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LAMMS: A Learner's Attendance Monitoring and Management System for Naawan Central School, Misamis Oriental, Philippines

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ABSTRACT

Attendance monitoring in basic education institutions continues to impose significant administrative demands on teachers, while simultaneously exposing records to errors, duplication, and loss. Although the Department of Education has streamlined school documentation, the Learner's Daily Attendance Report, using School Form 2 (SF2), still relies on manual recording and monthly computations, which limit instructional efficiency. This study presents the development and evaluation of the Learner's Attendance Monitoring and Management System, a teacher-assisted, QR code–based web application designed for Naawan Central School. The system automates the capture of SF2-compliant attendance reports using a centralized database, while retaining teacher validation and administrative oversight. It was developed using the Agile Scrum framework and implemented through a hybrid web architecture utilizing Laravel, PHP, Vue.js, and PostgreSQL. System evaluation employed black-box functional testing and a usability assessment using the System Usability Scale, involving 30 participants, comprising 29 teachers and 1 IT administrator. Functional testing achieved a 100% success rate across all scenarios, confirming system stability and correctness. Usability results yielded an overall score of 89.75, indicating strong user acceptance and ease of interaction. Furthermore, a time-efficiency analysis revealed substantial reductions in administrative workload, with SF2 report preparation decreasing from 90 minutes using manual methods to 10 seconds using the system, representing a 99.81% improvement. Across routine attendance tasks, a 99.41% workload reduction was achieved. These findings demonstrate that the system is a reliable, efficient, and scalable solution for modernizing attendance management in elementary education settings.

INTRODUCTION

Accurate attendance monitoring is a critical component of basic education administration, supporting learner engagement assessment, early intervention, and institutional reporting. In the Philippine public elementary school system, attendance records are integral to official documentation and learner progress tracking. Despite policy efforts to reduce administrative burden, the persistent reliance on School Form 2 (SF2) reveals the continued dependence on attendance documentation and the monthly reporting process.

In practice, SF2 preparation continues to rely on manual procedures that require daily encoding and repeated computations. Teachers must calculate attendance indicators such as Average Daily Attendance and Monthly Attendance Percentage, tasks that are both time-intensive and prone to human error. Existing studies consistently report that excessive clerical responsibilities reduce instructional focus, contribute to workload stress, and limit opportunities for lesson preparation and learner support.

Naawan Central School (NCS) in Misamis Oriental, Philippines, continues to face these challenges as enrolment increases and reliance on handwritten attendance records persists. Manual processes expose records to risks such as data loss, duplication, and inconsistent computations caused by repeated transcription and consolidation. To address these operational constraints, this study developed the Learner's Attendance Monitoring and Management System (LAMMS), a teacher-assisted QR code–based platform designed to automate attendance recording and SF2 reporting while remaining aligned with DepEd requirements.

Background

Attendance monitoring is widely regarded as a critical indicator of learner engagement and academic risk, with persistent absenteeism often linked to declining performance and increased likelihood of dropout. Prior research emphasizes that the timely detection of attendance issues allows schools to implement early interventions that support learner retention and achievement (Kearney *et al.*, 2023). Consequently, effective attendance monitoring systems are essential for enabling proactive, data-driven school practices that support both instructional planning and learner welfare.

However, studies conducted in both Philippine and international contexts consistently report that teachers spend a substantial amount of time on non-instructional tasks, particularly documentation and attendance reporting. Manual record-keeping and

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repetitive computations reduce instructional efficiency and contribute to workload-related stress and burnout (Ancho & Bongco, 2019; Magtalas, 2024; Solania *et al*., 2023). In response, digital attendance and record management systems have been shown to address these challenges by automating routine processes, minimizing human error, and improving data consistency, thereby allowing teachers to redirect their time and effort toward instruction and learner development (Nacional, 2022; Ronquillo *et al*., 2022).

Recent advancements in educational technology highlight the growing adoption of QR code–based and centralized web-based attendance systems due to their cost-effectiveness, ease of deployment, and scalability. Research demonstrates that QR-based solutions significantly improve the speed and accuracy of attendance recording compared to manual roll calls and ID-card approaches (Abu Bakar *et al*., 2020; Sondhi & Kumar, 2022), while centralized systems enhance real-time access, reporting efficiency, and data integrity through role-based controls and audit mechanisms (Nwazor & Olusolape, 2021; Perin, 2025).

