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Design and Implementation of a QR Code-Based Attendance Application at SMA Negeri 1 Cangkringan

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Abstract

The manual attendance system at SMA Negeri 1 Cangkringan still faces various obstacles, such as the time-consuming recording process, the risk of data loss, and the possibility of manipulating student attendance. Overcome these problems, a web-based student attendance application was developed using the Waterfall method. The method used in completing this system is the waterfall method, which consists of needs analysis, system planning, development, and testing. The system is designed using web technology, which allows better accessibility for teachers and administrative staff in recording attendance in real-time. The result of the user-friendly application design, allows teachers to record student attendance quickly and accurately. The system is also a report feature that can be accessed easily, making it easier to make decisions regarding student attendance. It is expected that the administration process at SMA N 1 Cangkringan can be more efficient, transparent, and reliable.

Keywords: Web Application; Waterfall Method; Precence.

Abstrak

Sistem absensi manual di SMA Negeri 1 Cangkringan masih menghadapi berbagai kendala, *seperti proses pencatatan yang memakan waktu lama, risiko kehilangan data, dan kemungkinan terjadinya manipulasi kehadiran siswa. Untuk mengatasi permasalahan tersebut, maka dikembangkanlah sebuah aplikasi absensi siswa berbasis web dengan menggunakan metode Waterfall. Metode yang digunakan dalam menyelesaikan sistem ini adalah metode waterfall, yang terdiri dari analisis kebutuhan, perencanaan sistem, pengembangan, dan pengujian. Sistem ini dirancang dengan menggunakan teknologi web, yang memungkinkan aksesibilitas yang lebih baik bagi guru dan staf administrasi dalam melakukan pencatatan kehadiran secara real-time. Hasil dari perancangan aplikasi yang user-friendly, memungkinkan guru untuk mencatat kehadiran siswa dengan cepat dan akurat. Sistem ini juga memiliki fitur laporan yang dapat diakses dengan mudah, sehingga memudahkan dalam pengambilan keputusan terkait kehadiran siswa. Diharapkan proses administrasi di SMA N 1 Cangkringan dapat menjadi lebih efisien, transparan, dan terpercaya.*

Kata-kata Kunci: *Aplikasi Berbasis Web; Metode Waterfall; Presensi.*

1. Introduction

The advancement of information technology has had a significant impact on various sectors of life, including education and administration. One increasingly popular technological implementation is the web-based online attendance system, which can be operated using QR Codes. This system is designed to replace conventional methods such as manual signatures or physical attendance devices like fingerprint scanners. The conventional methods come with several limitations, such as susceptibility to data manipulation, limited accessibility, and time-consuming recapitulation processes. These drawbacks have prompted the need for a more efficient and integrated attendance system.

In the context of educational institutions, a web-based online attendance system using QR Codes offers various benefits, including ease of access for both teachers and students, as well as improved accuracy and efficiency in attendance data management. With this technology, attendance records can be stored and processed automatically within the system, reducing the risk of data loss or damage. Additionally, features such as automated notifications and real-time reporting enable stakeholders to monitor attendance more effectively and transparently.

Information technology serves as a means to simplify, accelerate, and organize task execution. Technological advancements have led to the development of information systems that facilitate the efficient completion of tasks, supported by the use of computers **[1].** Given these considerations, the use of computers as work aids has become increasingly widespread, especially in data processing activities. At present, attendance recording at SMA Negeri 1 Cangkringan is still conducted conventionally—by visiting each class to ask about students' presence that day. This method is considered ineffective and inefficient, especially in light of ongoing technological progress. Manual attendance assessment is deemed suboptimal, and students may manipulate the data by forging signatures.

The limitations of the conventional attendance system at SMA Negeri 1 Cangkringan not only complicate the duties of supervising teachers but also hinder school principals and administrative staff in monitoring students' attendance in real time. The time-consuming recapitulation process often obstructs data analysis for evaluation purposes. Moreover, students may falsify their attendance, resulting in discrepancies between manually filled attendance sheets and actual real-time attendance. Human error during data recapitulation may also lead to inaccuracies in the collected data.

Furthermore, manual attendance is inflexible, particularly when detailed attendance data is required within a short period. Therefore, digitizing the student attendance process is essential to streamline all aspects, from the students themselves to the school administration. The use of a QR Code-based attendance application is considered an effective solution to minimize fraud, input errors, and time inefficiencies during student data recapitulation.

