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DESIGN OF E-PAYMENT USING RFID (RADIO FREQUENCY IDENTIFICATION) BASED ON WEBSITE (CASE STUDY: BTH RESTO)

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ABSTRACT

The use of technology in payment systems has influenced changes in payment patterns. BTH Resto, as one of the canteens in the BTH Tasikmalaya University environment, experiences challenges in managing electronic payments because it does not yet have a special E-payment for the Resto. This study aims to develop E-payment using RFID (Radio Frequency Identification) based on the website at BTH Resto to improve efficiency and practicality.

Electronic payment design using USB RFID Reader technology consists of several stages starting from the problem analysis stage, system design, Flowchart and system implementation. The digital payment system using RFID is able to overcome the increasing demand for digital payments, as well as separate the restaurant transaction history from employee personal data.

Based on the tests conducted, the results obtained that the USB RFID Reader can be used as an electronic payment tool. With the adoption of this technology, the speed of service, reducing queues, and updating the payment system.

ARTICLE INFORMATION

Keywords:
E-Payment, RFID, Website.

1. Introduction

Rapidly developing technology and information have resulted in changes in everyday life, one of which has an impact on the payment methods used by the community. According to the Indonesian information portal on its website indonesia.go.id, the value of electronic money transactions is projected to increase by 23.9 percent compared to last year to reach IDR 495.2 trillion in 2023 (Administrator, 2023). This is proof that electronic payment methods are acceptable to the community.

BTH Resto, a canteen located in the BTH University Tasikmalaya environment, also feels the impact of technological developments, especially in managing the payment process. The demand for electronic payments is increasing among buyers, but in reality, cash payments are still the main method at BTH Resto. This causes several problems, including frequent loss of money due to the difficulty of tracking transactions accurately. In addition, cash payments also result in long queues because of the time it takes to give change to customers.

Although BTH still makes cash payments, electronic payment requests are still served by the restaurant, but the electronic payment platform in this restaurant belongs to a personal employee. So, it is difficult to record income, this policy also causes the history of electronic payments to be mixed with employee personal data. This provides an extra obstacle, because the separation between Restaurant transactions and personal data becomes difficult to do. This condition reduces the efficiency in managing transactions at BTH Resto. With this consideration, an innovative solution is needed that can overcome these obstacles and improve the payment experience at BTH Resto to be more efficient, practical and fast.

The use of Radio Frequency Identification (RFID) technology is expected to emerge as an innovative solution to overcome payment problems at BTH Resto. RFID is a radio wave-based identification system, where by using an RFID tag attached to the card, customers can quickly make payment transactions.

Not only as an identification tool, RFID technology also allows student cards and employee cards to be used for cashless transactions at BTH Resto. By utilizing the card, transactions can be carried out completely cashless. Another advantage is the ability to separate restaurant transaction data and employee personal information efficiently. This not only increases the speed of service, but also reduces the queues that occur at the payment counter.

By adopting RFID technology, BTH Resto can upgrade their payment system and provide a secure alternative for customers. Thus, the backlog of orders can be reduced, and the payment experience at BTH Resto becomes more efficient and practical.

From these conditions, it is necessary to develop a payment tool that can work practically and quickly, is able to manage balance data accurately, can be accessed by customers at any time, and has reliable technology.

2. Theoretical basis

2.1. E-Payment

Pratiwi (2021, https://www.harmony.co.id/blog/e-payment-sistem-pembayaran-yang-memudahkan/, accessed December 15, 2023) stated that:

"E-payment is a payment system that involves internet technology as a means of sending money. Without the internet, e-payment is impossible. Usually, e-payment is a payment system in contemporary startups or businesses in the digital era." (Pratiwi, 2021)

According to (Tarantang et al., 2019) in his journal, it provides an understanding that:

"Digital payment is a technology-based payment. In digital payment, money is stored, processed, and received in the form of digital information and the transfer process is initiated through electronic payment instruments."

