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Requirements Analysis and Initial Use Case Design of a Web-Based Student Data Management Information System at SMP Negeri 37 Bandung

Annisa Nur Rohmah[1*], Muhammad Khali Fauzy[2], Micky Ardian Ananta[3], Darmawan Yudhanegara[4]

[1234]Digitech University, Bandung, Indonesia

*Correspondent email: ichacha170602@gmail.com

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Abstract. Student data management is an essential component of school administration because it supports identity recording, administrative reporting, and information retrieval for institutional decision-making. However, in many schools, student data are still managed manually or using simple spreadsheet-based applications, which may cause data duplication, input errors, slow data retrieval, and inefficiency in report preparation. This study aims to analyze the requirements and develop an initial use case design for a web-based student data management information system at SMP Negeri 37 Bandung. The study employed a descriptive qualitative approach focusing on the early stage of the information system development cycle, namely requirement analysis. Data were collected through observation, interviews with school administrative staff, and literature study. The collected data were analyzed descriptively to identify the current condition of student data management, functional requirements, non-functional requirements, user roles, and initial data structure. The results show that the proposed system should provide several main functions, including adding student data, editing student data, deleting student data, displaying student data, searching student data, and printing student data reports. The system also needs to fulfill non-functional requirements related to accessibility, security, usability, and reliability. The proposed use case design identifies administrative staff as the main actor responsible for managing student data through the system. This study contributes an initial requirement analysis and use case design that can serve as a foundation for further system design, database development, interface design, implementation, and testing.

Keywords: student data management; requirement analysis; web-based information system; use case design; school administration; SMP Negeri 37 Bandung

Abstrak. Pengelolaan data siswa merupakan komponen penting dalam administrasi sekolah karena mendukung pencatatan identitas, penyusunan laporan administrasi, dan pencarian informasi untuk pengambilan keputusan kelembagaan. Namun, pada banyak sekolah, data siswa masih dikelola secara manual atau menggunakan aplikasi sederhana berbasis spreadsheet, sehingga berpotensi menimbulkan duplikasi data, kesalahan input, lambatnya pencarian data, dan ketidakefisienan dalam penyusunan laporan. Penelitian ini bertujuan untuk menganalisis kebutuhan dan menyusun rancangan awal use case sistem informasi manajemen data siswa berbasis web di SMP Negeri 37 Bandung. Penelitian ini menggunakan pendekatan deskriptif kualitatif yang berfokus pada tahap awal

siklus pengembangan sistem informasi, yaitu analisis kebutuhan. Data dikumpulkan melalui observasi, wawancara dengan staf administrasi sekolah, dan studi literatur. Data yang diperoleh dianalisis secara deskriptif untuk mengidentifikasi kondisi pengelolaan data siswa saat ini, kebutuhan fungsional, kebutuhan non-fungsional, peran pengguna, dan struktur data awal. Hasil penelitian menunjukkan bahwa sistem yang diusulkan perlu menyediakan beberapa fungsi utama, yaitu menambahkan data siswa, mengedit data siswa, menghapus data siswa, menampilkan data siswa, mencari data siswa, dan mencetak laporan data siswa. Sistem juga perlu memenuhi kebutuhan non-fungsional yang berkaitan dengan aksesibilitas, keamanan, kemudahan penggunaan, dan keandalan. Rancangan use case yang diusulkan mengidentifikasi staf administrasi sebagai aktor utama yang bertanggung jawab dalam pengelolaan data siswa melalui sistem. Penelitian ini memberikan kontribusi berupa analisis kebutuhan dan rancangan awal use case yang dapat menjadi dasar bagi tahap perancangan sistem, pengembangan basis data, desain antarmuka, implementasi, dan pengujian lebih lanjut.
Kata Kunci: manajemen data siswa; analisis kebutuhan; sistem informasi berbasis web; rancangan use case; administrasi sekolah; SMP Negeri 37 Bandung

1. Pendahuluan

The rapid development of information technology has encouraged educational institutions to adopt digital systems to support administrative, academic, and managerial activities. Schools are required not only to provide learning services, but also to manage administrative data accurately, efficiently, and systematically. Student data are among the most important administrative assets in schools because they contain information related to student identity, class placement, addresses, parent or guardian information, and other records needed for reporting and decision-making. In this context, an information system functions as a mechanism for collecting, processing, storing, and presenting data so that it can support organizational activities and improve administrative efficiency (Laudon & Laudon, 2020; Stair & Reynolds, 2018; Sutabri, 2016).

