

Traveling information on smartphone

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Abstract— Quick Response (QR) code is now being widely used in a variety of businesses. QR codes appear on posters, magazine ads, websites, product packaging and so on. Using the QR codes is one of the most intriguing ways of digital connecting consumers to the product via mobile phones. This becomes comfortable for mobile phone users because nowadays, mobile phones have become a basic necessity accessory for everyone. In addition, with the advancement of internet access technology, Using QR Code via mobile phone also plays an important role in business sector such as to facilitate tourists in the tourism industry. This paper presents the advantage of using QR Code and mobile phone for tourism industry. This paper proposes the QR Code plaques of six traveling places in Phetchabun province, Thailand. These plaques allow travelers to scan QR codes that link directly to the mobile web of traveling places to display local tourist information.

Keywords— Mobile internet, QR code, Quick Response Code, Tourism

I. INTRODUCTION

According to statistical data from International Telecommunication Union (ITU) and Statistical Forecasting Bureau, National Statistical Office of Thailand, the numbers of Mobile cellular subscriptions per 100 inhabitants have been increasing continuously since the last decade. Until 2010, there were more mobile phones than inhabitants in Thailand (with 100.80 Mobile cellular subscriptions per 100 inhabitants) as shown in Table I and Fig. 1.

From this point of view, it can be simply noticed that cell phones have become part of our daily life. With the rapid development of mobile technology, surfing the internet is available at anytime and anywhere. Moreover, mobile phones with built-in camera can be used to recognize the QR code [1-5]. Therefore, QR code (Quick Response code) seems to be one of the perfect solutions to quickly and efficiently bring mobile phone users onto the mobile web.

QR Code is two-dimensional barcode which is categorized in matrix barcode that can store data information. QR stands for “Quick Response” which refers to its characteristic of high speed decoding. It was first introduced in Japan by Denso Corporation in 1994 [1] for tracking inventory in vehicle parts manufacturing. Nowadays, it is widely used in a wide range of industries [6]

such as QR Code for showing TV program guides, QR Code for paying trains tickets, QR Code on the packaging of fruits or vegetables to retrieve information about the name of the farm where the fruits and vegetables are grown and harvested.

Table I. Mobile cellular subscriptions per 100 inhabitants

	2006	2007	2008	2009	2010
Developed	92.90	102.00	108.50	113.20	114.20
Thailand	60.50	78.10	90.60	96.00	100.80
World	41.80	50.60	59.90	68.30	78.00
Developing	30.20	39.10	49.10	58.40	70.10

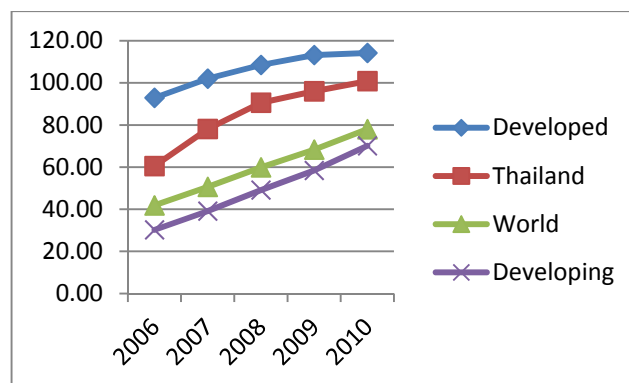


Figure 1. Mobile cellular subscriptions per 100 inhabitants

In addition, many countries have adapted the use of QR Code to promote the tourism industry in their countries. In United Kingdom, the Monmouthpedia project [8] allows travelers to scan QR code that link directly to the Wikipedia article in their own languages. Moreover, it also provides free Wi-Fi and implements QRpedia (as shown in Fig. 2) to go one step further by allowing a single QR code to seamlessly send you the mobile-friendly version of any Wikipedia article in your own language. Therefore, the town is likely to be the only place where visitors can tour in Hungarian, Hindi, Indonesian, Welsh, or numerous other Wikipedia languages using QR codes.



Figure 2. A plaque on Monmouth Shire Hall

In Thailand, the QR Code can be a very crucial tool to support the economic growth by facilitating tourists from all around the world. This is because the Thai government strongly promotes the tourism industry in Thailand in which the direct contribution of Travel & Tourism to GDP was 7.1% of total GDP in 2011 [7].

