

What's the Power behind 2D Barcodes? Are they the Foundation of the Revival of Print Media?

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Abstract: 2D barcodes are capable of storing different kind of data. A significant number of new mobile phones come with a built-in camera. These technologies together with the fact that mobile phones are next to the owner most of the time are the foundation of a variety of interesting applications. In Japan more than 75% of all mobile phones do have already a pre-installed barcode reader, that allows the user to decode the incorporated information of a barcode. This procedure can be used to improve the user experience while simplifying the input of data into the mobile device. These 2D barcodes can be used to exchange information between mobile phones and to connect to the mobile web. These days the Western World is gaining interest in this technology. In this paper the most important applications are introduced. The relevance to print media and the advertising industry is shown.

Keywords: ad tracking, Datamatrix, 2D barcodes, QR Codes, mobile phone, mobile tagging

Categories: L.1, L.7, H.3, H.5, K.4

1 Introduction

1D barcodes are already ubiquitous as they can be found on the packaging of virtually any product. 2D barcodes or matrix codes are symbologies that are capable of storing more data than 1D barcodes.

Mobile phones are another technology that is becoming ubiquitous in the developed countries. Also the number of devices with built-in cameras and internet connectivity is increasing rapidly.

The merge of these two technologies allows the link from the physical to the digital world in a simple way.

In this context 2D barcodes are also called “mobile tags”, and are placed on e.g. physical objects, that for additional information will be provided on a web page.

Mobile Tagging is the process of [Fig.1]:

- 1) capturing the image of the barcode with the camera-equipped mobile phone
- 2) decoding the image using a software program, called barcode reader

- 3) linking to the decoded URL on the world wide web to get more information.



[Fig.1] Graphical illustration of the process “mobile tagging” [Wiki08]

This approach is an inexpensive and an easy to use solution to several problems: Mobile phones are used most of the time just by the owner and serve through the wide range of functionalities (e.g. phonebook, organizer, ..) as personal assistants. An unsatisfying user experience in dealing with mobile devices is the entry of data. Instead of typing the data key by key, 2D barcodes are one solution to this task. Using the barcode reader application, scanning and storing of the e.g. contact details of a conference participant is a task of pressing a couple of keys. Also date, location and description details of events can be saved to the organizer this way. While reading the newspaper several articles come with hyperlinks providing further information. Very often the personal computer is not nearby (e.g. in the bus or train, ...). Even the content would be of interest to the reader it is less likely that the content will not be checked out. Using the mobile phone which is in reach at any time accessing the link immediately or at least saving it to the bookmarks for use at a convenient time becomes easy. The link from print media to the World Wide Web brings several advantages to the end user and the publisher as well. The main purpose of this paper is to give an overview how to use 2D barcodes in print media and on advertising billboards to get more accurate estimates about the interest of the targeted audience. The advantages of ad tracking and opting in to build a relationship with the potential customer, already common on the World Wide Web are becoming available to the physical world as well.

2 Types of 2D barcodes

Meanwhile there do exist more than 1000 different barcodes. More than 100 of them are 2D barcodes.

The number of 2D barcodes used for mobile tagging is around twelve different ones [MoTag07]. In [Kato05] nine criteria were outlined that should be fulfilled by a standard 2D barcode for applications (e.g. mobile payment) with mobile phones. Also several barcodes have been developed especially for the use of mobile tagging none of the surveyed code satisfied all criteria. The outcome of this research selected VSCoDe™ [VSCoDe02] as the best choice as a standard 2D barcode for this purpose. But considering which barcodes and barcode readers are mentioned more often on websites dealing with this topic, VSCoDe does not seem to play a very important role currently.

In [Fig.2] an overview of relevant mobile tagging barcodes is given.



[Fig.2] Overview of relevant mobile tagging barcodes [Wiki08]

2.1 QR-Code

QR-Code [ISO18004] was developed by the Japanese cooperation Denso Wave [Denso03] in 1994. QR-Code (“Quick Response”) is the de facto standard for Japanese telecommunication providers and handset vendors. 3G Vision’s [3G Vision] barcode reader decodes QR-Codes and is installed on 75% of Japanese handsets.

2.1.1 Micro QR-Code

Micro QR-Code is distinct smaller than the original QR-Code. The capacity is very limited(maximum 35 numeric characters or 21 alphanumeric characters). A barcode reader decoding QR-Codes is not necessarily able to decode Micro QR-Codes.

