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Development of A Presence System for Students using QR Code Based on Android Application

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Abstract

The Department of Information System at Institut Teknologi B.J. Habibie still physically records each student's attendance by having them sign a presence sheet for each course. Due to the ease with which fraudulent signatures can be used to manipulate the traditional system, there may be some issues. Additionally, manual presence recapitulation takes more time and could be less precise and effective. This research aims to develop a prototype of Android-based application of student presence system with QR Code technology in the Department of Information System, Institut Teknologi B.J. Habibie. Following the creation of the presence system prototype, ISO 25010 quality standards were used to evaluate the application. The criteria evaluated are functionality, usability, portability, performance efficiency, and security. The application's functionality was tested by two system experts by using Guttman Scale and it gained 100% yes answer. The usability was tasted from 30 users rating the application usability through a survey using Likert Scale, it achieved the average percentage of positive answers is 91%. The performance efficiency was classified as grade A by *GTmetrix* testing site. Similarly, the security system tested by *sslabs.com* achieved grade A. Furthermore, the portability was tested by using 4 different web browsers for the web version and by installing the application on 4 different smartphones and they showed no errors. Based on the overall assessment result, the Android-based Student Presence System is feasible, efficient, suitable and secure.

Keywords: Android; functionality; portability; presence system; QR Code

1. Introduction

In higher education, the lecture/teaching process is carried out using various methods based on the standards set by the Directorate General of Higher Education as well as by the institution itself. The lectures are an advanced learning process and the presence of students is very important to support the continuity of the teaching and learning process. The students attending lectures are recorded and sometimes it become additional assessments to determine the student grades. In addition, student and lecturer presence system can also be the information about how the student's or lecture's discipline is concerned [1].

Presence refers to the ability to create a learning environment and atmosphere that enables learners to communicate in a friendly and supportive environment, and demonstrate true social and emotional expression capabilities [2]. For presence detection, using multiple technologies, it's very hard to converge and a single platform is not available yet [3]. The old presence system is prone to misuse and data manipulation, so it is necessary to develop a new presence system based on smartphones [4].

Presence system is one of the important components in the lecture process and student attendance recap is one of the elements in various aspects of lecture assessment. Presence has been carried out by signing students. The use of telecommunications technology which is now growing rapidly is the smartphone where one of the operating systems used in smartphones is the Android operating system, Android provides an open platform for users to create their own applications that have been used if various mobile devices [5].

Presence system is a crucial process in campus that involve students [6]. Presence system for a fairly number of participants, this situation is a wasting of time as well as reduces convenience for participants [7].

The technology is currently developing very fast wherein the industrial era 4.0 all activities can be connected and accessed by using the internet and smartphone [8].

With the advent of new mobile technologies, the Mobile application industry is advancing rapidly. Consisting of several operating systems like Symbian OS, iOS, blackberry, etc., Android OS is recognized as the most widely used, popular and user-friendly mobile

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platform. This open-source Linux kernel-based operating system offers high flexibility due to its customization properties making it a dominant mobile operating system. Android applications are programmed in java language. Google android SDK delivers a special software stack that provides developers an easy platform to develop android applications. Moreover, developers can make use of existing java IDEs which provides flexibility to the developers. Java libraries are predominant in the process of third-party application development. Cross-platform approaches make sure that developers do not have to develop platform-dependent applications. With the help of these approaches, an application can be deployed to several platforms without the need for changes in coding [9].

A Quick Response (QR) code is a two-dimensional barcode of black and white squared modules that is traditionally used for inventory tracking. QR Code technology is also used as a media to store student attendance data. QR Code is a medium used to store information quickly and get fast response without manually inputting by typing. The information encoded in the QR Code can be in the form of a URL, telephone number, SMS message, V-Card, or any text. The use of the QR Code is easily scanned and the data can be directly identified [10]. QR codes are being used increasingly to share data for different purposes. In information communication, QR code is important because of its high data capacity [11].

After direct observation of the Department of Information System, Institut Teknologi B.J. Habibie, one of the problems found related to the student presence process is that practice was still done manually by using signatures on the absence sheet for each course. Carrying out manual presence may ease the students to manipulate the presence by writing down the name of a friend listed in the course (entrust presence) who is actually absent. In addition, manual presence requires time to recapitulate the presence of students and lecturers, and it becomes less effective and less accurate.

