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TWO-DIMENSIONAL BARCODES IN MOBILE APPLICATIONS

Two-dimensional barcodes are printed marks, readable by mobile devices. They have important value in new generation of interactive marketing. In this paper, there is a description of popular 2D barcodes and their possible business and economic impact when promoting physical products.

Keywords: 2D barcodes; mobile application; smartphone; interactive marketing.

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ДВОМІРНИЙ ШТРИХ-КОД ДЛЯ МОБІЛЬНИХ ПРИЛАДІВ

У статті показано, що двомірні штрих-коди — це поліграфічне позначення, яке можуть розрізняти мобільні прилади. Такі коди мають велике значення на сучасному етапі розвитку інтерактивного маркетингу. Описано технологію роботи двомірного штрих-коду, наведено приклади їх застосування при просуванні різноманітних товарів.

Ключові слова: двомірний штрих-код; програмне забезпечення для мобільних пристроїв; смартфон; інтерактивний маркетинг.

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ДВУХМЕРНЫЕ ШТРИХ-КОДЫ ДЛЯ МОБИЛЬНЫХ ПРИЛОЖЕНИЙ

В статье показано, что двухмерные штрих-коды — это полиграфические знаки, которые могут считываться мобильными устройствами. Они имеют огромное значение на современном этапе развития интерактивного маркетинга. Описана технология работы двухмерного штрих-кода, даны примеры их применения в продвижении различных товаров.

Ключевые слова: двумерный штрих-код; мобильные приложения; смартфон; интерактивный маркетинг.

Introduction. The definition of a barcode is given by ISO/IEC: barcode is a machine-readable representation of information formed by combinations of high and low reflectance regions of the surface of an object, which could be converted to "0"s and "1"s [7].

Two-dimensional barcodes (or "matrix codes") are printed marks composed of usually black squares in two-dimensional schema, which can contain some information. One of the most popular standards, the QR-Code (Quick Response Code), introduced by Toyota's subsidiary Denso Wave in 1994 in the process of tracking newly built cars in factories, is now commonly used for presenting information, especially for mobile devices [2].

Mobile devices, cell phones, PDAs, and now smartphones, since the beginning of the XXIth century are being equipped with a camera. Even small resolution of early smartphones was sufficient for reading 2D codes, needless to say that today built-in cameras are more than enough. This paper concentrates on handheld mobile devices, especially so-called "smartphones" and the possible use of them and QR codes to promote products and services.

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QR Code. QR-code, as said earlier, was introduced in Japan in the well-known "just in time" Toyota's production process. However, when the standard documents were published broader, QR code was started to be used in various media and to store various information. Primary aim of the code is being a symbol which can be easily interpreted by scanner equipment [4]. 2D codes contain information in both horizontal and vertical directions, thus holding a greater volume of information than a regular barcode. QR codes, as stated by the Denso Wave, can hold up to 20% more data than other 2D codes, maximum is about 2953 bytes [8].

Figure 1. **QR code with encoded web-address, http://moodle.cs.pollub.pl**

The standard one today may store not only typical text data or numbers, but also whole telephone numbers, WWW addresses (see Figure 1), or vCards and proper software can read these information and act accordingly.

QR codes have also a error correction up to 30% (using Reed-Solomon code), which allows them be readable even if partially destroyed, dirty, damaged or partially invisible [9]. QR codes may be printed or displayed, and mobile devices easily decode them, they are readable in any direction, 360 degrees.

Mobile devices with cameras. Cameras in mobile devices appeared about 10 years ago. Nokia 7650, one of the first devices on the Nokia's S60 platform, had an VGA camera (640x480 resolution, 0,3 megapixels). Since then, all middle- and high-end mobile phones are equipped with a camera, with better and better lenses and higher resolution. Now, even low-end phones have cameras, and high-end ones have a sensor with a serious resolution, for example, Nokia's N8 12Mpix (4000x3000). This allows users make rather good photos, and in case of 2D barcodes — reading them without any problem.

Not only mobile phones have built-in cameras nowadays — laptops with webcams also deal with increasing resolution and lowering costs, and webcams with HD (1280x720) resolution aren't expensive or hardly obtainable. The rising market of internet tablets also features cameras similar to phones, and even producers of modern TV boxes are using cameras to provide video communication services, like Skype.

However, most smartphones and tablets are only capable of reading 2D barcodes, due to lack of software in the rest of devices. Software is ready for all mobile platforms available today, including low-end J2ME-based devices. There is no software yet for TVs, but this is of course only a software flaw, and we can be sure if there is a camera, a device manufacturer, or sometimes 3rd party company could provide a software to read and recognize 2D barcodes.

