

Development of Lecture Attendance System Using QR Code in Information and Computer Engineering Education Study Program of Universitas Negeri Makassar

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ABSTRACT

This research is a software development research that aims to develop a lecture attendance system because from the past until now the computer engineering and informatics education study program did not have an attendance database, therefore the attendance data collection itself was done manually which could trigger human error and attendance fraud which is often done by students. Therefore it is necessary to develop a student attendance information system using a QR Code. The application quality based on ISO 9126 quality standards. In this study, system data analysis and collection, prototyping, prototyping, system coding, system testing, system evaluation, and system use. Data was collected using interviews, observation, and survey techniques. The system was validated by two system experts and evaluated by 40 students from the Information Technology and Computer Engineering study program at UNM. Data analysis used descriptive statistical analysis techniques. Based on these findings, we created an application that can manage wedding guest data. Based on the test results, you will get the following results: (a) Very good functionality in this category; (b) The maintainability aspect has met the maintainability standard; (c) The portability aspect is rated 1 or very good category; (d) Aspect of reliability with a percentage value of 99.9 so that it meets the reliability standards set in the Telcordia standard; (e) The efficiency aspect of this application is Grade B with a performance percentage of 83; and (f) The system user rating (usability aspect) has a score of 88.05 or very good in the category.

Keywords: System Attendance, Lectures, QR Code, ISO 9126

INTRODUCTION

Information technology is a rapidly developing technology, and I feel its superiority in my daily life. Advances in information technology have made it possible to access available data and information quickly and accurately. Today's technology also makes it easier and more profitable for users, especially in sharing information.

Attendance is a data collection activity used to determine the number of participants in an event [1]. There must be activities that require information about participants. This also happens in the learning process. This is very important for face-to-face lectures because each student can only take the final exam of a course after attending 80% of the lectures [2].

The attendance data search itself is done manually, and the student attendance form used

for attendance is susceptible to damage such as cracks, scratches, and fades when exposed to water, and is easily scattered and lost. So far, Information and Computer Engineering Education Study Program does not yet have an attendance database, considering the attendance data of students are very important and the problems arise if the attendance data was lost. Also the attendance data collection itself was done manually which could trigger human error and attendance fraud which is often done by students.

So therefore, the Information and Computer Engineering Education Study Program needs to develop an information system about student attendance using a QR code because the attendance data must be stored and archived properly so it could reduce the occurrence of human error and attendance fraud. In the system all students already have a QR code, all QR

codes are student identification, and every time a student enters a course, they simply scan the QR code and enter the class-room. You can find the QR code for each student by going to the website. This student QR code is used to record attendance, not manual attendance. The QR code is used as an attendance method that is directly integrated with the current academic information system application [3]. This QR code can be used for all registered courses and will not change. Attendance can only last 30 minutes after the start of the lecture to reduce student errors in the attendance process. The development of this information system uses the prototyping model. The prototyping model consists of several phases: requirements analysis and gathering, build prototyping, prototyping evaluation, system coding, system testing, system evaluation, and system usage.

METHODS

A. Types of Research

This type of research is research and development (R&D). R&D is a research method used to produce certain products and test the effectiveness of these products. The results of certain products will be used to analyze needs and test the effectiveness of these products so that they are available to the wider community. Research is needed to test the effectiveness of this product

B. Research Time and Place

This research was started from July to September 2020 in the Informatics and Computer Engineering Study Program of Makassar State University.

C. Development Procedure

The model used to develop this information system is a prototype model with the steps of analysis and requirements gathering, build prototyping, prototype evaluation, system coding, system testing, system evaluation, and system usage.

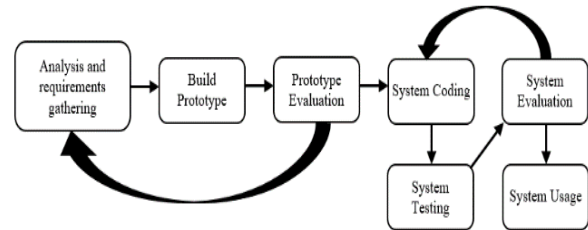


Figure 1. Development Procedure

In the analysis and data collection stage of the system, the researchers conducted a needs analysis by observing so that the results of the system requirements analysis could be identified and the information collected could be used as planning material in system development. The next stage is building prototyping to match user requirements. Evaluation of prototyping by supervisors by adjusting to the problems encountered. If it is appropriate then the next step can be carried out, but if it is not appropriate then return to the initial stage. The prototyping design that has been evaluated is implemented at the system coding stage using a programming language. After the system becomes software, the system must be tested. The user will evaluate the system that has been created, whether it is in accordance with the needs and can overcome the problem. If it has met then the next step is carried out, but if it is not appropriate, the system will repeat the coding step. The system has been tested and accepted by ready to use

D. Research Design

The system is designed by making system architecture, use case diagrams, activity diagrams, sequence diagrams, and flowcharts.