Due to the problematic implementation of manual presence in this modern era, therefore an innovative technology system development is needed. One of technological developments that can be utilized is QR code. The QR code is used as presence method that is directly integrated with the presence system in the Department of Information System, Institut Teknologi B.J. Habibie which validate and recapitulate student presence more accurately and more effectively.

2. Proposed Method

The prototype of the developed model in this study, as shown in Fig. 1. The initial stage in this research was gathering needs which was carried out by direct observation and interviews in the department of Information System, Institut Teknologi B.J. Habibie.

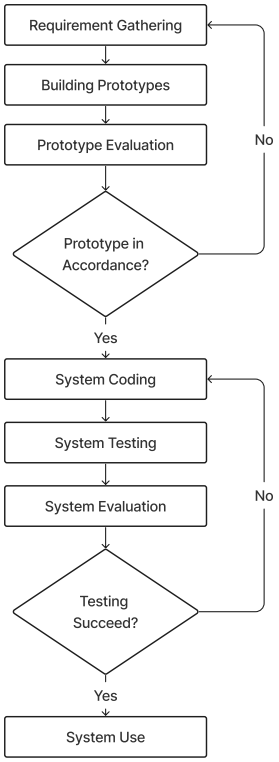

Figure 1. Stages of the prototyping method

The correspondences of the interview were the staffs/admins in the Department Information System. The aim was to collect information about current presence system and its obstacles as well as to gather required data to the presence system such as the list of students, the lecturers, the courses of the Information System program.

The second stage of this research is to build the prototype. This is done by creating a simple design consisting of flowcharts and activity diagrams.

2.1. Flowchart

One of the flowcharts in this study is the admin flowchart, as shown in Fig. 2.

2.2. Activity Diagram

The activity diagram in this study, as shown in Fig. 3.

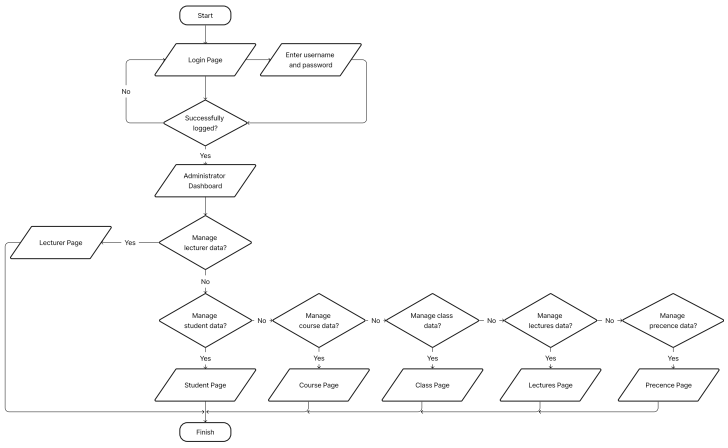

Figure 2. Admin flowchart

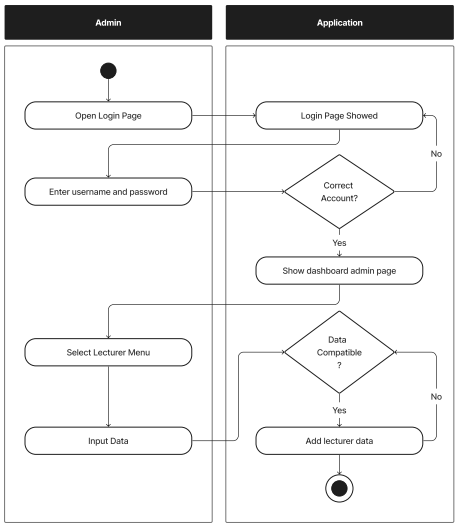

Figure 3. Activity diagram

The third stage is the evaluation of the prototype. In this stage, the client and developer identify the format that has been made according to the needs as a whole, including the software to be used and the features to be made. If the software developed is appropriate then it would be proceeded to the next stage, otherwise the prototype stage will be repeated from the first stage.

The fourth stage is the system coding. In this stage, the prototype that has been mutually agreed upon will then be translated into PHP programming language for web application and into Dart programming language for mobile application. Other technologies used are Laravel as the framework for web version, Fluter framework as the framework for mobile, MySQL as the database and Visual Studio Code as a code editor.