Student data management plays an important role in school administration because the accuracy and availability of student records influence various administrative processes. These processes include student registration, data reporting, school documentation, preparation of administrative reports, and internal decision-making. When student data are not managed properly, schools may experience difficulties in retrieving information, maintaining data consistency, updating records, and generating reports in a timely manner. Manual data management or spreadsheet-based recording may still be useful for simple administrative tasks, but it has limitations when the number of records increases and when data need to be updated, searched, and reported repeatedly (Connolly & Begg, 2015; Hutahaean, 2015; Whitten & Bentley, 2007).

At SMP Negeri 37 Bandung, the student data management process is still carried out manually or using simple applications such as spreadsheets. This condition creates several problems in daily administrative activities. First, data retrieval takes a relatively long time because student records may be stored in separate files or documents. Second, the risk of data entry errors increases because similar information may be entered repeatedly into different documents. Third, report generation becomes inefficient because student data must be manually compiled and formatted before it can be used. Fourth, the absence of a centralized system makes it difficult for administrative staff to access data quickly and accurately. These problems indicate that the current student data management process requires improvement through a more structured and integrated information system.

A web-based information system offers a practical solution because it enables centralized data management and browser-based access. Web-based systems can improve accessibility, reduce dependence on local files, support structured data storage, and accelerate information retrieval. In the context of school administration, a web-based student data management information system can assist administrative staff in adding, editing, deleting, searching, displaying, and printing student data reports through a single integrated platform. Previous studies have also shown that web-based academic and administrative information systems can improve data management effectiveness, accelerate information retrieval, and support more efficient school administration (Aprianti & Nugraha, 2021; Hashim et al., 2020; Putri Winahyu & Janti, 2017; Wibawa & Saputra, 2020).

However, before a web-based information system is developed, a clear requirement analysis is required. Requirement analysis is an important stage in the software development process because it identifies what the users need, what problems must be solved, and what functions the system must provide. A system that is developed without adequate requirement analysis may fail to address actual user needs, even if it is technically functional. Therefore, requirement analysis helps ensure that the system design is aligned with organizational conditions, user expectations, and operational workflows (ISO/IEC/IEEE, 2018; Pressman & Maxim, 2020; Sommerville, 2016).

In system development, requirement analysis includes the identification of functional and non-functional requirements. Functional requirements describe the services or functions that the system must provide, such as adding data, editing data,

deleting data, searching data, and generating reports. Non-functional requirements describe quality attributes or constraints, such as accessibility, security, usability, reliability, and maintainability. In software engineering, both types of requirements are necessary because system success depends not only on the availability of features, but also on the quality and suitability of the system for its users (ISO/IEC/IEEE, 2018; Pressman & Maxim, 2020; Sommerville, 2016).

System modeling is also needed to represent requirements in a more structured form. Unified Modeling Language (UML) is commonly used to visualize system requirements, actors, processes, and interactions. One UML model that is widely used during the early analysis stage is the use case diagram. A use case diagram describes the interaction between actors and the system, making it easier for developers and stakeholders to understand what functions the system should provide (Ladjamudin, 2013; Lauw, 2022; Whitten & Bentley, 2007). In this study, the use case design is used to represent the interaction between school administrative staff and the proposed web-based student data management information system.

Several previous studies support the relevance of developing web-based information systems for educational institutions. Aprianti and Nugraha (2021) showed that web-based academic information systems can support more effective academic data management. Hashim et al. (2020) developed a web-based student information system for higher education and emphasized the importance of digital platforms in managing student information. Putri Winahyu and Janti (2017) discussed a web-based school academic information system for junior high school, while Wibawa and Saputra (2020) examined a web-based student data management information system at the junior high school level. These studies indicate that web-based systems are relevant for improving data management in educational settings.

