are described. The next section presents the steps and plans for developing and implementing the new system.

II. BRIEF HISTORY OF QR CODES

The QR code or Quick Response Code is a type of matrix barcode that was first designed for the automotive industry in Japan in 1994 by the Denso Wave Company. This code contains information about the item to which it is attached. It is a machine-readable optical label that can store 7,089 characters, compared to the traditional bar code that can hold at most 20 digits. Four standardized encoding modes (numeric, alphanumeric, byte/binary, and kanji) are used in these codes [2].

QR codes are scanned and decoded via the camera of a mobile device. The mobile device must have a proper software-QR code scanner or reader installed.

QR codes can contain various types of data:

- **URL/web address**, the most often used type of QR codes. The code represents a web address that can be easily opened by the web browser on the mobile device.
- **Text**, for storing textual information.
- **Send email**, after scanning the code, the user can send an email to a predefined address with a predefined or custom message.
- **Send SMS**, after scanning the code, the user can send an SMS (Short Message Service) to a predefined phone number with a predefined or custom message.
- **Geolocation**, the code contains data for latitude and longitude. It is mostly used in applications with maps.
- **Calendar**, the code contains data of some event that can be easily stored in the calendar option of the mobile device.
- **WIFI network**, the code contains access parameters for the WIFI network.

- **vCard**, the code contains contact information of a person, in the form of a business card, which can be stored in the contacts of the mobile device [3].

These codes can be easily created with the help of a great number of online QR code generators. Special libraries for creating QR codes are developed for today's most popular programming languages. Programmers can implement QR code libraries into their applications in various ways [6].

III. FIRST RESEARCH

The initial research was conducted with the cooperation of a local ICT Company. The main goals were to make a pilot version of the web based system that would collect the data from users' scans of QR codes and to determine how users react to the various representations of QR code. The greatest challenge is how to show QR codes so as to make them eye-catching for people. Is it enough to show the QR code without any additional information or is it maybe more effective when integrated with a slogan, company logo or both?

The created QR codes were shared on the company's Facebook page in an interval of one or two days. For scanning the chosen QR code, the user received a unique promo code that could be used for shopping in the company's shop with a discount of 3, 5% or 10%.

A. Types of used QR codes

Five types of QR codes were used in this research, four of them were images and the fifth one was a short video file including a presentation of the company. At the end of the video file, the QR code was shown for 20 seconds.



Figure 1. Pure QR code



Figure 2. Logo of the company and QR code



Figure 3. Slogan of the campaign and QR code



Figure 4. Image with the QR code, company's logo and slogan of the campaign



Figure 5. Video file with the QR code at the end

B. How the system works

The system is divided into two main parts: college server and company server. The college server hosts the database, the application with all necessary classes, while the company server hosts the web page that presents the information for the user. The administrative interface for the management of data is also on the college's server.

When the user selects the QR code at the social network, they can scan it with their mobile device. The QR code reader decodes the code and the mobile device shows a web address that can be opened with the web browser. Every QR code contains URL but the main parameter of URL is different for all of them. This

parameter is used to help the detection script to determine the type of scanned code.

The URL used in this system is `http://qrcode.vts.su.ac.rs/index.php?qr=number`. The number is a value of the primary key of the QR code data stored in the database.

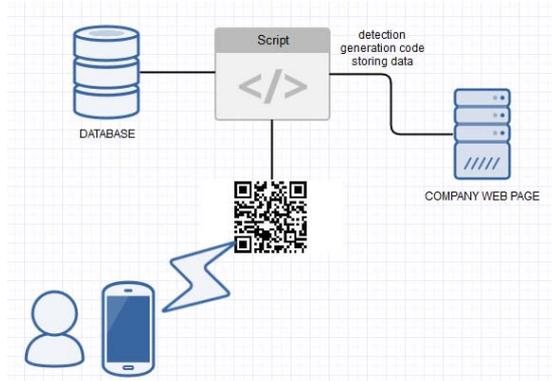


Figure 6. Schema of the pilot web based system

After receiving the request with the parameter, the detection script checks if the request is sent by the mobile device (smartphone or tablet). If the origin of the request is not a mobile device, the script shows a warning message. It is very important because on the web there are several online tools that can scan a QR code. These scans are not important for this research and they must be ignored.

When the request came from a mobile device, the script stores collected the data in the database and the user is redirected to the company's web page. This redirection contains two parameters: the promo and hash of this promo code. The promo code is shown on the company's web page with additional information and images. The following data is stored in the database: IP address of the request, http header with the user agent's string of device, the date and time of the scan, type of QR code and promotional code that is unique for every scanning.

