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Development Of A QR Code-Based Online Attendance Mobile Application At SMK Negeri 1 Talamau

Hayati Ikhwani[1], Rahayu Trisetyowati Untari [2], Randika Farike Bania[3]

[1-3] Teknologi Informasi, Universitas PGRI Sumatera Barat
[1*]hayatiikhwani @gmail.com, 3.untari@gmail.com, randikafarike29@gmail.com

ABSTRACT

The attendance system at SMK Negeri 1 Talamau has so far been focused mainly on teachers and relies on a fingerprint method that frequently experiences problems such as reading failures, system errors, and delayed data synchronization. This research aims to develop a QR Code-based online attendance mobile application that can be used by both teachers and students in real time. The research method used is Research and Development (R&D) with the Waterfall software development model, covering the stages of requirements analysis, design, implementation, testing, deployment, and maintenance. The application was developed using WebApp as the mobile platform, Laravel as the backend, and MySQL as the database. The student attendance process is carried out by scanning a QR Code displayed by the teacher, after which attendance data is automatically stored in the database via a REST API. System testing was conducted through alpha testing (white box and black box) as well as beta testing involving experts and end users. The test results show that all primary system functions run according to the design. Beta testing with experts obtained an average score of 86%, categorized as very good, while beta testing with users obtained an average score of 96%, also categorized as very good. The developed application is considered feasible for use and able to improve the effectiveness and efficiency of the attendance process at the school.

Keywords : Mobile Application, Online Attendance, QR Code, Waterfall

INTRODUCTION

The development of information and communication technology in the current digital era has had a significant impact on various fields, including education. The use of information technology is not only applied as a learning medium but is also utilized in school administrative management, one example being the attendance system. The attendance system is an important part of school operations because it relates to the management of teacher and student attendance data, which can be used as an indicator of discipline as well as evaluation material in the educational process [1].

One technology that can be implemented to support the attendance process is QR Code, a two-dimensional code that can store information and can easily be scanned using a smartphone camera. This technology simplifies the verification and data collection process, making it highly useful in mobile-based digital attendance systems, as it allows students to record attendance quickly and makes it easier for administrators to manage and summarize attendance data [2]. The application of QR Code in attendance systems has also been shown to minimize recording errors, resulting in attendance data that is more accurate, transparent, and reliable [3].

Based on an interview with the system operator at SMK Negeri 1 Talamau, it was found that the attendance system currently in use is the “Sipondik Pasaman” application, which is integrated with Dapodik and uses a fingerprint method available only for teachers. Although already digital, this system still experiences problems such as fingerprint reading failures, system errors, and delayed data synchronization when the internet connection is unstable. The school requires an attendance

system capable of recording attendance data in real time so that the principal and administrative staff can directly monitor teacher and student attendance, and one that can be used not only by teachers but also by students.

Several previous studies have addressed similar topics in the development of QR Code-based attendance systems. Baiin et al. developed a student attendance application using QR Code at SMK Negeri 3 Pontianak with the Waterfall method, PHP, and MySQL on a web-based platform [4]. Falaqi et al. developed a QR Code-based student attendance system at SMK Negeri 1 Selayar, evaluated it using ISO 25010, and obtained a usability score of 91.33% [5]. Pratiwi et al. developed a web-based teacher and student attendance system using the Django framework, which improved administrative efficiency and real-time attendance verification [6]. Hardinata et al. developed a web-based attendance application using QR Code technology with login, scanning, data management, and attendance recap features [7]. In addition, Ipnuwati and Ariyanti implemented QR Code-based student attendance on a web platform at SMA Xaverius Pringsewu [8]. These five studies share a common use of QR Code as an attendance medium, yet most were developed on web platforms and had not yet integrated the roles of Admin, Teacher, and Student together within a single mobile application.

Based on the problems and the review of previous studies above, the author developed a QR Code-based online attendance mobile application that can be used by the Admin, Teachers, and Students at SMK Negeri 1 Talamau. This research aims to develop the application and implement QR Code technology in the student attendance process, so that attendance data can be presented in real time, accurately, and transparently in order to support a more effective and efficient attendance monitoring and management process.

METHODOLOGY

This research was conducted at SMK Negeri 1 Talamau, Talamau District, West Pasaman Regency, West Sumatra Province, during the 2025/2026 even semester. The research method used is Research and Development (R&D), a method used to produce a specific product and test its effectiveness. The product developed in this study is a QR Code-based student attendance mobile application that was not only designed theoretically but also implemented and tested directly according to user needs.

