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Design and Development of an E-learning Information System Using the Laravel Framework at SMA Negeri 3 Medan

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ABSTRACT

This research discusses the design and development of an e-learning information system using the Laravel framework specifically for SMA Negeri 3 Medan. The system aims to address the growing need for a more accessible and engaging learning platform, adapting to the increasing influence of technology in the field of education. The development process employs a structured and comprehensive methodology, incorporating thorough needs analysis, detailed system design, implementation using the robust Laravel framework, and rigorous testing procedures. The resulting e-learning system offers a wide range of features, including interactive learning modules, online assessments, and robust communication tools, all tailored to enhance the overall learning experience for the students and teachers at SMA Negeri 3 Medan. This innovative system is expected to contribute significantly to the creation of a more effective, modern, and technology-driven learning environment within the school, providing a seamless and user-friendly platform for enhanced teaching and learning outcomes.

Keyword :E-learning, Laravel, SMA Negeri 3 Medan, Web Aplicaiton.

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1. INTRODUCTION

The rapid advancements in information and communication technologies have significantly transformed the landscape of education, with the emergence of e-learning platforms becoming an integral part of the modern learning experience. (Wibowo & Sediyono, 2021) The integration of technology-driven solutions in the educational sector has the potential to revolutionize the way knowledge is acquired, shared, and applied, ultimately leading to improved learning outcomes and better-prepared students

In the context of SMA Negeri 3 Medan, the need for a comprehensive e-learning information system has become increasingly apparent. The school's desire to embrace the digital transformation and provide a more engaging and accessible learning environment for its students has prompted the exploration of innovative solutions that can cater to the evolving educational needs. (Ningsih et al., 2018)

This research aims to design and develop an e-learning information system using the Laravel framework, a popular and robust PHP-based web application framework, to address the specific requirements and challenges faced by SMA Negeri 3 Medan. The choice of the Laravel framework is strategic, as it offers a range of features and functionalities that can be leveraged to create a highly scalable, secure, and user-friendly e-learning platform. The framework's emphasis on rapid development, modular architecture, and seamless integration with various technologies makes it an ideal choice for building a comprehensive e-learning system that can meet the diverse needs of both students and teachers at SMA Negeri 3 Medan.(Melyanti & Febriani, 2021)

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2. Literature Review

a. E-Learning

E-learning, or electronic learning, refers to the use of technology-based educational tools and resources to facilitate and enhance the learning process. E-learning encompasses a wide range of digital platforms, including web-based learning, mobile learning, and virtual classrooms, all of which aim to provide a more personalized, engaging, and accessible learning experience for students.

The growth of e-learning has been driven by several factors, including the increasing availability of internet access, the proliferation of mobile devices, and the need for more flexible and adaptable learning solutions. E-learning offers numerous benefits, such as:

1. Increased accessibility: E-learning platforms allow students to access learning materials and resources from anywhere with an internet connection, removing geographical barriers and providing more flexibility in the learning process.Web Aplication.
2. Improved engagement: E-learning platforms can incorporate interactive and multimedia elements, such as videos, simulations, and gamification, to enhance the learning experience and increase student engagement.
3. Enhanced flexibility: E-learning enables self-paced learning, allowing students to study at their own convenience and revisit course materials as needed.
4. Cost-effectiveness: E-learning can reduce the costs associated with traditional classroom-based instruction, such as transportation, facilities, and administrative expenses.
5. Recent studies have shown that e-learning can lead to improved learning outcomes and increased student satisfaction, making it an increasingly valuable tool in the educational landscape (Ongko & Napitupulu, 2018) (Raharja & Rokanta, 2023)(Kadir & Aziz, 2016) (Nebot et al., 2020) (Adelakun & Omolola, 2020) (Atıcı et al., 2022).

b. Web Aplication

Web applications are software programs that are accessed and used through a web browser, such as Google Chrome, Mozilla Firefox, or Microsoft Edge. Unlike traditional desktop applications, web applications are hosted on a remote server and can be accessed by users from anywhere with an internet connection.

The development of web applications has been greatly influenced by the rise of frameworks and libraries, such as Laravel, which provide a structured and efficient approach to building web-based systems.

