

Development of Student Attendance System Application Using QR Code at MAN 1 Kota Gorontalo

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ABSTRACT

Manual paper-based attendance systems are still prevalent in many madrasahs. This study aims to: (1) develop a QR Code-based student attendance system at MAN 1 Kota Gorontalo, (2) test the system's performance, and (3) determine its feasibility. This research and development (R&D) study employs the Waterfall model, encompassing the stages of Analysis, Design, Implementation, Verification, and Maintenance. The subjects were 33 teachers. Product trials were designed in three parts: testing by system experts, operational testing, and user testing. The system's quality was evaluated based on ISO 25010 and Olsina et al. standards, covering functional suitability, usability, performance efficiency, reliability, and maintainability. Data were collected through questionnaires and observations. Questionnaires gathered data on functional suitability, usability, and customer intimacy, while observations collected data on performance efficiency and reliability. Data analysis used quantitative descriptive techniques. The results are: (1) a functional web-based student attendance system using QR Code, (2) the product met quality standards, receiving the predicates "Highly Feasible" for functional suitability (100%), "Feasible" for usability (68.95%), and "Good" or "Passed" for performance efficiency, reliability (100%), and maintainability, and (3) the system's use significantly impacted customer intimacy, with a score of 85.67% (Highly Influential). In conclusion, the developed QR Code attendance system is feasible and effective, recommending its application to enhance administrative efficiency in educational environments.

INTRODUCTION

Development of a QR code attendance system is a two-dimensional code that originates from the advanced development of barcodes (De Seta, 2023). Denso Wave created the QR Code in 1994 (Jayasuriya et al., 2025). The initial goal of Denso Wave in creating QR Codes was to accommodate kana characters along with kanji letters, due to the barcode's limitation in encoding alphanumeric characters (Donzelli, 2025; Solanki, 2021). The use of QR Codes has spread to various parts of the world; especially in Japan, where it has been widely implemented in industry (Ozturkcan & Kitapci,

2025). Meanwhile, several companies in Indonesia have also adopted QR Code technology (Sun, 2025).

Attendance is the process of collecting data on a person's presence status, both at school and at work (Shrivastava et al., 2025; Singer, 2025). Currently, many parties use technology for attendance, such as QR Codes, web-based attendance systems, fingerprints, and Android-based attendance (Bajaj et al., 2025; Komalla, 2025). With this technology, managers can simplify their work, particularly in managing attendance data (Lakhamraju, 2025; Musundire, 2025). The purpose of the research is to develop an application in the form of a student attendance system using QR Code at MAN 1 Gorontalo City, to determine the feasibility of this system, and to test the system's performance (Algorashi, 2024; Rahman & Bagana, 2025).

Attendance systems play an important role in various sectors including schools, factories, hospitals, universities, offices, and other places requiring attendance. Initially, attendance relied heavily on paper (Hoo & Ibrahim, 2019; Vardhan et al., 2025). However, attendance activities have now shifted to electronic systems such as fingerprint scanners, eye recognition, and QR Codes. In daily operations, MAN 1 Gorontalo City conducts routine activities, including student attendance data recaps, which indicate that attendance is a vital part of the teaching and learning activity (*Kegiatan Belajar Mengajar* [KBM]) process. The growing number of students at MAN 1 Gorontalo City increases the need for attendance devices, which correlates directly with increasing paper consumption (Limbong et al., 2025; Pratama, 2025). The rise in paper usage runs counter to environmental sustainability goals (Asif et al., 2024; Miao et al., 2025). Paper-based attendance not only leads to an accumulation of documents in storage that can foster disease and create an untidy impression but also causes school budget overruns.

The hope for using the QR Code method in the student attendance system is to facilitate the attendance process (Liew & Tan, 2021; Rabu, 2019). Each student simply scans their ID card on a provided QR Code scanner device. The device records the time of attendance and stores this data in the database. QR Code input data serves as a reference to record students' arrival times (Josphine, 2025; Shetty, 2025).

