

Rapid Application Development of Group Attendance System for Higher Education Using Laravel and VueJS

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Abstract

This research presents the development of a Group Attendance System for higher education institutions using Laravel and VueJS frameworks. The system addresses the limitations of traditional attendance tracking methods by offering a web-based, mobile-optimized solution. Employing the Rapid Application Development (RAD) methodology, the study outlines the design and implementation process, including the creation of a user-friendly interface for both administrators and student coordinators. The application facilitates efficient management of student groups, scheduling of meetings, and real-time attendance tracking. Comprehensive blackbox testing validated the system's functionality across critical areas such as user authentication, student registration, and attendance recording. The results demonstrate significant improvements in efficiency, accuracy, and accessibility of attendance management, contributing to the advancement of digital solutions in educational administration..

Keywords: Attendance System, Rapid Application Development, Web Application, Development, Laravel, VueJS

Pengembangan Aplikasi Sistem Absensi Kelompok Secara Cepat untuk Pendidikan Tinggi Menggunakan Laravel dan VueJS

Abstrak

Penelitian ini menyajikan pengembangan Sistem Absensi Kelompok untuk institusi pendidikan tinggi menggunakan kerangka kerja Laravel dan VueJS. Sistem ini mengatasi keterbatasan metode pencatatan kehadiran tradisional dengan menawarkan solusi berbasis web yang dioptimalkan untuk perangkat mobile. Menggunakan metodologi Rapid Application Development (RAD), penelitian ini menguraikan proses desain dan implementasi, termasuk pembuatan antarmuka yang ramah pengguna untuk administrator dan koordinator mahasiswa. Aplikasi ini memfasilitasi pengelolaan kelompok mahasiswa secara efisien, penjadwalan pertemuan, dan pencatatan kehadiran secara real-time. Pengujian blackbox yang komprehensif memvalidasi fungsionalitas sistem di berbagai area penting seperti autentikasi pengguna, pendaftaran mahasiswa, dan pencatatan kehadiran. Hasil penelitian menunjukkan peningkatan signifikan dalam efisiensi, akurasi, dan aksesibilitas manajemen kehadiran, berkontribusi pada kemajuan solusi digital dalam administrasi pendidikan.

Kata Kunci: Sistem Absensi, Rapid Application Development, Aplikasi Web, Laravel, VueJS

1. Introduction

At Universitas Advent Indonesia (UNAI), various student groups and organizations frequently organize activities and events that require precise attendance tracking. These groups are often managed by student coordinators who are responsible for documenting the activities and attendance of group members. Accurate attendance records are crucial for multiple purposes: they help coordinators identify active members, enable the university to reward student participation, and promote students to more advanced roles within their respective groups [1].

The limitations of manual attendance systems are numerous. They are highly susceptible to human error, which can compromise data integrity, and they consume a significant amount of time that could otherwise be used for teaching activities [2]. Additionally, the handling and storage of physical records are inefficient and cumbersome, raising concerns over sustainability due to excessive paper usage [3][4]. Furthermore, the risk of damage or loss of paper records poses a significant challenge for the long-term maintenance of accurate attendance records [5][6]. The current methods for tracking attendance involve either paper-based systems or manual entry into spreadsheets, presenting significant challenges in data collection and the compilation of comprehensive, easy-to-understand reports. Consequently, there is a clear need for a more efficient and accurate attendance tracking system.

Previous solutions to the problems of inefficient attendance tracking and activity reporting in educational settings have been explored through various web-based systems leveraging modern frameworks and technologies. Studies have demonstrated that implementing systems using the Laravel framework significantly enhances efficiency and user experience in managing educational activities and attendance records [7]. For instance, QR code-based online attendance systems developed with Laravel have shown to streamline attendance processes and provide real-time notifications [8]. Other research has focused on creating web-based internship applications, which facilitate the registration and reporting of student activities, further proving Laravel's capability in enhancing data management and usability [9]. Similarly, systems designed for school payment administration and feedback collection have utilized Laravel to automate processes and reduce errors associated with manual data handling [10]. The adoption of Laravel in various educational applications, including internship management [11] and contribution payment systems [12], highlights its effectiveness in addressing common challenges such as data collection, error reduction, and comprehensive reporting. Additionally, web-based attendance systems for elementary schools and higher education institutions have shown to improve the process by digitizing data collection and management [13]. Research into specific applications of Laravel has also highlighted its role in enhancing the efficiency of ticketing and feedback systems in educational environments, further emphasizing its broad utility in various administrative functions [14]. However, previous solutions for attendance tracking and activity reporting in educational settings have often lacked the flexibility needed to manage the dynamic requirements of university student groups, failing to adequately align with the specific needs of coordinators and administrators. Moreover, these systems have not leveraged modern Single Page Application (SPA) technologies like VueJS to provide a more responsive and seamless user experience, resulting in inefficiencies and difficulties in real-time data management and reporting.

