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A Responsive Web-Based QR Code for Inventory in The Laboratory of Informatics, UNESA

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Abstract. The laboratory is a facility that provides all kinds of equipment necessary for scientific activities. As one of the majors in the Faculty of Engineering, Universitas Negeri Surabaya, Department of Informatics Engineering (JTIF) also has several laboratories to support teaching and learning process for both students and teachers. Lots of equipment stored in the laboratory to support learning in the Department of Informatics. Because many equipment's in the laboratory, it is necessary to record inventory. The records that have been done so far are still manual using MS word or MS excel. One of the weaknesses of manual system is the possibility of missing notebooks, so lab work inventory evidence is missing. Of course, this will reduce the quality value of a laboratory and of course this is very ineffective. In this paper, we propose the application of Quick Response (QR) codes to conduct laboratory inventory. This application use framework Bootstrap which supports responsive web technology. By using the framework, the application can be accessed by mobile phone. This framework can respond to user behavior and environment based on platform size, as well as monitor screen orientation. The outcome is expected to facilitate the process of laboratory inventory in the Department of Informatics Engineering UNESA.

1. Introduction

Technology is constantly evolving. Every day, human deals with the progress of technology. The goal is to create a more advanced technology and able to bring great changes in helping every human task.

One of the technological developments that are developing is QR code. QR Code stands for "Quick Response" Code is a barcode type that contains scanned dots matrix / scan using QR scanner or smartphone with built-in camera. QR code is widely developed in various fields for reasons of its practicality.

Responsive Web Design is a web system designed to be optimally accessible from both ordinary computers and from mobile phone. it will make the web adapt well when accessed either from a regular computer or mobile phone. When accessed using a regular computer then the size in accordance with computer and when opened from mobile phone then the size will adjust according to the size of mobile phone. Of course, this will be very fun because it provides a fun experience while surfing in cyberspace.

In this paper, QR code will be applied in the inventory system of informatics engineering laboratory of UNESA. QR code supports with web responsive technology which can be accessible from both web and mobile phone. The previous inventory system was manually operated. To make it

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more effective than the implementation of this QR code will be implemented in laboratory. This is very useful because of supporting to be more green, healthy and paperless environment.

2. Literature

2.1. QR code

QR code was first developed by Denso Wave, a division of Denso Corporation which is a Japanese company and published in 1994. QR Code is an image containing a two-dimensional matrix that can store data with a size large enough. The QR Code was first introduced in Japan in 1994 by Denso, one of Toyota's subdivisions [1,2]. Here is one of the QR code images that can be seen in Figure 1.

Figure 1. The Example of QR Code.

Here are the explanations related to the anatomy of QR Code [3]:

a. Finder Pattern serves to identify the location of QR Code.
b. Format Information serves for information about error correction level and mask pattern. Data serves to store encoded data.
c. Timing Pattern is a pattern that serves to identify the central coordinates.
d. QR Code, in the form of black and white modules.
e. Alignment Pattern is a pattern that serves to improve QR Code deviation, especially non-linear distortion.
f. Version Information is a version of a QR Code.

2.2. Responsive web

Responsive Web Design is a terminology introduced by web designer Ethan Marcotte on an article published by A List Apart website. The approach of Responsive Web design provides a web design and development which can respond to user behavior and environment based on platform size, as well as monitor screen orientation. Implementation of this approach involves a combination of grids and flexible layouts, drawings, and the careful use of CSS.

2.3. PHP

Hypertext Pre-processor (PHP) is a server-side scripting language that integrates with HTML to create dynamic web [4]. PHP is widely used for dynamic WEB site programming. Because PHP is server-side scripting then the syntax and PHP commands will be executed on the server then the results are sent to the browser in HTML format. So, the program code written in PHP will not be visible to the user so the security of web pages more secure.

PHP version 5.3 [5] is one version of PHP that is quite up to date and widely used by some programmers in creating a web application. PHP programming can also be combined with MySQL [6] and AJAX [7] in generating good web applications.

2.4. MySQL

MySQL is a multi-user, multi-user SQL or DBMS database management software system with around 4 million installations worldwide [8]. MySQL AB makes MySQL available as a free software under the GNU General Public License (GPL) license, but they also sell under a commercial license for cases where its use does not match the use of the GPL.

2.5. Web application

Web app is an application that uses browser technology to run applications and accessed through a computer network. Another opinion related to web applications is a program stored on the Server and sent over the internet and accessed through the browser interface.

Web application technology comes into two namely server-side technologies and client-side technology.