Although the majority of attendance system research focuses on administrative efficiencies, a recent empirical investigation on technology implementation highlights that the integration of digital systems can positively influence learner engagement, attendance, and related academic outcomes, reinforcing the potential benefits of automated attendance technologies in educational practices (Saro & Taray, 2024). Additionally, research in organization and administrative systems suggests that technological factors – including system quality, compatibility, and user acceptance – can significantly affect the success of information systems implementation, underscoring the need for context-appropriate technology adoption strategies in school environments (Haleem & Ditsa, 2024).

Despite these advantages, existing literature provides limited empirical evidence on systems that are fully aligned with standardized Department of Education (DepEd) reporting requirements, such as School Form 2 (SF2), particularly in elementary public schools. Most available studies focus on general system efficiency without explicitly addressing institutional compliance and reporting integrations. This gap underscores the need for context-specific solutions that combine technological efficiency with regulatory alignment.

In response to this gap, the present study seeks to develop and evaluate a teacher-assisted, SF2-compliant attendance monitoring and management system. By examining its efficiency, usability, and practical applicability, this study aims to contribute empirical evidence on how technology-driven attendance systems can enhance administrative processes while supporting instructional effectiveness in public elementary schools.

MATERIALS AND METHODS

Research Design

This study employed a system development and evaluation research design aimed at designing, implementing, and assessing a digital attendance solution aligned with the operational requirements of Naawan Central School. The design integrated both developmental and evaluative components to address the project's objectives.

The research process consisted of requirements analysis, system design, iterative development, functional testing, usability assessment, and time-efficiency analysis. This structured approach ensured that the developed system was not only technically sound but also practically effective in addressing inefficiencies associated with manual SF2 attendance preparation.

Software Development Model

LAMMS was developed using the Agile Scrum methodology, which emphasizes iterative development, stakeholder collaboration, and adaptability to changing requirements (Beck, 2001; Schwaber, 2011) (Beck *et al*., 2001; Schwaber & Sutherland, 2011). Agile Scrum was selected to support the first and second objectives of the study—system design and development—by allowing continuous refinement based on user feedback.

Development activities were organized into short sprints, with regular consultations involving teachers and the school IT administrator. Feedback gathered during sprint reviews guided refinements to attendance workflows, report generation, and user interface design. The use of Agile Scrum ensured that the system evolved in close alignment with actual school practices and DepEd SF2 requirements while minimizing rework and development risks.

System Architecture and Development Tools

The system adopted a hybrid web-based architecture to support scalability, data integrity, and maintainability. The backend was developed using Laravel and PHP, which handled authentication, role-based access control, attendance processing, and automated SF2 report generation. Laravel's MVC architecture facilitated an organized code structure and efficient maintenance.

The frontend utilized Vue.js integrated with HTML, CSS, and Tailwind CSS to deliver a responsive and user-friendly interface capable of real-time updates during attendance sessions. A PostgreSQL database served as the centralized data repository, ensuring secure storage of learner records, attendance logs, and audit trails. The architecture directly supported the study's objective of developing a reliable and scalable attendance management system suitable for school-wide use.

System Evaluation Methods

Functional Testing

Black Box testing was employed to validate whether the system's observable outputs matched expected

results based on defined functional requirements. This method evaluates system behavior without examining internal code, making it suitable for assessing user-facing functionalities (Myers, 2004). Test scenarios were developed for teacher and administrator roles, covering QR-based attendance recording, attendance validation, SF2 report generation, and administrative data management. Successful execution of all scenarios confirmed that the system performed its intended functions correctly.

Usability Testing

System usability was evaluated using the System Usability Scale (SUS), a standardized and widely validated instrument for measuring perceived usability (Brooke, 1996). A total of 30 participants—29 teachers and 1 IT administrator—performed predefined task scenarios before completing the SUS questionnaire. SUS was selected due to its reliability, simplicity, and suitability for evaluating interactive systems in real-world environments (Bangor *et al.*, 2008). Results were interpreted using the Adjective Rating Scale (ARS) to classify overall usability and user acceptance.