C. Detection script

Mobile Detect class for PHP programming language is used for the detection of devices [5]. It is enough to include the *Mobile_Detect.php* file and to make a new object of *Mobile_Detect* class. After that some checks of request parameters can be performed and the required methods of object are called to determine if the access device is a mobile device.

```
<?php
require_once("Mobile_Detect.php");
require_once("functions.php");

$detect= new Mobile_Detect;

if(isset($_GET["qr"]) and
is_numeric($_GET["qr"]) and
existsQRCode($_GET["qr"]))
{

    $id_qr_code = (int)$_GET["qr"];

    $device = ($detect->isMobile() ? ($detect->
isTablet() ? 'tablet' : 'phone') : 'computer');
```

D. Possible security issues

To avoid abuse, several security methods and techniques were used during the development.

Access to the administrative interface requires a valid authentication with a username and password.

When the user scans the code, the script sets the Cookie data to prevent receiving another promo code with a new refresh of web page.

The generated promo code and the 32-character-long hash of code are sent to the company's web page. The hash is made with the so called salt technique. This technique uses randomly generated long strings-salts that are put at the beginning and at the end of the promo code. The connected string is further hashed with the MD5 hashing algorithm. When the company's web page receives the two parameters, the script generates a hash with the same algorithm to check if the sent code has a proper hash. In this way, it is impossible to send non-existent codes.

IV. RESULTS OF RESEARCH

The initial research lasted for 10 days. Only 2% of the users scanned the codes using a tablet. The rest of the scans were done with mobile phones. It is possible to have $\pm 1\%$ for the amount of tablet scans, because in the beta test phase, Mobile Detect class erroneously detected some smart phones.

Based on the results, as shown in Fig.7, it can be concluded that the two QR codes that were first posted on the social network have the largest number of scannings. Visitors of the page trust the company, they like posts with the company logo. People are curious and they want to see the hidden information that is behind the encrypted data. This is one of the reasons that the post with pure QR code has the highest number of scans. The second reason for these results could be the date of the post. When the company first shared time QR code, it was new and people reacted with interest, and they scanned it. Also, it is interesting to note that the period when the largest number of scans was performed was immediately a few minutes after posting the QR code [4].

The smallest number of scanning was detected for the video file. This may be explained by the fact that the video material was posted last or it was not so interesting so as to hold the attention of the users.

In order to receive more relevant data, another research is planned with the same QR codes, but the order of posting will be different.

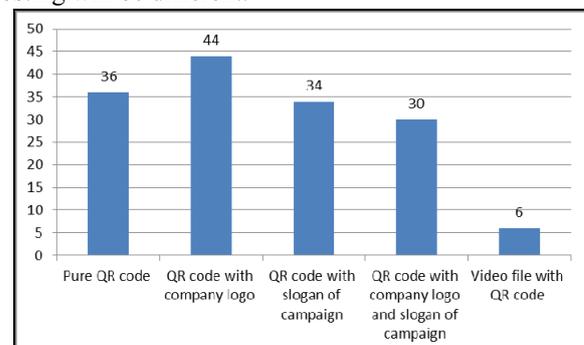


Figure 7. Results of the research

One of the complaints for the pilot version of the system was that people sometimes failed to write down the promo code on paper and they needed to scan it again in order to receive the new one.

Also, it would be advisable to insert an option to report the wrong detection of the access device. It could help in the process of improving the detection algorithm.

V. NEW RESEARCH

Based on the results of the initial research, a new research plan is defined. Generally speaking, nobody takes it well, if someone stands in front of them and starts asking them questions. With the use of electronic systems, this discomfort could be minimized, and more accurate data can be collected.

The main aim is to create an integrated multiplatform web based system with open access to companies. The second aim is to test the implementation of the system in a real environment. This system will help companies to make QR codes that contain URL to the web page with the created survey or questionnaires. Further, they will have access to a detailed review of the collected data. The collected data could be filtered for receiving various reports (based on date, time, device...) with graphical representation in the form of charts.

Instead of showing a promo code on the web page, the system will be more personalized and it will send the promo code in the form of an SMS.

The application will be multiplatform and optimized for the usage on mobile devices, as well as tablets.

The system distinguishes between two access levels: Company and user. Table I below shows the main privileges of the users.

