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Abstract— Quick Response (QR) codes seem to appear everywhere these days. We can see them on posters, magazine ads, websites, product packaging and so on. Using the QR codes is one of the most intriguing ways of digitally connecting consumers to the internet via mobile phones since the mobile phones have become a basic necessity thing of everyone. In this paper, we present a methodology for creating QR codes by which the users enter text into a web browser and get the QR code generated. Drupal module was used in conjunction with the popular libqrencode C library to develop user interface on the web browser and encode data in a QR Code symbol. The experiment was conducted using single and multiple lines of text in both English and Thai languages. The result shows that all QR encoding outputs were successfully and correctly generated.

Keywords—QR code, Quick Response Code

I. INTRODUCTION

QR Code is two-dimensional barcode which is categorized in matrix barcode that can store data information. QR stands for “Quick Response” as the creator intended the code to allow its contents to be decoded at high speed. It is introduced in Japan by Denso Corporation in 1994 [1]. This kind of barcode was initially used for tracking inventory in vehicle parts manufacturing and is now used in a variety of industries.

Nowadays, mobile phones with built-in camera are wildly used to recognize the QR code [1-4]. There have been many URL shortening services that automatically generate QR code links to websites such as Goo.gl [5] and Bit.ly [6]. Goo.gl is the first introduced URL shortening service that provides automatically generates QR codes. only 12 days after introducing Goo.gl, Bit.ly launched the same service. The URL shortening service shortens link and turn it into a QR code that, when scanned with a mobile QR code reader, automatically direct users to the shortened link. It really shows that QR codes are going to become more and more popular.

To create a QR code via goo.gl, simply visit goo.gl and type in a URL address as shown in Fig. 1, then click the “Shorten” button. The shorten link <http://goo.gl/H3xr> will show up as shown in Fig. 1. If we copy <http://goo.gl/H3xr> into a new browser window and append “.qr” to the end of the link as: <http://goo.gl/H3xr.qr>, the QR code will be shown as in Fig. 2. Now you can then print out, send to your friends via e-mail,

post on your blog, *etc.* If we do the same thing via bit.ly, the shorten link will show up as shown in Fig. 3 and the QR code will be generated as shown in Fig. 4.



Figure 1. Create shorten URL via goo.gl



Figure 2. QR code generated from goo.gl, <http://goo.gl/H3xr.qr>

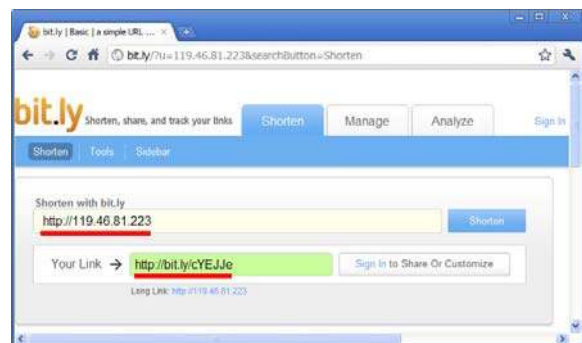


Figure 3. Create shorten URL via bit.ly



Figure 4. QR code generated from blt.ly, http://bit.ly/cYEJJe.qr

While the ability to create QR codes via URL shortening services is not revolutionary in any sense, it is a fun feature that should increase interest and familiarity with QR codes, which continue to grow in popularity among marketers.

II. QR CODE

QR Code has been approved as an AIM Standard, a JIS Standard and an ISO standard [7]. In 2000 years, QR Code is being issued as National standard in China [8]. The QR code provides 40 specifications and correct grade such as L, M, Q, H. A QR Code can hold a considerably greater volume of information: 7,089 characters for numeric only, 4,296 characters for alphanumeric data, 2,953 bytes of binary (8 bits) and 1,817 characters of Japanese Kanji/Kana symbols. QR Code also has error correction capability. Data can be restored even when substantial parts of the code are distorted or damaged.

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 stand for 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.

QR Code contains *information in both the vertical and horizontal directions*, whereas a bar code contains data in one direction only. QR Code holds a considerably greater volume of information than a bar code as shown in Fig. 5.



Figure 5. two-dimensional QR code vs one-dimensional barcode [9]

B. Error correcting in QR Code.

QR Code has a function of an error correcting for miss reading that white is black. Error correcting is defined in 4 levels as below.

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

C. Typical 2D Code

The comparison of the QR Code and some other kinds of 2D code are shown in Fig. 6. Below is a table of typical 2D codes and their features [9].

III. DRUPAL

Drupal is a free software package written in PHP language that allows anyone to easily publish, manage and organize a wide variety of content on a website [10]. Drupal is part of a technology stack that contains a number of important pieces as Server, Operating system, Database, Web server, and PHP as shown in Fig. 7

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 need simply 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.