System Development Model

The system development model used is the Waterfall model, a software development model carried out systematically and sequentially, in which each stage must be completed before proceeding to the next [9]. The stages carried out include requirements analysis, system design, implementation, testing, deployment, and maintenance, as shown in Figure 1.

Figure 1. Waterfall Development Model (Source: [9])

The requirements analysis stage was carried out through observation and interviews to identify problems in the existing attendance system and the needs of users, namely the Admin, Teachers, and Students. The system design stage was carried out by creating a design using the Unified Modeling Language (UML), including use case diagrams, activity diagrams, and class diagrams, as well as designing the user interface. The implementation stage was carried out by building the attendance application using QR Code technology based on the design that had been created, followed by the testing stage to ensure the application runs according to requirements and is free of errors.

System Design

The interaction design between users and the system is illustrated through the use case diagram in Figure 2. The system involves three main actors: Admin, Teacher, and Student. The Admin has access rights to log in, manage user data, and view attendance reports. The Teacher's role is to generate or display the attendance QR Code and monitor student attendance. The Student logs in, scans the QR Code to record attendance (scan QR Code), and views their own attendance history.

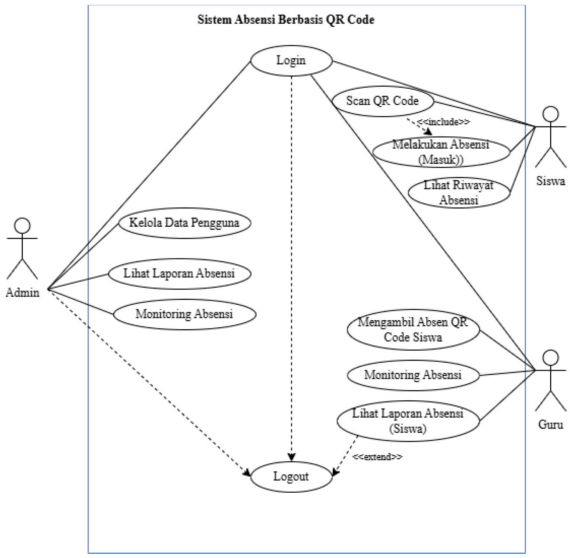

Figure 2. Use Case Diagram of the QR Code Attendance System

Technology Used

The application was developed using a client-server architecture with WebApp as the mobile platform, the Laravel framework as the backend [10], and MySQL as the database. The attendance process is carried out by scanning the QR Code using a smartphone camera, after which attendance data is sent via a REST API and automatically stored in the database. An authentication mechanism using a username and password is applied so that each user obtains access rights according to their role.

RESULTS AND DISCUSSION

System Implementation Results

The implementation results produced a QR Code-based online attendance mobile application that can be used by the Admin, Teachers, and Students according to their respective access rights. The Administrator can manage teacher, student, class, and department data, as well as user accounts and QR Codes, and can print attendance reports. Teachers display a unique QR Code on the mobile application during teaching and learning activities and can monitor student attendance through the monitoring menu. Students log in and then scan the QR Code displayed by the teacher; if the QR Code is valid and still active, the system automatically stores the attendance data along with the

date, time, and attendance status, whereas an invalid QR Code triggers a failure notification so the student can repeat the scan.