Several previous studies are relevant to this issue, including research conducted by Septiani and Sanjaya **[2]**, Rizqi **[3],** Dani Hamdani et al. **[4],** Azmi **[5],** Baiin et al. **[6],** Safikri et al. **[7],** Witriyono et al. **[8],** Fitriani et al. [9], Permana and Zain **[10],** Aminuddin et al. **[11],** Nuraeni et al. **[12],** Purnomo et al. **[13],** Minartiningsih and Tambagistra **[14],** Kurniawan et al. **[15],** Herlina and Hidayatulloh **[16],** and Haqi and Sinaga **[17].**

2. Method

The Waterfall method is a software development model that employs a linear-sequential approach. It is likened to a waterfall, where each phase flows sequentially from top to bottom, and each stage must be completed before proceeding to the next [18]. The Waterfall model is particularly well-suited for large-scale application development and projects with well-defined requirements. In this study, the researchers adopted the Waterfall method for the "Design and Development of a Web-Based QR Code Attendance Application at SMA Negeri 1 Cangkringan", as illustrated in Figure 1.

Figure 1. Stages of the Waterfall Method

2.1 Problem Identification

The first stage of this study involved identifying the problems faced by conducting interviews with stakeholders at SMA Negeri 1 Cangkringan. The issues identified in this research encompass three main problems. Based on the problems observed, appropriate solutions were formulated to address each issue. The problem identification and the proposed solutions are presented in **Table 1.**

Table 1. Problem Identification and Proposed Solutions

No	Problem	Proposed Solution
1	Errors in writing names or dates can result in inaccurate data.	Implement scanning technologies such as barcodes or QR Codes to ensure the accuracy of student attendance data.
2	Physical documents may be lost or damaged, leading to a loss of attendance records.	Digitize documents by converting physical records into digital files, which are safer and easier to retrieve.
3	Manual attendance recording takes longer compared to digital systems.	Design a web-based attendance system that allows students to scan a barcode each time they record their presence.
4	Students may commit fraud by asking friends to forge their signatures.	Impose sanctions on students who are found to have committed fraud, according to school regulations.

2.2 Requirements Analysis

Requirements analysis is the stage where data and information are collected to support the development of a web-based attendance system at SMA Negeri 1 Cangkringan. This process was conducted through interviews. The analysis phase is divided into two categories: functional and non-functional requirements. Functional requirements refer to the essential processes and features that the system must perform [19]. There are four key functional requirements identified for the Web-Based Attendance System at SMA Negeri 1 Cangkringan:

1. The admin requires features to input, edit, and delete student data.
2. The admin requires a camera scanner feature to scan student attendance QR Codes.
3. The admin requires an editing feature to update attendance status for students who are absent due to illness or other reasons.
4. The admin requires an automatic monthly attendance report feature that can be downloaded in Word or PDF format.

Non-functional requirements refer to the supporting needs that are not directly related to the system's functionalities. These include hardware, software, and brainware requirements. Hardware requirements encompass the physical devices utilized in the design and implementation of the system, as outlined in **Table 2.** Software requirements refer to the software tools and platforms needed for system development and implementation, presented in **Table 3**. Brainware requirements refer to the human resources involved in using the application, namely

the admin and students, as shown in Table 4.

Table 2. Hardware Requirements

Hardware	Spesifikasi
Processor	AMD Ryzen 3 PRO 4350G with Radeon Graphics 3.80 GHz
Memory	16384MB RAM
SSD	256 GB
VGA	NVIDIA GeForrce RTX 3060 Ti

Table 3. Software Requirements

Software	Version
Operating System	Windows 10 Pro
Text Editor	Visual Studio Code
Programming Language	PHP
UI Tools	Figma

Table 4. Brainware Requirements

Brainware	Responsibilities
Admin	Monitoring attendance and generating monthly attendance recap reports.
Siswa	Recording their attendance using the barcode scanning system.

2.3 Design

At this stage, system design is carried out based on the results of the requirements analysis. This phase includes detailed descriptions consisting of the use case diagram and user interface (UI) design. The use case diagram is used to illustrate the activities or interactions between actors and the system **[20].** It helps visualize the functional relationships between users and the system components. The user interface design represents the visual layout that will be implemented in the web-based attendance application. The design is intended to ensure user-friendliness and functional accessibility. The use case diagram and interface design of the attendance web application are shown in **Figure 2.**