Time-Efficiency Analysis

To assess operational efficiency, a time-efficiency comparison was conducted between traditional manual attendance processes and system-assisted execution using LAMMS. Teachers provided typical time estimates for completing attendance-related tasks, particularly SF2 preparation. These values were compared with system-measured execution times recorded during testing. The percentage reduction in task duration was computed using a standard time-reduction formula, providing quantitative evidence of efficiency gains achieved through automation:

Reduction(%)=(Tradional Time-LAMMS Time)/(Traditional Time)×100 (1)

RESULTS AND DISCUSSION

Research Design

This system architecture of LAMMS, as presented in Figure 1, illustrates a centralized web-based framework where teachers and IT administrators access the system through dedicated user interfaces connected to a central server. The server manages all processing tasks and interacts with the database via structured query operations (SQL) to store, update, and retrieve attendance data. Network connectivity enables real-time communication and synchronization between the client interfaces and the centralized database, ensuring reliable and consistent data flow across all system components.

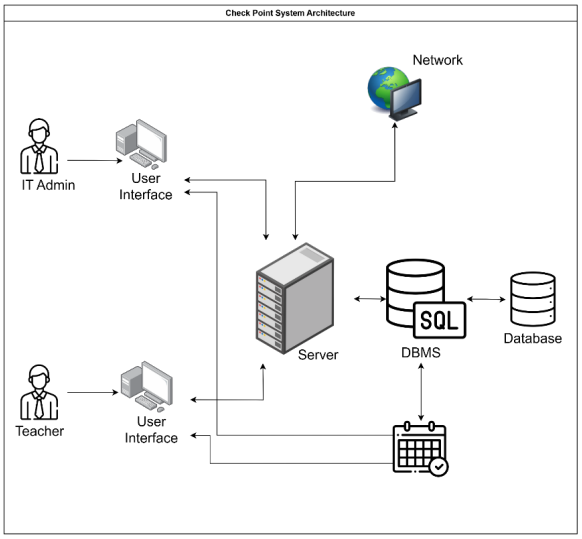

Figure 1: System Architecture of the Learner's Attendance Monitoring and Management System.

Figure 2 presents a comprehensive overview of class attendance information, including the teacher's name, section, total number of students, average attendance rate, and distribution of risk levels. It also displays the schedule of the next class and integrates visual analytics such as attendance trend graphs and reason heatmaps to highlight late and excused patterns. These data visualizations assist teachers in identifying learners who require attention and facilitate timely, data-driven interventions to improve attendance and engagement.

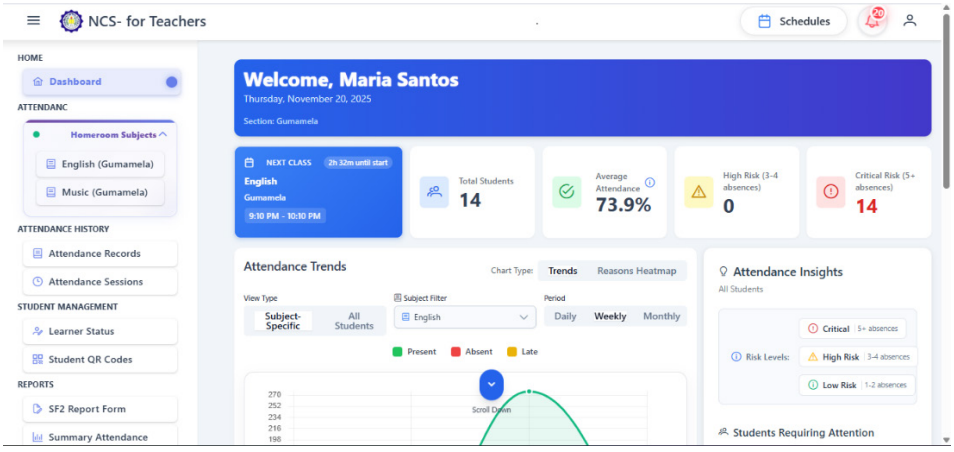

Figure 2: System Architecture of the Learner's Attendance Monitoring and Management System.

Figure 3 illustrates the Attendance Records page, which serves as the primary interface for teachers to monitor and manage learner attendance within a selected time frame. It consolidates daily attendance data into a single view, enabling teachers to track attendance status and total absences for each student. The use of visual status indicators—such as icons for Present, Absent, Late, Excused, and Inactive—enhances readability and minimizes interpretation errors. This feature simplifies attendance validation, supports timely identification of attendance issues, and facilitates more accurate reporting and intervention planning.

