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Academic Monitoring Information System Using Task Centered System Design Method Based On Web

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Abstract

Manual academic monitoring systems at SMA Swasta Teladan Cinta Damai present several challenges, such as delayed information delivery, data entry errors, and lack of transparency in academic records. This study aims to design and develop a web-based Academic Monitoring Information System using the Task Centered System Design (TCSD) approach, which focuses on the actual needs and tasks of users such as teachers, students, and parents. The system was developed using PHP as the programming language and MySQL as the database, following the Waterfall development model, which includes requirements analysis, system design, implementation, and testing stages. The final stage of this study involved system evaluation through functional testing using the Black-Box Testing method with 40 respondents, consisting of administrators, teachers, homeroom teachers, and students. A total of 25 test scenarios were successfully executed with a 100% success rate, indicating that all system functionalities operated properly, were easy to understand, and met user expectations. The results demonstrate that the system can present academic information in real time, improve monitoring efficiency, and facilitate access to information for all stakeholders. With its intuitive interface and task-oriented features, the system provides a digital solution that is effective, efficient, and feasible to enhance the quality of academic management in the school environment.

Keywords: Academic Monitoring, Task Centered System Design, Web-Based Information Systems

1. Introduction

The development of information technology has brought significant transformation across various sectors, including education. One innovation that has been increasingly adopted is the web-based academic monitoring information system[1][2][3]. This system is considered effective in enhancing efficiency, transparency, and speed in managing student academic data[4]. However, its implementation remains uneven, particularly in schools with limited infrastructure and human resources lacking technological proficiency.

State that although over 70% of schools in Indonesia have initiated the implementation of digital information systems, many continue to encounter significant challenges in maximizing their utilization. The primary obstacles include insufficient training for educators, limited internet connectivity, and inadequate funding for the development of comprehensive information systems[5].

Teladan Cinta Damai Private Senior High School, located in Medan Helvetia District, Medan City, currently still employs a manual method for recording and monitoring academic data such as grades, attendance, class schedules, and announcements. This manual approach often leads to delays in information dissemination, lack of transparency, and a high risk of recording errors[6]. The institution's readiness to transition to a web-based system is further hindered by the limited technological proficiency among teachers and staff.

Several previous studies have indeed examined the implementation of web-based academic information systems. However, most of these studies have primarily focused on technical aspects such as system design and features, without taking into account user readiness or the actual conditions within schools. Therefore, a user-oriented approach is needed to ensure that the system truly addresses their needs.

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This study proposes the implementation of the Task-Centered System Design (TCSD) method, a system design approach that focuses on the core tasks performed by users. Through this approach, the system is developed based on real-world activities frequently carried out by teachers, students, and parents, such as checking grades, attendance, class schedules, and announcements[7]. The expected outcome is a web-based academic monitoring information system that is intuitive, efficient, and user-friendly, as well as capable of enhancing transparency and accuracy in the management of academic data at Teladan Cinta Damai Private Senior High School.

Therefore, this study was conducted to design and implement a web-based Academic Monitoring Information System using the Task-Centered System Design (TCSD) method, as an innovative solution to support the effectiveness of academic monitoring and address the specific needs of users within the school environment.

2. Research Methods

2.1 Research Approach

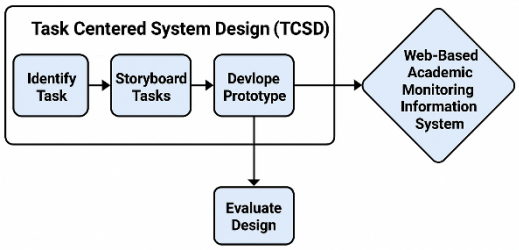
This study employs a descriptive qualitative approach to gain an in-depth understanding of the conditions and needs of users in academic monitoring activities at Teladan Cinta Damai Private Senior High School. Data were collected through interviews, direct observation, and literature review to explore the challenges and user preferences regarding the currently manual academic monitoring system.

The research subjects include school administrators, teachers, students, and parents, selected due to their direct involvement in the management and utilization of academic data. Semi-structured interviews were conducted to identify obstacles and expectations regarding a digital system, while observations aimed to capture the actual operational processes, such as recording grades, attendance, and announcements. The literature review supports the theoretical and methodological framework, particularly in relation to user-centered system design using the Task-Centered System Design (TCSD) approach[8].