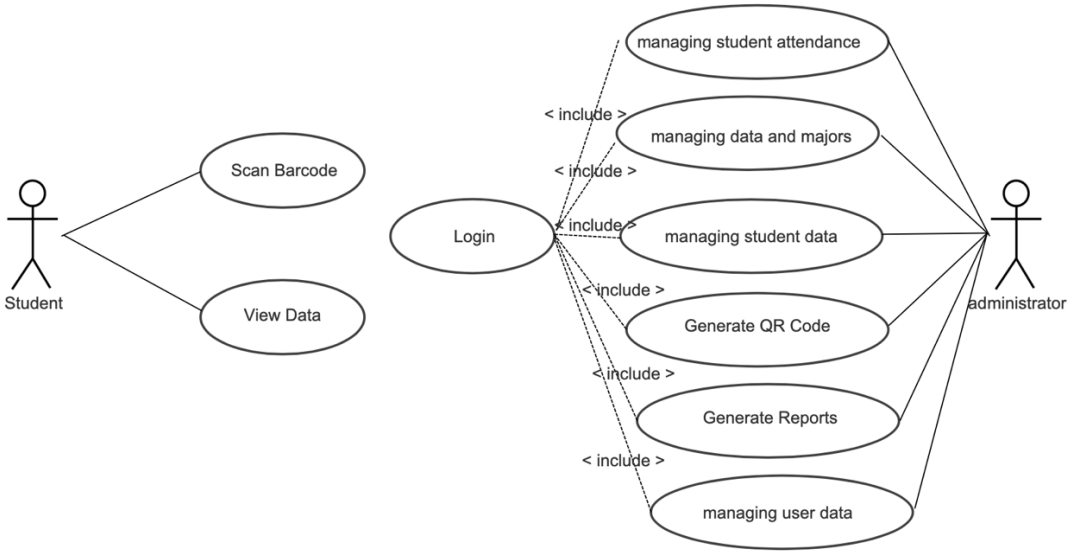

Figure 2. Use Case Diagram

Figure 2 illustrates the use case diagram of the web-based attendance system at SMA Negeri 1 Cangkringan. This application involves two actors: the administrator and the student. The administrator is a staff member of SMA Negeri 1 Cangkringan, while the student is a learner enrolled at the school. The administrator interacts with the web application by managing student attendance records, class and major data, student data, generating QR Codes for student attendance, generating monthly attendance reports, and managing user data (input, edit, delete). All administrative actions require the administrator to log in first. Students interact with the system primarily by scanning the attendance QR Code and checking whether their attendance data has been recorded.

2.4 Implementation

The approved web attendance interface design was subsequently implemented. The attendance web application was developed using the PHP programming language. Figure 3 shows a code snippet from the implementation of the Monitoring Repository. The Monitoring Repository functions to process the API (Application Programming Interface) before the data is displayed.

```
<?= $this->extend('templates/admin_page_layout') ?>
<?= $this->section('style') ?>
<!-- Chartist JS -->
<link href="<?= base_url('assets/js/plugins/chartist/chartist.min.css'); ?>" rel="stylesheet" />
<?= $this->endSection() ?>

<?= $this->section('content') ?>
<div class="pagetitle">
    <h1><?= $title; ?></h1>
    <nav>
        <ol class="breadcrumb">
            <li class="breadcrumb-item"><a href="index.html">Home</a></li>
            <li class="breadcrumb-item active"><?= $title; ?></li>
        </ol>
    </nav>
</div><!-- End Page Title -->
<section class="section">
    <!-- REKAP JUMLAH DATA -->
    <div class="row dashboard">
        <div class="col-lg-4 col-md-6 col-sm-6">
            <div class="card info-card sales-card">
                <div class="filter">
                    <a class="icon" href="#" data-bs-toggle="dropdown"><i class="bi bi-three-dots"></i></a>
                    <ul class="dropdown-menu dropdown-menu-end dropdown-menu-arrow">
                        <li class="dropdown-header text-start">
                            <h6>Link</h6>
                        </li>
                        <li><a class="dropdown-item" href="<?= base_url('admin/siswa'); ?>">Data Siswa</a></li>
                    </ul>
                </div>

                <div class="card-body">
                    <h5 class="card-title">Siswa</span></h5>

                    <div class="d-flex align-items-center">
                        <div class="card-icon rounded-circle d-flex align-items-center justify-content-center">
                            <i class="bi bi-people"></i>
                        </div>
```

Figure 3. Code Snippet of the Attendance Application

2.5 Testing

Black box testing is a method that tests only the external aspects of software [21]. In this study, the researchers applied black box testing based on the website's details and interface, application functionality, and conformity of functional workflows with the desired system operation. If bugs were found, corrections were made until the web application was free of errors. The results showed that the web-based QR Code attendance application for SMA Negeri 1 Cangkringan can be effectively implemented at the school, with several features functioning as intended. Multiple tests were conducted to ensure all functions operated correctly and were free from bugs or errors, as detailed in **Table 5.** Testing was performed by both the developers and users of the web application based on a list of web functionalities.