2.2. E-Payment RFID (Radio Frequency Identification)

The definition of RFID according to Topan et al (2019, in Sufra Alfari et al, 2020, p. 155) states that:

"RFID (Radio Frequency Identification) is a wave-based identification technology using a medium called an RFID tag to retrieve data remotely. RFID has very important parts, namely the frequency tag and the tag reader. The tag reader reads the signal emitted by RF. The tag responds by retransmitting data including a unique serial number" (Sufra Alfarizi et al., 2020)

RFID (Radio Frequency Identification) is an electronic device used to access and recognize data using magnetic cards or barcodes. The advancement of RFID technology currently has a major impact on speed. The application of RFID allows the transfer of information to be more efficient and faster. Basically, RFID uses 2 main devices, namely RFID tags and RFID readers. RFID tags are devices that store data in the form of unique code numbers, while RFID readers are devices that read the information contained in the RFID tag. (Hastuti et al., 2020).

According to (Yahya et al., 2022) "When an RFID tag is activated, the tag will store data and provide a response according to the information that has been entered via the RFID reader."

So simply the author concludes, RFID (Radio Frequency Identification) is a wave-based identification technology that uses RFID tags to retrieve data remotely. RFID involves two main devices: frequency tags and readers. Frequency tags store unique data, and readers read the signals emitted by the tag, which then respond by retransmitting data, including unique serial numbers. RFID is used to access and recognize data using magnetic cards or barcodes. The advantage of RFID technology is that it increases the speed of information transfer, making it more efficient and faster.

Figure 2 . 2.1 RFID Tag
(Source: techsolutions.co.za)

Figure 2.2.2 RFID Reader
(Source: raspberrypi-spy.co.uk)

Figure 2.2.3 USB RFID Reader
(Source: panduanteknisi.com)

2.3. UML (Unified Modeling Language)

According to Rosa Ariani Sukamto and M. Shalahuddin:

"Unified Modeling Language (UML) is one of the most widely used language standards in the world. Industry to define requirements, make analysis and design, and describe architecture in object-oriented programming." (Sukamto & Shalahuddin, 2019) .

2.3.1 UML (Unified Modeling Language)

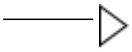
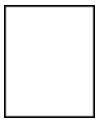
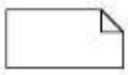
According to Sukamto and Shalahuddin

"Use Case or Use Case diagram is a modeling for the behavior of the information system to be created. Use Case describes an interaction between one or more actors with the information system to be created" (Sukamto & Shalahuddin, 2019)

The following are the symbols in the Use Case diagram according to Rosa and Shalahuddin:

Table 2.3.1.1 Symbols in *Use Case Diagrams*

NO	PICTURE	NAME	INFORMATION
1		Actor	Specifies the set of roles that users play when interacting with a Use Case.
2		Dependencies	A relationship in which changes that occur in an independent element will affect elements that depend on it (non-independent elements).
3		Direct Association	What connects one object to another directly.
4		Include	Specifies the source Use Case explicitly.
5		Extend	Specifies that the target Use Case extends the behavior of the source Use Case at a given point.

6		Association	What connects one object to another.
7		Generalization	A relationship in which a child object (descendent) shares the behavior and data structures of the parent object (ancestor).
8		System	Specifies a package that displays the system in a limited way.
9		Use Case	A description of the sequence of actions performed by the system that produces a measurable outcome for an actor.
10		Note	A physical element that exists when an application is running and represents a computing resource.

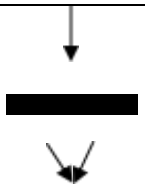
2.3.2 Activity Diagram

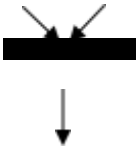
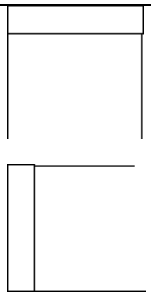
Sukamto and Shalahuddin (2019:161) stated:

"Activity diagrams describe the workflow or activities of a system or business process or menu in the software."

The following are the symbols in the activity diagram according to Rosa and Shalahuddin (2019:162):

Table 2.3.2.1 Symbols in Activity Diagrams

NO	PICTURE	NAME	INFORMATION
1		Activities	Shows how each interface class interacts with each other.
2		Action	The state of the system that reflects the execution of an action
3		Initial Node	How objects are formed or initiated.
4		Activity Final Node	How objects are formed and destroyed
5		Fork Node	One flow which at a certain stage turns into several flows
6		Fork	To show activities that are carried out in parallel

7		Join	To show combined activities
8		Decision	Branch association where if there is more than one activity option
9		Swimlane	Swimlane separates the business organizations responsible for the activities that occur.