To address these challenges, this research proposes the development of a smart attendance and activity reporting application for UNAI. This application will be accessible to both the university administration and group coordinators, streamlining the process of recording group activities and student attendance. The backend of the application will be built using Laravel, a robust PHP framework known for its elegant syntax, comprehensive documentation, and built-in features that enhance development efficiency and security [15]. The frontend will be developed using VueJS 3 Single Page Application (SPA), which provides a reactive and user-friendly interface, facilitating seamless interaction and real-time updates. By leveraging the strengths of Laravel and VueJS, the proposed system aims to significantly improve the efficiency of tracking student group activities and generating detailed reports. This solution is expected to offer a scalable and reliable platform that meets the needs of both coordinators and university administrators, ultimately fostering a more organized and transparent system for managing student group activities at UNAI.

2. Research Methodology

Figure 1 illustrates the iterative and dynamic Rapid Application Development (RAD) process employed in developing the UNAI Sabbath School Attendance System. The RAD model created an environment conducive to rapid and responsive development, allowing the team to closely align with end-user requirements and continuously refine the system through successive iteration [6].

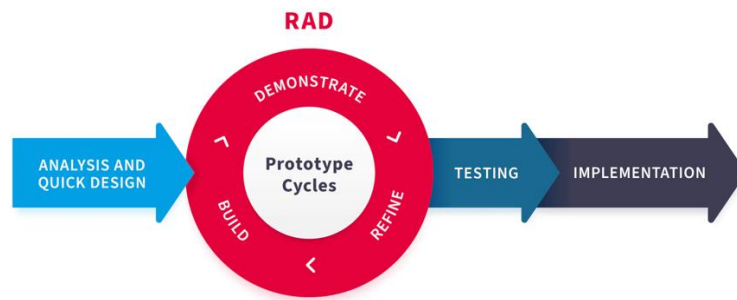


Figure 1 Rapid Application Development Diagram

Analysis and Quick Design: The initial phase of our RAD approach involved a brief analysis, which led to the establishment of a foundational design. This phase focused on identifying key user needs and system requirements specific to Universitas Advent Indonesia. It laid the groundwork for the first prototype of the attendance system, emphasizing mobile-first and user-centric design principles [16][17].

Prototype Cycles (Build, Demonstrate, Refine): Central to the RAD model are the prototype cycles. During these cycles, we developed successive versions of the system based on user feedback and performance analysis. These cycles involved:

- **Build:** Constructing incremental prototypes that included essential functionalities like managing attendance records, reporting, meeting scheduling, and group management [18].
- **Demonstrate:** Presenting these prototypes to users to gather insights and validate the design against user experiences and expectations [19].
- **Refine:** Enhancing the system based on feedback, which included improving the user interface, data handling, and ensuring the application's responsiveness met the needs of a mobile-first approach [16].

Testing: Comprehensive testing followed the prototype cycles to ensure the system's reliability and stability. This phase aimed at identifying and rectifying defects, optimizing performance, and verifying that the application met both functional and non-functional requirements [20].

Implementation: The final phase involved deploying the fully developed attendance system into the operational environment of Universitas Advent Indonesia. This phase culminated the RAD cycles, delivering a robust and user-friendly digital solution that effectively replaced the outdated paper-based attendance tracking.

This RAD cycle diagram emphasizes the flexibility and efficiency of the development process, showcasing the benefits of iterative design in creating a customized attendance system. The methodology was crucial in realizing notable enhancements in user satisfaction and operational efficiency as highlighted in our research outcomes [21].

Application Design

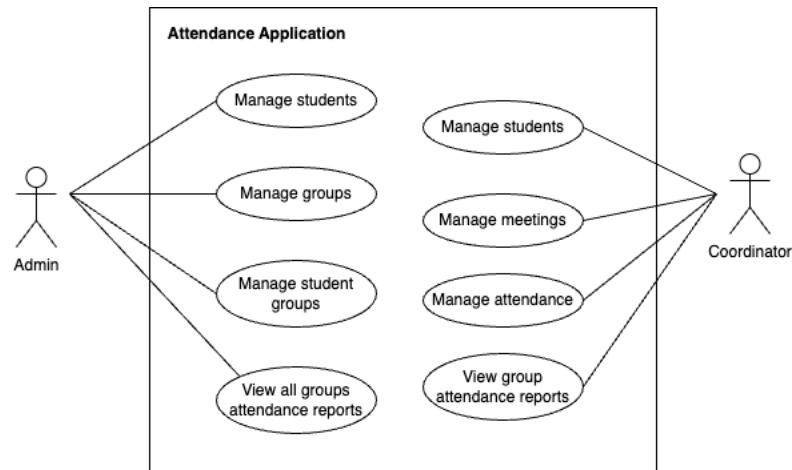


Figure 2 Use Case Diagram of the Proposed Attendance Application

Figure 2 details the interactions within the Group Attendance and Activity Reporting System designed for UNAI. This system leverages modern web technologies to enhance the efficiency and accuracy of attendance tracking and activity management, addressing the shortcomings of traditional methods. The diagram highlights two primary user roles—Admin and Coordinator—and the specific functionalities they can access within the application.