Table 5. Application Testing Results

Test	Test Result	
	Success	Failed
1. Student barcode scanning for attendance	V	
2. The attendance success/failure notification appears	V	
3. Admin login	V	
4. Student attendance menu	V	
5. Student data menu	V	
6. Class and major data menu	V	
7. Generate QR Code menu	V	
8. Generate the report menu	V	
9. Staff data menu	V	
10. Attendance date	V	
11. Edit button for student data, attendance, class, major, and staff data	V	
12. Delete button for student, class, major, and staff data	V	
13. Add class button	V	
14. Generate QR Code all button	V	
15. Generate QR Code per class button	V	
16. Monthly student attendance report button	V	
17. Class report button	V	
18. Generate attendance report (.pdf) button	V	
19. Generate attendance report (.doc) button	V	

3. Results and Discussion

The user interface design was presented to SMA Negeri 1 Cangkringan and received several feedback suggestions. Based on the input provided, the design was revised and subsequently approved for implementation. Following the revised research phase, the QR Code attendance application was successfully implemented at SMA Negeri 1 Cangkringan. Figure 4 shows the main page of the application. On this page, there is a login button that allows the admin to monitor student attendance. Additionally, there is a camera feature used to scan students' QR Codes during attendance. The admin login page can be seen in **Figure 5.**

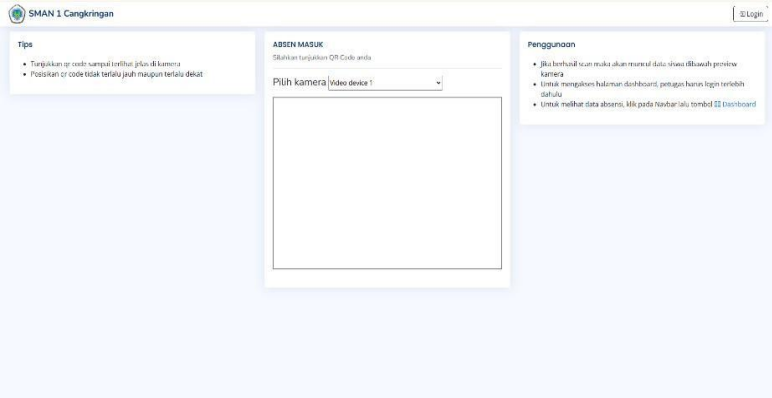

Figure 4. Main Page of The Application

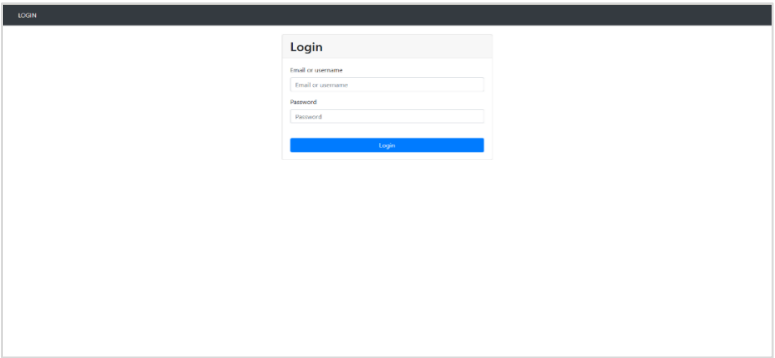

Figure 5. Admin Login Page

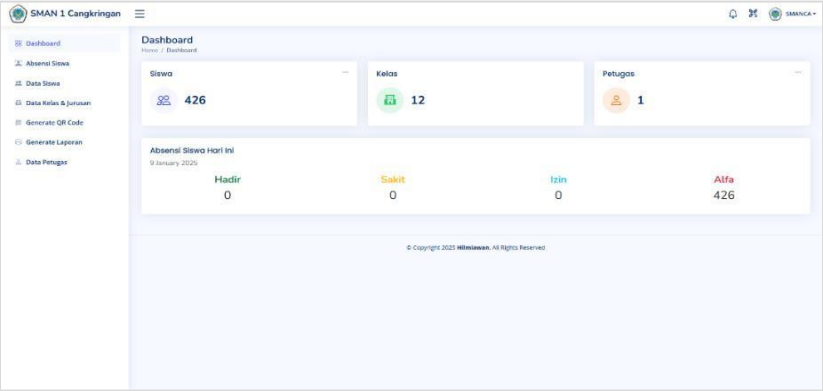

Figure 6. Attendance Monitoring Page

As shown in **Figure 6**, on this page, the admin can monitor attendance for all classes, view and edit student data, manage majors and classes, generate QR Codes, generate reports, and view and edit staff data. The teacher acting as the admin can see the attendance data of students who have recorded their presence by scanning the QR Code assigned to each student. Thedmin is also able to view and edit student data to ensure that the displayed information is updated in real-time. Additionally, the admin can create majors and classes that correspond to each student's respective group.