The next question is how many of mobile phones' users can have Internet access, as QR codes are typically linked to some websites or web applications with more information. Based on Opera Software's report "State of the Mobile Web" newest issue, (October 2011), in 22 countries the Opera Mini web browser (available mainly for non-smartphones) is used by 1 mln. or more people. These countries include BRIC (Brasilia, Russia, India, China), but also Eastern/Central Europe countries and even countries as exotic as Kenya or Bangladesh [10]. If a device provides connection to the Internet, it probably features also a camera, and if there is a Opera Mini — a user can install other applications, like QR codes reader. According to the report [10], there are 140 mln. unique users and possible users for QR code marketing worldwide.

Usage in mobile marketing. QR codes are raising quickly in popularity. They originated in Asia, are popular in Japan and South Korea, but spreading throughout Europe and Middle East [7]. Mobile devices are raising in popularity even more, especially among people in their 20s [1].

As stated earlier, QR codes can store WWW addresses, text, phone numbers, or vcards. And they can be readable by most of mobile devices available today. If so, there is a possilibity to use them in marketing to provide a completely unique ads or offers, targeted especially on mobile users.

Codes can be printed and are easy to use: start an application, point to code, make photo, recognize. There is no need to type anything or download any additional software. Easiness of usage is now used when downloading applications from mobile app stores if a user finds an interesting application, he or she can point to the code visible on the screen and the software can be downloaded instantly, without a need of sending special text message, memorizing codes or even memorizing the application's name.

Considering the usage of QR codes we can start with Boise State University's Albertsons Library — it has a mobile website and it uses QR codes to take people to sites, without a need of typing addresses on small devices [3]. This is a popular method to avoid users' typing anything on their mobile devices, which is slow and inaccurate when compared to real PC keyboard. QR codes are simply faster. At the author's university, there is a plan to improve configuration of mobile devices connecting to the campus' network by allowing users to scan codes and being redirected to detailed instructions (see Figure 2).

Get the free mobile app at
http://gettag.mobi

Figure 2. **"Microsoft Tag" code with information how to get an application to read this type of code. Note: this code standard is using color codes which are not visible in this paper's printed version**

In United States in November 2011, millions of Coca-Cola cups were distributed with QR codes on them – the brand was partnering with the World Wildlife Fund, which aims to help conserve the polar bear's Arctic habitat [6]. Consumers who scanned codes downloaded an application for the Apple iPhone, with a Facebook-connected game. People who generated the most points in the game won the prizes. But the app also lead to a mobile website where consumers donated to WWF. Earlier, the company ran other QR code programs in Japan (where codes are extremely popular), and the former was the first try in the US [6].

Charities, not connected with large corporations, could also use QR codes – with no costs, as the standard is freely available. A good example was a campaign to sign a petition for the Mexico Gulf restoration – codes were printed on t-shirts. Overall, the petition was signed by more than 100 000 people [3].

TV series can feature QR codes too – in the last episode of "Lost", HBO used a code to promote "True Blood". Code was shown at the end of a commercial and its design was consistent with the "True Blood" branding – black and white with red accents [3].

A few real estate agents add QR codes to their "For Sale" signs, so a buyer can scan the code and see all the details about a house, even with photos and videos [3].

In Poland, one of the restaurants was sticking QR codes on mailboxes. Anyone with a QR code reader could scan the code and was given the discount at this restaurant. This type of mobile marketing targeted specifically the users who knew what to do with the code.

Malicious codes. The growing popularity of QR codes among customers has caught the attention of cybercriminals. Internet security company, Kaspersky Lab, detected malicious websites containing QR codes [5]. Those codes were nearly like legitimate ones providing simple access to applications, as said at the beginning of the previous chapter, but the app wasn't "instant messenger" as the site suggested, but was a malicious application sending highly paid text messages. Each of those messages could give about $10 to the cybercriminals. The codes were targeted to all popular mobile platforms available, and it is predicted that similar actions may be repeated in future.

Summary. QR codes are free-to-use, safe and can provide fast access to data or websites. There are millions of mobile devices users, and their popularity is growing. Most of those devices are capable of recognizing QR codes, which can be used to market specific audience, or to guide customers to websites with more information about advertised products.

However, malicious QR codes described in the previous chapter, could be a threat to a growing popularity of mobile marketing if no way to fight them is found in the following years.

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