3. Results and Discussion

3.1. System Analysis

Electronic payments have become a major trend in various sectors including the culinary industry, the demand for electronic payments has also increased significantly. BTH Resto as part of the university environment also feels the impact of this change. The impact of the change is more pronounced because BTH Resto still implements cash payments as the main payment method. The efforts made by BTH Resto at this time to keep up with the digital trend, they still accept when buyers ask to make electronic payments, but with the limitations of the technology they have, the payments go into their employees' electronic money platform. This policy causes BTH Resto's digital payment history to be mixed with employees' personal data. This provides an extra obstacle, because the separation between Resto transactions and personal data becomes difficult.

This challenge drives BTH Resto to innovate in terms of electronic payments. Merchants need to update their payment systems, and may be able to implement new technologies such as RFID to increase the speed and efficiency of transactions. By presenting innovative solutions to the needs of modern customers, BTH Resto can ensure that they remain relevant in following the ever-growing trend of electronic payments.

3.2. Problem Analysis

The payment process that is currently taking place is as follows:

1. Customers generally pay with cash, payment can be made before or after eating. However, when payment is made after eating, customers who want to pay off the bill will rejoin the queue of new food orders. This results in a buildup of customers, which can have a negative impact on the efficiency of the restaurant's service.
2. Buyers who make electronic payments will first adjust to the electronic money platform owned by the restaurant employee. Payments will also go into the employee's personal account. This is an additional obstacle for employees and restaurant owners when recording

income, because they have to sort the restaurant's transaction history with the employee's personal transaction history.

3. When electronic payments cannot be made, this can be caused by several factors, such as the incompatibility of the digital money platforms owned by the seller and the buyer, so that the transfer of funds cannot be carried out. In addition, the possibility of internet disruption experienced by the buyer can also be a serious obstacle in carrying out electronic transactions. If this happens, the buyer must find other alternatives such as asking for help from friends by making transfers through their accounts, or making transactions in cash.

3.3. Current Payment Process Flowchart

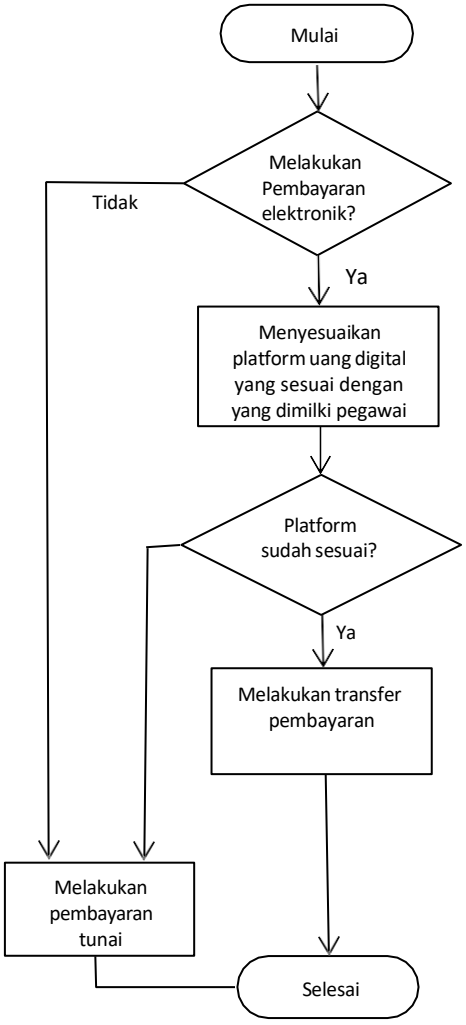


Figure 1. Payment Process

Analysis:

1. Does the buyer want to make electronic payments?
2. If yes, the buyer must adjust the digital currency platform that suits the employee.
3. Otherwise, the buyer makes payment in cash (Done).

4. Is the digital currency platform suitable?
5. If yes, the buyer makes a fund transfer (Done).
6. Otherwise, the buyer makes payment in cash (Completed).