Although previous studies have discussed the development of school information systems, each institution may have different administrative needs, workflows, and technical conditions. Therefore, system requirement analysis must be conducted based on the specific context of the institution. In the case of SMP Negeri 37 Bandung, the main need is not yet a full academic information system covering grades, attendance, tuition, or learning management, but a more focused system for managing student data. This study therefore focuses on the requirement analysis and initial use case design of a web-based student data management information system.

Based on the problems described above, this study aims to identify the functional and non-functional requirements of a web-based student data management information system at SMP Negeri 37 Bandung and to develop an initial use case design as a reference for the next development stage. The contribution of this study lies in providing a structured requirement analysis that can guide future technical design, database design, user interface design, implementation, and system testing. By conducting requirement analysis before implementation, the proposed system is expected to be more aligned with actual administrative needs in the school.

2. Method

This study used a descriptive qualitative approach focusing on the system requirement analysis stage. This approach was selected because the purpose of the study was to describe the current condition of student data management, identify user needs, and develop an initial use case design for the proposed web-based information system. The study did not focus on measuring system performance or testing a completed application, but rather on analyzing requirements as the foundation for future system development. In software engineering, requirement analysis is an essential early stage that determines whether a system design corresponds to actual user needs (ISO/IEC/IEEE, 2018; Pressman & Maxim, 2020; Sommerville, 2016).

The research was conducted at SMP Negeri 37 Bandung, located in Bandung City, West Java, Indonesia. The object of the study was the student data management process used by the school administration. The analysis focused on how student data were recorded, stored, searched, updated, and used for reporting. The respondents involved in this study were administrative staff who were responsible for managing student data. The selection of administrative staff as key informants was appropriate because they were directly involved in the daily student data management process.

Data were collected through observation, interviews, and literature study. Observation was conducted by directly examining the current student data management process at the school. This technique was used to identify how student data were handled, what tools were used, what difficulties occurred, and what activities required system support. Interviews were conducted with administrative staff to explore their needs, expectations, and problems related to student data management. Literature study was conducted by reviewing books, journal articles, and other

references related to information systems, student data management, web-based systems, requirement analysis, UML modeling, and school administration. The combination of these data collection techniques helped provide a more complete understanding of the system requirements (Ladjamudin, 2013; Pressman & Maxim, 2020; Whitten & Bentley, 2007).

The data obtained from observation and interviews were analyzed using descriptive analysis. The analysis was conducted by identifying the main problems in the existing student data management process, classifying user needs into functional and non-functional requirements, identifying the main system user, and preparing the initial use case design. Functional requirements were determined based on the activities that administrative staff need to perform in managing student data. Non-functional requirements were identified based on quality aspects that the system needs to fulfill, including accessibility, security, usability, and reliability. These requirements were then used as the basis for the initial use case design.

The system modeling stage used an object-oriented approach through use case design. Use case modeling was used to describe the interaction between the main actor and the proposed system. The main actor identified in this study was the school administrative staff. The use cases included adding student data, editing student data, deleting student data, displaying student data, searching student data, and printing student data reports. This use case design provides an initial representation of the system functions that should be developed in the next technical stage. UML-based modeling is useful because it helps communicate system requirements clearly between users, analysts, and developers (Ladjamudin, 2013; Lauw, 2022; Whitten & Bentley, 2007).

The output of this study consists of four main components: description of the current student data management condition, functional requirement analysis, non-functional requirement analysis, and initial use case design. In addition, this study also proposes an initial data structure required to support the future development of the system. The proposed data structure includes student identification number, full name, gender, place and date of birth, address, class, parent or guardian name, and contact number. These attributes were identified as minimum data elements required for student administrative records.

3. Results and Discussion

3.1 Current Condition of Student Data Management

The results of observation and interviews showed that student data management at SMP Negeri 37 Bandung is still carried out manually and using a simple spreadsheet application. This condition indicates that the existing data management process is not yet fully integrated into a centralized information system. Although spreadsheet applications can support basic recording activities, they have limitations when used for repeated data processing, searching, updating, and reporting. This is consistent with the view that information systems are needed to improve data processing efficiency and support organizational activities (Laudon & Laudon, 2020; Stair & Reynolds, 2018; Sutabri, 2016).