Data were analyzed through three stages: data reduction, data presentation, and conclusion drawing. This process aims to filter relevant information, systematically present user needs patterns, and formulate a web-based system design that aligns with the real conditions in the field[7].

2.2 System Development Method

For system development, this study applies the Task-Centered System Design (TCSD) method, which focuses on the primary tasks performed by users to ensure the system development aligns with real needs in the field[8]. The method consists of four main stages: task identification, task storyboarding, system development, and system evaluation[9].



Gambar 1. Tahapan TCSD

3. Results and Discussion

The Academic Monitoring Information System in this study is designed using the Task-Centered System Design (TCSD) approach, which focuses on the real tasks of users. This method ensures that the system features align with the needs of the primary users, namely administrators, teachers, students, and parents. Each user has different access rights and functions, such as managing academic data, monitoring attendance, viewing grades, and receiving announcement information. The system is developed using PHP programming language and MySQL database, with an intuitive and user-friendly interface design. This approach aims to replace the manual academic monitoring method, which is considered inefficient and prone to errors[10]. By implementing a task-based and structured system, the application not only improves the accuracy and efficiency of academic data management but also provides convenience for all parties involved in the education process.

The development of a web-based academic monitoring information system following the TCSD method must be integrated with essential elements such as needs analysis, testing strategies, and the selection of appropriate technologies to achieve optimal results[9].

3.1. *Identify Task*

This stage aims to identify the primary tasks frequently performed by system users, such as administrators, teachers, homeroom teachers, and students. These tasks include checking academic grades, recording and verifying attendance, viewing class schedules, as well as delivering and reading academic announcements. To support this stage, student data were collected at Teladan Cinta Damai Private Senior High School, including important information such as student identification number (NIS), national student identification number

(NISN), full name, gender (M/F), and religion. The collected data comprised 20 students, consisting of 10 male and 10 female students. This information serves as a crucial foundation in system development because it enables the system to accurately store and display student identity data, thereby facilitating the monitoring process of grades, attendance, and other academic information according to user needs.

Tabel 1. Pengumpulan Data

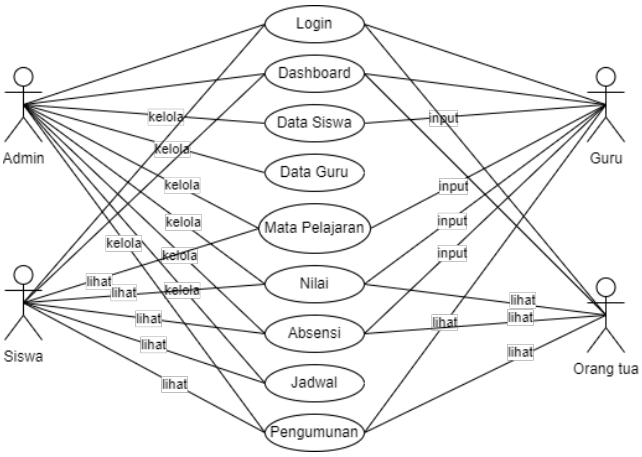
No.	NOMOR INDUK SISWA		NAMA	L/P	AGAMA
	NIS	NISN			
1	4744		Aurelia Laurensia	P	
2	4745		Apriansyah	L	
3	4746		Bela Rospita Hutauruk	P	
4	4747		Christivan Bilmero Sipayung	L	
..	…	…	…	..	….
20	4764		Winsen Fransisco Japaris	L	

3.2. *Storyboard Task*

This stage involves creating storyboards that depict the workflow of users, such as teachers checking attendance or students viewing schedules[11]. To support this visualization, use case diagrams and activity diagrams are employed to illustrate interactions and process flows in detail[12]. This design process helps ensure that the system aligns with the needs and habits of the users.

A. Use Case Diagram

In the context of an academic monitoring information system, the use case diagram serves to illustrate the interactions between various actors—including administrators, teachers, students, and parents—and the system's core functionalities[13][14][15]. The significance of this diagram lies in ensuring that all stakeholders have clear and structured access to academic data, including grade monitoring, attendance records, schedules, and announcements. A well-implemented academic information system can enhance the effectiveness of academic data management within the school environment.