3.4. Needs Analysis

Needs analysis is done to find out from the application that will be used. At this stage will discuss the hardware and software used in making the tool **"Payment Using RFID (Radio Frequency Identification) Based on Website"**

3.4.1. Technology Feasibility

The application of appropriate technology (TTG) in the culinary field is an appropriate experiment. In terms of advanced technology, this device is worthy of being used and implemented because it is a development of advanced technology. This device uses a USB RFID Reader as the main component.

3.5. Application Design and Creation

Based on the results of the study on the payment process at Resto BTH, several obstacles were found in the payment process. Therefore, the author proposes an opinion to design an alternative electronic payment system and tool, so that the payment process can be more modern. The following author includes a proposed analysis in the form of Unified Modeling Language (UML).

3.5.1. Use Case Diagram of Proposed System

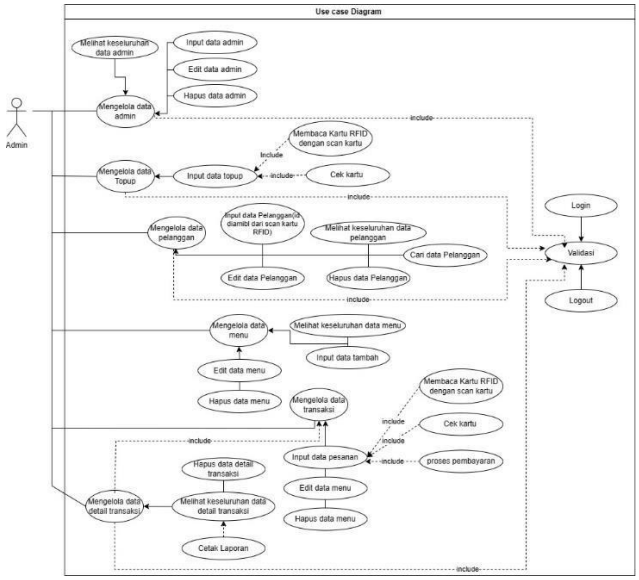


Diagram 3.5.1.1 Proposed *Use Case* Diagram

1. Definition of Actor

The following is a description of the actors in the electronic transaction application system using RFID:

Table 3.5.1.1 Definition of actors in Use Case diagram

No	Actor	Description
1.	Admin	People who have access rights to manage users, manage customer data, manage menu data, and manage transaction data.

2. **Definition of Use Case**

The following is a description of the Use Case in the electronic transaction application system using RFID:

Table 3.5.1.2 Use Case Definition

No	Use Case	Description
1.	Validation	It is the process of checking the access rights of those who have the right to access the data processing process. Validation is a generalization of the login, logout, and status checking processes.
2.	Login	It is the process of logging in.
3.	Logout	It is the process of logging out.
4.	Managing admin data	Managing admin data includes four data management processes, namely viewing data, editing data, deleting data, and inputting data.
5.	View admin data	It is a process to display admin data from the database.
6.	Admin data input	View existing letter classifications.
7.	Edit admin data	It is a process to edit admin data in the database.
8.	Delete admin data	It is the process of deleting data from a database.
9.	Managing customer data	Managing customer data includes five data management processes, namely viewing data, editing data, searching for data, deleting data, and inputting data.
10.	Customer data input	This is the process of inputting customer data into the database. The process is carried out by scanning an RFID card into the device as the ID to be used.
11.	View customer data	It is a process to display customer data from a database.
12.	Search customer data	It is a process to search for one or more data from a database.
13.	Delete customer data	It is the process of deleting data from a database.
14.	Edit customer data	It is the process of editing customer data in the database.
15.	Managing menu data	Managing customer data includes four data management processes, namely viewing data, editing data, deleting data, and inputting data.

16.	View menu data	It is a process to display menu data from the database.
17.	Input menu data	It is the process of inputting customer data into a database.
18.	Edit menu data	It is a process to edit menu data in the database.
19.	Delete menu data	It is the process of deleting data from a database.
20.	Managing transaction data	Managing customer data includes one thing, namely data input.
21.	Input transaction data	It is the process of inputting transaction data into a database or the process of selecting a menu as part of a transaction process.
22.	Reading RFID cards	It is the process of scanning RFID cards to make electronic payments.
23.	Check Card	It is a card checking process to validate card ownership.
24.	Payment process	It is a payment process with confirmation whether the balance is sufficient or not to make the payment.
25.	Manage topup data	Managing detailed transaction data includes one thing, namely data input.
26.	Top up data input	It is the process of inputting top-up data into the database.
27.	Manage detailed transaction data	Managing detailed transaction data includes one thing, namely viewing data.
28.	View detailed transaction data	It is a process to display detailed transaction data from a database.
29.	Delete Menu detail data.	It is the process of deleting data from a database.

