

User Requirements Analysis for Developing a Web-Based Intelligent Attendance System in Vocational Schools

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Abstract

The student attendance process is an administrative activity that plays a crucial role in supporting attendance data management and fostering student discipline. However, manual attendance management still presents various challenges, such as relatively time-consuming recording, administrative errors, delays in information delivery, and the lack of integration of attendance data. This study aims to analyze the need for a Web-Based Intelligent Attendance System and to develop system specifications that meet user needs. The study employed a descriptive qualitative approach using observation, semi-structured interviews, and document analysis. The informants were teachers, students, and parents at SMK PK Nurussalam in Tasikmalaya Regency. Data were analyzed using the interactive analysis model of Miles, Huberman, and Saldaña, through the stages of data condensation, data presentation, and conclusion drawing. The results indicate that the manual attendance process results in low administrative efficiency, limited data integration, weak information security, and suboptimal student attendance monitoring. Based on the analysis, 15 functional requirements were identified, including user authentication, digital attendance, time-stamping, automatic recapitulation, attendance dashboard, reports, parent notifications, and centralized data management. Furthermore, fifteen non-functional requirements were identified, including ease of use, data security, response speed, device compatibility, system reliability, and data backup mechanisms. The results of this needs analysis formed the basis for developing the specifications for a Web-Based Intelligent Attendance System, which is expected to support effective, efficient, and secure attendance management, while also orienting toward improving student attendance discipline.

Keywords: Needs Analysis, Web-Based Attendance System, Student Discipline, SDLC, Educational Information System

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INTRODUCTION

The development of information technology has driven digital transformation in various sectors, including education (Javed, 2023; Long et al., 2022; Samala et al., 2023). This transformation focuses not only on the learning process but also on school administration, which demands effectiveness, efficiency, and accountability. One crucial aspect of administration is student attendance management. Attendance data not only serves as proof of attendance but also serves as an indicator for measuring student discipline, evaluating the learning process, and supporting school decision-making (Candrasari et al., 2023; Epifanić et al., 2021). Implementing a web-based attendance system integrated with Quick Response (QR) codes can improve the efficiency of the attendance recording process, accelerate attendance data management (Kuruppu

et al., 2024; Putra, 2023), and increase the accuracy of attendance information, making it easier for teachers and administrators to manage attendance data more effectively.

Despite ongoing digitalization in school administration, attendance management across various educational units still relies heavily on manual methods, such as attendance books or sheets (Chaudhari & Bhornya, 2022; Marnita et al., 2023; Muhith et al., 2023). This situation creates various problems, such as a time-consuming recording process, a high risk of recording errors, difficulty recapitulating data, and delays in delivering attendance information to relevant parties. The manual student attendance process leads to various errors in attendance recording (Fahmi et al., 2024; Sari et al., 2020). To address this issue, a web-based attendance information system is needed to record and summarize attendance data in an integrated manner, making attendance management more effective and efficient.

Similar issues have been identified in various studies on the development of web-based attendance systems in Indonesia. Implementing a web-based student attendance information system using Quick Response (QR) Code technology can improve the efficiency of attendance data management by enabling more practical recording, easier recapitulation, and fewer obstacles commonly encountered in manual attendance systems (Taylor & Frankenberg, 2021). The study also emphasized that the system development process must begin by identifying user needs through observation and interviews to ensure the system aligns with real-world conditions in schools.

In software engineering, requirements analysis is a crucial stage in the success of an information system development (Lenchuk & Mosiuk, 2023; White & Newby, 2024). This stage aims to identify user needs, understand ongoing business processes, and formulate functional and non-functional specifications as the basis for system design. Requirements analysis is the initial stage in system development using the System Development Life Cycle (SDLC) method, which identifies user needs and problems in the existing system as a basis for the system design process (Christanto & Singgalen, 2023; Pargaonkar, 2023). Therefore, a properly conducted needs analysis will produce a system better suited to user needs and better able to support effective problem-solving.

A preliminary study conducted at SMK PK Nurussalam in Tasikmalaya Regency showed that student attendance is still being recorded manually by teachers using attendance books. Observations revealed that teachers record attendance by calling students' names one by one, a relatively time-consuming process. Furthermore, changes in attendance status were observed when students arrived late after the attendance process was completed. Data recapitulation is still conducted separately by each subject teacher. Attendance information is not yet directly communicated to parents. A system capable of automatically integrating attendance data is not yet available. These conditions result in an attendance monitoring process that is suboptimal and may affect student attendance discipline.