Several previous studies have explored implementing QR Code-based attendance systems in educational contexts. Hermanto and Baihaqi (2018) successfully developed an Android and web-based student attendance system using QR codes and IMEI, demonstrating improved efficiency in attendance recording. Similarly, Ifanda et al. (2023) implemented a mobile-based QR Code attendance system at UPT SMP Negeri 2 Gadingrejo, reporting significant time savings compared to manual methods. In a university setting, Hermanto and Riyanto (2019) created an Android-based student attendance application that proved effective for streamlining administrative processes. These studies collectively highlight the potential of QR Code technology in transforming traditional attendance systems, although they mainly focused on technical implementation without comprehensive quality testing based on international standards.

While previous research demonstrated the technical feasibility of QR Code attendance systems, there remains a gap in comprehensive quality assessment based on established international standards. Most existing research has focused on functional implementation without evaluating multiple quality

aspects such as usability, performance efficiency, reliability, and maintainability simultaneously. This study addresses this gap by developing a QR Code-based student attendance system at MAN 1 Gorontalo City with thorough evaluation based on ISO 25010 standards and Olsina et al.'s criteria. The novelty of this research lies in its holistic approach to quality assessment, covering five key aspects: functional suitability, usability, performance efficiency, reliability, and maintainability, providing a more comprehensive understanding of system quality in educational settings.

Based on this background, the main problem faced by MAN 1 Gorontalo City is the student attendance system, which is still carried out manually using paper. This method not only complicates the administrative process but also causes resource waste, such as increased paper consumption and full archive spaces. Additionally, the lack of a web-based attendance system has resulted in inefficient attendance recording and reporting. Therefore, this research is limited to the development and implementation of a web-based attendance system using QR Codes to improve efficiency, accuracy, and ease in the student attendance process. The formulation of the research problem includes three aspects: how to develop a student attendance system using QR Codes, how the system functions at MAN 1 Gorontalo City, and how feasible the developed system is. The purpose of this study is to develop, test, and assess the feasibility of a QR Code-based student attendance system as a solution to existing problems. The product is a QR Code-based attendance application that manages student attendance data and conveys personalized attendance information to teachers and students through a web-based system.

This research is expected to provide benefits both theoretically and practically. Theoretically, it contributes to the development of knowledge in electronics and informatics education, especially in QR Code-based attendance information systems. Practically, this study facilitates MAN 1 Gorontalo City teachers in conveying student attendance information and enhances user-system closeness (customer intimacy). The development of this system is based on assumptions including adequate technological infrastructure in schools, user competence in operating devices, and availability of well-documented student attendance records. Furthermore, the system's successful implementation depends heavily on school commitment and continued developer support. Security and privacy of student data are top priorities, ensuring confidentiality of information uploaded into the application. By fulfilling these assumptions, it is hoped that the QR Code-based attendance system implementation at MAN 1 Gorontalo City can run smoothly, improve student attendance administration efficiency, and support digital transformation in education.

METHODS

The research method used in this study was the Research and Development (R&D) approach to develop and test the effectiveness of a QR Code-based student attendance system application. The Waterfall model guided the development process through five main stages: analysis, design, implementation, verification, and maintenance. During the analysis stage, system needs were identified by distributing questionnaires to teachers to understand obstacles in the existing attendance system. The design stage involved creating the system architecture, algorithms, and user interfaces.

Implementation was carried out using PHP 8.5, JavaScript with the Laravel framework, Bootstrap 5.0.1, MySQL database, and XAMPP web server.

After completing the system, verification tested product quality based on five aspects from ISO 25010: usability, functional suitability, performance efficiency, maintainability, and reliability. Maintenance addressed error fixes, bugs, and feature additions. The system was further tested through trials: media experts evaluated functional suitability and usability, performance and reliability were tested using WAPT 10.1 and GTMetrix, and maintainability was assessed using the Land (2002) method. A customer intimacy test gathered user feedback from teachers via questionnaires based on software quality characteristics.

Data analysis employed quantitative-descriptive methods to describe eligibility percentages. Validity and reliability of instruments were examined using SPSS with Pearson's correlation and Cronbach's Alpha, respectively. This process confirmed the developed QR Code-based attendance system's eligibility, effectiveness, and user acceptance.