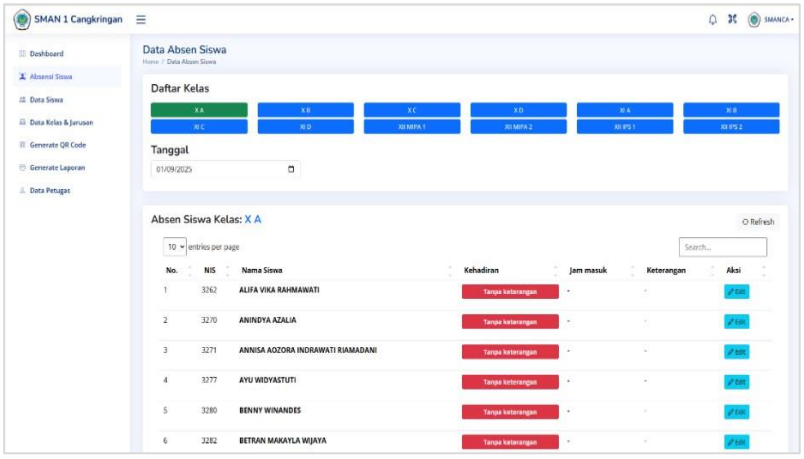

Figure 7. Student Attendance Page for All Classes

Figure 7 depicts the page used by the admin to monitor attendance for all classes. The admin can view student attendance based on the selected date and class. This feature facilitates the admin in easily identifying which students were present or absent on a particular date.

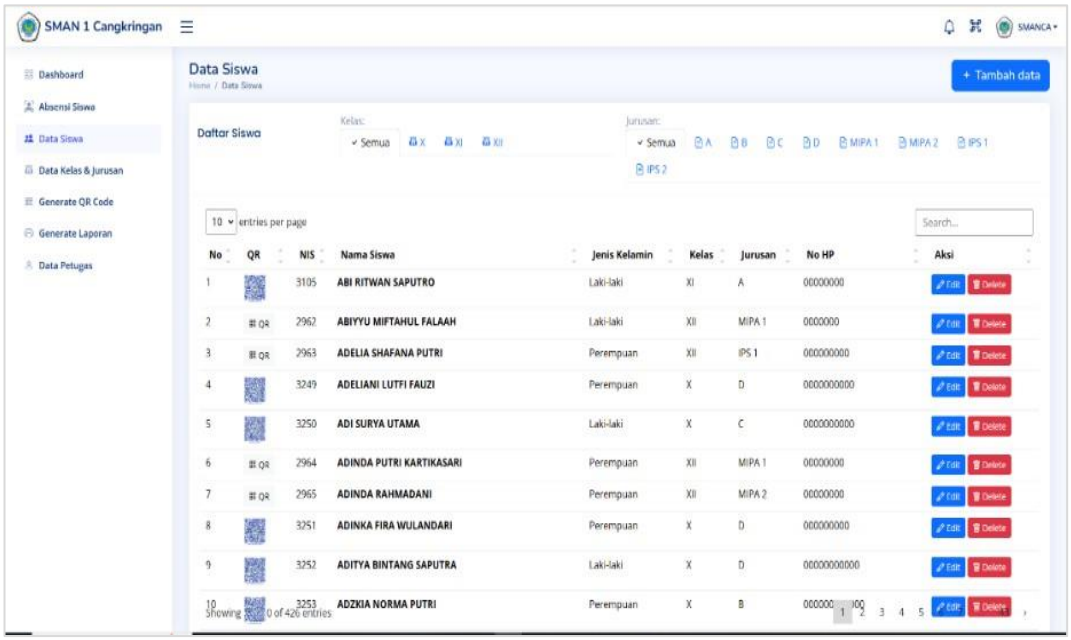

Figure 8. Student Data Page

Figure 8 shows the page used to display all student data, which can be managed by the admin, including inputting, editing, and deleting student information. The admin can input student details such as the student's name, QR Code, student identification number (NIS), gender, class, major, and phone number.