	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
	Alphanumeric	4,296	1,850	2,355
	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

Figure 6. The comparison of the QR Code and some other kinds of 2D Code.

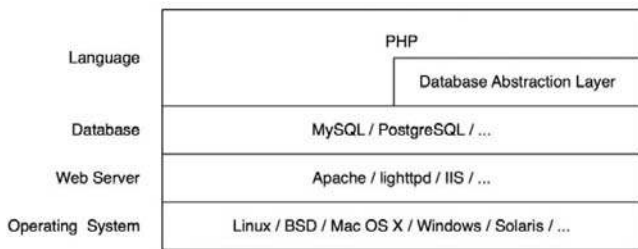


Figure 7. Drupal's technology stack [11]

IV. LIBQRENCODE

Libqrencode is a C library for encoding data in a QR Code symbol, a kind of 2D symbology 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, and is highly robust. [12] This library is characterized by:

- Does not require any additional files at run time.
- Fast symbol encoding.
- Automatic optimization of input data.

Libqrencode provides command line interface as *qrencode* command, some common used options are described below:

- -o FILENAME is used to specify output filename
- -s NUMBER is used to specify the size of image
- -l {LMQH} is used to specify error collection level from L (lowest) to H (highest).
- -v NUMBER is used to specify the version of the symbol.
- -m NUMBER is used to specify the width of margin

V. IMPLEMENTATION

The code was implemented on the Ubuntu 10.04 operating system [13] with Drupal 6.19 [10] and qrencode-3.1.1 [12]. The Drupal module extended was written in PHP. There are four parts in this module as shown below.

A. Implementation of hook_menu()

```
function qrcode_menu() {
    $items['qrcode'] = array(
        'title' => 'QR Code',
        'page callback' => 'qrcode_page',
        'access arguments' => array('access content'),
    );
    return $items;
}
```

B. Menu callback.

Called when user goes to <http://example.com/?q=qrcode>

```
function qrcode_page() {
    $output = t('Input your content to create QR Code. ');
    $output .= drupal_get_form('qrcode_nameform');
    return $output;
}
```

C. Define a form.

```
function qrcode_nameform($form_id, $form_state = NULL) {
    $form['user_name'] = array(
        '#title' => t('Your Content'),
        '#type' => 'textarea',
        '#description' => t('Please enter your content.'),
    );
    $form['submit'] = array(
        '#type' => 'submit',
        '#value' => t('Submit')
    );
    return $form;
}
```

D. Handle post-validation form submission.

```
function qrcode_nameform_submit($form_id, $form_state) {
    $name = $form_state['values']['user_name'];
    exec("qrencode '" . $name . "' -o /var/www/sites/default/files/qrcode.png -s 3");
    drupal_set_message(t('<p>Your content, %name<p>',
        array('%name' => $name)));
}
```

Fig. 8 shows the web page resulting from the implemented modules. After typing some text into the content area and click the "SUBMIT" button, the QR code will be automatically generated as shown in Fig. 9.

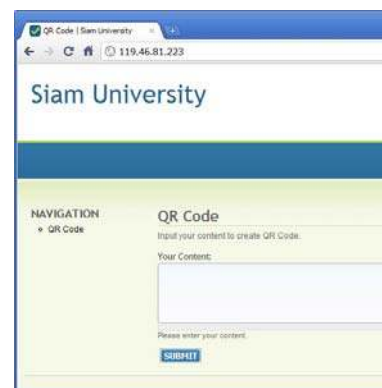


Figure 8. QR code submission page.



Figure 9. The resulting QR code.

VI. EXPERIMENTAL RESULT

To test the proposed module, we conducted the experiment using single and multiple lines of text in both English and Thai languages containing URL, text, name and address. The resulting QR codes are shown in Fig. 10.



<http://ict-ke.org>

(a)



Siam University

(b)



มหาวิทยาลัยสยาม

(c)



Siam University

มหาวิทยาลัยสยาม

(d)



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เทคโนโลยีสารสนเทศ

มหาวิทยาลัยสยาม

(f)

Figure 10. QR codes.

VII. CONCLUSION

QR code is now being widely used in a variety of businesses. QR code is a way of encoding more information than a traditional bar code. And most importantly, it contains information that can be easily decoded at high speed. In this paper, we show how to create the QR codes via the web browser that facilitates users to easily create their own QR codes for websites, emails, business cards, print ads and so on. The proposed method was developed using entirely open source software such as Libqrencode, Drupal and Ubuntu. The experimental results show that the QR codes were successfully and correctly generated. Therefore, the proposed method is considerably a QR code generator collaborative tools that is available for free use.

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