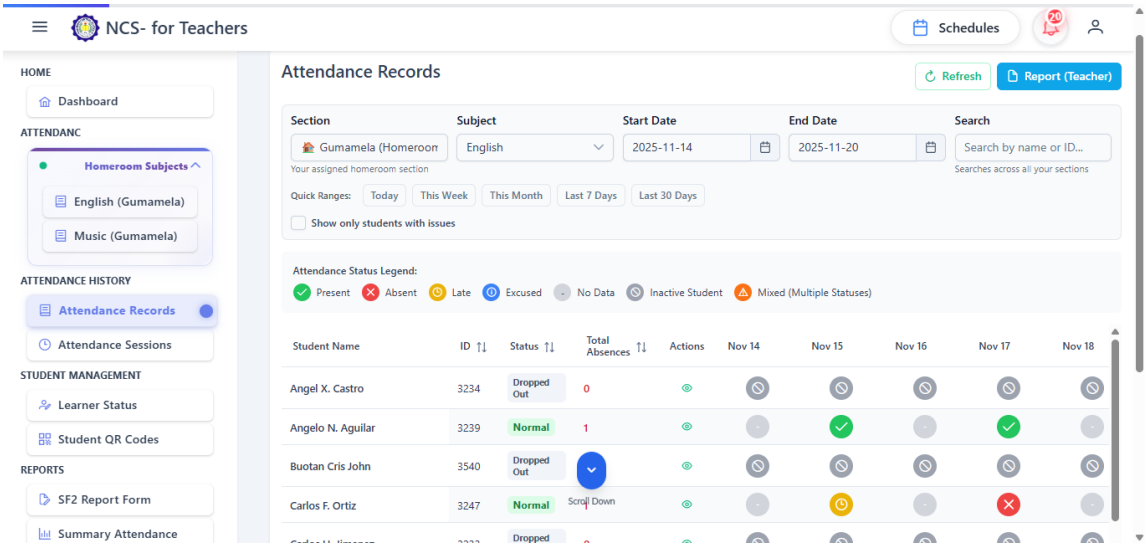

Figure 3: Teacher's Attendance Record Interface for Students.

Figure 4 presents the Homeroom Student QR Code, where teachers efficiently manage attendance identifiers for all students in their advisory section. Each learner is assigned a unique QR code, automatically generated and stored in the centralized database. Teachers can easily regenerate, download, or print these codes for use during classroom attendance or guardhouse check-in procedures. This functionality supports seamless attendance tracking while minimizing errors and preparation time associated with manual recordkeeping.