Various previous studies have developed web-based attendance systems using various approaches to improve the efficiency, accuracy, and security of attendance recording. A web-based attendance system that integrates dynamic QR codes with location validation via IP-address-based access control (Romlah et al., 2024; von Gerich et al., 2022). The system was developed using Agile Extreme Programming (XP) methods and is equipped with real-time reporting features and security mechanisms to prevent manipulation of attendance data. The developed system improves the efficiency of the attendance process, the accuracy of data recording, and system security compared to manual attendance methods. However, the research focuses more on the design, implementation, and testing aspects of the system after user requirements have been determined (Arar & Nasra, 2020; Ramaboea et al., 2023; Villalobos & Salazar, 2023). Discussion of the

comprehensive user requirements analysis process as a basis for formulating system specifications has not been the main focus, even though requirements analysis is a stage that determines the suitability of the system to user needs and the success of software implementation.

Based on this review, a research gap remains: the limited number of studies that identify user needs by analyzing existing conditions, functional requirements, non-functional requirements, and information needs in the development of a web-based attendance system aimed at improving student attendance discipline. Most research focuses on technology implementation, while the needs analysis process as the foundation of system development has not been discussed in depth. Yet systems developed without a user-centered understanding of users' needs risk failing to provide appropriate solutions to real-world problems.

Therefore, this study aims to analyze the needs for developing a web-based intelligent attendance system at SMK PK Nurussalam, Tasikmalaya Regency. The analysis was conducted by identifying the current attendance process, user issues, and the system's functional and non-functional requirements. The results of the needs analysis are expected to provide a comprehensive foundation for developing an attendance system appropriate to the school's characteristics, supporting effective and efficient attendance management, and contributing to improved student attendance discipline.

RESEARCH METHOD

This research uses a descriptive qualitative approach focused on requirements analysis as the initial stage in developing a Web-Based Intelligent Attendance System. The needs analysis aims to identify the current state of the attendance system, problems faced by users, and the requirements of the system to be developed. This stage is the initial part of the System Development Life Cycle (SDLC), which serves as the basis for designing system specifications that meet user needs. The research was conducted at SMK PK Nurussalam in Tasikmalaya Regency during the even semester of the 2025/2026 academic year. The research location was selected based on the results of a preliminary study, which indicated that the student attendance process was still carried out manually, necessitating a needs analysis before system development. The research subjects were selected using purposive sampling, with informants chosen for their direct involvement in the student attendance process. Informants included the principal, vice principal for curriculum, school administrative staff, subject teachers, homeroom teachers, and 11th-grade students, all serving as system users.

Research data was collected through observation, semi-structured interviews, and documentation studies. Observations were conducted to identify the current attendance process flow, user activities, operational constraints, and potential problems that arise during attendance. Interviews were conducted with informants to explore user needs, expectations for the system to be developed, and issues that could not be resolved by the manual attendance system. Meanwhile, documentation studies were conducted on attendance books, attendance recapitulation formats, and other supporting documents to complement the observations and interviews.

The research instruments included observation guidelines, interview guidelines, and documentation sheets, compiled based on indicators from the information system needs analysis. The observation guidelines were used to identify the existing conditions of the manual attendance process, including attendance procedures, timeliness, data accuracy, process efficiency, attendance monitoring, data integration, information transparency, student attendance discipline, data security, and technology utilization. The interview guidelines were developed to obtain information on functional and non-functional requirements, as well as user expectations for the web-based attendance system.

Data validity was verified using source and technical triangulation techniques. Source triangulation was conducted by comparing information obtained from the principal, teachers, administrative staff, and students, while technical triangulation was conducted by comparing the results of observations, interviews, and documentation. This process aims to enhance the credibility of the needs analysis results, ensuring that the system requirements obtained truly represent field conditions.

Data were analyzed using the interactive analysis model of Miles, Huberman, and Saldaña, which includes data condensation, data display, and conclusion drawing and verification (Miles et al., 2015). The analysis was carried out iteratively from data collection through to the validation of system requirements. The analysis results were then grouped into functional and non-functional requirements as the basis for developing the specifications for the Web-Based Intelligent Attendance System, which will be developed in the next.