E. Software Testing

Software testing research uses the ISO 9126 standard to get the highest rating for the application and uses the ISO 9126 method, which is not too widely used as research material. This study uses six aspects of ISO 9126: functionality, usability, portability, maintainability, reliability, and efficiency.

Functionality according to Supriyono, functionality is the ability of the software used to provide functions that meet user needs to be stated or implied [4]. Functionality is the system

test results based on the functionality aspect use the ISO 9126 standard calculation to analyze the functionality test result data using the following formula [5]:

$$X = 1 - \frac{A}{B} \quad (1)$$

$$X = 1 - \frac{0}{79} \quad (2)$$

$$X = 1 \quad (3)$$

When tested, the X value obtained is 1, so it can be concluded that the developed system is functionally feasible.

Usability aspect in human and computer interaction is an important part that must be fulfilled in software design [6]. Usability test used when we evaluating the system, we perform usability tests and use surveys to capture the results of user responses to the system. This questionnaire consists of 20 questions on a likert scale and distributed to 40 students of the Informatics and Computer Engineering Education Study Program. Usability test using this following formula:

$$\text{Usability Percentage} = \frac{\text{Total Score}}{\text{Maximum Score}} \times 100\% \quad (4)$$

Then the conclusions that are adjusted to the distribution of scores and percentages against the predetermined assessment categories.

Software is said to be portable if it runs in different environments and can still run. To test the level of portability of a web-based application, the application is tried to run using a different browser [7]. In addition, experiments using different devices can also determine the level of portability of the software. Testing portability by using tools named browserstack.com.

The maintenance aspect is related to software changeability. Modifications include corrections, improvements, or adaptations to changes in the environment, requirements, and functional specifications.

Reliability is a series of measurements or a series of measuring instruments that have consistency if the measurements made with the measuring instrument are repeated. Reliability

testing is carried out by stress testing using WAPT software, which gives some burdens to the software so that it can be seen whether the software is functioning properly [8].

Efficiency is the ability of the software to deliver the correct performance to the number of resources used. Efficiency test with GTMetrix, a tool intended to easily check the performance of your website. GTMetrix is one of the most popular and widely used website speed checking tools besides Pingdom [9].

F. Data Analysis Techniques

This test is carried out by distributing surveys. Users rate it on a Likert scale. The Likert scale is used to measure a person's attitudes, opinions, and perceptions [10]. The scale to each instrument that uses a likert scale has a gradation from very positive to very negative, namely strongly agree, agree, somewhat agree, disagree, and strong-ly disagree [5]. The value of each response can be seen in the following table.

Table 1. Likert Scale

No.	Percentage	Categories
1.	Strongly Agree	5
2.	Agree	4
3.	Somewhat Agree	3
4.	Disagree	2
5.	Strongly Disagree	1

Testing usability characteristics uses descriptive statistical analysis techniques where this analysis is needed in order to be able to explain data by describing it so that the conclusion of the data is obtained [11]. In the feasibility analysis of this application, such as the example given by Sugiyono [12], the following calculations are used:

$$\text{Percentage} = \frac{\text{Observed Score}}{\text{Expected Score}} \times 100\% \quad (5)$$

Then draw conclusions that are adjusted to the distribution of scores and percentages of the predetermined assessment categories. Table 2 is a qualitative conversion table of percentages.

Table 2. Qualitative Conversion of Percentage

No.	Percentage(%)	Categories
1.	81%-100%	Very Good
2.	61%-80%	Good
3.	41%-60%	Quite Good
4.	21%-40%	Bad
5.	<21%	Very Bad

Based on the table 2, it can be concluded that when the percentage of usability test results is <21% the feasibility category is very bad, the percentage value is 21%-40% the feasibility category is bad, the percentage value is 41%-60% the feasibility category is quite good, the percentage is 60%-80% good category and if the percent-age is 81%-100% the eligibility category is very good.

