A Responsive Web-Based QR Code for Laboratory Clearance Form

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Abstract. Engineering faculty of UNESA has a policy for students who will graduate to collect a form called Laboratory Clearance Form. Laboratory Clearance Form is a letter stating that student has no indemnity in labs. To have Laboratory Clearance Form, student should get the signature approval many sub heads of the laboratories in the department. It is a problem if the department has a lot of laboratories. Department of PKK, one of department in UNESA has 21 laboratories so their students should ask each 21 sub head laboratories to sign their forms. The process takes a long time. The second problem is sometimes there are students who cheat at the signatures. To avoid cheating, Laboratory Clearance Form should be completed with QR code. In this paper, we propose the design of the application relating to Laboratory Clearance Form using QR code. This application use framework Bootstrap which supports responsive web technology. By using the framework, the application can be accessed by mobile phone. The outcome is expected a design of application to ease student who will graduate having their Laboratory Clearance Form in the Departments of Engineering faculty of UNESA

1. Introduction
Over the years, technology has been growing [4]. Jobs that are usually done manually, can now be done by the app. Recent years, human needs are increasingly complex. everything is online. As well as education, the information related to education needs to be online as it is faster and more efficient. Engineering faculty of UNESA has a policy for students who will graduate to collect a form called Laboratory Clearance Form. Laboratory Clearance Form is a letter stating that student has no indemnity in labs. Student should get the signature approval from many sub heads of the laboratories in the department. Because there are a lot of laboratories in technical faculty of UNESA, it takes time to proceed Laboratory Clearance Form. QR code is one of technology which can be used to prevent duplicating something we protect. It also can be used to prevent student from doing cheating in applying Laboratory Clearance Form. It is effective to use because QR code can be recognized with mobile phone. Nowadays, almost everyone has mobile phone. Therefore student can proceed Laboratory Clearance Form easier without having to chase sub heads of the laboratories to find the signatures. In this paper, we propose the design of the application relating to Laboratory Clearance Form using QR code. This application use framework Bootstrap which supports responsive web technology.
2. Literature

2.1. QR Code
QR code is an image of a matrix barcode that stores data in two dimensions. Data is presented as square dots with specific pattern in both horizontal and vertical dimensions. QR codes can be used in items’ identifications, objects’ tracking, general marketing and advertisements [1]. QR code is now being widely used in a variety of businesses [2]. QR code seems to be applied not only in business but almost in everywhere, QR Code is developed by automotive company from Japan in 1994 by Denso Wave [3], [4]. The advantages of QR Code can keep some information. Contact information such as phone numbers, contact names and emails can also store in QR code labels. Information such as text, images, even videos can also store in QR code. International Standards Organization and International Electro technical Commission (ISO/IEC) have published two standard since year 2000 about QR Code. QR code example is shown in Figure 1.

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. In the last four years, there is an increase for more than 45% of the use of mobile phones for accessing the web [5]. Certainly many people access website through mobile phones. The problem is when website accessed through different devices can lead a broken design [6] that is why responsive web is needed. The broken design happened such as hidden critical links, hidden components as well as hidden important information [7]. In general, Responsive web is method to create web which is the UI could be easily seen and use by any size of screen. Responsive Web design can respond environment based on platform size. It can be resized depend on the size of device [8].

2.3. PHP
PHP was invented for the first time by Rasmus Lerdoff in 1994. He wrote the code using C programming language to build websites for many clients. Next, PHP was quickly following by other web developers and continue to improve PHP [9].

2.4. PostgreSQL
PostgreSQL is a database management system that is quite popular in the world. For more than 15 years developed, postgresql and has proven to have a good reputation. PostgreSQL has complete features and has the same quality as Oracle and SQL Server although it is free, those features are streaming replication, aggregate function, etc. The latest version of PostgreSQL is version 10.

2.5. Web Application
Web application is a computer software that is encoded in a programming language that supports web-based software such as HTML, JavaScript, CSS, Ruby, Python, Php, Java and other programming languages.