FINDINGS AND DISCUSSION

Attendance Activities in Class

Observations were conducted on Wednesday, April 1, 2026, to identify the current state of the student attendance process at SMK PK Nurussalam in Tasikmalaya Regency, as a basis for analyzing the need to develop a Web-Based Intelligent Attendance System. Observations focused on ten aspects: attendance procedures, timeliness, data accuracy, process efficiency, attendance monitoring, data integration, information transparency, student attendance discipline, data security, and technology utilization. Observation results were then confirmed through interviews with teachers, students, and parents to obtain a more comprehensive picture of the system requirements to be developed. The attendance process at SMK PK Nurussalam is still conducted manually, with each teacher using an attendance book brought to class. Teachers take attendance by calling students' names one by one before the start of the lesson and then manually recording their attendance status in the attendance book. This process makes attendance recording entirely dependent on teacher accuracy and takes longer than a digital system.

In terms of punctuality, attendance has not been consistently implemented. Teachers generally wait for all students to enter the classroom before taking attendance, while students still arrive late after the lesson has begun. This reduces learning time and lacks a mechanism to objectively record student arrival times. Furthermore, attendance status changes from "absent" to "present" when students arrive late, indicating that attendance recording is still prone to manual corrections.

From an efficiency perspective, the attendance process is considered suboptimal because teachers must call students' names one by one before starting the lesson. This activity takes up a significant portion of teaching time, reducing the effectiveness of classroom learning. Meanwhile, in terms of data monitoring and integration, each teacher still uses a separate attendance sheet, requiring the homeroom teacher or school administrators to manually recap attendance. This situation results in attendance information not being quickly accessible or updated in real time. Limited transparency of information to parents. Information about student attendance was generally provided only during report card distribution or when parents arrived at school. As a result, parents were unable to directly monitor student attendance and learning discipline. Furthermore, students were still arriving late and receiving only verbal warnings, with no systematic mechanism for recording lateness.

Regarding data security, attendance books were deemed to have a low level of security because attendance data can be changed manually and lack an authentication mechanism or record of data change history. Furthermore, observations indicated that the use of information

technology in the attendance process has not been implemented. Teachers still rely on attendance books as the primary means of recording attendance, while digital devices are used only as an alternative when attendance books are unavailable. This situation indicates that the attendance administration process has not been digitized and cannot support the delivery of fast, accurate, and integrated information. The classroom observation process is presented in Figure 1.



Figure 1. Observation of Attendance Activities in Class

The observation results indicate a gap between the actual conditions and the expected characteristics of the attendance system. Problems found include low process efficiency, data accuracy that remains vulnerable to errors and manipulation, a lack of data integration, delays in delivering information to parents, weak data security, and suboptimal supervision of student attendance and discipline. These findings serve as the basis for formulating system requirements, which are then further deepened through interviews with teachers, students, and parents to obtain more specific user needs before compiling the system's functional and non-functional requirements specifications.

Student Attendance

Interviews were conducted to obtain more in-depth information regarding user needs for the development of a Web-Based Intelligent Attendance System. The research informants consisted of two subject teachers, one student, and one parent. Teachers were selected because they play a direct role in implementing attendance, students are the users of the attendance service, and parents are the recipients of student attendance information. Interview data were used to confirm observational findings and identify user needs for the system to be developed.

Teacher Perspective

Interviews with teachers indicated that the manual attendance process presents various challenges in implementing learning administration. Teachers explained that recording attendance using attendance books is relatively time-consuming because they must call each student's name one by one before the lesson begins. Furthermore, teachers revealed that the recording process relies heavily on accuracy, which can lead to errors, data loss, and delays in summarizing student attendance. Teachers also stated that attendance data has been used as an indicator to monitor student discipline. However, because recapitulation is still done manually, identifying students who are frequently late, frequently request permission, or are absent without explanation can only be done after some time.

Regarding system development, teachers are hoping for a web-based attendance system that can expedite attendance recording, automatically generate recapitulations, provide attendance reports and graphs, display data in real time, and send notifications to parents when

students are late or absent. Teachers also emphasized the importance of a smartphone-based system that supports learning activities without increasing the administrative burden.

Student Perspective

Interviews with students indicated that the manual attendance process was relatively easy to understand but time-consuming because teachers had to call each student's name individually. Students also admitted to experiencing errors in attendance recording, requiring teachers to manually correct the data. Furthermore, they believed that the manual attendance system still allowed for delays and the practice of "don't-take-no-attendance" due to suboptimal oversight. Students stated that they were accustomed to using applications and web-based systems, so they encountered no difficulties with digital attendance. According to students, a web-based attendance system could speed up the recording process, automatically record attendance times, and increase the transparency of attendance data. Students also hoped for a personal attendance history feature and notifications to parents when there were latenesses or absences. According to students, these notifications would encourage greater discipline because parents could directly monitor attendance.