The final stage is the application testing using the indicator feasibility test based on ISO 25010 to fulfill several criteria. These criteria are the functionality, the usability, the portability, the performance efficiency and the security system. The ISO/IEC 25010 software quality model is an international standard for assessing software quality from two points of view which are the quality in using the application and the product quality [12].

2.3. Data analysis technique

2.3.1. Guttman scale

Guttman Scale is used to rate each feature. Guttman scale is a type of scale to get clear (firm) and consistent answers, usually the answers are yes-no or success-failure or true-false. The answer to this test can be in the form of a tick with an assessment of 1 as the highest value and 0 as the lowest value. The test cases are tested by 2 system experts [13]. Then the results of the test are calculated by [14].

Table 1. Guttman scale

Answer	Score by validator	
	Validators 1	Validators 2
Yes	-	-
No	-	-
Total	-	-

Table 2. Likert scale

Answer	Score
Strongly agree	5
Agree	4
Somewhat Disagree	3
Disagree	2
Strongly Disagree	1

Presentation for all grades is:

$$Yes = (\sum \frac{Score}{Item\ Question})\ x\ 100 \quad (1)$$

2.3.2. Likert scale

The application usability is assessed through a survey of user's attitudes, opinions and perceptions by using Likert scale. This scale is ranging of 5 options that had gradations from very positive to very negative, namely strongly agree (SS), agree (A), somewhat disagree (SD), disagree (D), and strongly disagree (StD) [15]. The scale of the options can be seen in the Table 2.

The result of this survey is collected and accumulated. Only percentage of strongly-agree answer is counted and considered to scale the usability of the application. This percentage is described in the Table 3.

3. Experimental and Results

The result of this study is a development system by utilizing QR code technology. The QR code is used as presence method that is directly integrated with the Android presence system in the Department of Information System, Institut Teknologi B.J. Habibie.

This section presents the system interface design and the system testing result.

3.1. The system interface design

The followings are the interface design of each page of the system.

3.1.1. Login page

This page displays the application logo and application name as well as the login form. Users (students) are given access to the system by entering their registered student number (NIM) as the initiate username as well as the password.

3.1.2. Aplication main menu

The page that appears after the user (students) successfully login is the page of the application main menu where 4 menu options in the form of buttons are displayed. The first button is to start presence, the second button is to view the presence history, the third is about menu, and the last is an exit button to end the access to this application.

Table 3. The Scale of Likes

Percentage (%)	Score
81-100%	Very satisfied
61-80%	Satisfied
41-605	Neutral
21-40%	Dissatisfied
<21%	Very dissatisfied

Figure 4. Course schedule page

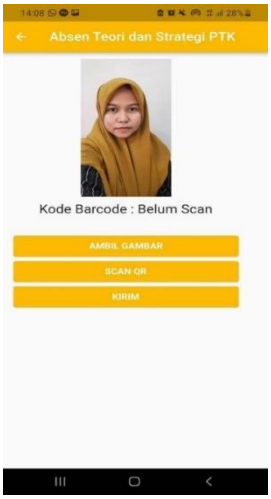

Figure 5. Image capture page

3.1.3. Course schedule page

The course schedule page is the page that shows the information about courses currently being held. Below the information, there is a take-a-picture button to take a real photo selfie. The course schedule page is shown in Fig. 4.

3.1.4. Image capture page

This page is used to take a selfie photo using cellphone's camera. This page will not allow students to upload a photo from the phone gallery.

The image capture page, as shown in Fig. 5. Beside taking photos, the page provides a button to scans the QR code of the course that is currently conducted. A barcode is displayed before the class so the student can scan the barcode from the presence application in their phone.

The example of the barcode and QR code scanning page, as shown in Fig. 6.

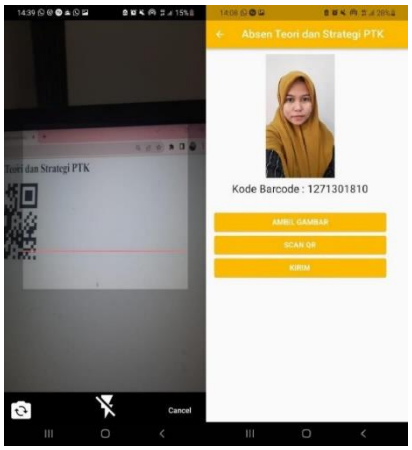

Figure 6. Scan QR code page

Table 4. System expert testing results

Answer	Score by validator	
	Validators 1	Validators 2
Yes	73	73
No	-	-
Total	100%	100%

After successfully scanning the barcode, the page will return to the main page and at the bottom of the page there will be a message to notify the user that the system successfully records their presence.