Therefore, this paper aimed to improve the advantages of the mobile phone and QR code technology by allowing tourists to scan QR codes that link directly to the mobile web of 6 traveling places in Phetchabun province to display local tourist information.

II. QR CODE

The QR code provides 40 specifications and correct grades such as L, M, Q, and H. It can hold a great volume of information: 7,089 characters of numeric, 4,296 characters of alphanumeric data, and 2,953 bytes of binary (8 bits) and 1,817 characters of Japanese Kanji/Kana symbols. In addition, it also has error correction capability. Data can be restored even when substantial parts of the codes are distorted or damaged.

There are several standards in documents covering the physical encoding of QR Codes (as shown in Table II) [6] such as an AIM Standard, a JIS Standard, an ISO international standard (ISO/IEC 18004:2006) [9] and a National standard in China [10].

Table II. QR Codes standards

Year	Organization	Standard
1997	AIM International	AIM-ITS 97/001
1999	Japanese Industrial Standard	JIS-X0510
1999	JAMA	JAMA-EIE001
2000, 2006	ISO	ISO/IEC 18004
2000	Chinese National Standard	GB/T 18284
2002	Korea National Standard	KS-X ISO/IEC18004
2003	Vietnam National Standard	TCVN7322

A. QR Code structure

QR Code is comprised of black and white patterns on geometric plane surface in the two dimensions. It uses black pattern to refer to binary number 1, and white pattern to represent binary number 0. The QR code is capable of 360 degree (Omni-directional). There are three finder patterns located at the corners.

Comparing with the bar code, QR Code holds a considerable greater volume of information than a bar code. QR Code contains information in both the vertical and horizontal directions, whereas a bar code contains data in one direction only (as shown in Fig. 3) [11].



Figure 3. Two-dimensional QR code vs one-dimensional barcode

B. Error correcting in QR Code.

QR Code has a function of an error correcting for misreading from white to black and vice versa. Error correcting is defined in 4 levels as below.

- Level L: about 7% or less error can be corrected.
- Level M: about 15% or less error can be corrected.
- Level Q: about 25% or less error can be corrected.
- Level H: about 30% or less error can be corrected.

C. Typical 2D Code





The comparison of the QR Code and some other kinds of 2D code are shown in Table III below which illustrate a different types of typical 2D codes and their features [11].

III. IMPLEMENTATION

The QR code was developed using entirely open source software that are available for free use such as Ubuntu operating system, Drupal and libqrencode library [12].

Firstly, the Ubuntu operating system [13] is fast, free and incredibly easy to use. This system empowers millions of desktop PCs, laptops and servers around the world including thousands of free apps.

Table III. The comparison of the QR Code and some other kinds of 2D Code

		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

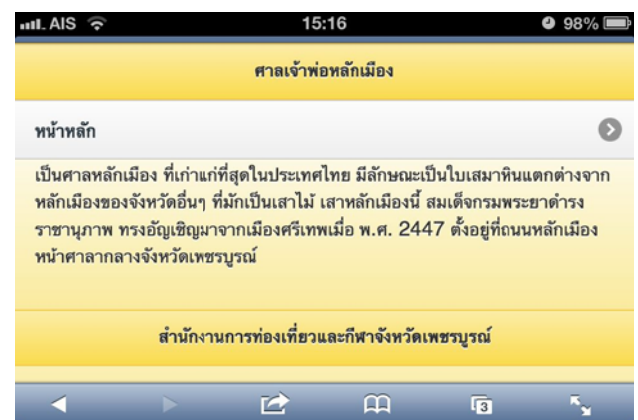
Secondly, Drupal [14] is a free software package written in PHP language that allows anyone to easily publish, manage and organize a wide variety of contents on a website. Drupal's module system is based on the concept of "hooks". A hook is a PHP function that is named foo_bar(), where "foo" is the name of the module (whose filename is thus foo.module) and "bar" is the name of the hook. Each hook has a defined set of parameters and a specified result type. To extend Drupal, a module simply needs to implement a hook. When Drupal wishes to allow intervention from modules, it determines which modules implement a hook and calls that hook in all enabled modules that implement it. The Drupal module extended for this research was written in PHP.