2.6. Laravel
Laravel is a PHP MVC framework developed by Taylor Otwell in 2011 [10] and now has reached version 7 and with the slogan laravel "Php That Does Not Hurt. Code Happy & Enjoy The Fresh Water". People will feel that php programming is fun and easy because there are so many features that will help us in coding using this laravel framework. Beta version was released in June 2011 and built
from scratch. Some features on that version is Eloquent ORM, routing based on closure function, helper for form, validation, authentication, etc.

3. Methods
Waterfall model, the most used system development life cycle, is used to design and develop the software. Waterfall model has five steps that shown in the Figure 2.

![Figure 2. Waterfall Model](image)

3.1. Requirement
Before using this system, collage students have to ask all signatures of sub head of laboratories and head of laboratory by face to face. But by using this system, collage students do not require to ask all signatures face to face. System will help students to get Laboratory Clearance Form without difficult steps, those are:

- Student has to submit the letter in submit form.
- Student must upload needed documents (depend on the lecturers).
- All of kasublab and kalab approve the submitted letter.
- Student downloads the letter.
- Lecturer can validate the letter using QR code in the printed letter from the student.

Students cannot manipulate the letter because every student has different unique QR code.

3.2. Flow Map
Flow map is the extended diagram from flowchart that represents the flow of the system. The flow map of the proposed system can be seen in Figure 3.

![Figure 3. Flowmap of the proposed system](image)

3.3. PDM (Physical Data Model)
PDM is used to represents the database of the system. PDM of this application is shown in Figure 4.
3.4. **PDM (Physical Data Model)**
DFD is used to make people understand about the flow of data or information through system. DFD of this application is shown in Figure 5.

3.5. **Implementation**
Applications we use in this paper are totally free and responsive web-based application. The software we used are:
- Linux Operating System
- PostgreSQL Database Server
- Apache Web Server
- PHP Web Programming Language
- HTML, CSS, JavaScript (jQuery, DataTables and Vue.js)
- Bootstrap Framework
- Laravel Framework
- Notepad++, HeidiSQL, GitKraken and Visual Studio Code
All software can be downloaded for free. This research used Bootstrap framework for responsive web and Laravel framework to ease developing system.

3.6. **Verification and Validation**
In this step, we used white-box and black-box testing before implementing it. White-box testing is to find the wrong groove source code algorithm and black-box testing for searching the wrong detail, user interface etc. We used those testing methods for searching some bugs and then we fixed it up.

3.7. **Maintenance**
In this step, we used white-box and black-box testing before implementing it. White-box testing is to find the wrong groove source code algorithm and black-box testing for searching the wrong detail, user interface etc. We used those testing methods for searching some bugs and then we fixed it up.

4. Results and Discussion

The result of this research is application to create Laboratory Clearance Form. To create license from this application, the student needs to request license by accessing this web application and filling request form with their registration number. If it success, each sub head laboratory and head laboratory will receive notification from the system about student who request the license. If all of sub head laboratories confirm, the head of laboratory will receive notification. After the head of the laboratory confirms, the student then can download the Laboratory Clearance Form.

4.1. Laboratory Clearance Form

Laboratory Clearance Form is generated by the system with pdf format. It contains QR code for validation which is generated when all sub head laboratory and head laboratory confirm. Laboratory Clearance Form can be seen in Figure 6.

![Figure 6. Laboratory Clearance Form](image)

4.2. QR Code Reader

The image of the generated QR code can be read to validate the user. The view of QR code Reader is shown in Figure 7.

![Figure 7. A Laboratory Clearance Form](image)

4.3. Responsive Web

This application can be accessed from both computer and smartphone. The GUI of Web Responsive can be seen in Figure 8 and 9.

![Figure 8. Accessed from computer](image)  ![Figure 9. Accessed from mobile phone](image)
4.4. Email Notification

Once the student requests Laboratory Clearance Form, each of the sub laboratory will receive message from the system. The view of email notification can be seen in Figure 10.

![Email Notification](image)

**Figure 10. Email Notification**

5. Conclusion

The result of this research is application to create Laboratory Clearance Form. To create license from this application, the student needs to request license by accessing this web application and filling request form with their registration number. If it success, each sub head laboratory and head laboratory will receive notification from the system about student who request the license. If all of sub head laboratories confirm, the head of laboratory will receive notification. After the head of the laboratory confirms, the student then can download the Laboratory Clearance Form.

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