3.2. System testing

The entire system will be tested based on the software quality standards at ISO 25010 standard with four aspects: functionality, usability, portability, performance efficiency and security. Then the user will give feedback which will be used to improve system requirement specifications. The followings describe the testing result of each aspect.

3.2.1. Functionality testing

The functionality test instrument consists of 73 statements related to the functions developed into the system. Each function was assessed by 2 (two) system experts. The summary of the functionality testing results by the experts are shown in the Table 4.

Based on the calculations in the Table 4 above, the score of the yes answer is > 50% so that the system can be accepted or considered appropriate and therefore, it is fulfilled the functionality aspects.

3.2.2. Usability testing

This testing is done through a survey using Likert Scale to collect users' response regarding the student presence application. From over 30 respondents, the average percentage of strongly agree answers was 91%. This number showed that the application usability is very satisfied based on the scale of likes.

3.2.3. Portability testing for the web version

Portability testing for the web version was done by using a web browser testing tool called browserstack.com. This tool supports cross browser testing. In this test, 4 different types of browsers were used and analyzed. The results of the portability testing can be seen in the following Table 5.

Table 5. Portability Testing Result for The Web Application

No.	Browser type	Type	Operating system	Hasil
1	Microsoft Edge	Desktop	Windows 11	No errors found
2	Mozilla Firefox	Desktop	Windows 11	No errors found
3	Opera Browser	Desktop	Windows 11	No errors found
4	Google Chrome	Desktop	Windows 11	No errors found

Table 6. Portability testing result for the mobile application

No.	Device type	Android Version	Installation process	Application Running process
1	Smartphone Samsung J7 Pro	9	Succeed	Runs fine without any glitches
2	Smartphone Vivo Y33S	12	Succeed	Runs fine without any glitches
3	Smartphone Samsung A50S	11	Succeed	Runs fine without any glitches
4	Smartphone Vivo 1820	8.1.	Succeed	Runs fine without any glitches

3.2.4. Portability testing for the mobile applications

In order to perform this testing, the application was installed on 4 (four) smartphones with different specifications of hardware and different versions of the Android OS. The results of the testing are shown in the Table 6.

3.2.5. Performance efficiency

Performance efficiency testing was carried out by utilizing a site called GTmetrix. The following figure is the result obtained from performance efficiency testing using GTmetrix. The image performance efficiency, as shown in Fig. 7.

Figure 7 shows the performance efficiency using GTmetrix is 93% and the structure is 95%. The load time is much faster or only 1.6 seconds (load time must be less than 10 seconds). The grade A category in the testing result proves that the performance efficiency is excellent.

3.2.6. Security testing

This test was carried out using a web security testing tool named sslabs.com and the results, as shown in Fig. 8.

Figure 7. Performance efficiency

Figure 8. Security testing results using *sslabs*

Based on the result, the security grade is A, indicating that the presence system developed is stated very well in terms of security system.

4. Conclusions

Based on the results of research, the development of presence system for students using QR Code on Android OS was created using a prototype development model. This presence system is an application for students to take presence without having to record on a sheet of paper manually. This system is developed using Dart programming language with Flutter framework for mobile application and PHP, HTML, and CSS with Laravel framework for the web application.

The application was assessed based on ISO 25010 on 5 criteria. They are the functionality, the usability, the portability, the performance efficiency and the security system. A variety of testing tools and human evaluation were used to assess the system's quality while examining its functionality, performance efficiency, security, and portability. The application's functionality was tested by two system experts by using Guttman Scale and it gained 100% yes answers over 73 test cases. The usability was tasted from 30 users rating the application usability through a survey using Likert Scale, it indicated that the application is very satisfied with the average percentage of positive answers is 91%. The performance efficiency was classified as grade A by *GTmetrix* testing site. Similar to the security system tested by using sslabs.com testing site, the application achieved an A grade too. Furthermore, the portability was tested for both web and mobile version. For the web version, 4 different browsers were used with the help of browserstack.com testing site and no error was found. This result was as satisfied as the mobile version result which installed on four different smartphones. Based on the overall assessment result, the Android-based Student Presence System is feasible, efficient, suitable and secure. Therefore, it can be developed and implemented in the Department of Information System, Institut Teknologi B.J. Habibie.

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