RESULTS AND DISCUSSION

Product Trial Results

This section explains the results of the test results of the products produced, by looking at several aspects that must be met. The results of the trial were obtained through an assessment by media experts and using certain software. The full results from the product trial are discussed below:

A. Product Trials by System Experts

1. Functional Suitability Aspect Test Results

The test results on the functional suitability aspect (Appendix 14) obtained from the two previous experts are described in Table 1.

Table 1. Functional Suitability Test Results

No	Testers	Test Pass Function	Function Not Passing Test
1.	Examiner I	27	0
2.	Examiner II	27	0
	Total	54	0

Source: Data processed by researchers (2024)

By result that Obtained at Table 1. The calculation is carried out using the formula below.

$$\text{Percentage of Eligibility(\%)} = \frac{\text{Number of scores obtained}}{\text{Jumlah skor yang diHarap}} \times 100$$

The percentage of feasibility for the functional suitability aspect obtained based on the calculation is 100%. These results show that all the benefits contained in the application of the warning presence system can be processed correctly. So that the application of the attendance system developed in this study meets the functional suitability aspect with the predicate of "Very Feasible".

2. Usability Aspect Test Results

The results obtained from the testing by two media experts on the usability aspect are described in Table 14. The overall results obtained from the two media experts are attached to Appendix 2.

Table 2. Usability Test Results

No.	Answer	Shoes	Number of Answers	Total Score
1.	Strongly agree	5	3	15
2.	Setuju	4	16	64
3.	Nervous	3	14	42
4.	Disagree	2	5	10
5.	Strongly Disagree	1	0	0
Total				131

Source: Data processed by researchers (2024)

Based on the results obtained, calculations are made to see the percentage of feasibility in the usability aspect of the developed product, namely with the following calculation.

$$\begin{aligned}
 P \text{ skor} &= \frac{\text{Total Score}}{ix r x 5} + 100\% \\
 &= \frac{131}{19 x 2 x 5} + 100\% \\
 &= 68,95\%
 \end{aligned}$$

The result of the percentage calculation was obtained which was 68.95%. With these results, based on the criteria table (Guritno S. 2011), the usability aspect of the developed product is categorized as "Feasible" to use.

B. Operational Trials

The following will describe the results of product trials by being tested operationally with the help of certain software.

1. Performance Efficiency Aspect Test Results

The following results of GTMetrix on web performance, web structure, and time required to create web pages in Table 3 below.

Table 3. Performance Efficiency Test Results

No	Field	Test Results		
		Performance (%)	Structure (%)	Fully Load (%)
1.	Login	71	95	3,9
2.	Dashboard	67	95	3,6
3.	QR Code Student Attendance	68	95	4,3
4.	Student Attendance Report	67	95	4,1
5.	Print Student Attendance	68	95	4,1
Average		68,2%	95%	4,0%

Source: GTMetrix output, processed by researchers (2024)

Based on the results of personal warning web performance per page, the average value of web performance was 68.2% (Grade B), web structure was 95% (Grade A), and the time needed to load-per-page was 4 seconds (Good).

2. Reliability Test Results

The results of the product reliability aspect test with WAPT 10.1 are presented in Table 4 below.

Table 4. Reliability Test Results

Metrics	Success	Failed	Success Presentation
Sessions	1	0	100%
Pages	7	0	100%
Hits	48	0	100%
Average Reliability Percentage			100%

Source: WAPT 10.1 output, processed by researchers (2024)

3. Maintainability Test Results

The results of the test on the maintainability aspect using the Land method are operational testing by the developer. The indicators used are in accordance with the Land method are instrumentation, consistency, and simplicity. The results of operational tests related to the three Land indicators can be checked in the following pictures.

