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Implementation of the Midtrans Payment Gateway in a Web-Based School Payment Information System Using a Design Thinking Approach (Case Study at Smp Pelita Nusantara)

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A B S T R A C T

The rapid development of technology cannot yet be utilized equally by several educational institutions in Indonesia. SMP Pelita Nusantara is one of the schools that still carries out administrative activities for paying education fees using manual recording. This of course takes a long time and causes long queues and sometimes errors occur in making reports. The aim of this research is to overcome problems that arise due to the ineffectiveness of the payment system currently running at the school. This research was obtained by taking a Design Thinking method approach because this method applies a combination of various ideas from various scientific disciplines with the aim of obtaining good solutions based on user experience. Design Thinking has several stages which include the Empathize, Define, Ideate, Prototype, and Testing stages. The results obtained from this research are the implementation of a website-based education fee payment application with the implementation of the Midtrans Payment Gateway. The conclusion is that the payment process at SMP Pelita Nusantara becomes more effective and efficient and saves a lot of time.

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INTRODUCTION

The rapid development of technology is an opportunity to obtain information faster and easily in various fields. One of them in the field of education, is greatly helped by the presence of information systems in an educational institution. Educational agencies get enormous benefits from the implementation of information systems, one of which is simplification of learning, document processing, document archiving, ease of payment of school fees for students. Using the manual method requires a long time in the data collection process. Another obstacle is that reporting requires a long time so that reporting to the principal becomes delayed (Irawan et al., 2023). Educational Development Donation Payment System (SPP) is one example of an administrative system whose writing still uses a manual system. Writing administrative data that still uses a manual system causes the Human Error System to pay for educational development (SPP) is one example of an administrative system whose writing still uses a manual system. Writing administrative data that still uses a manual system causes human error (Mersita et al., 2022). In addition to some of these problems, the process of payment transactions of school fees manually will also result in long queues if there are many students who pay simultaneously. Which of which the impact of these problems will allow data collection errors to increase.

To overcome the problems above, a different type of payment is needed to facilitate users in completing transactions. Midtrans as a payment gateway is the solution to the problem. Payment gate is a system that connects websites and financial institutions to process transactions online. Midtrans is one of the payment gateway service providers in Indonesia. Payment gate is an online transaction system that authorizes the payment process via credit cards, bank transfers, or other direct payments. Payment gates make it a simple but safe method to make payment transactions without the hassle of opening the bank website or visiting ATMs (Gibran et al., 2024).

Pelita Nusantara Middle School is a junior high school located on Jalan Telukampel, Telukampel Hamlet, Karyamakmur Village/Kelurahan, Batujaya District, Karawang Regency, West Java Province. However, in input data on payment of educational development contributions (SPP), it still uses manual methods such as viewing student data that has not and already paid SPP and does not yet have a system that supports to facilitate notes or enter new data. Of course this is very vulnerable to errors during the process of entering student payment data.

Seeing the above problems and adapting to technological developments, the author plans to implement the Midtrans Payment Gateway Online School Payment System by using the Design-Thinking approach with the aim of helping the school to manage student payment information better so as to minimize potential errors. The system development method with the Design Thinking approach provides a solution -based approach to solving problems. Design thinking is a way of thinking and working with a series of simple and clear methods, with design thinking can help us observe and develop empathy for user targets (Candra, 2023).

THEORETICAL REVIEW

Information System

Information system is a system in an organization that brings together daily transaction processing needs that support managerial organizational functions in the strategy activities of an organization to be able to provide certain outsiders with reports needed (Suryadharma & Budyastuti, 2019).

Information systems are ways that are organized to collect, enter, and process and store data and ways organized to store, manage, control, and report information in such a way that an organization can achieve the stated goals (Rasefta & Esabella, 2020).

Midtrans

Midtrans is a payment method application provided by Midtrans as a payment gateway for various types of payments. This service facilitates the work of entrepreneurs in the industry and increase sales. The payment method offered is card payments, bank transfers, direct debit, e-wallet and over-the-counter (Syahputra & Mulya, 2023).

Midtrans is one of the Payment Gateway developed by GoTo Financial who has the aim to make online payments easier. Midtrans has many types of payments that can be used in the business process flow such as gopay, qris, bank transfer, etc (Nurfadhilah et al., 2024).