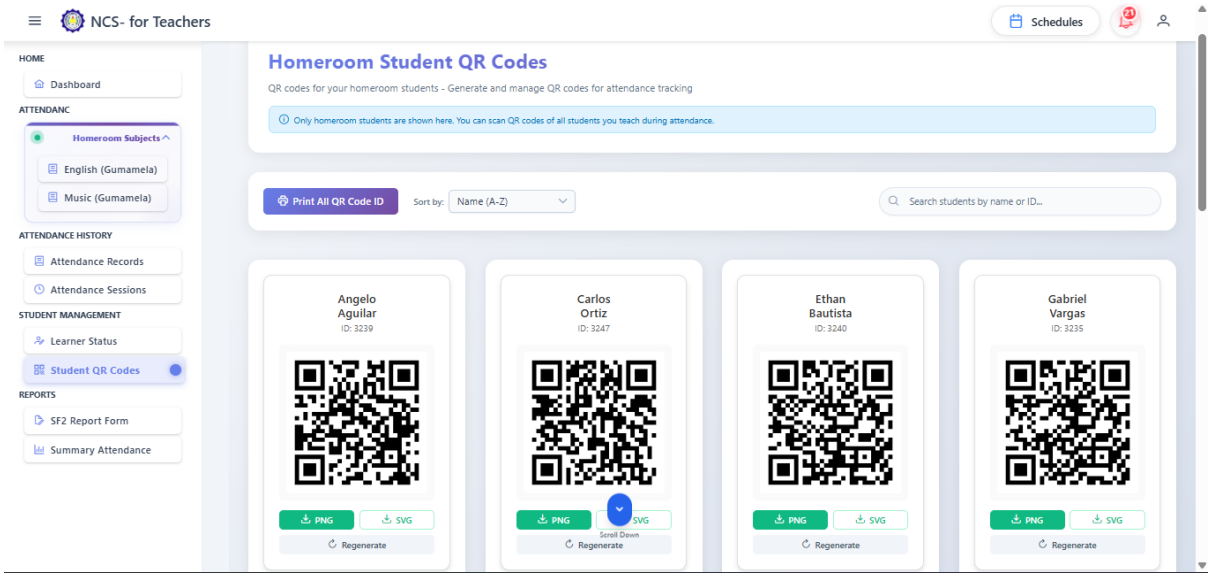

Figure 4: Homeroom Student QR Code Attendance Interface.

Figure 5 shows the Summary Attendance Management interface, which compiles and visualizes learners' overall attendance performance for a defined period. The system automatically calculates attendance rates and integrates DepEd SF2-compliant remarks to ensure accurate documentation. Teachers can access detailed attendance histories for individual students or generate printable reports for administrative submission. This module enhances data reliability and reporting efficiency, reducing the workload associated with manual summary preparation.

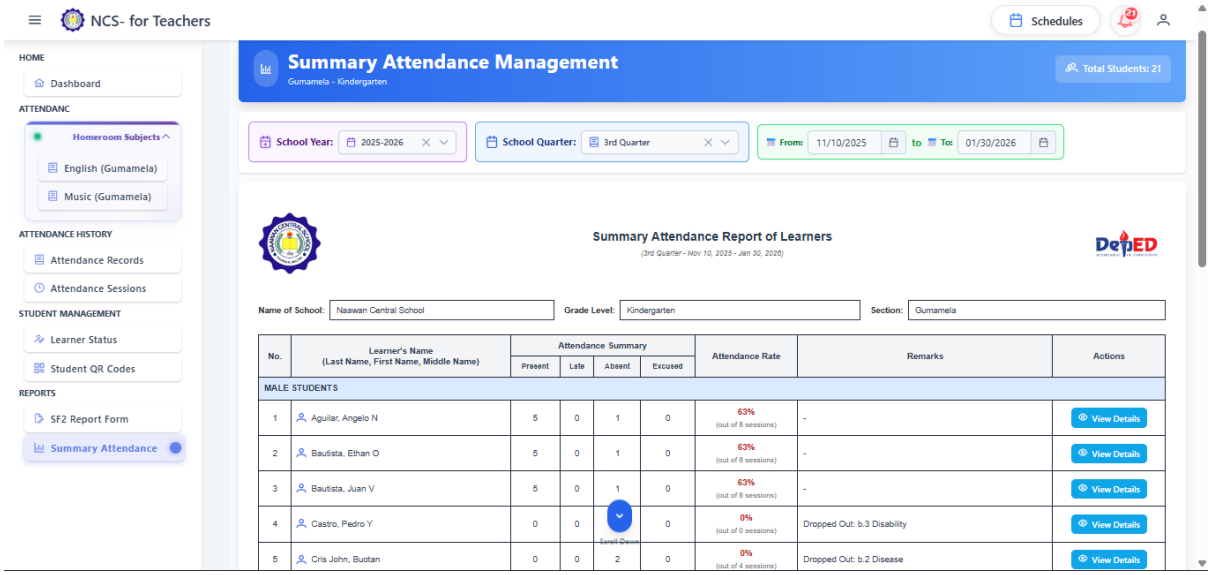

Figure 5: Summary Attendance Management Interface.

Functional Testing

The functional evaluation involved 29 participants performing 21 assigned task scenarios using Black Box testing to determine whether system outputs conformed to its specified functional requirements. All defined test scenarios for both teacher and administrator roles passed successfully, resulting in a 100% pass rate. This outcome indicates that the system consistently executed its core functions—such as QR-based attendance recording, attendance validation, report generation, and administrative data management—without observable errors or functional failures during testing.

The results demonstrate that the integration of the system's front-end interface with its backend logic and centralized database operated as intended. Critical workflows, including the creation of attendance sessions, automated computation of SF2 indicators, and secure data access by authorized users, were completed reliably. The absence of failed test cases suggests that the system is stable and sufficiently robust for deployment in a real school environment, where uninterrupted operation is essential to maintaining accurate attendance records.