Use Cases for Admin:

1. Manage Students:

- Admins can perform operations such as adding, updating, or removing student information. This ensures that the student database remains accurate and up-to-date, which is essential for reliable attendance tracking and activity reporting.

2. Manage Groups:

- Admins have the ability to create, update, or delete student groups. This functionality supports the organization of student activities and ensures that group memberships reflect the current structure and needs of the university.

3. Manage Student Groups:

- Admins can assign students to specific groups and manage these memberships. This aligns with the university's objective to track active participation among students, facilitating the identification of students who are highly engaged and might be eligible for awards or advanced activities.

4. View All Groups Attendance Reports:

- Admins have access to comprehensive attendance reports for all groups. This functionality allows for an overview of student engagement across the entire institution, aiding in administrative decisions and the recognition of active participants.

Use Cases for Coordinator:

1. Manage Students:

- Coordinators, typically student leaders assigned by the university, can manage student information within their specific groups. This capability supports accurate attendance tracking and ensures that the data related to group activities is precise.

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2. Manage Meetings:

- Coordinators can schedule and manage meetings for their groups. This includes setting up meeting times, notifying group members, and ensuring that all activities are well-organized and documented.

3. Manage Attendance:

- Coordinators are responsible for taking attendance during meetings and managing attendance records. This helps in identifying active members, maintaining accurate logs, and ensuring that attendance data is correctly recorded and stored.

4. View Group Attendance Reports:

- Coordinators can view attendance reports for their respective groups. This functionality enables them to monitor participation, identify trends in member engagement, and make informed decisions about group activities and member involvement.