3. Methods

Software design and development in this resarch are refer to Waterfall model, a common system development life cycle [9]. There are five steps in this model. These steps are shown in Fig 2.

Figure 2. Waterfall Model.

These steps are requirements, design, implementation, verification & validation, and maintenance with the following explanation:

3.1. Requirement

The software must meet the needs of users and business processes that have been running. In this process before knowing the needs of users conducted literature studies first. Collection of materials is done by searching for literature sources related to QR code. The collection of materials is obtained from internet sources and from many research publications related to QR code. After that start to learn what the user needs or in other words the system analysis needs of users. In this study, the user's need is to conduct an inventory of the items in this laboratory and label the goods using QR code.

The process without using QR code in previous research, admin will enter the item code to enter the input of equipment's. By using this QR code, the process which should be done are:

1. Admin generates QR code in label form
2. The label is then affixed to the item to be stored in the lab inventory.
3. Information attached to the goods will be displayed to the user through this application

This research not only records laboratory inventory through laboratory inventory information systems but can also print labels containing laboratory information in the form of QR code. Each label will be affixed to each laboratory item.

3.2. Design

At this stage modelling of the software is created. The purpose of making this model is to obtain a better understanding of the flow of data and control, functional processes, operating behaviour and the information contained in there. It consists of the main activity of process modelling, data modelling and design.

3.2.1 *Flowchart of proposed system*

A flowchart is a type of diagram that represents an algorithm. The proposed system is a web-based application used to create QR Code. The flowchart of proposed system can be seen in Figure 3.

Figure 3. Flowchart of proposed system.

3.2.2 *CDM (Conceptual Data Model) and PDM (Physical Data Model)*

CDM Is a database design based on data collection and analysis. It needs analysis user requirement to create CDM. PDM is a physical database design. The design of PDM is a physical representation of the database. CDM and PDM of this application is shown in Fig 4.

Figure 4. CDM and PDM

3.3. Implementation

Applications in this paper is a web-based application where all software support is open source. The technology used in this research are:

1. Linux Operating System
2. PostgreSQL / MySQL Database Server
3. Apache Web Server
4. PHP Web Programming Language
5. HTML, CSS, JavaScript (jQuery)
6. Framework Bootstrap
7. Notepad ++ and NetBeans

All the above support software can be obtained free of charge by downloading directly from each official website. The reason for using open source software is related to free cost. The use of the Bootstrap framework is intended to support responsive web technologies. This application will be accessible via mobile phone. By using Bootstrap will respond to user behavior and environment based on platform size, as well as monitor screen orientation.

3.4. Verification & Validation

In this stage, we take some software testings before implemented in the actual business processes. The testing simulates both data and processes such as the actual event. Searching for some bugs or errors will be done then fixing it. From this stage, the software is expected to be error free and fill the user requirements.

3.5. Maintenance

This stage is the final step. Maintenance involves correcting errors which were not discovered in earlier stages of the life cycle [10]. Maintenance in this research are fixing the bugs and perform data backups on a regular basis.

4. Results and discussion

The results of this research are applications for laboratory inventory. To be able to run this application, what must be done first is to generate a QR code image that will degenerate automatically from the application. Then the picture will be read. The result of the reading is information about laboratory equipment's. Here are the results of the implementation of the created application:

4.1. QR code generator

QR code will generate QR code images for each lab item where the image will be read to get the information. The GUI of QR code Generator is shown in Figure 5.

Figure 5. QR Code Generator

4.2. QR code reader

Once the image is generated, the image can be read to produce information about lab inventory items. The GUI of QR code Reader is shown in Figure 6.

Figure 6. QR Code Reader

4.3. Responsive Web

Applications are made to be accessed not only using the web alone but can be accessed using the mobile phone as well. The GUI of Web Responsive is shown in Figure 7.

Figure 7. Web Responsive

This application is tested using PC and mobile phone. During testing the application, looks very clear the difference between the previous system and after implemented using this application. The previous system which use manual system like typing in Microsoft word or excel is very ineffective because it must be typed using Microsoft word and excel. By using this application, it will be more effective and quick because it can be accessed from mobile phone.

5. Conclusion

Inventory for laboratory needs to be implemented because the laboratory has a lot of equipment's. Inventory implemented so far using manual method. This research is aimed to create application which helps to do inventory in laboratory of Informatics Department of UNESA. This application is supported with responsive web technology where with this technology will provide convenience because it can be accessed by using mobile phone. The application is tested in the laboratory. The result shows that the use of the application is more effective when compared to the manual system.

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