Gambar 2. Usecase Diagram[16][17]

Each actor can utilize specific features to support the efficient and integrated management and monitoring of acad`emic data. The following is an explanation of each use case involved in the system:

1.Login / Logout

All actors (administrators, teachers, students, and parents) must first log in to the system to access its features according to their respective access rights.

2.Dashboard

After logging in, users are directed to the main dashboard, which contains a summary and navigation to features tailored to their respective roles.

3. Student Data

Administrator: Manages student data (add/edit/delete).

Teacher: Inputs student data.

4. Teacher Data

Administrator: Manages teacher data (add/edit/delete).

5. Subjects

Administrator and Teacher: Input and manage subject data.

Student: View the list of subjects.

6. Grades

Teacher: Inputs student grades.

Student and Parent: View student grades.

Administrator: View and manage grades when necessary.

7. Attendance

Teacher: Records and views student attendance.

Parent and Student: View attendance history.

Administrator: Monitor overall attendance records.

8. Class Schedule

Administrator: Manages class schedules.

Student: Views individual class schedules.

9. Announcements

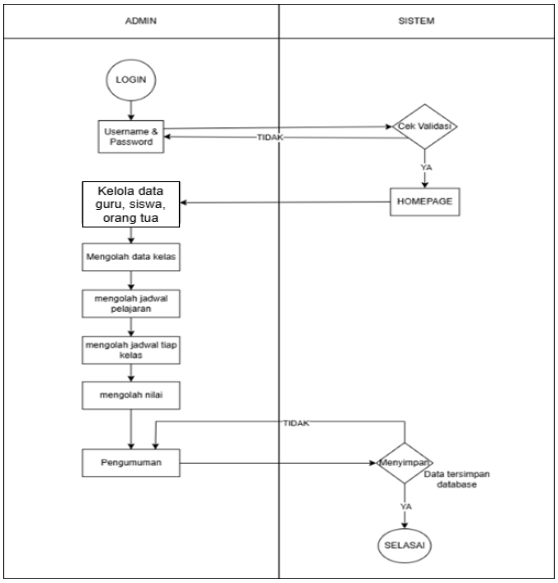
Administrator and Teacher: Create and manage announcements.

Student and Parent: View relevant announcements.

B. Activity Diagran

An activity diagram is used to illustrate the flow of activities or processes that occur within the academic system, starting from when a user logs in to the system and proceeds to perform actions according to their role[18]. This diagram helps in understanding how the workflow dynamically operates between actors and the system, including processes such as data entry, monitoring, and information delivery. By using an activity diagram, the operational flow of the system becomes clearer and more structured.

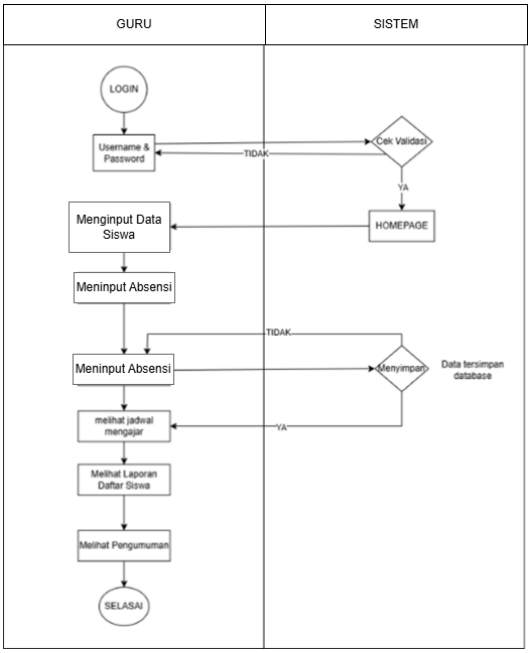
B.1 Activity Diagram Admin



Gambar 3. Activity Diagram Admin

The diagram above presents the activity diagram of the administrator's workflow within the academic information system. The process begins with login authentication using a username and password, which is then validated by the system. If the credentials are valid, the administrator is directed to the homepage and can access various features, such as managing teacher, student, and parent data; processing class and schedule data; and entering grades. Once the data is processed, the administrator can create announcements and choose to save the data. If the saving process is successful, the data is stored in the database, and the activity is considered complete.