2.2 Data Matrix

Data Matrix [ISO16022] was developed and standardized by NASA, Department of Defense and several other companies. The Consumer Electronics Association, R9 Automatic Data Capture Committee, did a comparison of the Data Matrix and the QR-Code and decided that there is no necessity to include the QR-Code as a permitted symbology. The comparison has shown that Data Matrix is the most space efficient of all the two-dimensional symbologies. At that time, 2001, it was the most widely implemented 2D barcode in the greatest diversity of applications and industries. No significant advantage of the QR-Code over the Data Matrix has been stated [CEA01]. The QR-Code was developed to allow the decoding of Japanese Kanji-characters and this feature has no relevance in the Western World .

2.3 Proprietary Codes

[Semacode06] compares Data Matrix vs. proprietary codes. In the discussion the expertise of the developers of proprietary codes in comparison to the industry driven development of Data Matrix is questioned. The availability of technical specifications and the width of industry support are mentioned as an argument for the standardized format. The reliance on a single vendor involves risks in case of a change in his business model or a close down. Proprietary codes may have limited capacity to store data. The reason behind may be, that the vendor wants to act as a required middleware service provider.

While the standardized codes will probably get support from manufacturers of mobile phones, this will most likely not be the case for proprietary codes.

Beetagg

Beetaggs have been optimised to address some issues of the Western mobile market [Beetagg08]. E.g. in Japan most mobile phones are equipped with an autofocus and/or a macro functionality. This is not the case in the Western World so the scanning of small printed codes is not possible.

Beetagg is designed, to overcome this issue, so that the mark could be encoded without autofocus and/or a macro lens.

Beetagg allows the placement of a logo for branding in the middle of the symbol. The developing company states that this is an advantage over the two standardized barcodes mentioned above. Even the standard does not provide the possibility of branding. But also the opportunity of branding is not included in the standards, there are already QR-Codes and Data Matrix codes holding a logo in the centre.

Some other proprietary codes for mobile tagging: Aztec [AIM], [Cybercode00], [Ezcode07], [mCode], [Quickmark], [Shotcode08], [Trillcode], [UpCode].

To emphasize the importance of barcodes, it should be mentioned, that Google launched Zxing [Zxing07], which is an open-source, multi-format 1D/2D barcode reader library implemented in Java. It is also part of Android [Android08], a project of the Open Handset Alliance [OHA], the first open and free mobile platform.

Barcodes are also a research topic at Microsoft Research [Microsoft].

3 Mobile tags and camera equipped mobile phones

To make use of mobile tags first of all a camera-equipped mobile phone is necessary.

At the current time only very few handsets in the mobile market outside Asia come with a built-in barcode reader, a software program that decodes the data from the two-dimensional symbology. These built-in programs in most cases can only handle Data Matrix code and/or QR-Codes. Different barcode readers are downloadable via the World Wide Web [I-Nigma08] [Kaywa08] [Neoreader08] [Nokia].

Someone can download the barcode reader directly to his mobile phone via UMTS, GPRS or wireless LAN. Otherwise the downloaded program can be transferred from the PC to the handset through a cable link, bluetooth or infrared connection.

Mobile tags can be created by everyone very easily with free resources on the World Wide Web [I-Nigma08] [Kaywa08] [Neoreader08] [Nokia]. For some proprietary barcodes the creation of codes and keeping them active requires a monthly fee.

The following list provides examples of incorporated data and its distribution:

personal use:

- simple text
- printed on business card to save contact details in phone book [Dawson98a]
- date, location and description of events or appointments to save into the organizer [Dawson98b]

- entering phone number
- subscribing to RssFeed
- data exchange direct from the display of one mobile phone to another one
- printed on clothing (T-shirt [FacebookApp], bags,...)
- Tattoo

general or commercial use:

- URL (coupons, incentives, mp3-, video download)
- predefined email or sms
- printed (e.g. newspaper, magazine, flyer)
- billboards
- flatscreens
- mobile payment
- special applications

Extracting the encoded data is very simple and takes only a couple of keystrokes.

To decode a barcode, the barcode reader application has to be launched on the mobile device and the barcode will be decoded when focusing the camera on the symbology.