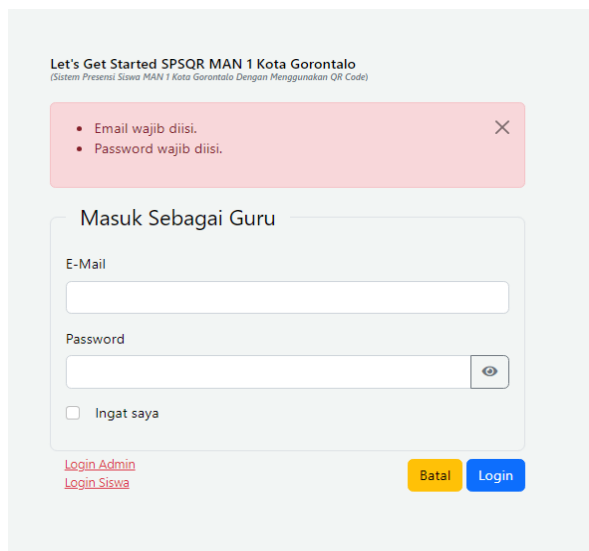


Figure 1. Error Message on Login Page Field Form

Source: System screenshots (2024)

Figure 1 above shows when the user clears the Email/username field when logging in. Then a notification will appear by the system. The image that has been presented previously concerns the

instrument indicator, which provides identification if an error occurs in the designed system at any time.

Based on the results of the maintainability aspect test carried out operationally by the researcher, several conclusions were obtained, namely with regard to the three indicators used as observation references. First, in terms of instrumentation, it has been fulfilled marked by the identification when an error occurs. Second, the system is designed using a consistent model, so that it meets the consistency indicator. Third, the system developed uses the MVC model so that it provides ease of management. The overall results of the maintainability test are presented in Table 5 next.

Table 5. Maintainability Test Results

Indicator	Indicators that Rated	Results obtained	Ket.
<i>Instrumentation</i>	If there is a fault in the system, a warning and identification of the error	When <i>the user</i> clears the data input page, the system will give a warning "Email must be filled in and Password required filled".	√
<i>Consistency</i>	Using a single plan model System	The model used to design this system has one the same form that is It is seen that some pages have similarities, and the same shape and consistency between the interfaces of page one with other pages.	√
<i>Simplicity</i>	The system designed has ease in terms of management, repair and system development	This system is designed using the Laravel framework which has an MVC (Model-View-Controller) model framework, so that if there is an addition of features or components to PHP, it can be easily implemented. Likewise, if one day there is an error in the code, it can be easily identified and corrected.	√

Source: Data processed by researchers (2024)

Final Product Review

The student attendance system application using QR code is a web developed as a medium that facilitates teachers to carry out the attendance process to students en masse by using QR codes on student cards pasted on the teacher's notebook/computer webcam. The results of the student attendance record are then stored in the system database. By utilizing this web application, the teacher on duty only needs to automatically recap attendance and print student attendance reports on specific dates and months. The development process of the student attendance system application using QR codes has gone through several development processes based on the Waterfall model, including analysis, design, implementation, verification and maintenance.

First, a needs analysis process was carried out, namely the distribution of questionnaires in the form of docs related to the perceived problems, namely the absence of attendance using QR codes, time effectiveness, efficient use of paper, so that teachers know how many times students are present during one semester for future class increases. From the results of the questionnaire conducted, it was

found that teachers hope that a system will ease teacher administrative work and time effectiveness in teaching and learning activities in the classroom.

The next step is design, which is a detailed and thorough definition of components, architecture, and relationships between components. At this stage, the components of the developed system are described in the form of diagrams, namely several diagrams are found that are used such as use case diagrams. UCD (Use Case Diagram) is needed to explain how actors and systems interact with each other. In this case, the actor is a teacher who is in charge of managing the spatial layout of the system, so that he can carry out activities in the system itself.

Then a sequence diagram is used which functions to describe the workflow of the system application and shows how the objects are related to each other in completing a task that has been determined. Sequence diagrams are used to document the workflow of the system and are used as a reference in the system development process. In this case, the sequence diagram is how the process occurs when the teacher performs certain activities such as student attendance by using the QR code on the student's identity card. The third is the use of class diagrams to describe how a data object relates to other data objects in a particular class. In this case, it is described how the login class relates to the teacher's class, attendance, and attendance report.