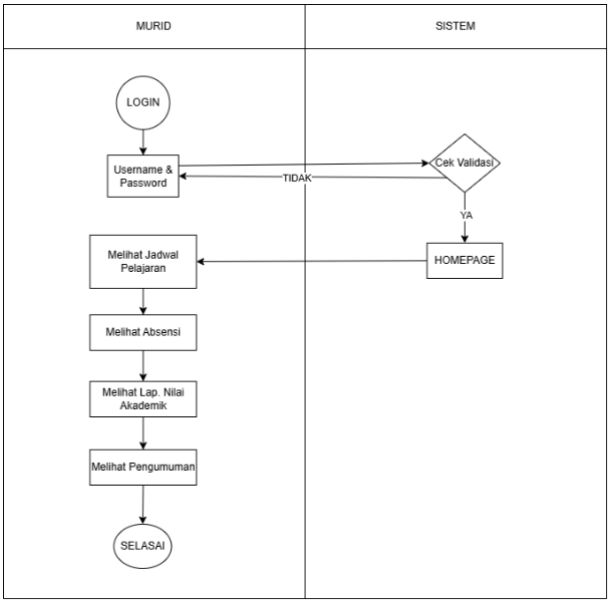
B.2 Activity Diagram Teacher



Gambar 4. Activity Diagram Teacher

The diagram above illustrates the activity diagram of the teacher's activities within the academic information system. The process begins with logging in using a username and password, which is then validated by the system. Upon successful login, the teacher is directed to the homepage and can perform various tasks, such as entering student data, recording attendance, and saving the data to the database. In addition, the teacher can view their teaching schedule, student lists, and announcements provided by the system. The entire process concludes with a completion activity once all data has been successfully processed and displayed.

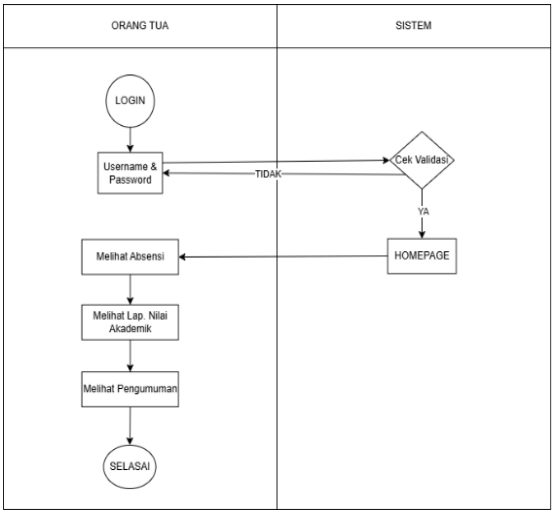
B.3 Activity Diagram Student



Gambar 5. Activity Diagram Student

The diagram above illustrates the activity diagram of student interaction within the academic information system. The process begins with the student logging in using a username and password, which is then validated by the system. If the login is successful, the student is directed to the homepage. From there, the student can access various types of information, such as viewing class schedules, attendance records, academic grade reports, and announcements. Once all information has been reviewed, the student's activity process concludes with a completion status. This diagram represents a simple and informative flow of academic data access for students.

B.4 Activity Diagram Parent



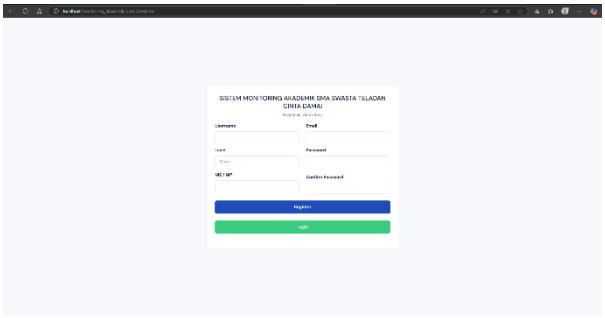
Gambar 6. Activity Diagram Parent

The diagram above illustrates the activity diagram of parental activities within the academic information system. The process begins with logging in using a username and password, which is then validated by the system. Upon successful validation, parents are directed to the homepage and can access important information related to their child, such as viewing attendance records, academic grade reports, and school announcements. The process concludes once all relevant data has been successfully displayed and reviewed by the user. This diagram represents a straightforward flow designed to facilitate parents in monitoring their child's academic progress.