Payment Gateway

Payment Gateway is an online payment whose function is to describe and ratify information on a milk transaction with the policies that have been regulated by the providers (Fian et al., 2020). Explanation of Payment Gateway is a service with an independent system for payment of payment transactions using digital technology in the form of debit cards, electronic money, credit cards and bank transfers. This method makes it easy for people to buy goods or pay services (Aszalty, 2023).

Website

Website is a collection of pages that display textual information, static images, animation, sound and/or combined, both static and dynamic, forming a series of interconnected buildings, each connected by a network of the page (hyperlink) (Hasan & Muhammad, 2020).

The web is a program that is designed to take information from a computer server on the internet network. For HTML whose program code is not compiled first, the web is tasked with interpreting (translating) HTML tags that will be shown in the browser window (Habibullah et al., 2023).

Database

Database system is a collection of data that is interrelated and stored in one data carrier and managed based on a particular system or structure using

software to process the data. This data is stored in a table or file consisting of columns and rows. Each column represents data types, such as text or numbers, whereas each line represents the entity or object represented by the data (Satyaninggrat et al., 2023).

SQL (Structured Query Language)

SQL (Structured Query Language) is a special script used to access data in relational databases. SQL is a computer language that follows the standard of ANSI (American Standard Institute) used to manage relational databases. SQL allows us to access the database, create query to retrieve data from the database, add data to the database, delete data from the database and change data in the database (Fitriastuti, 2019).

MySQL

MySQL is an open source database software developed by a community named MySQL AB to help users store data in the table. The table consists of fields (columns) that group information based on certain categories, such as names, addresses, telephone numbers, etc. The second part of the table is a record (row) that includes the actual data (Hasan & Muhammad, 2020).

PHP (Hypertext Preprocessor)

PHP stands for Hypertext Preprocessor, which is a code -based programming language (script) used to process data and return it to a web browser as an HTML code (Hasan & Muhammad, 2020). So it can be concluded that PHP is an additional programming language on the HTML server side that allows dynamic web applications, can be connected to the database and create an attractive appearance (Herdiansyah, 2019).

Design Thinking

Design Thinking is an approach, which is a concept that can be used both in theory and production. The concept of design thinking process approaches was developed by Design School University. Design Thinking is a solution method that is centered on humans which mostly leads to innovative solutions in terms of feasibility, desires, and profitability of a product or service (M. Y. N. Putra, 2022).

Design Thinking is a method in which one views people's needs in terms of satisfying those needs to meet the requirements of a human-centered system. There are five stages in Design Thinking, namely empathize, define, ideate, prototype, and testing (I. M. Putra & Indah, 2023).

How Might We Method

The How Might We method is a method that asks questions, starting with the question "How Might We", which is useful for framing challenges as questions and creating a comfortable atmosphere for designing innovative solutions (M. Y. N. Putra, 2022).

How Might We questions are a great way to brainstorm and exchange ideas because they can be used to explore ideas and solve problems. How Might We be broad enough to create different ideas (Rezeki, 2024).

Black Box Testing

The Black Box Testing method is easy to use because it only requires a lower and upper limit on the expected data (Herdiansyah, 2019). This testing is done from the end user's perspective (Praniffa et al., 2023).

METHODOLOGY

In this research, the author uses a Design Thinking approach. This method helps carry out research through to the manufacturing and design process. Design Thinking uses combining ideas from different fields to find solutions. Design Thinking not only prioritizes visual and emotional aspects, but also focuses on user experience.

The author uses this method because he feels it is very suitable for finding ideas that can be used as solutions to user-centered problems. It can be said that because Design Thinking is a human-centered method which aims to find ideas for solutions to existing problems through collaboration between developers and potential users to produce creative ideas and innovative results by combining several research phases, including empathy, define, ideate, prototype and testing, the author explains the results at the implementation stage.