Parent Perspective

Interviews with parents indicated that student attendance information was generally obtained from their children or homeroom teachers, and that it often arrived after some time. Parents reported experiencing delays in receiving information when their children were absent or late because the manual attendance system was not yet able to provide immediate information. This situation prevents parents from immediately supervising and guiding their children. Parents have welcomed the plan to develop a web-based attendance system. The expected information includes students' attendance status, arrival times, tardiness, and notifications of absences. Furthermore, parents prefer a smartphone-accessible platform, as it is considered more practical and easier to use in daily activities. According to parents, providing real-time attendance information will strengthen collaboration between schools and families to monitor and foster discipline in student attendance.

Synthesis of Interview Results

The interview results indicated a shared perception among teachers, students, and parents regarding the need for a digital attendance system. Teachers needed a system that could reduce administrative burdens through automated recording and recapitulation; students desired a system that was fast, transparent, and easy to use; and parents needed access to real-time attendance information to improve supervision of their children. These findings indicated that the system to be developed would not only function as a medium for recording attendance but also as a means of communication between the school and parents and as a supporting instrument for improving student attendance discipline. These interview results then served as the basis for developing the functional and non-functional requirements for the Web-Based Smart Attendance System.

Functional Requirements Analysis Results

The functional requirements analysis was conducted through observations and interviews with teachers, students, and parents, who were potential system users. This phase aimed to identify the key functions required for the Web-Based Intelligent Attendance System to address issues encountered in the manual attendance system. Based on the analysis, the functional requirements focused on automating the attendance process, integrating data management,

providing real-time information, and improving the effectiveness of monitoring student attendance and discipline.

Observations indicated that the attendance process was still carried out manually using attendance books, which was relatively time-consuming, prone to recording errors, and complicating data recapitulation. These findings were reinforced by interviews with teachers, who stated that the attendance administration process remained time-consuming, especially when recapitulating attendance at the end of the week or month. Teachers also desired a system capable of digitally recording attendance, generating automatic recapitulations, displaying attendance reports, and providing real-time access to information.

From the students' perspective, the developed system is expected to have a simple, easy-to-use interface and be able to display attendance history independently. Students also expect the system to automatically record attendance, making the attendance process more transparent and minimizing the practice of being late or asking for someone else's attendance. Furthermore, students support a notification feature for parents to monitor school attendance. Meanwhile, interviews with parents indicated that the primary need is for easy, accurate access to information about their children's attendance. Parents expect the system to provide notifications when students are present, late, or absent from school, enabling more effective monitoring of their children's learning activities. This information is expected to be accessible via smartphones, as this is considered more practical for everyday use.

Based on the synthesis of observations and interviews, fifteen functional requirements were identified as the foundation for specifying the Web-Based Intelligent Attendance System. These requirements reflect not only the operational needs of users but also the critical limitations of the existing manual attendance process, particularly in data recording, information accessibility, attendance monitoring, and administrative efficiency. Prioritizing these functional requirements ensures that system development addresses the most essential user needs while supporting a user-centered design approach. Furthermore, the prioritization provides a structured roadmap for implementation, enabling core functionalities to be developed first before incorporating complementary features that enhance system usability and long-term sustainability.

Table 1. Functional Requirements Analysis of a Web-Based Intelligent Attendance System

No	Functional Requirements	Priority
1	The system provides role-based login.	Very High
2	Teachers can digitally record student attendance.	Very High
3	The system automatically records attendance timestamps.	Very High
4	The system differentiates between present, late, permitted, and absent statuses.	Very High
5	Attendance data is automatically stored in a centralized database.	Very High
6	Admins can manage user data.	High
7	The system provides attendance summaries.	Very High
8	The system displays a real-time attendance dashboard.	Very High
9	Parents can access student attendance information.	High
10	The system provides downloadable attendance reports.	Very High
11	The system stores student attendance history.	Very High
12	The system supports searching and filtering of attendance data.	Very High
13	The system sends attendance notifications to parents.	Very High
14	Teachers can make data corrections with authorization.	Very High
15	The system records user activity (activity log).	High

Table 1 show that most functional requirements are categorized as very high. This indicates that users prioritize functions that can improve the efficiency of the attendance process, expedite information delivery, and strengthen monitoring of student attendance. Furthermore,

requirements such as user data management, parental access, and *activity logs* are categorized as high priorities because they support system operations and enhance data management security.