The third step is development. In this part, the development of a system that refers to the design that has been determined is carried out.

The fourth step is implementation (implementation). The system development process is carried out at this stage. Referring to the design that has been built before, system development begins to be carried out using the PHP language, and utilizing the framework needed for system development, until the system is completed.

The fifth step is evaluation. After the system/web is completed, a test is carried out to determine the feasibility of the web. The test is carried out based on ISO25010 standards and Olsina et al., containing 5 aspects of testing, namely aspects of functional suitability, usability, performance efficiency, reliability, and maintainability.

As per the web development step using the Waterfall model, that last step is Evaluation. This is intended to be how to manage the developed system. The student attendance application using QR codes is developed with the Laravel framework which carries the MVC (Model-View-Controller) model framework, so that if features are added or subtracted in the presence application developed, it can be easily managed.

1. Product Quality Attendance System

The quality of student attendance products can be seen based on the results of previous tests using the standard ISO25010 and Olsina et al., The summary of the test results is presented in Table 6. Next.

Table 6. Overall Web Quality Test Results

No.	Test Aspects	Result	Predicate
1.	<i>Functional Suitability</i>	Based on testing by 2 media/software experts, it is known that all functions run 100%	Highly Worth It
2.	<i>Usability</i>	This test was carried out by media experts/software as many as 2 people and get a percentage result of 95%	Proper
3.	<i>Performance Efficiency</i>	Web reliability testing with WAPT 10.1 software 100% of the results met the reliability criteria, which were >95%	Good
4.	<i>Reliability</i>	Web reliability testing with WAPT 10.1 software 100% of the results met the reliability criteria, which were > 95%	Lulus
5.	<i>Maintainability</i>	The maintainability aspect was tested using the Land method, which is based on operational field observations by researchers. The observation results show that the developed system meets 3 aspects, namely instrumentation, consistency, and simplicity.	Lulus

Source: Data processed by researchers (2024)

Based on the summary of the results presented in Table 6 above, it can be seen that the functional suitability aspect gets a very decent predicate. This shows that all system functions have operated properly and correctly without any errors or failures. Meanwhile, the usability aspect tested by 2 experts received a decent predicate with a 95% percentage problem.

The percentage results are still far from the usability test expectations, but they have met the test feasibility criteria. Furthermore, the performance efficiency aspect received a good predicate, because the time needed for the entire system to display is less than 2 seconds so that it meets the criteria used as a reference for assessment. The reliability aspect with testing using WAPT 10.1 was obtained with a percentage result of 100% so that it was said to have passed the test. The maintainability aspect was tested using the Land method by means of operational testing, it was found that the entire web developed met the assessment aspect, so it was said to have passed the maintainability aspect test. Based on the overall results of testing with ISO25010 standards and Olsina et al., it is concluded that the developed product meets software quality testing and is ready to be used for field testing to obtain customer intimacy data.

2. Customer Intimacy

In an effort to see the effect of the use of the developed product on the customer intimacy aspect, a test was used. The test is intended as a summative evaluation of the use of the product to the user. This test was carried out through the distribution of questionnaires consisting of 36 questions related to the usability of the product, the feasibility of the information submitted, and the services provided. The respondents who gave answers to the questionnaire given amounted to 33 people, all of whom were teachers of MAN 1 Gorontalo City. The overall answer results can be seen in Appendix 16. The following is a diagram of the average percentage of answers.