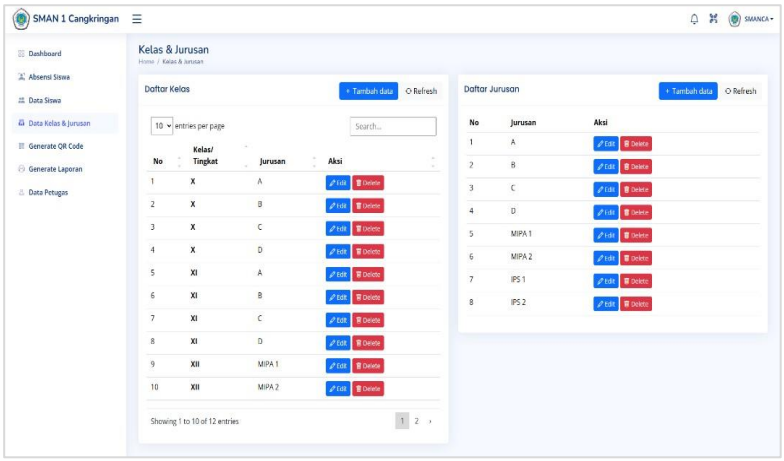

Figure 9. Class and Major Data Page

Figure 9 displays the page used to view class and major data. On this page, the admin can perform actions such as editing and deleting class or major information. Additionally, the admin can add new class and major data, as shown in Figure 10.

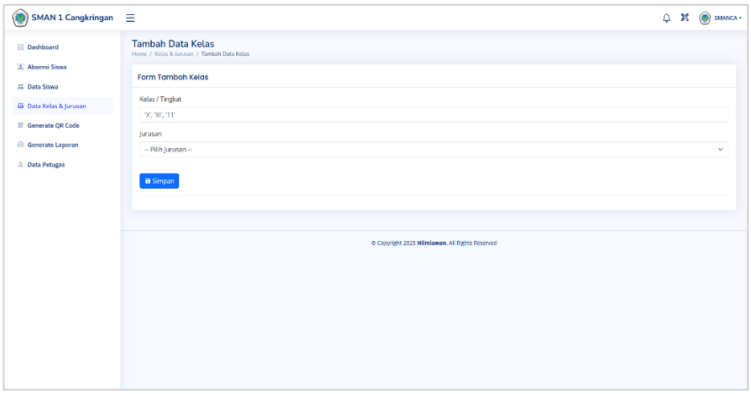

Figure 10. Add Class and Major Data Page

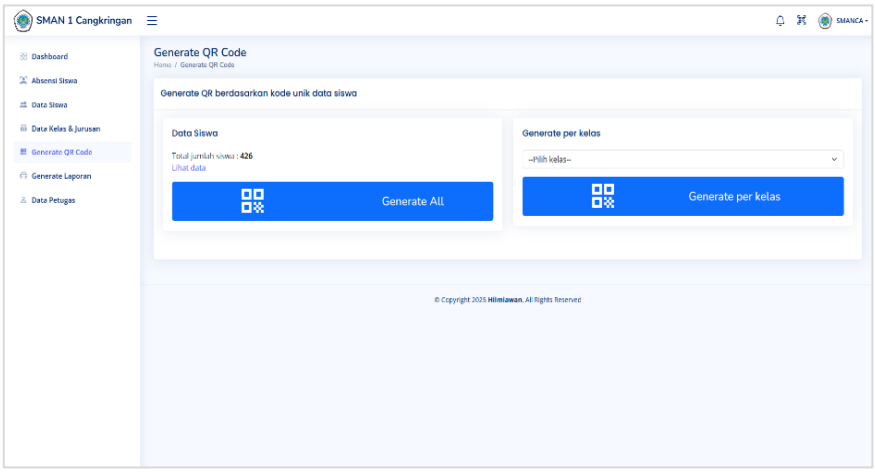

Figure 11. Generate QR Code Page

Figure 11 displays the page used to generate QR Codes for students, either per class or

for all classes. This feature allows the admin to access each student's data directly through the generated QR Code. Additionally, the QR Code can be customized to display data specific to a selected class. On this page, the admin can also generate monthly student attendance reports, as shown in **Figure 12.** These reports can be downloaded directly in PDF format, as illustrated in **Figure 13**, or in Word format, as shown in **Figure 14.**