3.5.2. Activity Diagram of Proposed System

Activity diagrams describe the work flow of a system or business process or menu in software that has a relationship with each other with data flow and storage. This activity diagram is to overcome obstacles regarding the design of electronic transaction applications using RFID technology.

1. Activity Diagram Input Topup

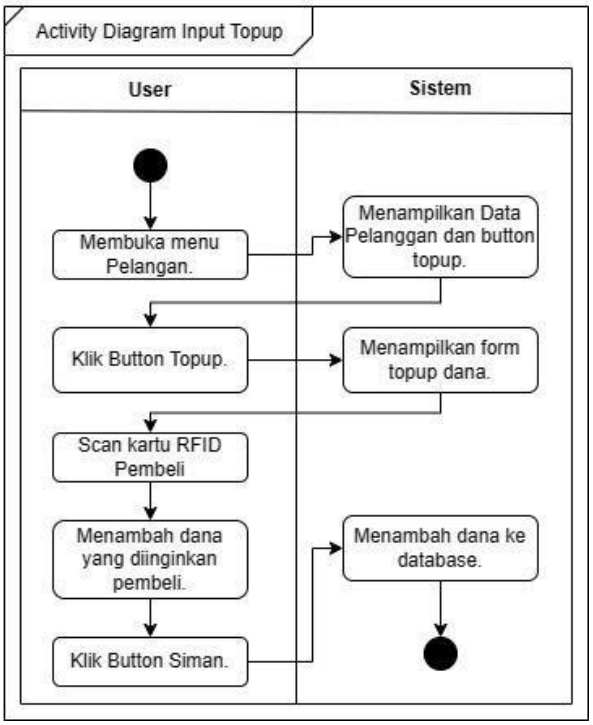


Diagram 3.5.2.1 Activity Diagram Input Topup

Table 3.5.2.1 Description of Topup Input Activity Diagram

Action	Description
Opens the Customer menu.	User opens customer menu.
Displays customer data and topup button.	The system displays customer data and a top-up button.
Click the topup button.	User clicks the top up funds button.
Displays the fund top-up form.	The system displays a top-up form to add funds.
Scan customer RFID card	User scans customer card to enter funds.
Add the funds the buyer wants.	The user writes the nominal amount of funds the buyer wants.
Adding funds to the database.	The system adds funds to the database.