G. Data Collection Techniques

The data collection techniques used to obtain the required data are interviews, observation, and survey distribution. Interviews were conducted by conducting direct questions and answers to the relevant resource persons, namely the supervising lecturer to obtain the necessary data and information. Observation is data collection through researchers who are directly involved or feel the life of the research subject. In this study also used a questionnaire. Questionnaires will be distributed to students and lecturers as research.

RESULT AND DISCUSSION

The result of this research is an information system of lecture attendance using qr code in Information and Computer Engineering Education Study Program of Universitas Negeri Makassar by using prototyping model, a system developed through testing based on the ISO 9126 standard, covering aspects of functionality, usability, portability, efficiency, reliability, and maintainability..

A. Analysis and Data Collection of The System

Information and Computer Engineering Education Study Program does not yet have an attendance database, considering the attendance

data of students are very important and the problems arise if the attendance data was lost. Also the attendance data collection itself was done manually which could trigger human error and attendance fraud which is often done by students. This study resulted in a lecture attendance system for students using a QR Code using a prototype model development procedure. The development of the prototype model begins with analysis and data collection.

The result of the analysis of this stage: (1) the informatics and computer engineering study program can use this attendance system to record student attendance, (2) the informatics and computer engineering study program requires the development of this attendance system to reduce the level of student cheating when there are students, (3) the informatics and computer engineering study program requires an attendance system to maintain the integrity of student data in the long term, (4) access levels consist of administrators/operators, lecturers, and students, (5) a system that can scan each student's QR code quickly through the system created, (6) each lecturer also has his own account to confirm the student's whereabouts, (7) each student can also view the course schedule on the system.

B. Build Prototypes

The results of building prototyping by making system architecture as shown on Figure 2, context diagram as shown on Figure 3, and use case diagram as shown on Figure 4.

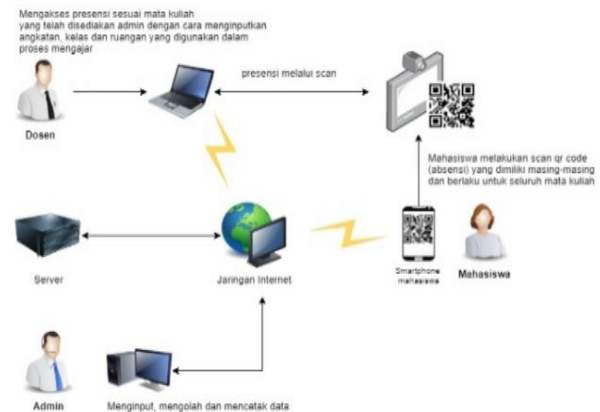


Figure 2. System Architecture

It can be explained that the design of the system in this study is that students access the system through the internet network that has been provided by the server and use a mobile phone as the device used, which is followed by a scan of the qr code of the courses being followed. So that the data of students who have made attendance through the qr code is accumulated in the database and can be monitored by the lecturer or admin concerned.

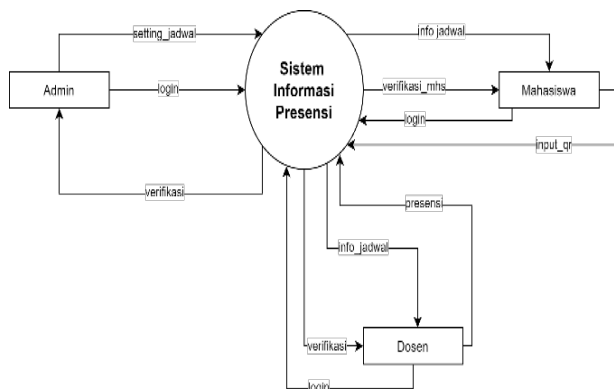


Figure 3. Attendance Information System Context Diagram

Based on Figure 3 explained that this attendance information system can be accessed by admin, lecturers, and students. Starting with the admin as the operator in the informatics engineering education study program and the computer login to the system to input student and lecturer data so that the admin can set the lecture schedule which can later be accessed by students and lecturers. If the lecturer logs into the system, the lecturer's main page will display information on the lecturer's teaching schedule.

In addition, the lecturer also performs the attendance process in the system, where when the lecturer presses the start attendance button, a camera will appear which will later be used as a scan tool or scan the qr code of each student. Meanwhile, when a student logs into the system, the main display is the student's qr code and the student's class schedule. Students scan their qr code to a scan camera that has been verified by the lecturer.