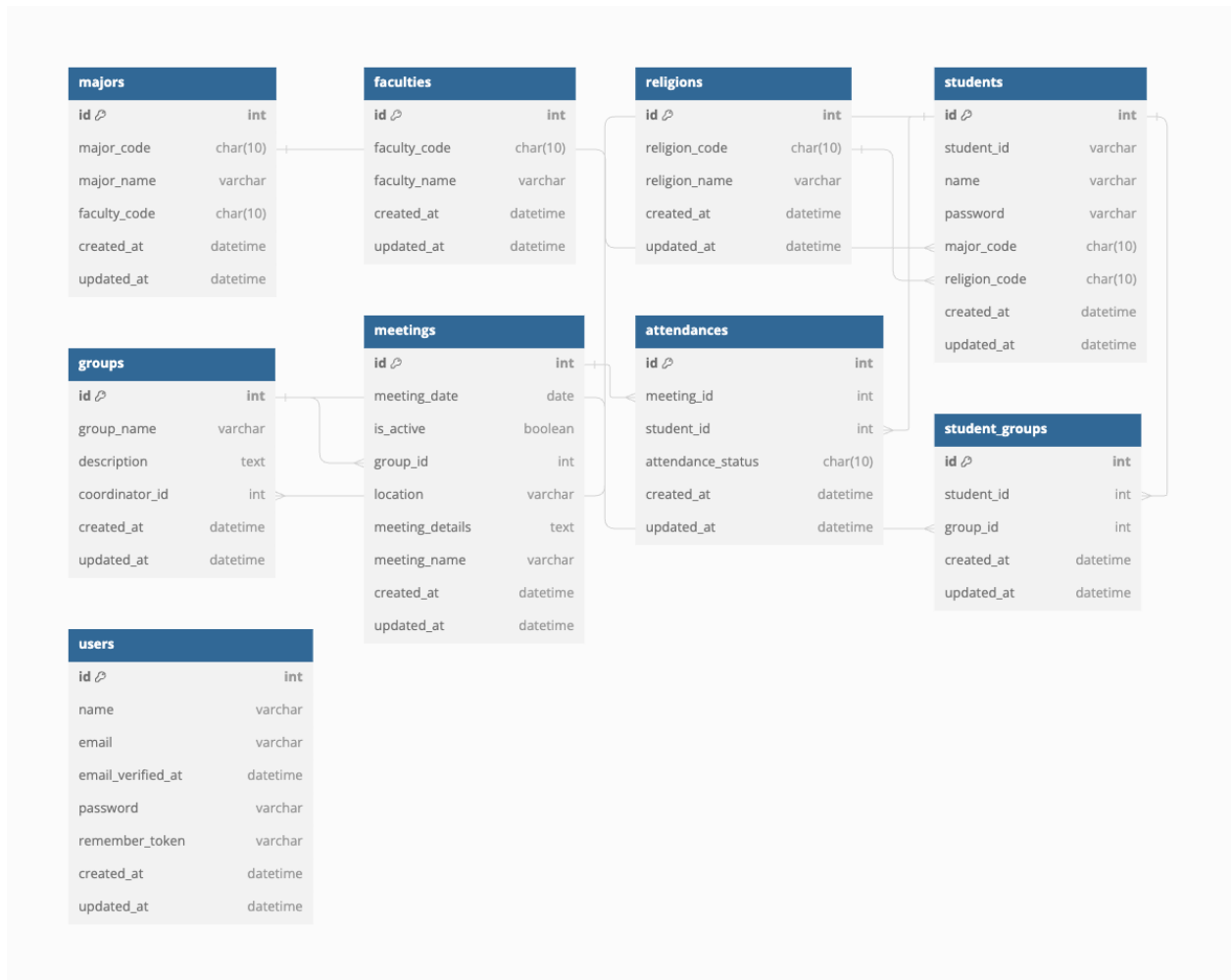


Figure 3 Entity Relationship Diagram of the Proposed Attendance Application

The Entity Relationship Diagram (ERD) for the smart attendance system, shown in Figure 3, explains how the database is organized to support the application. The ERD shows how different parts of the database, like users, students, majors, faculties, religions, groups, meetings, attendances, and student groups, are connected. Each table in the database has a specific job to make sure data is managed well. For instance, the users table keeps track of user login details, while the students table stores information about students, linking them to their major and religion. The tables for majors, faculties, and religions provide the necessary academic and demographic details to support these links and ensure data is accurate.

The ERD also highlights how group activities and attendance tracking are linked in the system. The groups table, along with the student_groups table, helps manage student group memberships and coordinators. The meetings table keeps track of group meetings, and the attendances table records if students were present at those meetings. These connections are important for the system to track and report attendance effectively, providing useful information for teachers and administrators. Using Laravel and VueJS, this database design supports the fast development of a smart attendance system, making student attendance tracking more efficient and accurate for higher education institutions.

3. Results

In this section, the proposed attendance application design is realized, resulting in a web-based application built using Laravel 9 and VueJS 3 Single Page Application. The user interface of the application is optimized for mobile use, as most users are expected to access the app via their mobile phones. Due to limited space, not all the pages within the application will be shown. However, the application has been tested using blackbox testing, and the results are discussed below.

Attendance Application User Interface

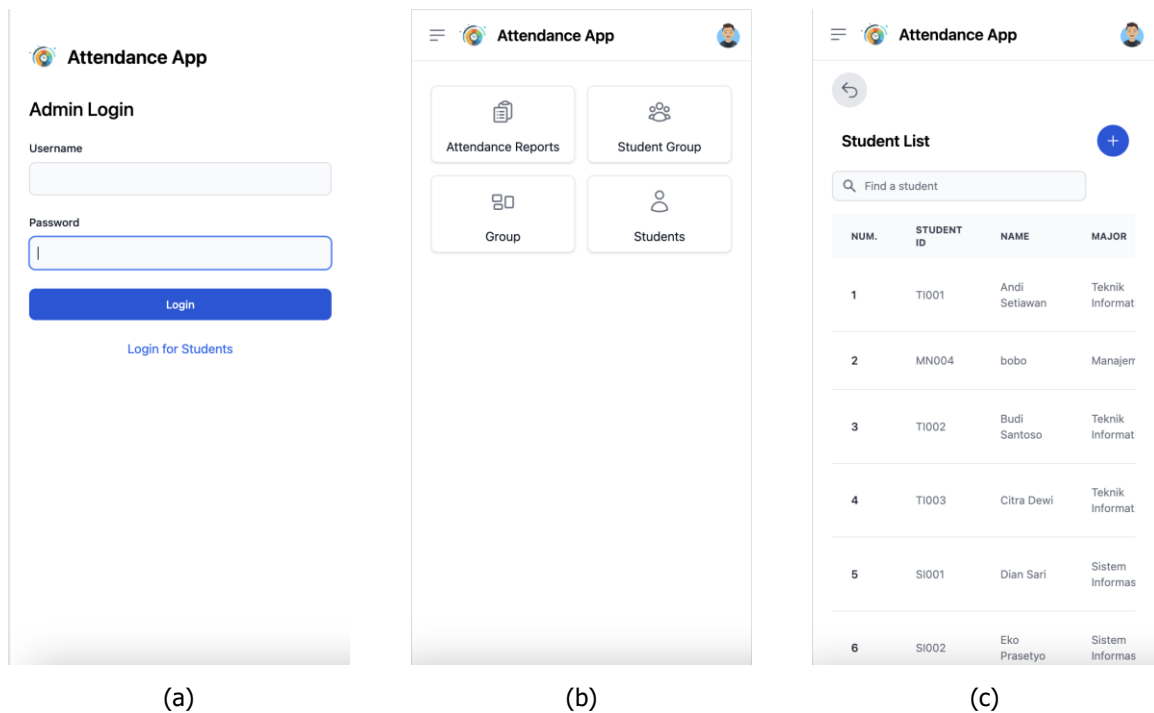


Figure 4 User Interface Pages of the Attendance Application for Administrators (a) Login Page (b) Home Page (c) Student Page