3.3 Development

This stage focuses on the initial development of the system based on the task identification and storyboard results. The developed system includes user interface designs such as the academic dashboard, grade menu, attendance, class schedules, and announcements. At this stage, system design is also created to depict the overall page structure and user interaction flow. This system serves as the foundation for implementation and is used as a reference for testing and validating user requirements.

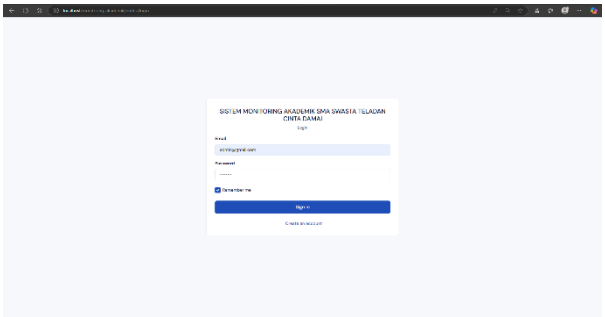
A. registration page



Gambar 7. Registration page

This page is used to register new user accounts, specifically for parents or students who do not yet have access. Users are required to fill in information such as full name, student identification number (NIS/NISN), email, and password. Once registration is successful, the account can be used to log in to the system.

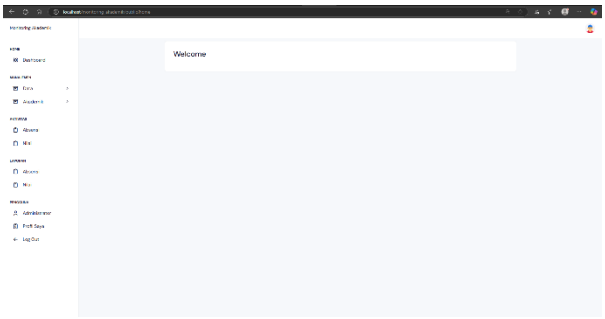
B. Login Page



Gambar 8. Login Page

The login page serves as the primary gateway for accessing the system. Users, including administrators, teachers, students, and parents, are required to enter a valid username or email and password to log in and access their respective dashboards based on their access rights.

C. Dashboard Page

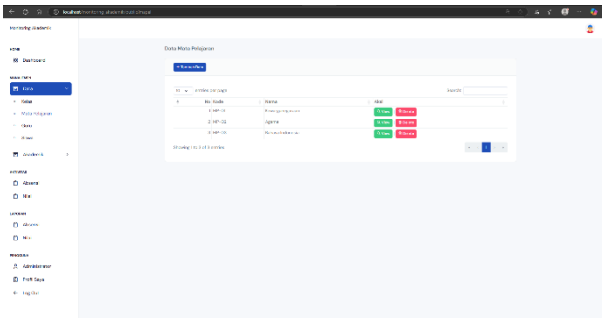


Gambar 9. Dashboard Page

The dashboard page serves as the main interface after login. It provides a summary of essential information

such as the number of students, today's schedule, announcement notifications, and charts displaying grades or attendance. The display is customized according to the user's role.

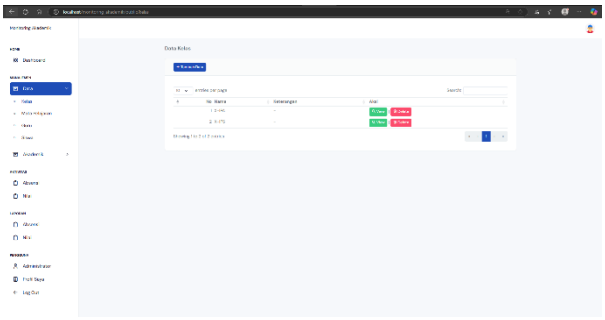
D. Subject Page



Gambar 10. Subject Page

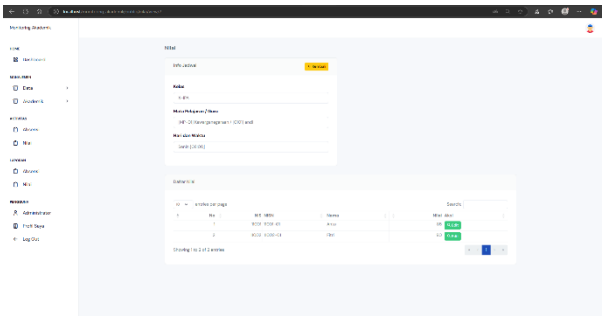
This page displays a list of subjects available at the school. Administrators or teachers can add, modify, and delete subjects as needed to align with the current curriculum requirements.