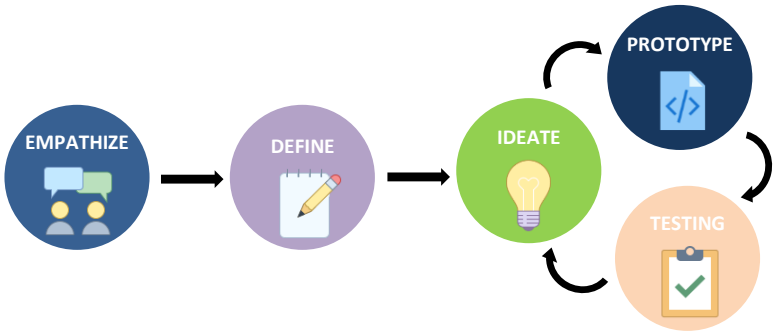

Figure 1. Design Thinking Stage Process

a. Empathize Stage

Empathize is the stage of understanding users through interviews or observations to study user experiences, behavior and feelings (Wardani et al., 2023).

b. Define Stage

Define is the process of analyzing and understanding the results of the empathize process. This step is used to identify the user's main problems or concerns (Wardani et al., 2023).

c. Ideate Stage

Ideate is a transition process from problem formulation to solution. At this ideate stage the focus is on the results of various ideas which become the basis for designing a prototype (Wardani et al., 2023).

d. Prototype Stage

A prototype is the result of changing a previous idea into an application that can be used for testing. In this phase, scenarios or stages for products and applications are planned (Wardani et al., 2023).

e. Testing Stage

Testing is the final step in the design thinking method. During this process, testing is conducted randomly on users (Wardani et al., 2023).

RESULTS

Empathize

Empathize is the core stage of the Design Thinking method, because the problems that arise must be resolved in a human-centered way. A number of processes, including interviews, observations, and creating empathy maps, were carried out to obtain information about user needs.

a. Empathy Map

In a quote from research written by (M. Y. N. Putra, 2022), he said that empathy maps are a user-centered approach, meaning the focus is on understanding other individuals by seeing the world through the user. The goal of creating an empathy map is to eliminate assumptions by looking for facts. Facts are revealed by interpreting the subject through interviews and observations to enhance the experience. Creating an empathy map can be done after the user interview process.

During the interview the topic of the school payment system was brought up, because at that time there were still many problems. Therefore, the author should study this topic thoroughly to find out and understand the information about SMP Pelita Nusantara. In this way the author can find out the needs of each user. Below is an empathy map based on user interview results.

Table 1. Empathy Map

SAYS	***DOES***
School fees paid by students go directly to the administrative officer, then the administrative officer checks the data of the student who wants to pay.	Receive payment money and SPP cards from students.
Student payment transactions for education fees using the SPP card or submitting the bill that has been given.	Receive payment money and SPP cards from student parents.

It often becomes a hassle if many students pay at the same time.	Prepare a bill for three months late payment of SPP.
There are several students who have payment arrears.	
FEELS	***THINKS***
Still unsure about other alternative payment systems.	Have considered computerizing the education fee payment process.
Feels comfortable with the manual recording method because she is used to it.	Desktop apps easily lose data when the device is damaged.
Requires media that can back up payment data and financial reports.	Want to raise school standards to keep up with the current developments towards computerization.

Define

Next is the define stage, at this stage the author defines more user needs, carries out data analysis and synthesis at the definition stage. To identify inefficiencies in the payment process which is carried out manually, the author must carry out an iterative process by looking at the empathize stages framed through an empathy map. At the define stage, the author creates a problem formulation that is meaningful and can be followed as a challenge to create a solution. The purpose of this process is to provide the author with an understanding of the user's needs for the current system. In an effort to help writers focus on the specific needs of users, it is very important to create a problem statement to be able to find the focus of these needs as well as to help writers express sustainable ideas at the ideate stage.

a. How Might We Method

After formulating challenges into questions, the author maps existing problems and creates solutions using tables to create a comfortable atmosphere for developing innovative solutions.

Table 2. How Might We Method

Problem	***Insight***	***How?***	***Might***
Treasurers find it difficult to create student data manually because it takes a lot of time.	Need a system that can make it easier for users to create student data in order to save time.	How can users add student data to the system?	Create an information system that is equipped with a feature to add student data with columns containing student biodata.