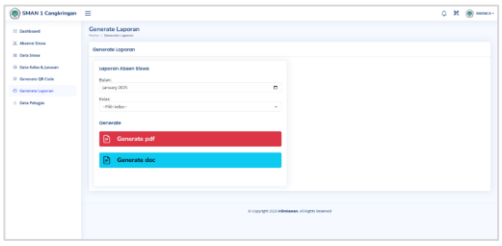

Figure 12. Generate Attendance Report Page

Figure 13. Generate Attendance Report Page in PDF Format

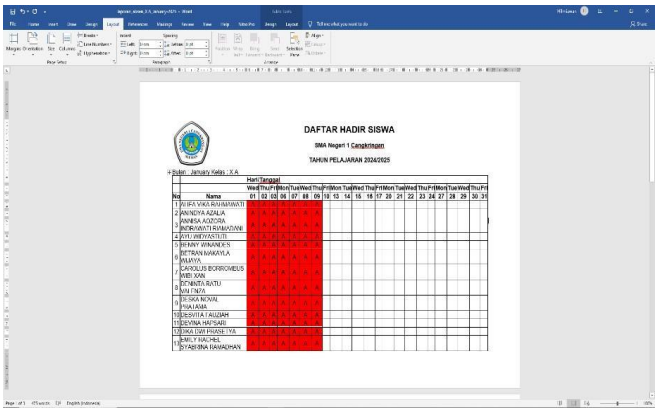

Figure 14. Generate Attendance Report Page in DOC Format

The QR Code-based attendance system has been directly tested to evaluate its effectiveness in practice. During its implementation, student data was successfully entered into the database and processed for recap purposes. No issues were encountered during the live testing phase. The QR Code attendance application is considered an effective solution that simplifies the process for

teachers in recapping student attendance data. The benefits of using this application include real-time data display, user-friendly interface, time efficiency in data recap, and reduced risk of fraud, as each student has a unique QR Code. Moreover, this system allows teachers to easily add, update, or delete student records as needed. All features within the application have functioned properly and smoothly. Testing was conducted directly with both students and teachers to ensure each feature performs as expected.

4. Conclusion

Based on the research conducted, it can be concluded that the author successfully designed a web-based Student Attendance Application for SMA Negeri 1 Cangkringan. The application functions properly according to the intended features, each of which was developed to facilitate both students and teachers. The Student Attendance Application for SMA Negeri 1 Cangkringan improves the attendance recording process and ensures that student attendance data is well-documented. Therefore, the use of this application is more effective than the conventional attendance method. Students can record their attendance in real-time, and teachers can easily monitor the attendance data of students who have checked in.

References

[1] Sutisna, F. Akbarulloh, A. A. Wahyudi, S. F. Banase, and N. I. Simarmata, "Rancang Bangun Aplikasi Absensi Karyawan menggunakan QR-Code Berbasis Web pada SMA Candra Naya," *AJAD J. Pengabdi. Kpd. Masy.*, vol. 4, no. 1, pp. 130–135, 2024, doi: 10.59431/ajad.v4i1.286.

[2] A. Septiani and R. Sanjaya, "PENERAPAN QR CODE UNTUK SISTEM ABSENSI PEGAWAI KANTOR KEPALA DESA JATIENDAH BERBASIS WEBSITE Amelia," *J. Multidisiplin Saintek*, vol. 3, no. 1, pp. 11–21, 2024, [Online]. Available: https://ejournal.warunayama.org/kohesi

[3] M. Teknologi and A. K. Rizqi, "PENERAPAN METODE WATERFALL PADA PERANCANGAN PROGRAM PRESENSI GURU MTS DARUL AMAL Media Teknologi dan Informatika," vol. 1, pp. 134–146, 2024.

[4] D. Hamdani, A. P. W. Wibowo, and H. Heryono, "Perancangan Sistem Presensi Online dengan QR Code Menggunakan Metode Prototyping," *J. Teknol. dan Inf.*, vol. 14, no. 1, pp. 62–73, 2024, doi: 10.34010/jati.v14i1.11844.

[5] M. Azmi, P. Sistem Informasi, S. N. Syaikh Zainuddin Anjani Jalan Raya Mataram, and L. Timur, "Sistem Absensi Menggunakan Scan Qr Code Berbasis Android (Attendance System Using Android-Based Qr Code Scanner)," pp. 103–108, 2024.

[6] A. Baiin, S. Mulyana, V. Cornelista, and R. Maulana, "Rancang Bangun Aplikasi Presensi Siswa Menggunakan QR Code Pada SMK Negeri 3 Pontianak," no. 1, pp. 34–46, 2024.

[7] D. Safikri, N. M. Faizah, and P. K. Karo, "Rancang Bangun Aplikasi Sistem Pemesanan Konsumen Pizza Hut Delivery Tulungagung Berbasis Website dengan Teknologi Quick Response Code (QR)," vol. 2, no. 2, pp. 48–60, 2024.