Rata-Rata Presentase Jawaban

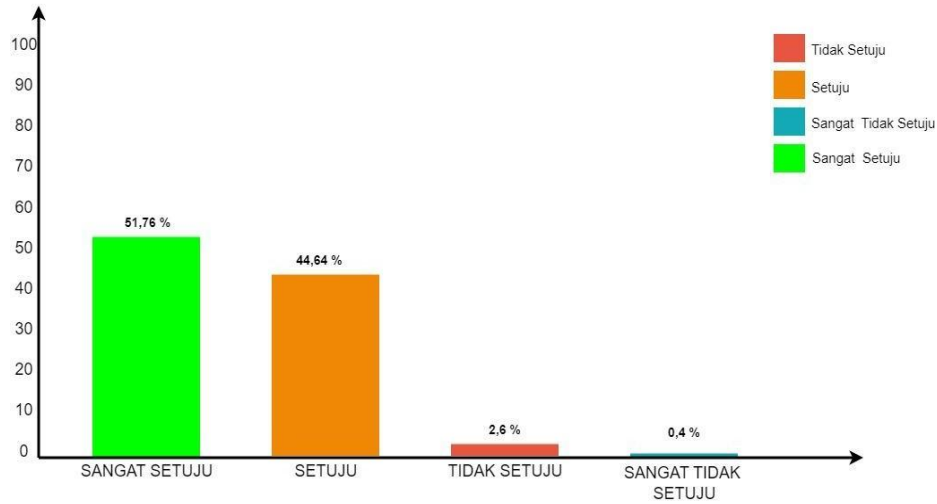


Figure 2. Average Answer Percentage Chart
 Source: Data processed by researchers (2024)

Table 7. Customer intimacy respondent results

Respond	Total Answer Score (f)	Maximum Answer Score (N)
1	178	180
2	143	180
3	178	180
4	170	180
5	158	180
6	133	180
7	163	180
8	165	180
9	139	180
10	160	180
11	169	180
12	132	180
13	162	180
14	143	180
15	145	180
16	178	180
17	178	180
18	133	180
19	177	180
20	170	180

Respond	Total Answer Score (f)	Maximum Answer Score (N)
21	172	180
22	152	180
23	149	180
24	178	180
25	161	180
26	178	180
27	136	180
28	164	180
29	189	180
30	178	180
31	144	180
32	178	180
33	141	180
Total	5294	6180

Source: Questionnaire data, processed by researchers (2024)

Based on the answers obtained by 33 respondents, who answered Strongly Agree 51.76%, the answer Agree 44.64%, the answer Disagree 2.6%, and the answer Strongly Disagree is 0.4%. The results of obtaining answers to the customer intimacy questionnaire are presented. All the results of the answers in Appendix 17.

$$\begin{aligned}
 \text{Presentase} &= \frac{f}{N} \times 100\% \\
 &= \frac{5294}{6180} \times 100\% \\
 &= 85,67\%
 \end{aligned}$$

Furthermore, the results of the customer intimacy response questionnaire were tested for validation and reliability. The significance value of all items used in the questionnaire using the Pearson Moment testing method was obtained <0.05 . So that all items are said to be "Valid" (Appendix 18). Likewise, the questionnaire used "Reliabel" is by looking at the cronbach alpha >0.6 , as shown in Figure 3. next.

Case Processing Summary			
		N	%
Cases	Valid	36	100.0
	Excluded	0	0.0
	Total	36	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of items
0.959	32

**Figure 3. Test the Validity and Reality of Customer Intimacy Answers
Cronback Alpha Reliability Test**

Source: SPSS output, processed by researchers (2024)

Based on the results obtained using the formula above, the percentage result was 85.67%. According to the category table that has been presented in the previous Chapter III, these results are included in the predicate of "Highly Influential". Therefore, it was concluded that the student attendance system facility used in conveying important information to teachers as respondents greatly affected customer intimacy in MAN 1 Gorontalo City.

Based on this research, the products that have been developed have a number of limitations, including:

1. The barcode distance on the student card is not accurate, so it is not fast in the process of recording student attendance data.
2. Sending student attendance information to students through each student's account.

CONCLUSION

The research concluded that the QR Code-based student attendance system developed using the Waterfall method successfully accelerated attendance processes at MAN 1 Gorontalo City, meeting ISO 25010 standards and Olsina et al.'s criteria across functional suitability, usability, performance, reliability, and maintainability. The system improved administrative efficiency and enhanced the relationship between teachers and students, and it is recommended for widespread adoption, provided data input is accurate and QR codes are clearly printed. Future research could explore integrating this system with other digital learning platforms, assessing long-term user acceptance, and evaluating its scalability and effectiveness in diverse educational settings.

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