Figure 4 depicts the various interfaces of the Attendance Application, designed to streamline the process of managing student attendance in higher education. Upon launching the app, administrators are

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greeted with a login page (a). The admin can input their username and password and press the Login button to enter the application. Below this, a link for student login, labeled "Login for Student," is provided. After successful login, the admin is directed to the main dashboard (b), which offers four key functionalities: "Attendance Reports" for accessing attendance statistics, "Student Group" for managing groups, "Group" for handling group-related tasks, and "Students" for viewing and managing the student list. By selecting the "Students" option, the admin is taken to the Student List page (c), where there is a search bar to find a student and a clickable blue button for adding new students. The student list is organized into columns displaying the student's number, ID, name, and major, etc. with each row representing individual students.

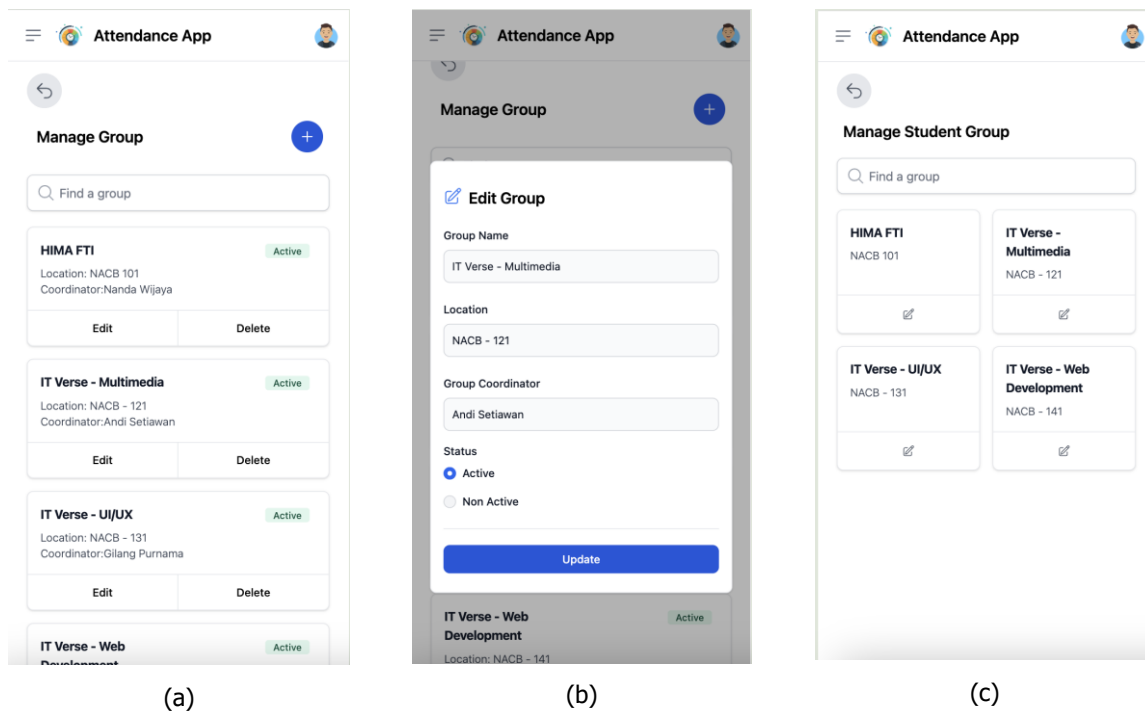


Figure 5 User Interface Pages of the Attendance Application for Administrators (a) Group Page (b) Edit Group Page (c) Manage Student group

Figure 5 illustrates the user interface pages of the Attendance Application designed for administrators. In the Group Page (a), administrators can view and manage student groups, each displaying its name, location, and coordinator, with options to edit or delete the groups. The Edit Group Page (b) is accessed by clicking the "Edit" button on the Group Page, allowing administrators to modify group details such as name, location, coordinator, and status, and save changes by clicking the "Update" button. The Manage Student Group Page (c) provides an overview of all student groups, where administrators can search for specific groups and click the pencil icon to edit group details. This functionality enables administrators to efficiently manage and update student groups, ensuring accurate and organized group information within the Attendance Application.