2. Transaction Input Activity Diagram

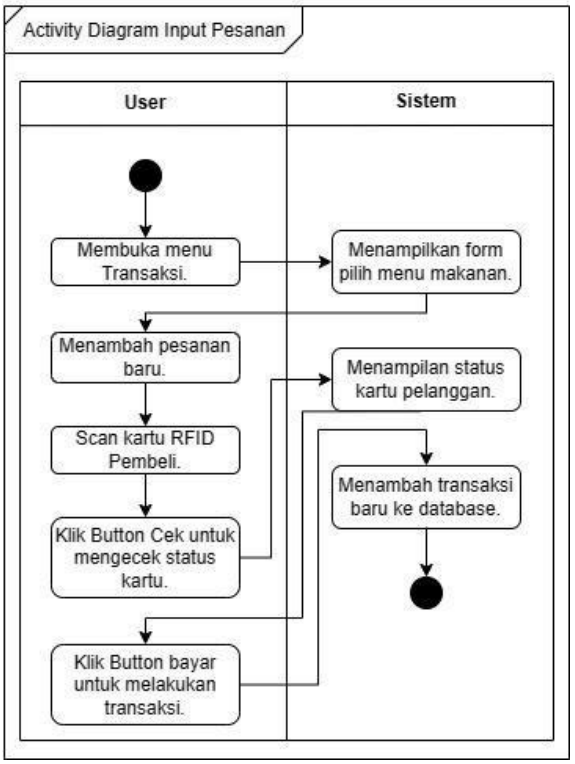


Diagram 3.5.2.2 Activity Diagram Input Transaction

Table 4.5.2.2 Description of Transaction Input Activity Diagram

Action	Description
Open the transaction menu.	User opens the transaction menu.
Displays the food menu selection form.	The system displays a form to select the food menu desired by the buyer.
Add new order.	Users choose the food that the buyer wants.
Scan customer RFID card.	User scans customer card to enter funds.
Click the check button to check the card status.	User clicks the check button to check the card status.
Displays customer card status.	The system displays the status of the checked card.
Click the pay button to make a transaction.	User clicks the pay button to complete the transaction process.
Adding a new transaction to the database.	The system adds a new transaction to the database.