The Laravel framework, in particular, has gained significant popularity in the web development community due to its robust features, intuitive syntax, and emphasis on maintainability and scalability. Some of the key benefits of the Laravel framework include:

- **MVC Architecture:** Laravel follows the Model-View-Controller architectural pattern, which promotes code organization and separation of concerns. This makes the codebase more maintainable, scalable, and easier to test.
- **Eloquent ORM:** Laravel's Eloquent Object-Relational Mapper provides a simple and elegant way to interact with databases. It allows developers to work with database tables as objects, simplifying database operations and reducing the amount of boilerplate code.
- **Blade Templating Engine:** Laravel's Blade templating engine offers a clean and intuitive way to create dynamic views. It allows developers to embed PHP code within HTML templates, making it easier to manage and maintain the presentation layer of the application.
- **Artisan Command-Line Interface:** Laravel's Artisan command-line interface provides a powerful set of tools for automating common tasks, such as generating code, running database migrations, and managing application dependencies.
- **Robust Security Features:** Laravel offers built-in security features, such as protection against cross-site scripting, SQL injection, and cross-site request forgery. These features help developers build secure and reliable web applications.

- **Large and Active Community:** Laravel has a large and active community of developers, which provides ample resources, support, and contributions to the framework's ecosystem. This ensures that the framework stays up-to-date and continues to evolve with the latest web development trends.
- **Comprehensive Documentation:** Laravel boasts comprehensive and well-maintained documentation, making it easier for developers to learn and use the framework effectively. The documentation covers all aspects of the framework, from basic concepts to advanced features.

c. Laravel Framework

The Laravel framework is a popular open-source PHP framework that is widely used for building web applications. Laravel is known for its elegance, simplicity, and focus on developer productivity.

One of the key features of Laravel is its adherence to the Model-View-Controller architectural pattern. This pattern separates the application logic into three interconnected components: the model, which handles data management; the view, which manages the user interface; and the controller, which acts as an intermediary between the model and the view.

3. METHOD

This study uses a methodology with an R&D (Research and Development) approach, which combines the Waterfall model as a framework for website development. The Waterfall model was chosen because of its systematic and sequential approach, which allows for reduced errors in the design process. Based on the literature, the Waterfall model includes several important stages in software system development, namely: 1) needs analysis, 2) system design, 3) code implementation, 4) system testing, and 5) maintenance.

The initial stage of this study focused on an in-depth needs analysis, involving the identification of services, constraints, and system objectives through discussions with the user community. The researchers used a multi-method approach to data collection, including observation, interviews, and literature reviews, to obtain the information needed. This needs analysis plays an important role in determining the functional requirements for a web-based e-learning information system at SMA Negeri 3 Medan.

Based on the results of the needs analysis, the researchers designed the system by creating a program flow plan using a use case diagram. This diagram visualizes the interaction between actors and the system, thus helping to determine the required functionality. In this study, there are three types of actors: Admin, Tutor, and Student, each of which has different access rights. Admin is responsible for managing primary data, uploading and managing user information (students and tutors), and confirming new student registrations. Tutors can upload learning materials, assign assignments and exams, grade, and send messages. Students are given access to view course materials, submit assignments and exams, view grades, and participate in discussion forums. The researchers include a use case diagram to illustrate the interactions between these actors, to explain the findings of this study.