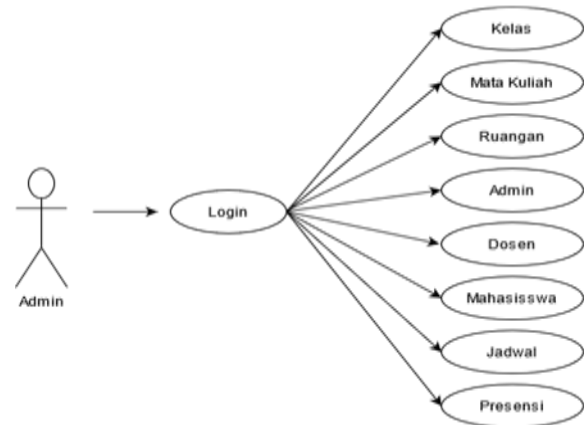


Figure 4. Usecase Diagram

Based on Figure 4 above, it can be explained that the admin can access the attendance system by logging in first so that it can access other menus contained in the system, namely classes, courses, rooms, admin, lecturers, students, schedules, attendance.

C. Prototyping Evaluation

This evaluation is carried out by the validator as a verifier. If that doesn't solve the problem, or if a fix is needed, it should be fixed first until the validator agrees and meets the user's expectations. As a result of the initial evaluation of the prototype by the validator, the developer was asked to modify it and then add some feat.

D. System Coding

The web programming language used is JavaScript, Hypertext Preprocessor (PHP), and a database processing system using MySQL. The system coding results are shown in the following sections.

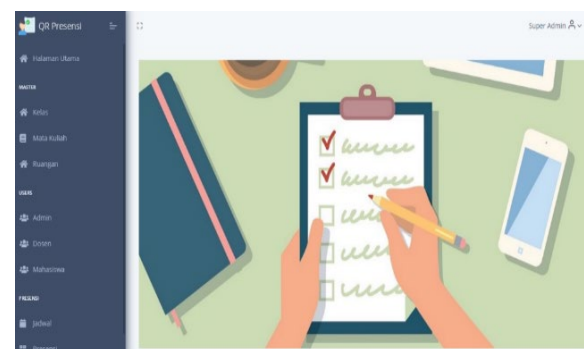


Figure 2. Admin Page



Figure 3. College Student Page

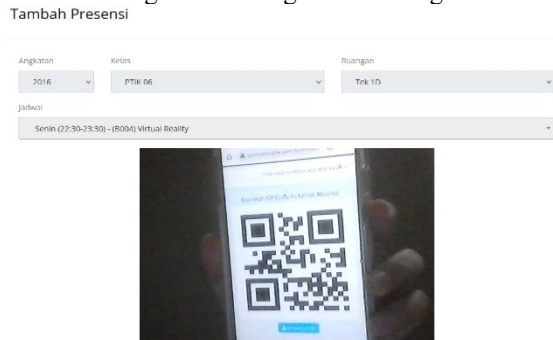


Figure 4. Attendance Page

From the pictures above, it can be explained that Figure 4 is the main administration page that displays all class, course, room, admin, teacher, student, schedule, and attendance information. Figure 5 is the main student page that displays each student's QR code. This QR code is used by students for attendance. In addition, there is a schedule and attendance menu. The schedule menu for students serves to display a list of student lecture schedules such as descriptions of the day, starting hours of lectures, hours of finishing lectures, courses, lecturers who teach, and classes. Figure 6 shows the attendance page for the scheduled class attendance schedule by selecting the student force, course, and class, as well as the room used for the lecture process so that students can scan QR.

E. System Test

The results of this test are system functionality, portability, maintainability, efficiency, and reliability.

Functionality test results or value of X is 1 (one) which is if the value of X close to 1 is good. When tested, the X value obtained is 1, so it can be concluded that the developed system is functionally feasible. The results obtained are

also said to have passed according to the standard criteria for the functionality aspect of the Microsoft Certification Logo because every function contained in the system can run as it should [13].

Testing this portability aspect is carried out using a web testing tool, namely browserstack.com. The test is carried out by cross-browser testing or system checking using various browsers on the desktop [14] (see table 3).