3.6. System Implementation

1. Login

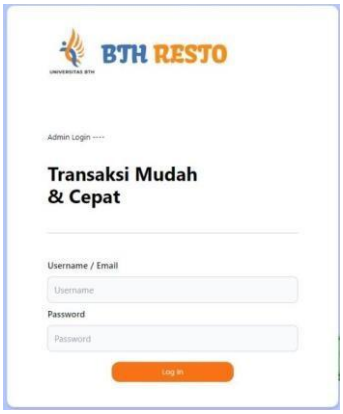


Figure 3.6.1 Login

2. Add User Menu View

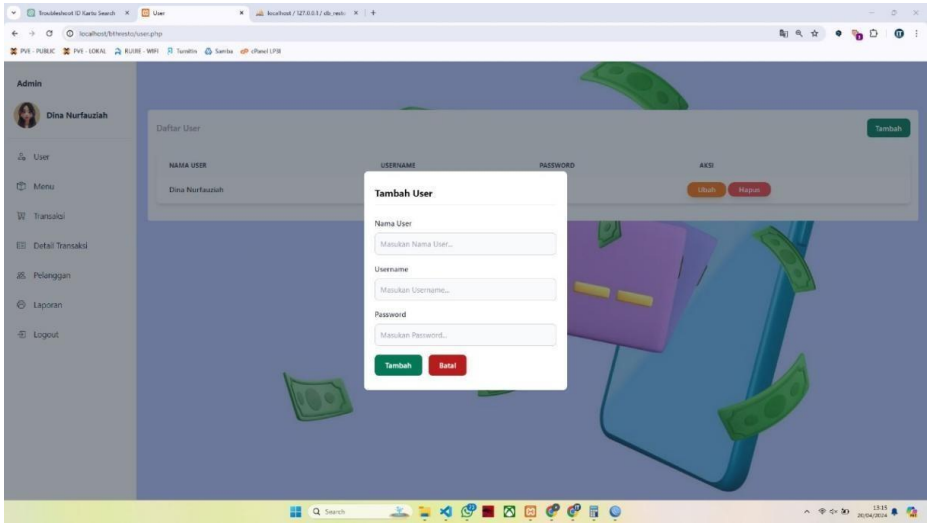


Figure 3.6.2 Add User Menu Display

3. Customer Menu View and Add Customer

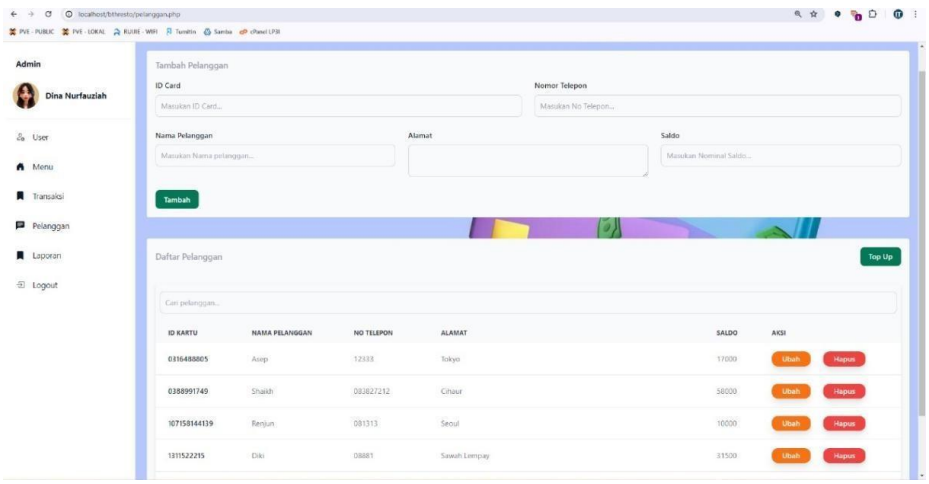


Figure 3.6.3 Customer Menu View

4. Customer Fund Topup Menu Display

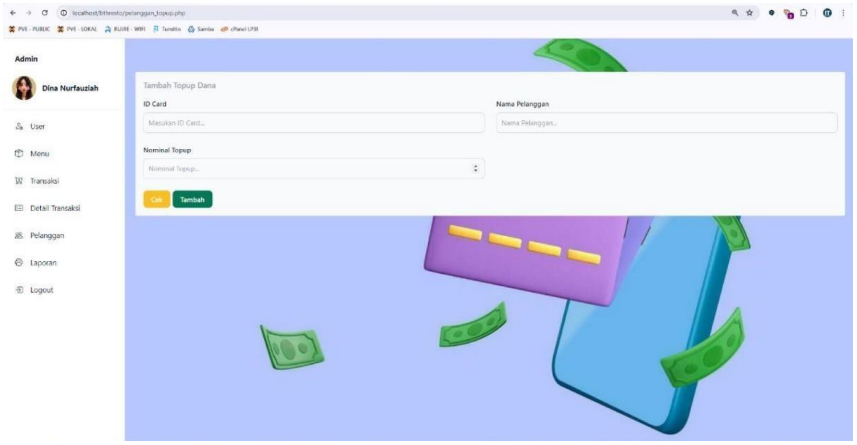


Figure 3.6.4 Customer Fund Topup Menu Display

5. Add Transaction Menu Display

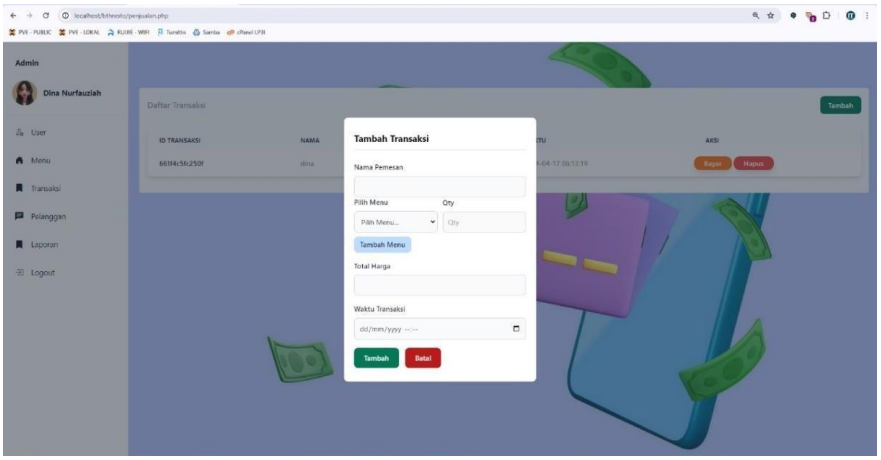


Figure 3.6.5 Add Transaction Menu Display

6. Order Payment Menu Display

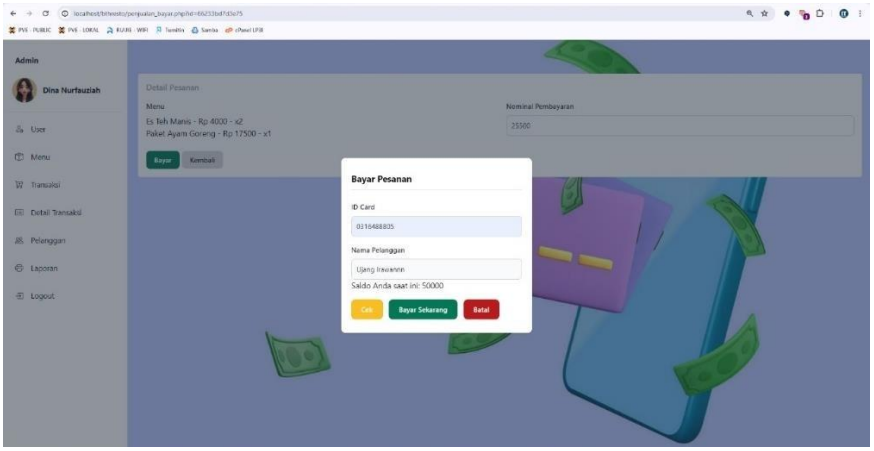


Figure 3.6.6 Payment Order Menu Display

7. Transaction Detail Menu View

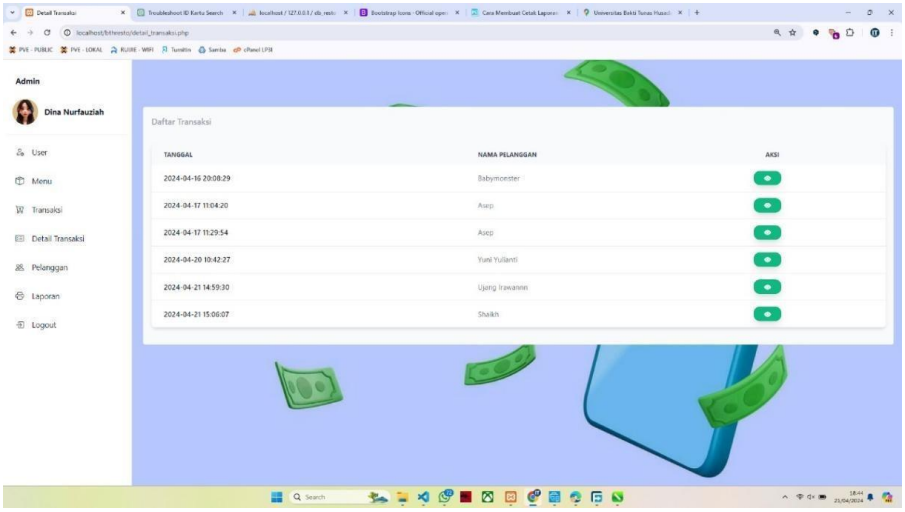


Figure 5.6.7 Transaction Detail Menu Display