The treasurer has difficulty recording payments if there are many students paying at the same time.	Need a problem solving that can reduce queues and minimize recording errors because we have to handle lots of payments.	How can users receive payments and make records online to reduce errors?	Create an online payment method with a payment gateway.
Parents have difficulty finding information about unpaid bills.	Need a feature that can check monthly bills that have not been paid or have been paid.	How can student parents access data on bills that must be paid?	Create a bill search feature that can show data on payments that must be paid.
The student's parents are worried that their child will not be honest if they are entrusted with paying the educational fees that must be paid.	Need an information system that includes a print proof of payment feature.	How can a student's parent print proof of payment without having to come to school?	Create a payment proof print feature on the student user dashboard.
The treasurer is worried that the financial report will be lost or damaged so she has to make it from scratch and forget which students have and have not paid.	An information system is needed that can store data in a database so that it can back up payment data in case of loss.	How can the treasurer back up this data?	Create a report recap feature that is connected to the data that has been entered into the database.

b. User Persona

User personas are used to understand different types of users. User participation should provide information and understanding to users. User personas are created based on the results of the empathy phase. To create a persona, the author creates it according to the problems contained in the problem formulation. The persona created by the author is divided into three stages, namely goals/needs, difficulties and features as seen in the picture below.

Figure 2. User Persona Treasurer

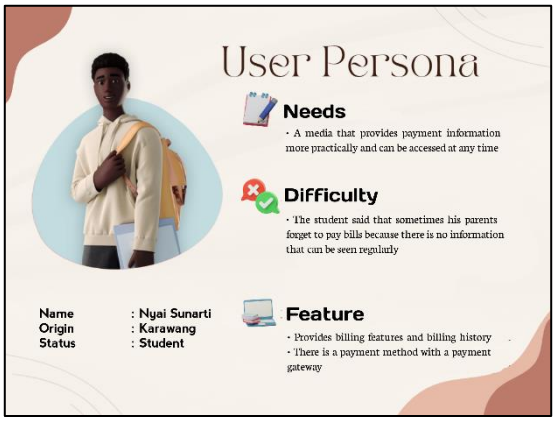

Figure 3. User Persona Student

Ideate

After passing the define stage, the author focuses on the solutions found to solve user problems at this stage and analyzes programming needs while designing the system to be built. When analyzing a system design, one of the first steps in system development is determining the system function that can solve the problem. The system design uses the UML (Unified Modeling Language) method which can be useful information in the programming process.

a. Use Case Diagram

Use case diagrams are used to explain what actions can be carried out by users or users of a work system. Use case diagrams describe interactions between one or more actors and the information system being created. Use cases are used to determine who has access to the system.

Use case diagrams can explain the relationships between actors and functional systems organized according to anticipated user needs, difficulties and capabilities, and summarize user personas. In the tuition fee information system created there are three actors, namely the treasurer, the school principal and students who are able to use the system.

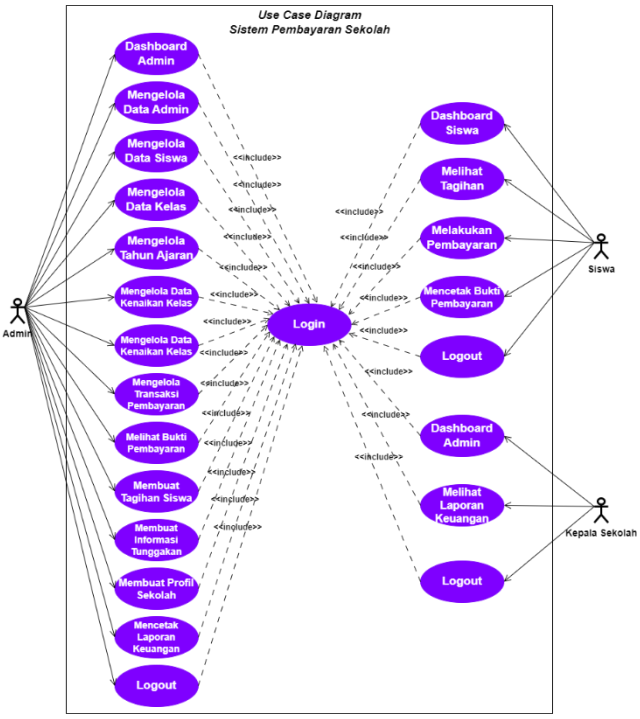

Figure 4. Use Case Diagram

b. Class Diagram

Class diagrams explain the relationships between classes in a system that work together to achieve goals. Based on the results of the needs analysis, the system class diagram that will be created is as follows:

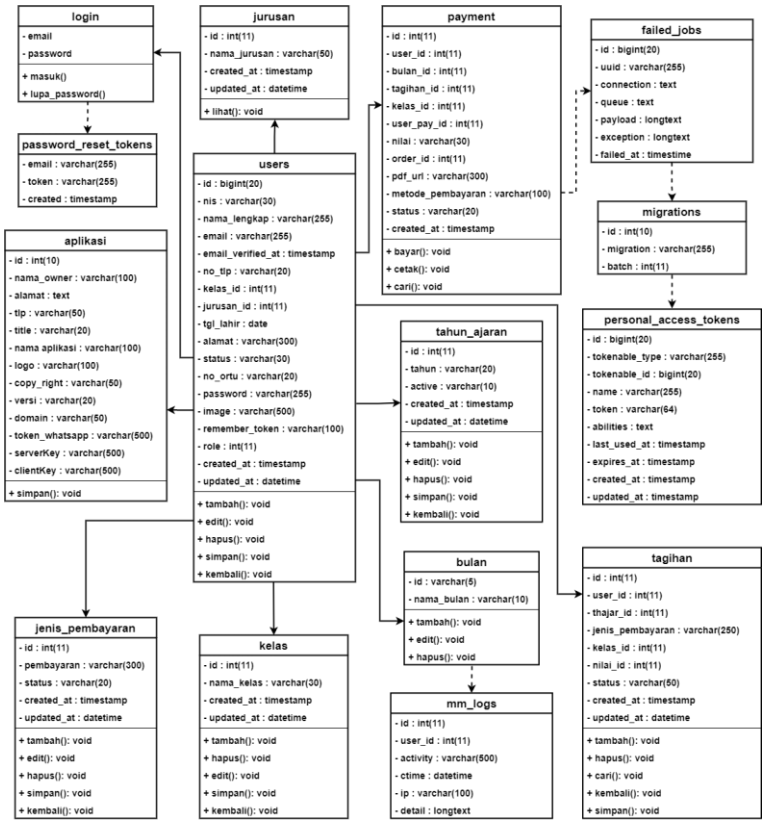

Figure 5. Class Diagram

Prototype

a. System Implementation

The implementation of this user interface is included in the fourth stage of the Design Thinking method, namely the prototype stage. Where the author implements the draft idea after going through several previous stages. The user interface is the visual part of a website and determines how users interact with the system. The user interface itself combines visual design, interaction design, and appropriate system functions to meet user needs. In designing a user interface you must pay attention to several principles that can be used to build a good user interface, user design uses a user interface that can be used to achieve a goal, the user interface must be easy to understand, easy and fun to use.