In the field deployment of the AURA system (Advanced User Resource Annotation) [Brush05] the usage of a mobile device in conjunction with an external barcode reader was observed. Users of the AURA system are able to enter or check comments, recommendations and other additional information for a specific product. Since the mobile phone together with the integrated camera is part of every day life and no additional device is needed, the usage may be more likely.

4 Applications of barcodes related to print media

Some projects using mobile tags, which launched recently:

1. The newspaper “Welt Kompakt” [Welt07] was the first one that introduced QR-Codes in the German-speaking countries. For several printed articles it is possible for the reader to get additional information on these topics following a link to mobile content through that is encoded in a QR-Code
2. Spektacle.com [Spek07] is the first QR-Code magazine in the Western World based in Great Britain. The magazine is issued bi-monthly, but the online content is updated more often. The magazine focuses on design, fashion and music. Some integrated QR-Codes allow the purchase of an advertised product via the mobile phone.
3. Recently Google launched the Google Print Ads platform [GoogleAd07] to manage the run of an ad in several newspapers of the United States online. Google also supports the use of QR-Codes within these print ads [Google07]

The main purpose of 2D barcodes in print media is to provide additional content. Additional information can be provided e.g. in form of multimedia, like animations to clarify some process, interviews via mp3-files, competition or simple games.

It will also be easier to allow the reader to participate and generate content, which is also one pillar of Web2.0 [OReilly05]. (user votings or comments).

At Graz University of Technology some research work is done by using QR-Codes. Perhaps the most interesting one is dealing with tracking conventional advertisement. Till now ad tracking was reserved for online marketing in the World Wide Web. With the use of 2D barcodes in print media it becomes possible to get better estimates about the consumed content. Which kind of additional content is checked out, will give a more accurate view of the readers wants. Also this method allows determining, at which time of the day which content is consumed.

Thinking of advertisements on billboards, passer-by could be offered an incentive to scan the code, like a coupon. With this method the quality of the location for the advertisement can be determined.

For this setting each advertisement would show a different 2D barcode, encoded a unique URI. This URI is looked up in a database, which holds the link to the targeted website and the description of the location of the billboard where the advertisement is shown. The content of the targeted website is sent to the users mobile phone automatically. Currently the first tests with a prototype are running.

5 Discussion

Mobile technology is still in progress and there are some issues to be solved.

- 1) The procedure of mobile tagging is a very convenient and easy way to deal with entering data into the mobile phone and improves the mobile user experience.
- 2) The mobile phone is next to the owner most of the time and also used rarely by someone else it is dedicated to serve as personal assistant. Therefore it is necessary to find a way to ease the input of personal contacts, events and other information.
- 3) For publisher of newspaper and magazines it provides the possibility to get accurate estimates about behaviour of the readers.
- 4) Now billboards become a mean to start a dialog with a prospect.
- 5) Data Matrix and QR-Codes are standardized codes but there is no guideline for the „internal structure“ of the encoded data. On December 17, 2007 Mobile Codes Consortium announced the commitment of the GSM Association [GSMA] and the Open Mobile Alliance [OMA], to drive worldwide barcodes standards
- 6) Older models of mobile phones with built-in cameras do not always allow to encode especially smaller printed 2D barcodes. Newer handset models equipped with autofocus and/or macro lenses are a part of the solution.
- 7) The number of different codes and the requirement of the installation of different barcode readers seems to stand in the way of the take-off of this technology.
- 8) Barcodes on advertisements can be replaced by an other ones.
- 9) Connecting to the Internet via mobile phone is still very.

6 Conclusions

This paper discusses the importance of 2D barcodes and their usage and impacts for print media and advertising. Mobile phones are converging to personal assistants which are storing essential personal data and they are next to the owner most of the time. It can be observed that the costs of the Internet access via mobile phones are becoming achievable and this eliminates the barrier of the price tag.

Organizations are taking efforts to set a standard for the use and the format of the incorporated data of mobile barcodes.

2D barcodes provide a mean to simplify the data entry to mobile phones in terms of a more convenient user experience. Mobile tags in conjunction with an appropriate infrastructure allow the tracking of ads and collecting accurate data about the interest of a targeted audience. This can be used to improve the relationship to the reader.

The link between print media and World Wide Web is the next big step in the digital world.

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