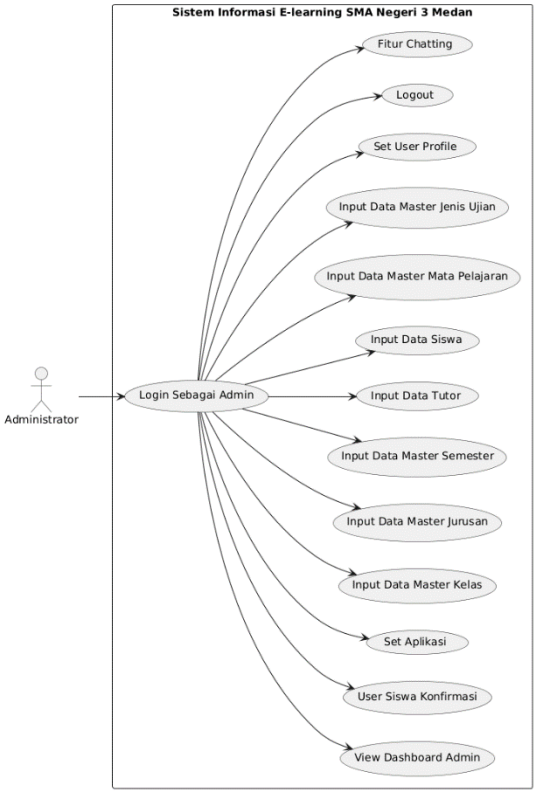

Figure 1. Use Diagram

Then, the system flow is explained by creating an Activity Diagram for system development, which helps researchers to be more focused and structured in the system development implementation process. Activity Diagram is a graphical representation of the steps and sequence of procedures of a program. The Activity Diagram in this study describes the process flow of the e-learning system created for SMA Negeri 3 Medan. The system design was developed using an Entity Relationship Diagram (ERD) which aims to explain how each entity in the system is interconnected and what attributes each entity that has been created has. The entities in this system also represent most of the database creation that will handle data in tables created via MySQL. Meanwhile, the flow of information system data is explained using an Activity Diagram as a replacement for the Data Flow Diagram (DFD). The Activity Diagram in this study describes the process of the e-learning information system that will be developed as a learning medium, which includes activities such as data input, content management, to user access to learning materials.

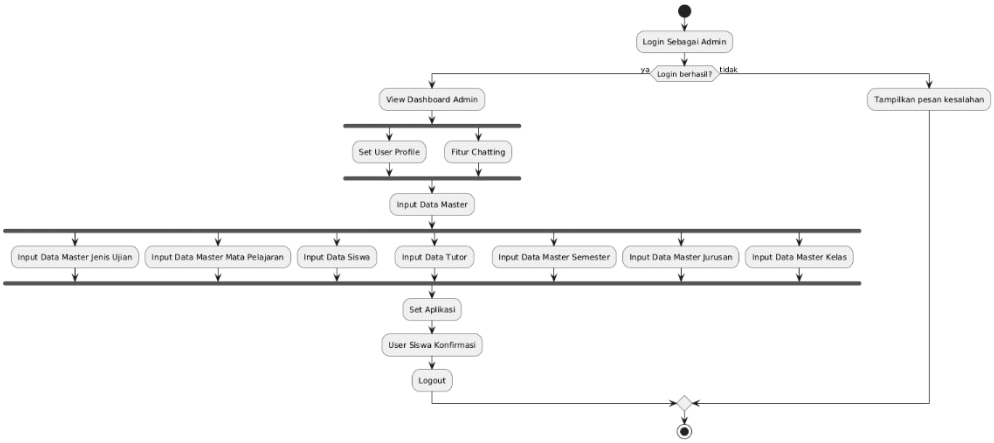

Figure 2. Activity Diagram

In the subsequent stage, the software design is implemented as a series of programs or program units. Testing involves verifying that each unit meets its specifications. The developed e-learning system utilizes two programming languages: JavaScript and PHP. JavaScript, a simple programming language, facilitates the creation of interactive web pages. PHP, a scripting language specifically designed for website development, along with its associated tools, enables the creation of dynamic, feature-rich web pages, simplifying web design and programming. Following this, individual program units or the entire program are tested as a complete system to ensure compliance with software requirements. The testing phase commences when the e-learning system is deemed to have met the coding completion target. Program testing aims to identify bugs for subsequent code correction. This research employs the black box testing method. In the program maintenance phase, the system is installed and put into practical use. Program maintenance can only be carried out after the analysis, system design, coding, and program testing stages have been completed.

4. RESULTS AND DISCUSSION

a. Website Home Page

The image below shows a dashboard titled "Main Info Dashboard". This dashboard is divided into several information boxes containing important data. There are five main information boxes, namely: the number of teacher data, the number of student data, the number of assignments or quizzes, and the number of materials. These boxes usually display data visually, such as graphs or numbers, to make it easier for administrators to quickly understand the condition of the system.