Several problems were identified in the current process. First, retrieving student data takes a relatively long time because the data are stored in separate files. Second, the risk of data entry errors is high because the recording process may be repeated across different documents. Third, the process of generating student data reports is inefficient because reports must be manually compiled and formatted. Fourth, the absence of a centralized system makes it difficult for authorized users to access accurate and up-to-date data quickly. These problems show that manual and spreadsheet-based data management are not sufficient to support efficient school administration.

The findings confirm that SMP Negeri 37 Bandung requires a web-based student data management information system that can centralize data storage and simplify administrative processes. A centralized database can help reduce scattered data storage, support more consistent records, and improve information retrieval. Database-based systems are more appropriate for structured data management because they allow data to be stored, accessed, updated, and reported systematically (Connolly & Begg, 2015; Hutahaean, 2015).

3.2 Functional Requirement Analysis

Functional requirements describe the main services that the proposed system must provide. Based on observation and interviews with administrative staff, the proposed system needs to support six main functions: adding student data, editing student data, deleting student data, displaying student data, searching student data, and

printing student data reports. These functions reflect the daily administrative tasks required in student data management.

Table 1. Functional Requirements of the Proposed System

Functional Requirement	Description
Add student data	The system allows administrative staff to enter new student records.
Edit student data	The system allows administrative staff to update existing student records.
Delete student data	The system allows administrative staff to delete unnecessary or incorrect records.
Display student data	The system displays all student records stored in the database.
Search student data	The system allows users to search student data based on name, student ID, or class.
Print student data reports	The system generates student data reports in printable format.

The functional requirements indicate that the system is designed to solve practical administrative problems. The add, edit, and delete functions support data maintenance. The display and search functions support faster data retrieval. The print report function supports administrative reporting. These functions are important because information systems should be designed based on actual user tasks and organizational needs (ISO/IEC/IEEE, 2018; Pressman & Maxim, 2020; Sommerville, 2016).

3.3 Non-Functional Requirement Analysis

In addition to functional requirements, the proposed system must also fulfill several non-functional requirements. Non-functional requirements are important because they determine the quality of system use, not only the availability of features. Based on the analysis, the main non-functional requirements are accessibility, security, usability, and reliability.

Table 2. Non-Functional Requirements of the Proposed System

Aspect	Requirement
Accessibility	The system can be accessed through the internet or local network

	using a standard web browser.
Security	The system requires a login mechanism so that only authorized administrative staff can access student data.
Usability	The system interface should be simple and easy to use by administrative staff without special training.
Reliability	The system should be able to store data consistently and in a structured manner within the database.

Accessibility is required because a web-based system should allow authorized users to access the application through a browser. Security is important because student data are administrative records that should only be accessed by authorized users. Usability is needed because the main users are administrative staff who require a simple and practical interface. Reliability is required to ensure that data are stored consistently and can be retrieved when needed. These quality aspects are consistent with software engineering principles, where system quality is evaluated not only by function, but also by usability, reliability, security, and maintainability (ISO/IEC/IEEE, 2018; Pressman & Maxim, 2020; Sommerville, 2016).

3.4 User Identification and Use Case Design

The main user identified in the proposed system is the school administrative staff. Administrative staff are responsible for entering new student data, updating existing data, deleting incorrect or unnecessary data, viewing student data, searching for specific records, and printing student data reports. Therefore, administrative staff act as the main actor in the use case design.

Table 3. Use Case Design of the Proposed System

Use Case	Actor	Description
Add Student Data	Administrative staff	The user enters new student data into the system.
Edit Student Data	Administrative staff	The user updates existing student data.
Delete Student Data	Administrative staff	The user deletes student data that are no longer required or incorrect.
Display	Administrat	The system displays all stored student

Student Data	ive staff	data.
Search Student Data	Administrative staff	The user searches for specific student data based on keywords.
Print Student Data Report	Administrative staff	The system generates a printable student data report.

The use case design shows the interaction between administrative staff and the proposed system. This design is important because it provides a clear description of system boundaries and user activities. Use case modeling also helps developers understand the core functions that must be developed in the next stage. The use of UML in system analysis and design can improve communication between system analysts, developers, and users because it provides a visual representation of system functionality (Ladjamudin, 2013; Lauw, 2022; Whitten & Bentley, 2007).