E. Class Page



The class page is used to manage class data, including class names, homeroom teachers, and the number of students. Teachers or administrators can view and organize the distribution of students into each class.

F. Grades Page



The grades page allows teachers to input students scores based on subjects and classes. Students and parents can view the recorded grades to monitor academic progress on a regular basis.

3.4 Evaluate System

The final stage of this study involved evaluating the developed system through functional testing using the Black-Box Testing method. The testing engaged prospective users, including administrators, teachers, homeroom teachers, and students. The results indicated that all core functions were executed successfully, aligned with user requirements, easy to understand, and met expectations regarding system functionality. User feedback was also utilized to identify and improve any existing shortcomings. Therefore, the developed system is considered effective, efficient, and suitable for implementation at SMA Swasta Teladan Cinta Damai.

Table 2. Test Results

No	Scenario	The Expected Result	Status
1	Perform registration by entering username, NIP/NIS, email, and password, then click Register	The system saves the user data into Firebase Realtime Database, then navigates to the main page and displays the username	Passed
2	Perform login with correct email and password, then click Login	The system navigates to the main page and displays the username	Passed
3	Perform login with incorrect email and password, then click Login	The system rejects the login and does not allow access to the main page	Passed
4	Perform login without entering email and password, then click Login	The system rejects the login and does not allow access to the main page	Passed

5	Click the Logout button	The system navigates to the login page and requires the user to log in again to access the application	Passed
6	Add class data	The system saves the class data	Passed
7	Add subject data	The system saves the subject data	Passed
8	Add teacher data	The system saves the teacher data	Passed
9	Add student data	The system saves the student data	Passed
10	Delete class data	The system deletes the class data	Passed
11	Delete subject data	The system deletes the subject data	Passed
12	Delete teacher data	The system deletes the teacher data	Passed
13	Delete student data	The system deletes the student data	Passed
14	Add schedule	The system saves the schedule	Passed
15	Delete schedule	The system deletes the schedule	Passed
16	Add attendance data	The system saves the attendance data	Passed
17	Delete attendance data	The system deletes the attendance data	Passed
18	Add grade data	The system saves the grade data	Passed
19	Edit grade data	The system saves the edited grade data	Passed
20	Delete grade data	The system deletes the grade data	Passed
21	Export grade report	The system displays the exported grade report	Passed
22	Export attendance report	The system displays the exported attendance report	Passed
23	Add admin data	The system saves the admin data	Passed
24	Edit admin data	The system saves the edited admin data	Passed
25	Delete admin data	The system deletes the admin data	Passed

Based on the testing results, it can be concluded that all designed test scenarios were successfully executed. A total of 25 test scenarios were evaluated by 40 respondents, achieving an average success rate of 100%. These results indicate that every core function, ranging from authentication processes to the management of classes, subjects, teachers, students, schedules, attendance, grades, and administrators, operated properly according to requirements. Therefore, the system demonstrates stable and reliable performance, making it feasible to be implemented in supporting

academic activities at schools as well as for practical use by the wider community.

4. Conclusion

Based on the data collected from students at SMA Swasta Teladan Cinta Damai, essential information such as student identification numbers, names, gender, and other personal details was obtained. This data serves as the foundation for developing a web-based Academic Monitoring Information System. The system is expected to facilitate more efficient, accurate, and real-time access to grades, attendance, schedules, and announcements. Using the Task-Centered System Design (TCSD) approach, the system is developed with a focus on users' primary tasks, making it more aligned with the actual needs of the school. For future research, this system can be further developed by integrating it with mobile applications or adding real-time notification features, allowing stakeholders to receive information more quickly and responsively.

5. Suggestion

To ensure optimal system implementation, it is recommended that the school provide training for administrators, teachers, and homeroom teachers on how to use the system. In addition, regular maintenance and evaluation are necessary to ensure the system continues to operate effectively in line with the evolving needs of the school. Another suggestion is to involve students and parents in the system trial process so that feedback from all stakeholders can be considered to improve the quality of academic services.

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