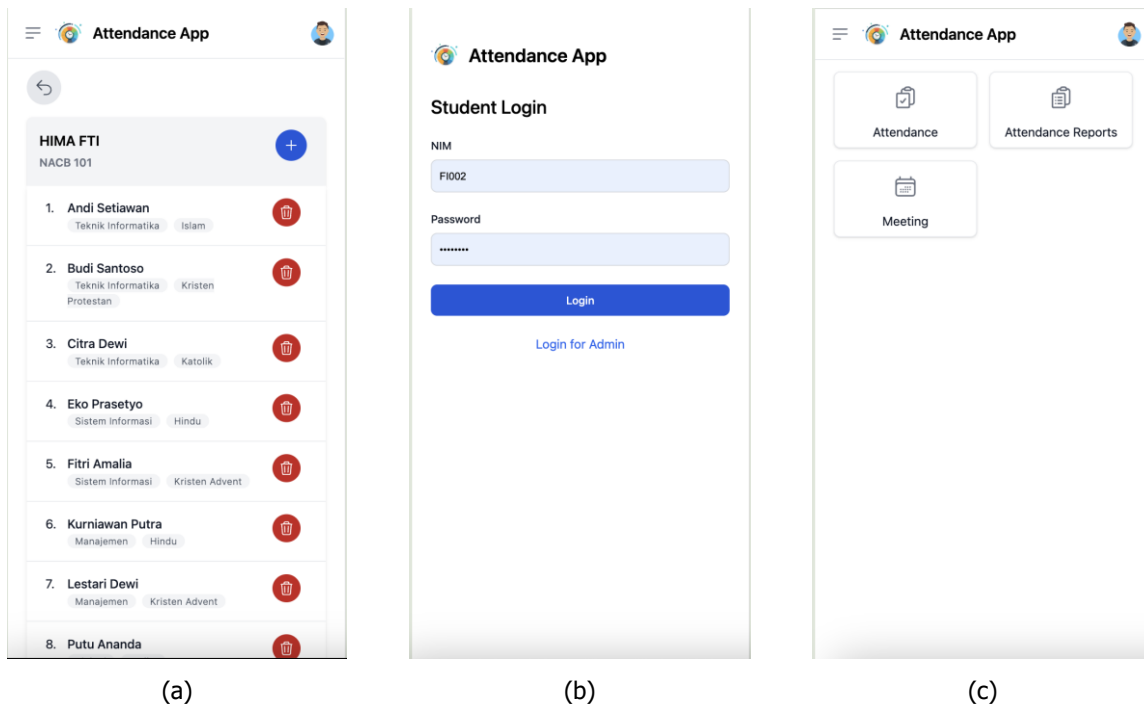


Figure 6 User Interface Pages of the Attendance Application for Administrators and Students as Coordinators
(a) Student Group Assignment (b) Student Login Page (c) Home Page for Students

Figure 6 illustrates the user interface of the "Attendance Application" for both administrators and students. In the first screen (a), the "Student Group Assignment" page is shown, where an administrator can view and manage the list of students in a specific group, such as "HIMA FTI." This page displays students' names along with their majors and religions, with an option to delete a student from the group by clicking the red trash icon. The second screen (b) presents the "Student Login Page," where students that has been assigned as a coordinator can enter their NIM and password to access the application. Additionally, there is a link labeled "Login for Admin" for administrators to switch to the admin login page. The third screen (c) showcases the "Home Page for Students," where students can access functionalities such as "Attendance," "Attendance Reports," and "Meeting." This page is designed for students who have logged in, allowing them to manage their attendance and view relevant reports efficiently.