3.5 Initial Data Structure Design

To support the proposed system functions, the student data structure must include several basic attributes. The minimum data attributes required include Student Identification Number, full name, gender, place and date of birth, address, class, parent or guardian name, and contact number. These attributes were selected because they represent essential student administrative information required by the school.

Table 4. Initial Student Data Structure

Attribute	Description
Student Identification Number	Unique student identity number used as the main student identifier.
Full Name	Complete name of the student.
Gender	Student gender information.
Place and Date of Birth	Student birth information.
Address	Student residential address.
Class	Student class information.
Parent/Guardian Name	Name of parent or guardian.
Contact Number	Contact number of parent, guardian, or student family.

The proposed data structure can serve as the initial reference for database design. A structured database is important because it supports efficient storage, retrieval, updating, and reporting. Proper database design also helps reduce data redundancy and improves consistency in managing administrative records (Connolly & Begg, 2015; Hutahaean, 2015).

3.6 Discussion

The results of this study indicate that the student data management process at SMP Negeri 37 Bandung requires improvement through a web-based information system. The current manual and spreadsheet-based process creates several administrative problems, especially in data retrieval, data accuracy, and report preparation. These findings are consistent with previous studies showing that web-based information systems can improve data management effectiveness in educational institutions (Aprianti & Nugraha, 2021; Hashim et al., 2020; Putri Winahyu & Janti, 2017; Wibawa & Saputra, 2020).

The functional requirement analysis shows that the proposed system needs to provide essential data management functions. These include adding, editing, deleting, displaying, searching, and printing student data. These functions are directly related to the administrative needs of the school. The availability of these functions is expected to reduce manual workload, accelerate data retrieval, and support more organized report preparation. Similar studies have also shown that web-based school information systems can support administrative efficiency by providing centralized access to academic and student data (Ikhwan et al., 2025; Sasmito, 2017; Susanto & Andriana, 2016).

The non-functional requirements also show that the system should not only provide basic functions, but also meet quality aspects such as accessibility, security, usability, and reliability. These aspects are important because a system that is difficult to access, insecure, or difficult to use may not be effective even if its functions are complete. Security is particularly important because student data contain personal information that should be protected from unauthorized access. Therefore, the proposed login mechanism is necessary as an initial security feature.

The use case design developed in this study provides an early model for the system development stage. It identifies administrative staff as the main actor and

describes the main interactions between users and the system. This design can be used as a reference for developing more detailed UML diagrams, database design, interface design, and program implementation. Therefore, this study provides a foundation for subsequent development rather than a final implemented system.

Overall, the requirement analysis and initial use case design show that the proposed web-based student data management information system is relevant to the needs of SMP Negeri 37 Bandung. The system is expected to improve administrative data management by centralizing student records, simplifying data processing, reducing input errors, and supporting faster report generation. However, because this study focuses only on the requirement analysis stage, further research is needed to continue the process into technical design, implementation, black-box testing, usability testing, and system evaluation.

4. Conclusion

Student data management at SMP Negeri 37 Bandung is still carried out manually and using simple spreadsheet applications. This condition creates several problems, including difficulty in retrieving student data, the risk of data input errors, data duplication, inefficient report generation, and the absence of a centralized data management system. These problems indicate the need for a web-based student data management information system that can support more structured, accurate, and efficient administrative processes.

The results of the requirement analysis show that the proposed system must provide several main functional requirements, including adding student data, editing student data, deleting student data, displaying student data, searching student data, and printing student data reports. In addition, the system must fulfill non-functional requirements related to accessibility, security, usability, and reliability. The study also identifies administrative staff as the main system user and proposes an initial use case design that describes the interaction between the user and the system.

This study concludes that requirement analysis is an important foundation for the development of a web-based student data management information system at SMP Negeri 37 Bandung. The initial use case design produced in this study can serve as a reference for further technical system development. Future research is recommended to continue this study into detailed database design, user interface design, system

implementation, black-box testing, usability testing, and security evaluation so that the proposed system can be implemented and used effectively in actual school administration.

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