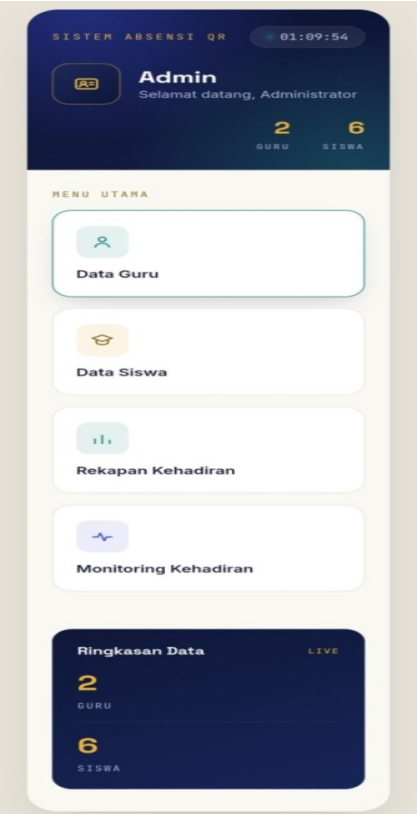

Figure 3. Admin Dashboard

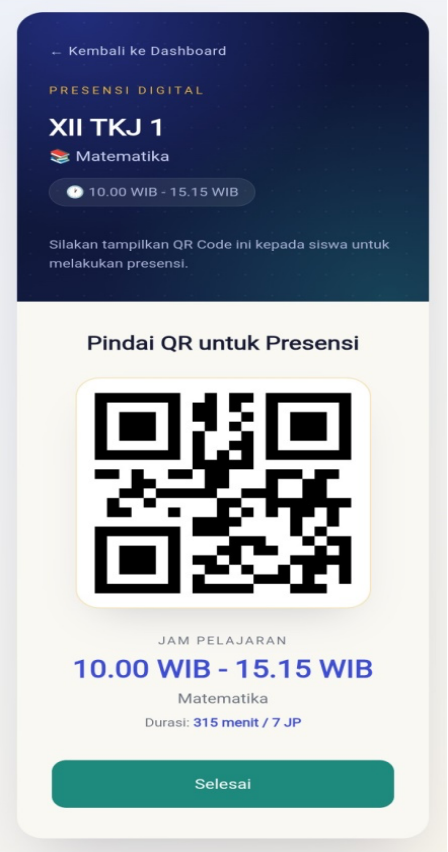

Figure 4. QR Code scanning page view.

System Testing Results

System testing consisted of alpha testing and beta testing. Alpha testing included white box and black box testing carried out by the developer to ensure that all main system functions, such as login, QR Code generation, QR Code scanning, attendance time recording, attendance data storage, monitoring, history, and report printing, run according to the design. The black box testing results show that all test scenarios were successfully executed with no functional errors found.

Beta testing was carried out to evaluate the level of conformity of the application with the functional and non-functional requirements based on the aspects of functionality, reliability, usability, efficiency, and maintainability [12]. The testing involved 3 experts and 24 users (teachers and students). A summary of the beta testing results is shown in Table 1.

Table 1. Application Beta Testing Results

Respondent Group	Highest Criterion	Lowest Criterion	Average (%)	Category
Experts (3 people)	Functionality (92%)	Maintainability (75%)	86	Very Good
Users (24 people)	Content (97%)	Format (94%)	96	Very Good

Based on Table 1, the beta testing results for experts obtained an average score of 86%, categorized as very good, with the highest score on the functionality aspect (92%) and the lowest on the maintainability aspect (75%). The beta testing results for users obtained an average score of 96%, categorized as very good, with the highest score on the content aspect at 97% and the lowest on the format aspect at 94%. These results indicate that the developed application has met user needs in terms of information quality, accuracy, ease of use, and timeliness of data presentation, and is therefore considered feasible for use.

Discussion

Compared with the studies of Baiin et al. [4] and Hardinata et al. [7], which developed web-based QR Code attendance systems, this research produced a mobile-based application that allows students to scan the QR Code directly through a smartphone. Compared with the study of Falaqi et al. [5], which emphasized ISO 25010 testing from a single user perspective, this research conducted beta testing on two respondent groups, namely experts and direct users, making the system quality evaluation more comprehensive. Compared with the study of Pratiwi et al. [6], which used the web-based Django framework, this research integrates the roles of Admin, Teacher, and Student together within a single Laravel-based mobile application.

The advantages of the developed application lie in the integration of three user roles within a single system, the implementation of QR Code for the attendance process, the availability of attendance monitoring, attendance history, manual attendance as an alternative option, and attendance recap and report printing features. All of these features have been tested and proven to function according to their intended design, so the application can help improve the effectiveness and efficiency of the attendance process and make it easier for the school to monitor and manage teacher and student attendance data.

CONCLUSION

Based on the research results and discussion regarding the development of a QR Code-based online attendance mobile application at SMK Negeri 1 Talamau, it can be concluded that the application was successfully developed as a system that helps record and manage teacher and student attendance. The application provides features for the Admin, Teachers, and Students, including user data management, QR Code generation, QR Code scanning, manual attendance, attendance monitoring, attendance history, attendance recap, and report printing, making the attendance process more practical and structured compared to manual recording.

The test results show that the system is able to properly run all of its designed functions in terms of functional suitability, usability, reliability, and performance efficiency. Beta testing with experts obtained an average score of 86%, and with users an average score of 96%, both falling into the very good category. Thus, the developed application is considered feasible for use and able to improve the effectiveness and efficiency of the attendance process at SMK Negeri 1 Talamau.

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