Usability

Usability evaluation using the SUS yielded an overall mean score of 89.75, which corresponds to the "Best Imaginable" category under the Adjective Rating Scale. This result reflects a high level of user satisfaction and indicates that the system was perceived as intuitive, easy to navigate, and efficient by its primary users. Teachers reported minimal difficulty in learning system functions, such as initiating attendance sessions, scanning QR codes, and generating reports, despite their prior reliance on manual attendance processes.

The high usability score is particularly significant in the context of basic education institutions, where the successful adoption of digital systems depends heavily on ease of use and minimal training requirements. The results suggest that the user-centered design of LAMMS—characterized by clear interfaces, logical workflows, and responsive feedback—effectively supports teachers and administrators in performing routine attendance-related tasks. This strong user acceptance enhances the likelihood of sustained system use and reduces resistance to technological transition.

Table 1: Comparative Time-Efficiency Evaluation.

Task	Manual System (sec)	LAMMS (sec)	Reduction (%)
Attendance Recording	300	30	90
Monthly SF2 Summary	5,400	10	99.81
Identifying At-risk Students	1,800	5	99.72

Time-Efficiency Analysis

The time-efficiency analysis revealed substantial reductions in the duration required to complete attendance-related administrative tasks. The most notable improvement was observed in the generation of the mandatory SF2 monthly report, which was reduced from 5,400 seconds or 90 minutes using traditional manual methods to only 10 seconds when performed through LAMMS. This corresponds to a 99.81% reduction in processing time, demonstrating the effectiveness of automated

computations and centralized data consolidation.

When considering routine attendance-related activities collectively, the system achieved 99.41% reduction in overall clerical workload. These findings highlight the practical value of the system in restoring instructional time that would otherwise be spent on repetitive encoding, calculation, and reconciliation tasks. By significantly shortening processing time, the system enables teachers to redirect their efforts toward teaching, learner monitoring, and timely intervention, thereby improving overall operational efficiency within the school.

RESULTS AND DISCUSSIONS

The results of this study demonstrate that LAMMS effectively addresses the major limitations associated with manual attendance monitoring systems. The combination of QR code–based automation and centralized data storage reduces the risk of data loss by eliminating reliance on paper records and repeated manual transfers. Automated computation of SF2 indicators strengthens data integrity by removing the possibility of miscalculations and unauthorized formula alterations, while centralized records prevent data redundancy and inconsistencies.

Importantly, the teacher-assisted design of the system ensures that operational efficiency does not come at the expense of accountability. Teachers retain control over attendance validation, while administrators maintain oversight through role-based access and reporting tools. This balance between automation and supervision aligns with institutional requirements and DepEd policies, which emphasize accuracy, transparency, and responsibility in school documentation. Overall, the findings confirm that LAMMS is not only technically effective but also contextually appropriate for basic education settings, providing a sustainable digital solution to longstanding attendance management challenges.

CONCLUSION

This study successfully designed, developed, and evaluated the Learner's Attendance Monitoring and Management System, a teacher-assisted QR code–based web application aligned with the operational workflows and reporting requirements of Naawan Central School. Developed using the Agile Scrum methodology, the system was iteratively refined through continuous stakeholder feedback, ensuring compliance with Department of Education policies, particularly the preparation and computation of School Form 2.

Empirical evaluation results confirm the effectiveness of the system. Black Box testing produced a 100% pass rate across all teacher and administrator scenarios, demonstrating reliable functional performance. Usability assessment yielded an overall System Usability Scale (SUS) score of 89.75, classified as "Best Imaginable," indicating strong user acceptance and ease of use. In addition, LAMMS significantly reduced administrative workload by automating attendance recording and report generation, decreasing SF2 preparation time from 5,400 seconds to 10 seconds (99.81% improvement) and achieving 99.41% reduction in routine clerical effort. These findings establish LAMMS as a practical, accurate, and scalable solution that effectively digitizes attendance processes while restoring instructional time and improving institutional efficiency in basic education settings.

To further enhance the system's impact and sustainability, future improvements may include the integration of automated SMS or email notifications to strengthen parent–school communication and support early intervention for absenteeism, the addition of digital document uploads for excuse letters to improve record transparency and validation, the implementation of backup attendance technologies such as RFID or biometric systems to ensure continuity during technical disruptions, and the expansion of role-based dashboards to provide school heads and supervisors with summarized attendance insights while maintaining data privacy and accountability.

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