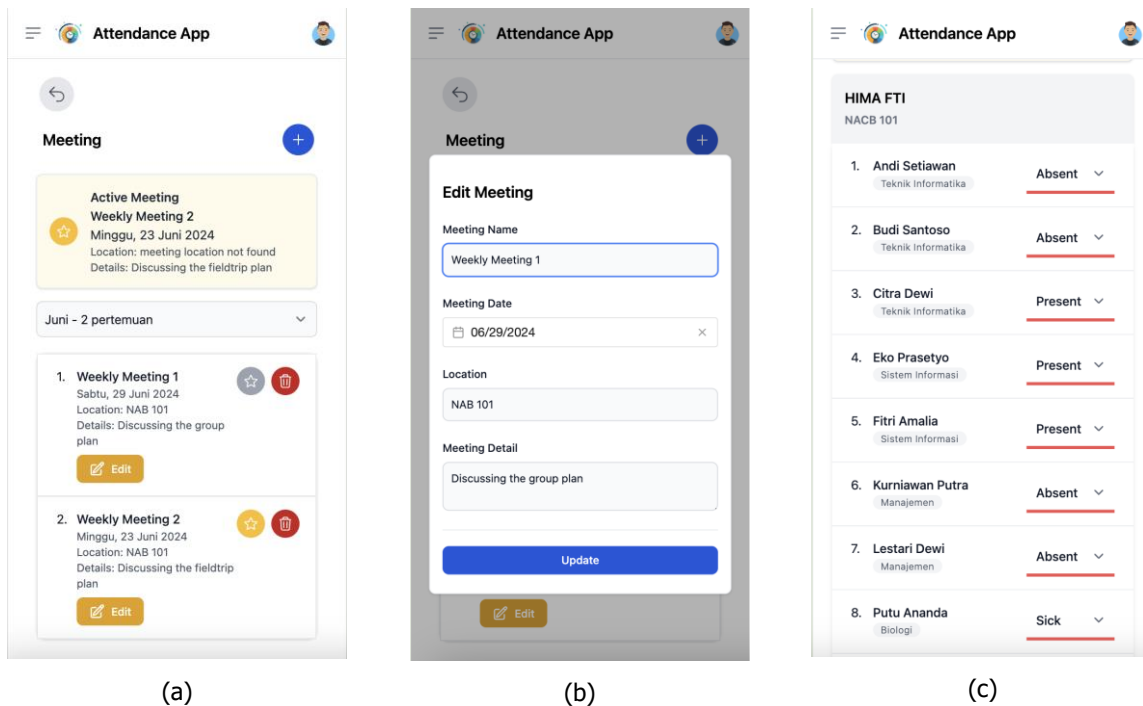


Figure 7 User Interface Pages of the Students Coordinator (a) Meeting Management Page (b) Edit Meeting Form Page (c) Attendance Taking Page

Figure 7 illustrates the user interface pages of the students' coordinator within the "Attendance Application." In screen (a), the "Meeting Management Page" is displayed, where the coordinator can view and manage meetings. This page lists active and past meetings, with details such as the meeting name, date, location, and additional details. Each meeting entry includes options to edit or delete the meeting. The second screen (b) shows the "Edit Meeting Form Page," where the coordinator can update meeting details such as the meeting name, date, location, and description. This form provides fields to input the necessary information and a button to save the changes. The third screen (c) depicts the "Attendance Taking Page," where the coordinator can record attendance for each student. This page lists students in the group, displaying their name, major, and current attendance status. The coordinator can mark each student as "Present," "Absent," or "Sick" by selecting the appropriate status from a dropdown menu. This interface ensures efficient attendance tracking and management.

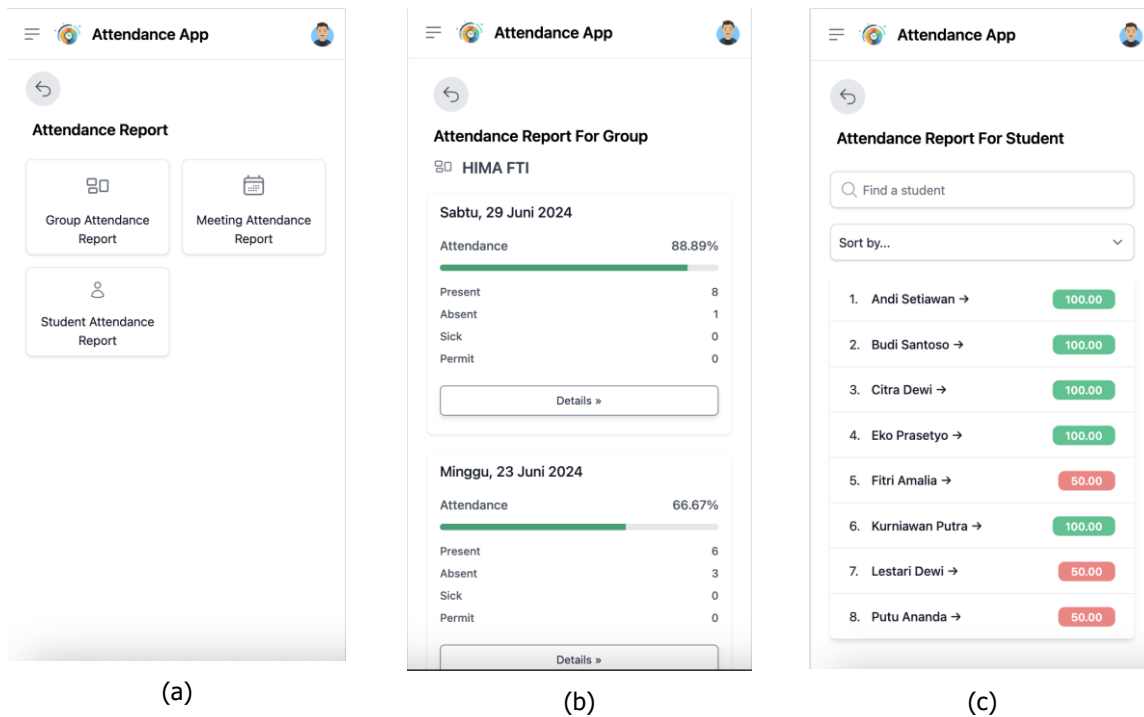


Figure 8 User Interface Pages of the Students Coordinator (a) Attendance Report (b) Attendance Report for Group Meetings (c) Attendance Report for Student in the Group