Lastly, the libqrencode library [15] is a C library for encoding data in a QR Code symbol. It is a kind of 2D symbol technology that can be scanned by handy terminals such as a mobile phone with CCD. The capacity of QR Code is up to 7000 digits or 4000 characters which is highly robust. This library is characterized by; does not require any additional files at run time, fast symbol encoding, automatic optimization of input data. Moreover, the libqrencode library can be used in conjunction with Drupal module to develop user interface on the web browser and encode data in a QR Code symbol. Users can enter text or URLs into a web browser and get the QR code automatically.

This paper created each QR Code plaques for six-traveling places in Phetchabun province for travelers to be scanned with mobile phone. The QR Code plaque will quickly and efficiently bring mobile phone users onto the mobile web of traveling place to provide the information to travelers. These QR Code plaques and screen captures of the mobile web are shown in Fig. 4-9.



(a)

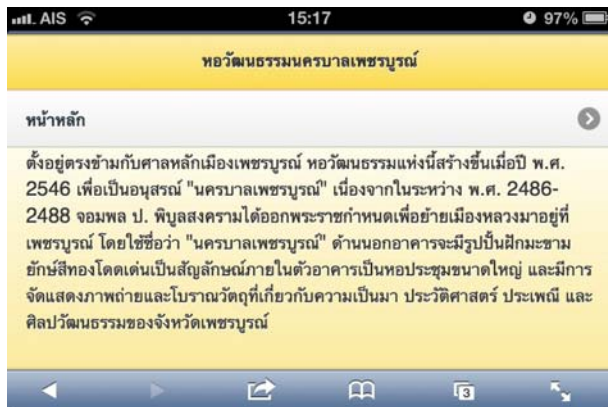


(b)

Figure 4. QR Code plaques and screen captures of the mobile web.



(a)

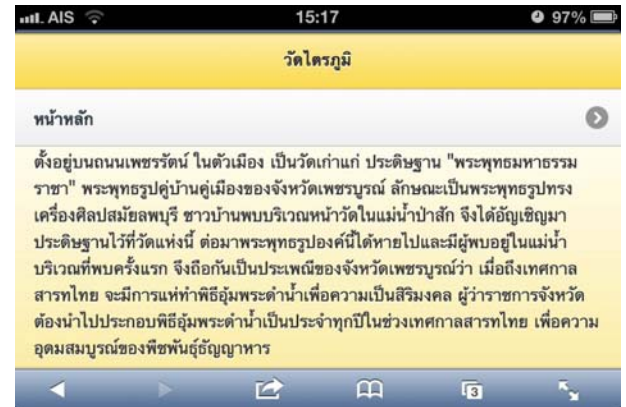


(b)

Figure 5. QR Code plaques and screen captures of the mobile web.



(a)

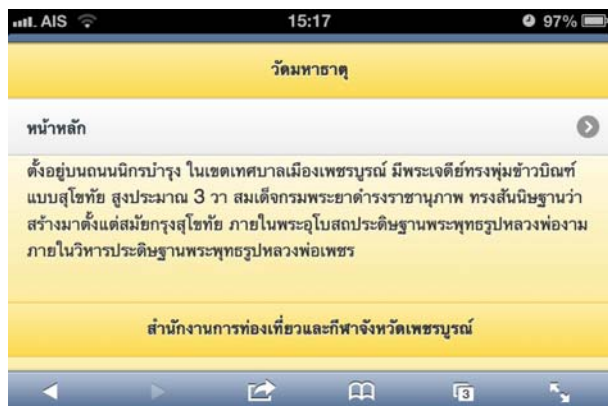


(b)

Figure 7. QR Code plaques and screen captures of the mobile web.



(a)

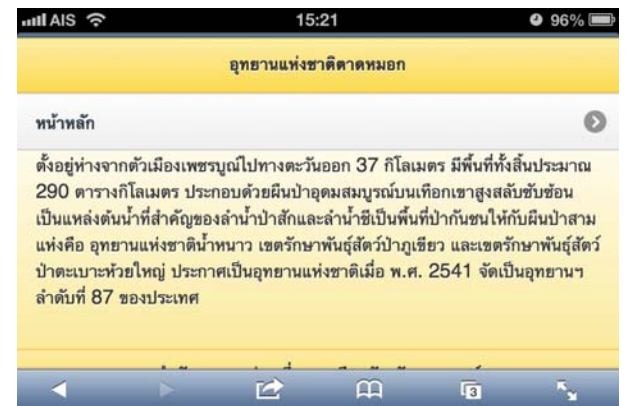


(b)

Figure 6. QR Code plaques and screen captures of the mobile web.