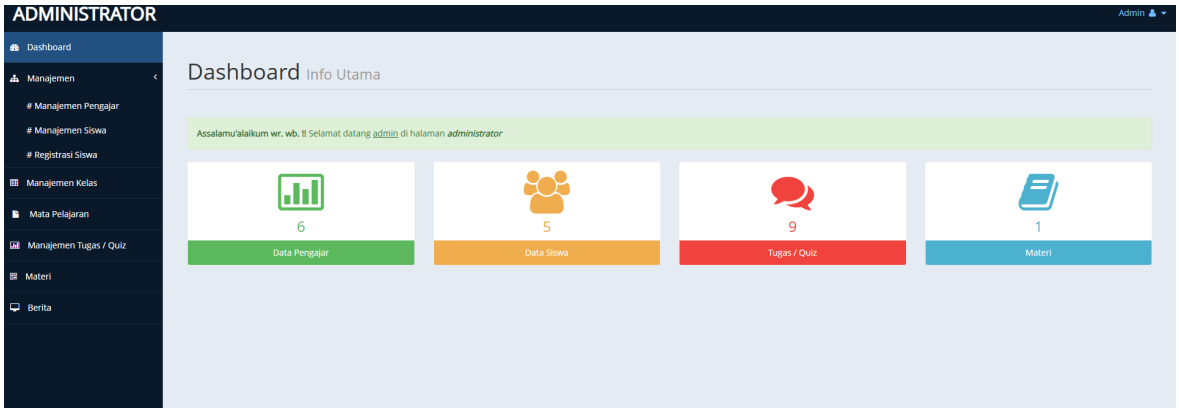

Figure 3. Website Home Page

b. teacher management page

The image below shows a data table titled "Teacher Management". This table contains information about teacher data, such as employee registration number (NIP), full name, gender, status, and options that can be done on the data. This table allows users to view a list of all teachers registered in the system, as well as perform several actions such as editing, deleting, or viewing details of certain teacher data. In addition, there is a search feature that allows users to search for teacher data based on certain keywords.

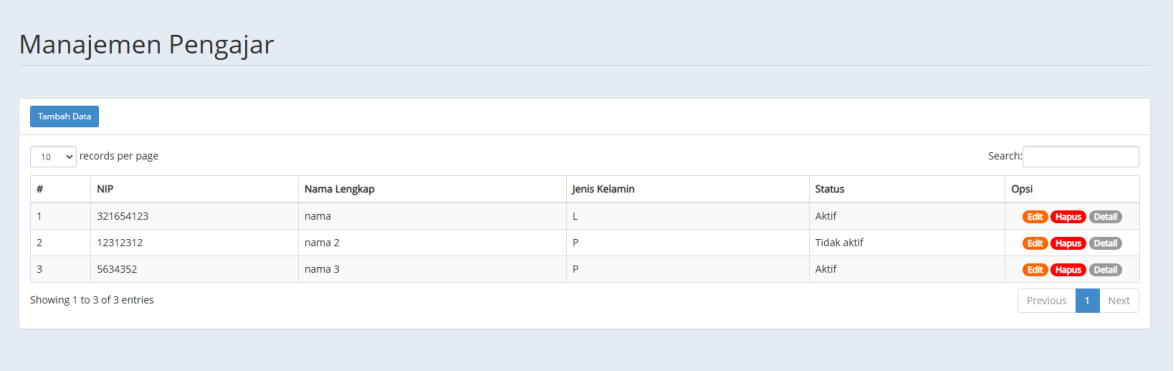

Figure 4. Teacher Management Page

c. student management page

The image shows a section of a web page titled "Manajemen Data Siswa" (Student Data Management) within an administrative system, likely for a school or educational institution. The section displays a table listing information about students, including their student ID (NIS), full name, gender, address, class, status (active or inactive), and options for editing (Hapus - Delete) or viewing details (Detail). A search bar is provided for filtering the list, and pagination controls (Previous, Next) are present to navigate through multiple pages of student data. A notice at the top informs the admin that they cannot edit student data directly, but only activate/deactivate and delete accounts. Students themselves are responsible for editing their own information.

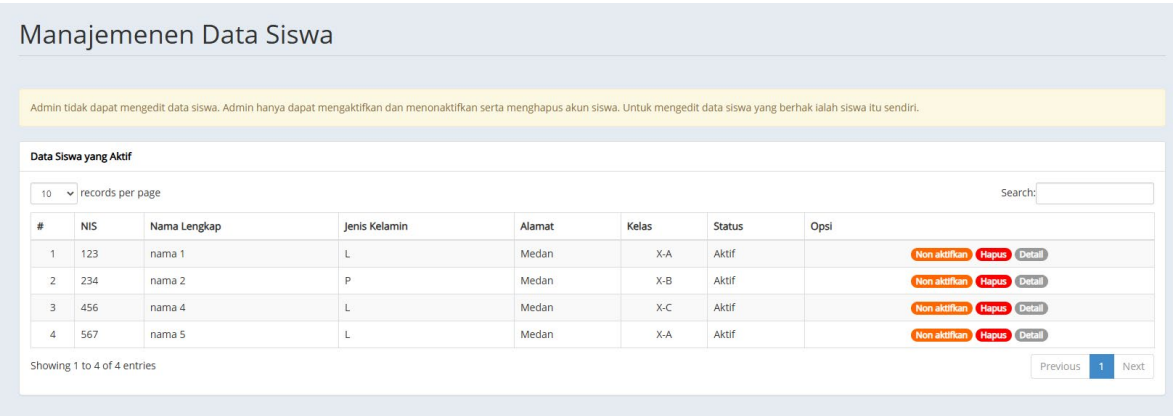

Figure 5. student management page

d. student registration page

The image displays a data table titled "Student Registration Management". This table contains information about student data that has registered. The information displayed includes student registration number (NIS), full name, gender, date of birth (TTL), address, registration status, and options that can be done on the data. This table allows users to view a list of all students who have registered, as well as perform several actions such as activating or deleting certain student data, or viewing further student data details.