[8] H. Witriyono and Y. Reswan, "Sistem Presensi Menggunakan QR Code di MAN 02 Kepahiang Berbasis Web," *J. Kom.*, vol. 3, no. 1, pp. 87–96, 2023, [Online]. Available: https://doi.org/10.53697/jkomitek.v3i1

[9] I. Fitriati, N. Fitrianingsih, I. Ilyas, and W. Wahyudin, "Perancangan Aplikasi Presensi berbasis QR Code untuk Efisiensi Manajemen Kehadiran Siswa MAN 1 Bima," *Invert. J. Inf. Technol. Educ.*, vol. 3, no. 2, 2023, doi: 10.37905/inverted.v3i2.20919.

[10] I. P. Solihin and R. A. Zain, "Sistem Absensi Mahasiswa Menggunakan Quick Response (Qr) Code Berbasis Android," *Ilm. Inform. dan Komput.*, vol. 7, pp. 1–7, 2019.

[11] F. H. Aminuddin, F. Purnama, and A. H. Ahadi, "Perancangan Sistem Absensi QRCode Siswa Menggunakan Framework Codeigniter Di SMKN 1 Muaro Jambi," *Digit. Transform. Technol.*, vol. 3, no. 2, pp. 888–894, 2024, doi: 10.47709/digitech.v3i2.3423.

[12] F. Nuraeni, R. Setiawan, and R. I. Amal, "Aplikasi Presensi Siswa Berbasis Web dan Qr-Code pada Pembelajaran Tatap Muka di Sekolah," *J. Algoritm.*, vol. 19, no. 1, pp. 1–11, 2022, doi: 10.33364/algoritma/v.19-1.983.

[13] E. Purnomo, "Implementasi Qrcode Pada Presensi Kehadiran Menggunakan Platform Appsheet Di TK Kusuma.," *COREAI J. Kecerdasan Buatan, Komputasi dan Teknol. Inf.*, vol. 3, no. 1, pp. 54–61, 2022, doi: 10.33650/coreai.v3i1.4170.

[14] B. A. Minartiningtyas and C. Tambagistra, "Presensi Kehadiran Mahasiswa Mengunakan QR-Code Dan Layanan Lokasi Berbasis Android," *J. Sains Dan Komput.*, vol. 6, no. 1, pp. 13–27, 2021.

[15] D. Kurniawan, H. Priono, R. Wirawan, M. B. Wadu, and B. Hananto, "Perancangan Sistem Presensi Menggunakan Qr Code Berbasis Android Pada Cv . Gamalama Mandiri Express," *Semin. Nas. Inform. Sist. Informasi, dan Keamanan Siber*, pp. 28–29, 2021.

[16] E. Herlina and T. Hidayatulloh, "Penerapan QR Code Untuk Sistem Absensi Siswa SMP Berbasis Web," *J. Teknol. dan Inf.*, vol. 7, no. 2, pp. 102–112, 1970, doi: 10.34010/jati.v7i2.865.

[17] B. Haqi and J. Sinaga, "Aplikasi Presensi Siswa Menggunakan Kode QR (QR Code) di SMK PGRI 28 Jakarta Timur," *Pros. Semin. Nas. SISFOTEK (Sistem Inf. dan Teknol.*, no. September, pp. 26–32, 2018, [Online]. Available: http://seminar.iaii.or.id

[18] A. W. Majid, D. A. Istiqomah, B. B. Wiratama, F. J. Guji S. U., S. N. Wahyuni, and V. A. Windarni, "Pembuatan Aplikasi Laporan Kinerja Online (Lakon) Berbasis Android Menggunakan Metode Waterfall," *Inf. Syst. J.*, vol. 7, no. 01, pp. 1–10, 2024, doi: 10.24076/infosjournal.2024v7i01.1528.

[19] N. Purwandari and A. Fauzi, "Perancangan Sistem Informasi Manajemen Pada Toko XYZ Berbasis Desktop," *J. Sist. Inf. Bisnis*, vol. 1, no. 2, pp. 54–64, 2020, doi: 10.55122/junsibi.v1i2.171.

[20] Ihramsyah, V. Yasin, and Johan, "Perancangan Aplikasi Sistem Informasi Penjualan Makanan Cepat Saji Berbasis Web Studi Kasus Kedai Cheese.Box," *J. Widya*, vol. 4, no. 1, pp. 117–139, 2023, [Online]. Available: https://jurnal.amikwidyaloka.ac.id/index.php/awl

[21] S. D. Pratama, L. Lasimin, and M. N. Dadaprawira, "Pengujian Black Box Testing Pada Aplikasi Edu Digital Berbasis Website Menggunakan Metode Equivalence Dan Boundary Value," *J-SISKO TECH (Jurnal Teknol. Sist. Inf. dan Sist. Komput. TGD)*, vol. 6, no. 2, p. 560, 2023, doi: 10.53513/jsk.v6i2.8166.