1. User Login Page

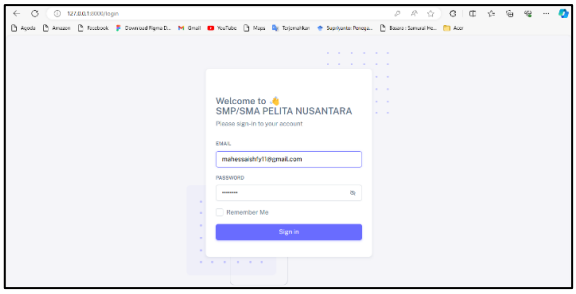

Figure 6. User Login Page

2. Admin Dashboard Page

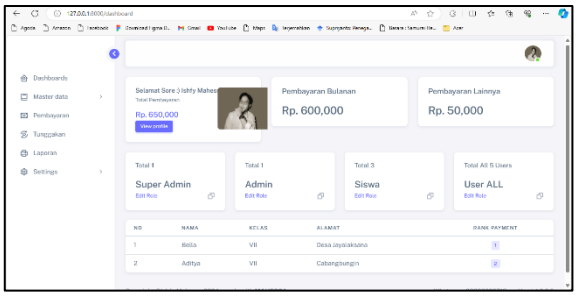

Figure 7. Admin Dashboard Page

3. Student Dashboard Page

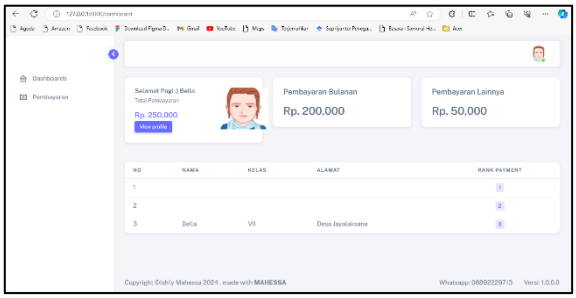

Figure 8. Student Dashboard Page

4. Principal Dashboard Page

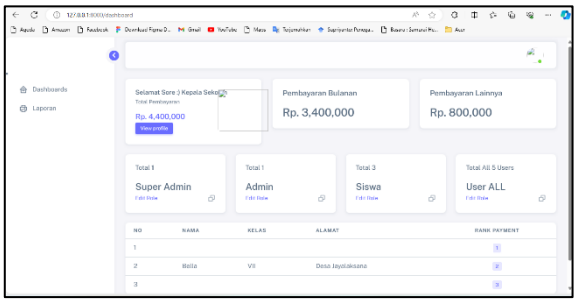

Figure 9. Principal Dashboard Page

5. Student Bill Page

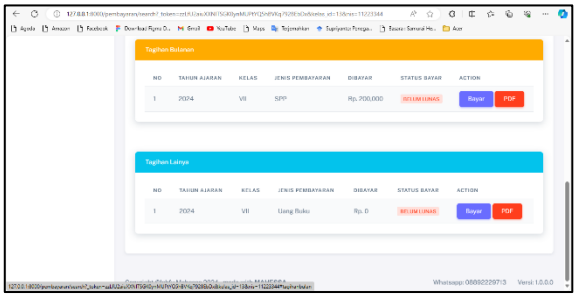

Figure 10. billing data page

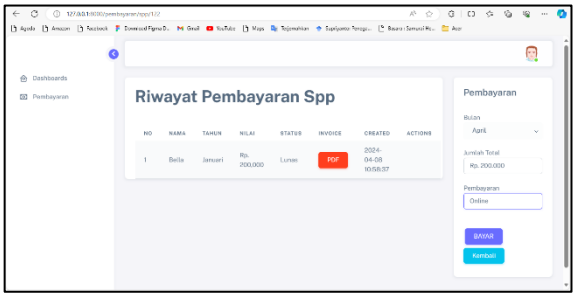

Figure 11. payment processing page

6. Midtrans Payment Page

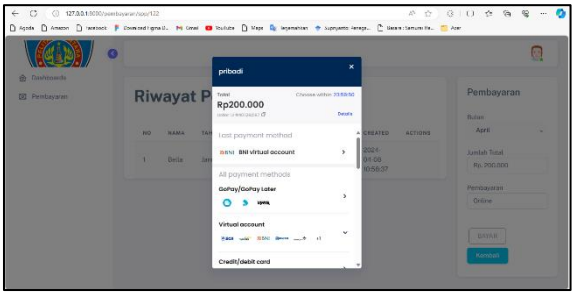

Figure 12. Page Select Payment Method

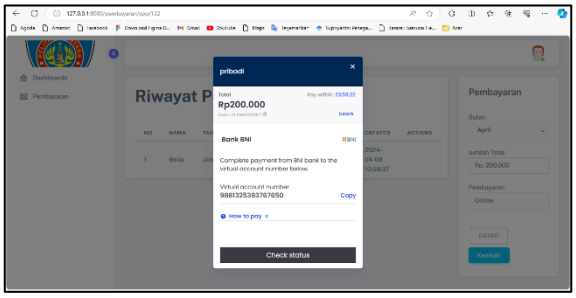

Figure 13. Payment Code Viewing Page

7. Financial Report Page

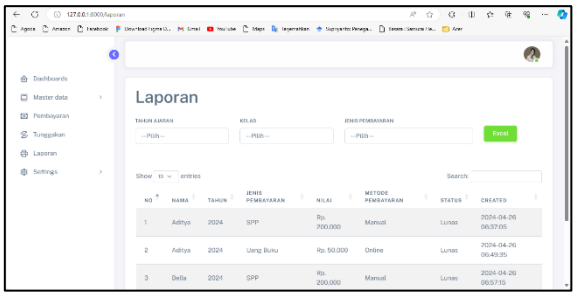

Figure 14. Financial Report Page

Testing

This sub-chapter explains the methods and steps for testing software implementation results, both modularly and systematically. The purpose of this discussion is to analyze and interpret the research findings that have been presented previously. This subsection explains the implications of the findings and their significance in the research context. Here the author also carries out tests that try to find errors and ensure that the input provides actual results that match the required output.