Figure 8 illustrates the user interface pages of the students’ coordinator in the “Attendance Application.” Screen (a) shows the “Attendance Report” page, where coordinators can choose between three types of reports: “Group Attendance Report,” “Meeting Attendance Report,” and “Student Attendance Report.” In screen (b), the “Attendance Report for Group Meetings” page is displayed, providing an overview of attendance for specific meetings within a group. This screen details the date, overall attendance percentage, and a breakdown of the number of students present, absent, sick, or with permission for each meeting. Screen (c) depicts the “Attendance Report for Student in the Group” page, listing individual students along with their attendance percentages. Each student’s status is indicated with green for 100% attendance and red for lower percentages, facilitating easy identification of attendance patterns.

Blackbox Testing Results

Table 1 provides an overview of the critical functionalities tested in the smart attendance system for higher education. Each test case is described in the Test Case Description column, detailing key aspects such as user login, student registration, major and faculty management, group and meeting scheduling, and attendance tracking. The Expected Result column outlines the anticipated outcomes for each test, while the Pass/Fail column indicates whether the tests met the expected criteria. This summary highlights the rigorous validation process undertaken to ensure the reliability, efficiency, and accuracy of the system developed using Laravel and VueJS. The results demonstrate that the attendance application successfully passed all the test cases, indicating that the application functions as intended across all critical areas. This ensures that users can log in seamlessly, students can be registered accurately, and management of majors, faculties, groups, and meetings is handled efficiently. Additionally, the system’s ability to track attendance accurately was validated, confirming that the application meets the high standards required for operational use in a higher education environment.

Table 1 Summary of Blackbox Testing Results

No	Test Case	Expected Result	Actual Result	Pass/Fail
1	Admin Login, Edit, and Delete Group	Admin can log in, edit, and delete groups successfully.	Admin logged in, edited, and deleted groups successfully.	Pass
2	Student Login and View Details	Student can log in and view their details successfully.	Student logged in and viewed their details successfully.	Pass
3	Manage Student List (Add, Edit, Delete)	Admin can add, edit, and delete students from the list successfully.	Admin added, edited, and deleted students from the list successfully.	Pass
4	Schedule and Manage Meetings	Admin can schedule, edit, and delete meetings successfully.	Admin scheduled, edited, and deleted meetings successfully.	Pass
5	Record and View Attendance	Admin and students can record and view attendance successfully.	Attendance recorded and viewed successfully.	Pass
6	Manage Faculties and Majors	Admin can manage faculties and majors successfully.	Admin managed faculties and majors successfully.	Pass
7	Manage Groups and Students in Groups	Admin can manage groups and assign students to groups successfully.	Admin managed groups and assigned students to groups successfully.	Pass
8	Manage Meeting Attendance for Groups	Admin can manage meeting attendance for groups successfully.	Admin managed meeting attendance for groups successfully.	Pass
9	Manage Detailed Student Attendance	Admin can manage detailed student attendance successfully.	Admin managed detailed student attendance successfully.	Pass
10	Admin/Student Coordinator Logout	1. Log in as any admin/student. 2. Click logout button.	User is logged out and redirected to the login page.	Pass

4. Conclusion

This research has demonstrated the successful development and implementation of a Group Attendance Application for higher education institutions using Laravel and VueJS frameworks. The web-based application, designed with a mobile-first approach, has effectively addressed the challenges associated with traditional attendance tracking methods. Key findings include:

1. Enhanced efficiency and accuracy in student attendance tracking.
2. Improved accessibility through a responsive, user-friendly interface optimized for mobile devices.
3. Successful integration of Laravel and VueJS, enabling real-time interactions and updates.

4. Validated functionality and reliability through comprehensive Blackbox testing, meeting all critical operational criteria.

The Group Attendance Application has proven to be a scalable and reliable solution, capable of managing various aspects of educational administration, including user authentication, student registration, and the organization of majors, faculties, groups, and meetings. The successful completion of all test cases underscores the system's robustness and its ability to function effectively across all critical areas. This project contributes to the field of educational technology by offering a modern, adaptable solution that not only meets current needs but also lays the groundwork for future advancements in digital attendance systems.

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