These findings indicate that user needs are not solely focused on digitizing the attendance recording process but also on providing a system that integrates all attendance administration processes into a single platform. Therefore, the resulting functional requirements serve as the basis for developing system specifications during the design stage, ensuring that the developed solution truly meets the needs of users at SMK PK Nurussalam, Tasikmalaya Regency.

Discussion

The research results show that the needs analysis process is a crucial stage in developing a Web-Based Intelligent Attendance System. Observation and interview findings indicate that the main problems with the attendance system at SMK PK Nurussalam are caused not only by the use of manual recording media but also by a lack of integration in the attendance information management process. This condition results in low administrative efficiency, delays in information delivery, and suboptimal monitoring of student attendance discipline. These findings support Amedi (2019) view that needs analysis is the primary foundation of software development, as all system specifications must be derived from actual user needs rather than solely from developer assumptions.

Observations show that teachers still record attendance manually, while interviews indicate that they need a system capable of automating attendance, generating automatic recapitulations, and providing real-time attendance information. This situation indicates that the primary user need is not only the digitization of attendance media, but also the transformation of administrative processes to be more effective and efficient. These findings align with research by Wang (2021), who stated that implementing a web-based attendance system can improve administrative efficiency, accelerate attendance data management, and facilitate the monitoring process by schools.

The student perspective provided different but complementary findings. Students not only expect a faster attendance process but also a system that is easy to use, transparent, and capable of displaying attendance history independently. This indicates that usability is a crucial factor in system acceptance (user acceptance). This finding supports research by Puspita et al. (2024), which explains that the successful implementation of a web-based attendance system is influenced by ease of use, a clear interface, and the system's ability to provide information that is easy for users to understand. From a parent's perspective, this study found that the need for real-time attendance information was a dominant aspect. Parents desired automatic notifications when students were present, late, or absent from school so that they could monitor their children's learning activities more quickly. These findings demonstrate that the attendance system is no longer viewed solely as a school administration tool, but also as a means of communication between the school and families. These results expand on the findings of Xia (2021), who emphasized the importance of technology integration in enhancing the effectiveness of attendance monitoring by adding parental involvement to the student discipline monitoring process.

Based on the synthesis of observations and interviews, this study generated fifteen functional and fifteen non-functional requirements as the basis for developing specifications for a Web-Based Intelligent Attendance System. Functional requirements focused on administrative process automation, centralized data management, report presentation, and real-time attendance information delivery. Meanwhile, non-functional requirements focused on software quality, including ease of use, data security, access speed, device compatibility, and system reliability. The combination of these two groups of requirements demonstrates that information system

development depends not only on feature completeness but also on the quality of service perceived by users.

The primary contribution of this study lies in the comprehensive needs-identification process involving three user groups: teachers, students, and parents. Most previous research on web-based attendance systems has focused on technology implementation or software testing after the system has been developed. In contrast, this study places primary focus on needs analysis, ensuring that the resulting system specifications are derived directly from the actual conditions and user needs in the school environment. This approach is expected to produce a system with a higher level of fit with user needs and increase the chances of successful implementation in subsequent development stages.

The implications of this research indicate that the needs analysis results can serve as a reference for compiling software specifications (Software Requirements Specification/SRS) during the system design stage. Furthermore, the identified functional and non-functional requirements can serve as a reference for educational information system developers in designing an attendance system that is not only oriented towards recording attendance but also supports monitoring student discipline by providing accurate, fast, secure, and integrated information.

CONCLUSION

A comprehensive needs analysis is a fundamental step in developing a Web-Based Intelligent Attendance System that effectively addresses the real challenges faced by SMK PK Nurussalam. By integrating findings from observations and interviews with teachers, students, and parents, the study identified fifteen functional and fifteen non-functional requirements that reflect users' actual expectations for efficient attendance management, real-time information access, usability, security, reliability, and integrated communication. The results demonstrate that the proposed system should function not only as a tool for digitizing attendance records but also as a comprehensive platform for improving administrative efficiency, strengthening student discipline monitoring, and enhancing collaboration between schools and families. Therefore, the identified requirements provide a solid foundation for preparing the Software Requirements Specification (SRS) and guiding the subsequent design and development of a user-centered, reliable, and effective web-based attendance system.

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