Testing is an important part of the software development cycle. Testing is carried out to ensure quality and also to identify software weaknesses. The purpose of this testing is to ensure that the quality of the software being built is reliable, that is, it is able to represent fundamental research from the analysis, design and coding specifications of the software itself.

a. Black Box Testing

The testing stage using the Black Box Testing method was chosen because it focuses on overall system performance. Black Box Testing is also a type of testing that does not need to know what actually happens to the system, but is a process of testing existing program modules using certain methods and testing in the form of input and output, which understands that the system or software meets the requirements.

Table 3. Black Box Testing

No	Testing	Test Results
1	The Users Log In	Valid
2	Displays The Dashboard Page After Successful Login	Valid
3	Students See Bills On The Payment Menu	Valid
4	Students Make Payments Online Using The Midtrans Payment Gateway	Valid
5	Students Select a Payment Method And Copy The Payment Code	Valid
6	Students Print Proof Of Payment	Valid
7	Admin And Principal Check Financial Reports	Valid

DISCUSSION

Based on the results of system testing using the Black Box Testing method as shown in the table above, it can be seen that there were 7 testing activities that obtained results with valid information. This means that the features tested using the Black Box Testing method are declared successful because the output produced matches the expected results. The activities carried out by the admin, students and principal have been described based on the function of each feature tested. The purpose of testing with this validation testing strategy is to measure the level of success of each function of the features contained in the education fee payment information system. In order to find out whether the system can produce the expected output, the system is first given an input under certain conditions. So that the output displayed matches the expected results, the activity can be declared valid.

The author will explain the test results obtained from this research in more detail below:

1. User Login Page
   Figure 6 shows the login page interface which contains email and password columns. Users who can access include treasurers, school principals, and students. Select the sign in action button to enter the dashboard page. After selecting the sign in button, the database will carry out a validation process if the email and password are correct then the system will display the default dashboard page. Conversely, if the email and password are incorrect, the system will return to the login page.
2. User Dashboard Page Display
   Figure 7 shows the admin user dashboard page interface which has seven menus with several sub-menus in the side bar. Meanwhile, in Figure 8, there is a student/parent user dashboard which has two menus on the side bar. Meanwhile, in Figure 9, the principal user dashboard page has the same number of menus as the student/parent user dashboard page, namely two menus on the side bar, but with different functions.

3. Payment Process Page Display
   Figure 10 shows the invoice payment page interface, there are two actions, namely pay and print PDF. If you choose the payment action, the system will display an online payment page as shown in Figure 11. On this page, students/guardians must enter which month they want to pay their bill, then select the online payment method and click the pay action button. Then the system will display a Midtrans payment gateway pop-up by selecting a payment method, such as using an electronic wallet or virtual account as shown in Figure 12. After selecting the payment method, the system will display another pop-up containing the payment code or virtual account number or electronic wallet number which must then be copied as shown in figure 13. If you want to print proof of payment, select the print proof of payment action button in PDF file format on the billing page in figure 10.
4. Financial Report Page
   Figure 14 shows the report page interface. On this page there is a student payment report data table. There is also an action button to download report data. Click on this button and the system will download the payment report in XLXS file format.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of research regarding the creation of an information system for paying education fees by implementing the Midtrans payment gateway in a case study conducted at SMP Pelita Nusantara, the transaction activities for paying education fees carried out by students became easier and the data collection of financial reports carried out by the treasurer became more precise and reduced errors. The following are the conclusions from the results of this research, including:

1. This research resulted in the development of an education fee payment information system that makes the treasurer's work more effective and efficient and reduces the occurrence of errors or data corruption.
2. This system was also built using MySQL as a database, PHP and HTML programming languages, and the Laravel framework as an application design framework.
3. The research method that the author uses in this research is a Design Thinking approach which has results that directly address user needs. Then the system testing method uses the Black Box Testing method which focuses on system functionality and user needs.

This research certainly still has many shortcomings, therefore the author provides several suggestions so that this application can continue to be developed and can be used for more complex needs. The author's suggestion is that it is hoped that this application can be developed by adding the function of sending broadcast messages directly to student/parent telephone numbers and features for online attendance.

FURTHER STUDY

This Web-Based School Payment Information System is only used to input student data, process payment data, carry out payment transactions, create student payment reports, and print proof of student payments. In addition, periodic evaluation is needed to make improvements in accordance with changes and developments in the system.

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