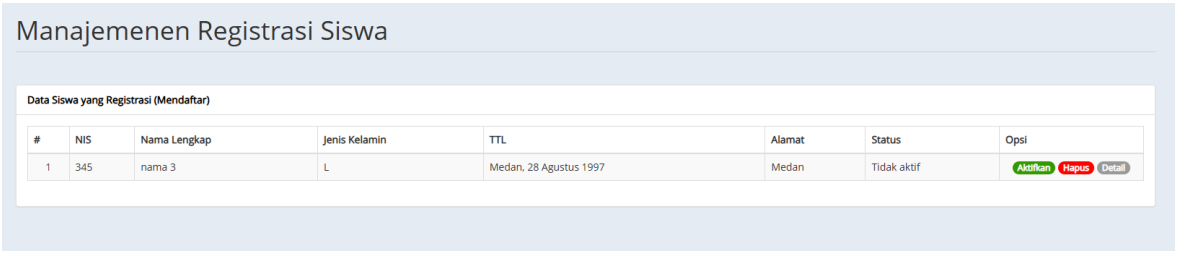

Figure 6. student registration page

e. class management page

The image shows a section of a web page titled "Manajemen Kelas" (Class Management) within an administrative system, likely for a school or educational institution. The section displays a table listing information about different classes, including class name, room number, class teacher, class leader, and options for editing (Edit), deleting (Hapus), or viewing details (Lihat Siswa). The table shows that some classes have a designated teacher and class leader, while others are still "Belum diatur" (not yet assigned).

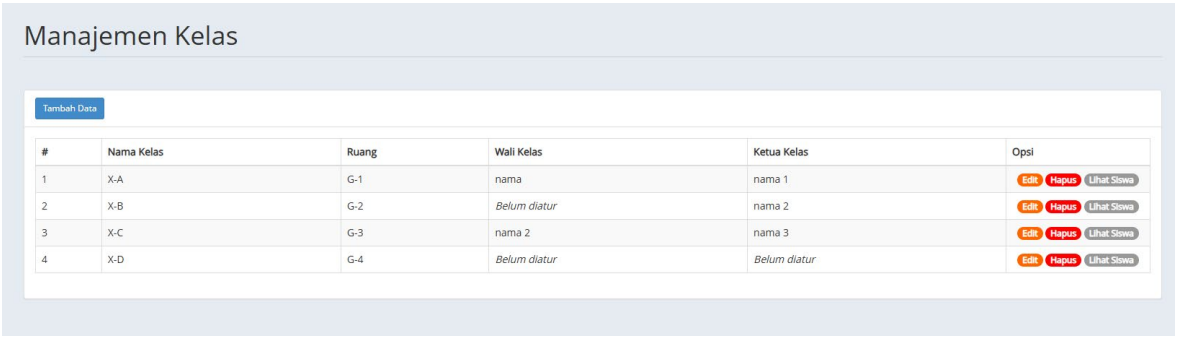

Figure 7. class management page

f. subject management page

The image shows a section of a web page titled "Manajemen Mata Pelajaran" (Subject Management) within an administrative system, likely for a school or educational institution. The section displays a table listing information about different subjects, including a subject code, subject name, and options for editing (Edit) or deleting (Hapus) the subject.