(a)

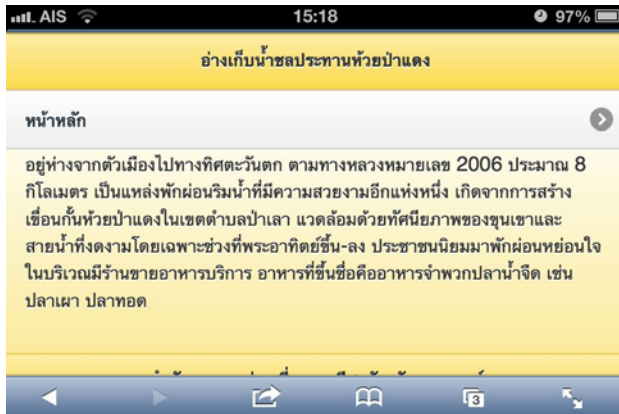


(b)

Figure 8. QR Code plaques and screen captures of the mobile web.



(a)



(b)

Figure 9. QR Code plaques and screen captures of the mobile web.

IV. CONCLUSION

The combination between the traditional printed media and the online world can be incorporated efficiently by using QR code which can self-contain much information such as URLs. This paper introduced the benefit of QR code for tourism industry on mobile phone accessed through 3G mobile networks. Due to the fact that internet access via mobile devices has been increasing considerably, in the future, the link between printed media and the online world will be the next big step towards the era of digitalization of human society.

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REFERENCES

- [1] Yue Liu, Ju Yang, Mingjun Liu, "Recognition of QR Code with mobile phones," Control and Decision Conference, CCDC 2008. Chinese, pp. 203 - 206, 2-4 July 2008.
- [2] Yu-Hsuan Chang, Chung-Hua Chu and Ming-Syan Chen, "A General Scheme for Extracting QR Code from a Non-uniform Background in Camera Phones and Applications," Ninth IEEE International Symposium on Multimedia, ISM 2007. pp. 123-130, 10-12 Dec. 2007.
- [3] Aidong Sun, Yan Sun and Caixing Liu, "The QR code reorganization in illegible snapshots taken by mobile phones," International Conference on Computational Science and its Applications, 2007. ICCSA 2007, pp. 532-538, 26-29 Aug. 2007.
- [4] Yuan-Cheng Lai, Frannie Han, Yi-Hsuan Yeh, Ching-Neng Lai and Yu-Chin Szu, "A GPS navigation system with QR code decoding and friend positioning in smart phones," 2nd International Conference on Education Technology and Computer (ICETC), pp.V5-66-V5-70, 22-24 June 2010.
- [5] N. Park, W. Lee and W. Woo, "Barcode-Assisted Planar Object Tracking Method for Mobile Augmented Reality," 2011 International Symposium on Ubiquitous Virtual Reality, pp.40-43, 2011.
- [6] T. J. Soon, "QR code," Synthesis Journal, Spring issue, Singapore: pp. 59-78, 2008.
- [7] [online] World Travel & Tourism Council, <http://www.wttc.org/>
- [8] [online] Wikipedia Town, <http://en.wikipedia.org/wiki/Wikipedia:GLAM/Monmouthpedia>
- [9] ISO/IEC 18004:2006, Information technology -- Automatic identification and data capture techniques -- QR Code 2005 bar code symbology specification, 2006.
- [10] QR Code standard, GB/T 18284-2000, National standard of the People's Republic of China: Quick Response Code (in Chinese), Issued by China State Bureau of Quality and Technical Supervision, 2000.
- [11] [online] QR Code.com, <http://www.denso-wave.com/qrcode/aboutqr-e.html>
- [12] P. Sutheebanjard and W. Premchaiswadi, "QR code Generator," IEEE ICT&KE 2010: Proceedings of the IEEE Conference on ICT & Knowledge Engineering, 24-25 November 2010.
- [13] [online] Ubuntu, <http://www.ubuntu.com/>
- [14] [online] Drupal, drupal.org
- [15] [online] Kentaro Fukuchi, "libqrencode," <http://fukuchi.org/works/qrencode/index.en.html>