TABLE I. PRIVILEGES OF USERS

Privilege	Company employment	User
Sign up / Login	+	+
Edit profile	+	+
Make QR code	+	-
Make a New survey	+	-
List statistics	+	-
See Map that shows other questionnaire's place	-	+
Put marker on map	+	-
Show archived surveys	+	+

The first step for company employees using the application is to sign up, then to prepare the survey or questionnaire.

The actual results for the admin will be displayed immediately when someone fills it out. It is a good way for customers to express their feelings about the questions in the query.

When the customer completes the form, they will receive an SMS, verifying that they have participated.

It is possible to sign up as a customer to this application. If the user already filled out a similar poll, the previous activities will be synchronized with their profile. With the help of Google Maps, they can receive new places to fill out more surveys.

A. Schema of system

Fig. 8 shows the schema of the new system. The main difference, compared to the old version, lies in the cloud APIs/Services and in the SMS gateway. Also, this system will be used by more companies and it will be a platform for creating surveys and questionnaires for the electronic market research.

The company's administrator will create a survey. After that, it is easy for the administrator to create the QR code and he has the possibility to use it in various ways. It can be printed manually or it can be downloaded to the personal computer for further usage in flyers, books or social networks.

Every survey will have a unique URL and the QR code will contain that URL. When someone scans the QR code, the script will execute detection and the people will receive the promo code in the form of an SMS, assuming they had filled in the field with their mobile number in the survey.

The user will have a chance to find locations of the QR codes on the map, which are generated through this system. Putting location of flyers or billboards or other public places with a QR code is not mandatory for companies but is a good way to promote the campaign to the people who are not physical close to the QR code.

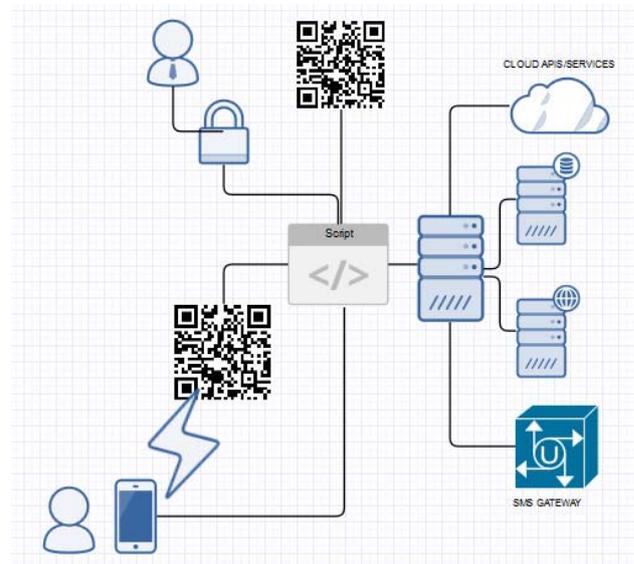


Figure 8. Schema of the new version of the web based system

For SMS gateway Gammu will be used. Gammu is a project providing abstraction layer for cell phones access.

Every survey and its results can be either private or public. The private surveys are accessible only to the company, while the public one is for everyone.

In the development of the new system, the following technologies and programming languages are used:

HTML5, JavaScript, CSS3, PHP, MySQL, Bootstrap framework, Google Maps API, Gammu project.

The new system is in the development phase and upon completion, will be tested in a real environment. The first step of expanding the database has been completed. There is parallel work going on both the front end and back end development of this application. The SMS gateway is currently in its testing phase.

B. Targeting population

The beta version of this new system will be tested at a local cafe bar in Subotica, Serbia. Every desk will have a flyer with a QR code and a short slogan on it. The potential user could scan the code which will then redirect them to the survey. After testing it and receiving feedback from both the users and companies, the creators will be able to define the items needing further improvement.

VI. CONCLUSION

This paper describes the usage of QR codes in a web based system, developed for the needs of promotion and electronic market research. QR codes can be used in several ways and they enable one to make various researches that focus on people's reactions or people's answers. The most important challenge is how to present QR codes so as to attract the users' attention.

The pilot version of the web-based system was developed and it was tested in cooperation with a local ICT company. Based on the results of the research, guidelines for new system and new research have been defined.

The results of the first research show that people best react to QR codes without additional information. Maybe the results would be different if the QR codes were posted in a different order. A good time for starting a QR code campaign could be the time of the upcoming holidays, when people usually buy more presents.

The new integrated multiplatform web system will give the companies more options in the field of electronic market research. With this system, and based on the collected data, managers can respond quickly. The advantage of this application is that every business can use this method (for example a restaurant, or a cafe). It is a good and cheap form of improving services such as electronic data collection.

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