Table 1. Portability Test Result

No	Browser types	Operation System	Result
1	Edge 90	Windows 7	1
2	Chrome 91	Windows 7	1
3	Internet Explorer 10	Windows 8	1
4	Mozilla Firefox 89	Windows 8	1
5	Opera 77	Windows 10	1
6	Yandex 14.12	Windows 10	1
7	Safari 14	macOS Big Sur	1
8	Chrome 91	macOS Big Sur	1
9	Samsung Galaxy A8	Android	1
10	Xiaomi Redmi Note 9	Android	1
Average			1

Number 1 (one) indicates that this system can be run without any errors. Based on the results of portability testing, it can be concluded that this information system is said to have good portability if when it is run in different environments, the software can still run [15].

The maintainability test is carried out in the field operationally according to the Land version of the instrument [16] (see table 4).

Table 2. Maintainability Test Result

No	Aspect	Aspects Assessed	Results Obtained
1	Instrumentation	There is a warning from the system if an error occurs along with identification of the error.	When an error is made by the user, the system issues a warning to identify the error
2	Consistency	Use of One design model in the entire system design.	The system design model already has the same form.
3	Simplicity	Ease of system management, repair, and development	Easy to manage, repair and expand.

The efficiency testing is carried out to assess how fast the display and website speed is using the GT-Metrix tool. The test was achieving Grade B performance within 83% performance and 87% structure. Grade B is the average speed category. The results of the efficiency test are shown in the Figure 7.

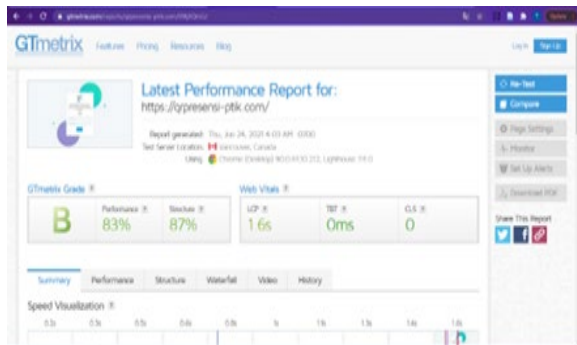


Figure 7. Efficiency Test Result

Reliability testing is done using WAPT software version 10. This test uses 20 users at once and has a test time of 10 minutes. The results obtained are a total of 83,619 test cases accessed and a total of 159 errors detected. The results show that the reliability value is 99.9% so that it can be said to 'meet' the reliability standard criteria set in the Telcordia standard [17]. The results of the reliability test are shown in the Figure 8.

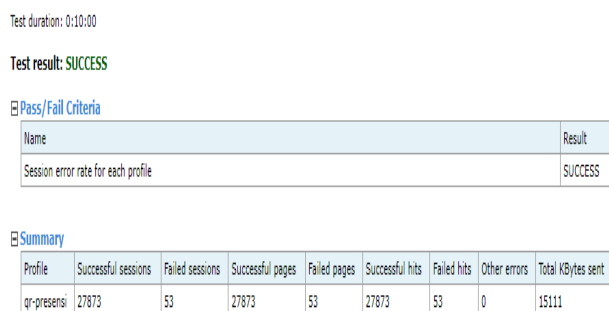


Figure 5. Reliability Test Result

F. System Evaluation

When evaluating the system, we perform usability tests and use surveys to capture the results of user responses to the system. This questionnaire consists of 20 questions on a likert scale and distributed to 40 students of the Informatics and Computer Engineering Education Study Program.

$$Usability\ Percentage = \frac{Total\ Score}{Maximum\ Score} \times 100\% \quad (6)$$

$$Usability\ Percentage = \frac{3522}{4000} \times 100\% \quad (7)$$

$$Usability\ Percentage = 88,05\% \quad (8)$$

Based on the final calculation, the questionnaire was distributed to 40 students of the study program. The total score obtained is 3522 and the maximum total score is 4000. So to calculate the percentage, the score obtained is divided by the maximum score and multiplied by 100% so that the user response results were 88.05%. Converted based on the Likert scale which is the answer to the classification of the "very good" category.

G. System Usage

This lecture attendance system was developed and implemented by simulating attendance using a QR code. To ensure that the system can be used correctly in the real environment.

CONCLUSION

Based on the development and testing, it can be concluded that the attendance system runs as expected with a web-based QR code and a server that can receive data. However, attendance checking can only last for 30 minutes after the lecture starts. Therefore, this system still has drawbacks in the form of no face verification of students attending lectures. This research is still far from perfect. The author suggests it is necessary to add a facial scanner feature that can recognize students' faces and confirm student attendance after attendance to prevent data falsification.

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