8. Report Menu View

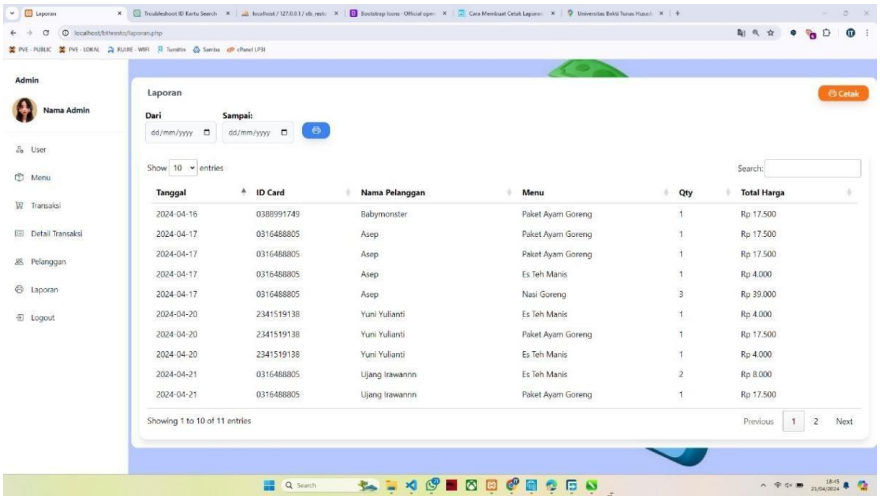


Figure 5.6.8 Report Menu Display

4. Conclusion

After designing a digital payment system using website-based RFID at Resto BTH Tasikmalaya, the following conclusions can be drawn:

1. Digital payment systems using RFID help address the growing demand for digital payments among shoppers.
2. By using a digital payment system using RFID, transaction history is focused on restaurant transactions.
3. By using a digital payment system using RFID, the risk of losing transaction data can be reduced.
4. By using a digital payment system using RFID, customers can quickly make payment transactions and reduce customer queues due to the change process.

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