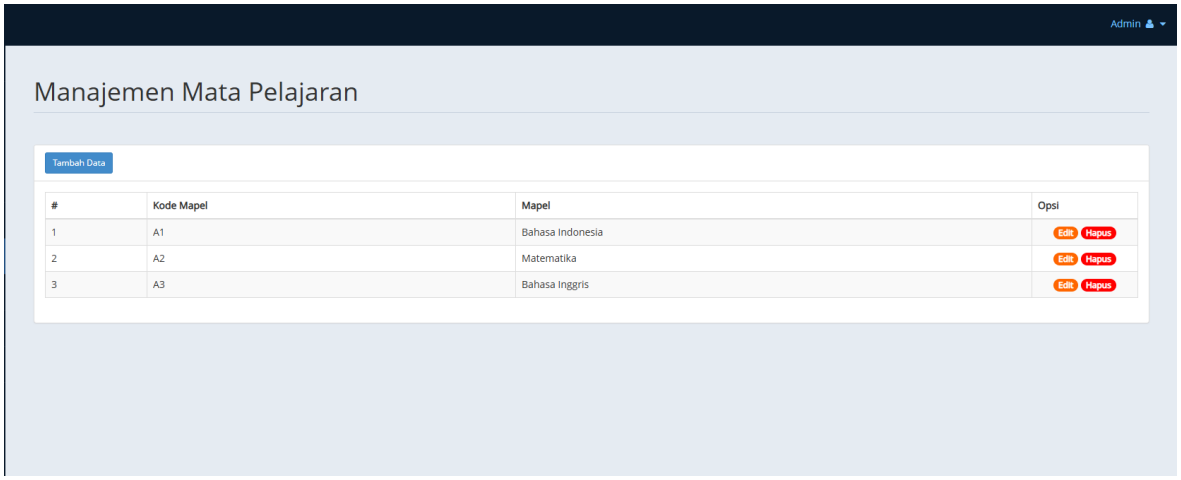

Figure 8. subject management page

g. Program Testing

Post-development, the system underwent black-box testing to assess its operational functionality. This involved executing 14 test cases, ranging from user authentication to CRUD operations across various system features.

Table 1. Blackbox Testing

Test Case ID	Test Case Description	Test Steps	Expected Result	Status
TC01	Admin Login	1. Navigate to the login page 2. Enter valid admin credentials 3. Click "Login" button	Admin is successfully logged in and redirected to the dashboard	pass
TC02	Admin Logout	1. Admin is logged in 2. Click on "Logout" button	Admin is logged out and redirected to the login page	pass
TC03	Set User Profile	1. Admin navigates to "Set User Profile" 2. Update profile details 3. Click "Save"	Profile details are updated successfully and confirmation message is shown	pass
TC04	Input Data Master (Exam Type)	1. Navigate to "Input Data Master Jenis Ujian" 2. Enter exam type details 3. Click "Save"	Exam type is added to the system and visible in the list	pass
TC05	Input Data Master (Subject)	1. Navigate to "Input Data Master Mata Pelajaran" 2. Enter subject details 3. Click "Save"	Subject data is saved and listed in the system	pass
TC06	Input Student Data	1. Navigate to "Input Data Siswa" 2. Enter student details 3. Click "Save"	Student data is added successfully	pass
TC07	Input Tutor Data	1. Navigate to "Input Data Tutor" 2. Enter tutor details 3. Click "Save"	Tutor data is saved and displayed in the system	pass
TC08	Input Data Master (Semester)	1. Navigate to "Input Data Master Semester"	Semester data is recorded successfully	pass

Test Case ID	Test Case Description	Test Steps	Expected Result	Status
		2. Enter semester details 3. Click "Save"		
TC09	Input Data Master (Department)	1. Navigate to "Input Data Master Jurusan" 2. Enter department details 3. Click "Save"	Department data is successfully added	pass
TC10	Input Data Master (Class)	1. Navigate to "Input Data Master Kelas" 2. Enter class details 3. Click "Save"	Class data is successfully saved	pass
TC11	Set Application Settings	1. Navigate to "Set Aplikasi" 2. Adjust application settings 3. Click "Save"	Application settings are updated	pass
TC12	Confirm Student Registration	1. Navigate to "User Siswa Konfirmasi" 2. Confirm registration of a student	Student registration is confirmed and status updated	pass
TC13	View Admin Dashboard	1. Navigate to "View Dashboard Admin"	Admin dashboard is displayed with relevant data	pass
TC14	Access Chatting Feature	1. Navigate to "Fitur Chatting" 2. Send a message to a tutor or student	Message is sent successfully and appears in the chat history	pass

From the calculation, it is known that the test results on 14 scenarios obtained results that are in accordance with the test case that was run. Therefore, it can be concluded that the e-learning website for SMA Negeri 3 Medan is feasible to use.

5. CONCLUSION

The design and development of the e-learning information system at SMA Negeri 3 Medan, which utilized the Laravel framework, has demonstrated its effectiveness in addressing the various challenges faced by the school. Through the successful implementation of this comprehensive and innovative system, the school has experienced several significant improvements that have had a positive impact on the overall educational process. These enhancements include enhanced administrative efficiency, improved data management capabilities, and increased accessibility for both teachers and students, ultimately leading to a more effective and engaging learning environment for all stakeholders involved.

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