International Journal Software Engineering and Computer Science (IJSECS) 3 (3), **2023, 495-503**
Published Online December 2023 in IJSECS (http://www.journal.lembagakita.org/index.php/ijsecs)
P-ISSN : 2776-4869, E-ISSN : 2776-3242. DOI: https://doi.org/10.35870/ijsecs.v3i3.1939.

Increasing Product Promotion by Implementing Association Rules in The Web-Based Second_Oldshoes Store Sales System

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Received: 5 December 2023; Accepted: 15 December 2023; Published: 30 December 2023.

Abstract: Promotion is one of the efforts that can be made to maximize profits. Currently, there are various techniques and models for promoting products, both through social media and advertising systems. To get optimal promotional results, it is necessary to calculate the level of customer attraction to a product being offered. The second_oldshoes shop is an original second-hand shoe shop, currently the second_oldshoes shop does not have media to promote its products. The application of association rules in the system is used to display the associative value of each product that a customer buys so that a pattern is formed of the products that are often purchased by each customer. So, it can be used as a basis for decisions in determining suitable products to promote to each customer. The design of this web-based sales system uses Navigation Structure and Unified Modeling Language (UML). Creating a system using the HTML, PHP, CSS, JavaScript, MySQL, and Bootstrap programming languages as a framework.

Keywords: Promotion; Sales System; Association Rule; Web Based.

1. Introduction

The Second_Oldshoes store specializes in offering authentic second-hand shoes. Currently, the store lacks an online presence to showcase its products, relying solely on in-store customers. This limitation has resulted in suboptimal product sales and a limited market reach. In response to the challenges faced by the Second_Oldshoes store in its current sales process, a web-based sales system has been developed using the association rule method. This system includes a market basket analysis feature on the website, which leverages transactional data related to customer product purchases to discover associative rules. These association rules serve as a tool to recommend products according to individual customer needs. The chosen development methodology for this system is the Waterfall model (Classic Life Cycle) due to its linear progression from the initial stages to the maintenance phase. The website was constructed using PHP and MySQL, chosen for their widespread use, and PHP's ability to integrate with various other programming languages. Additionally, the system's design is based on the Unified Modeling Language (UML), encompassing use case diagrams, activity diagrams, sequence diagrams, and class diagrams.

The Association Rule method, also known as market basket analysis, is an analysis technique commonly used to examine the contents of customers' shopping baskets in a supermarket setting. For instance, it can determine the likelihood of a customer purchasing pencils concurrently with erasers. The application of association rules in such cases assists store owners in optimizing product placement, managing inventory, and implementing marketing promotions by offering

discounts on specific product combinations [1][2]. Association analysis is defined as a process to discover all association rules that meet the minimum support and minimum confidence requirements. The foundation of association analysis is divided into two stages:

1) High-Frequency Pattern Analysis: In this stage, combinations of items that meet the minimum support threshold in the database are sought. The support value of an item is obtained using the following formula: Support (A) = Number of transactions containing A / Total transactions.
2) Confidence Calculation: After identifying high-frequency patterns, association rules that meet the minimum confidence requirement are determined. The confidence value of an association rule A → B is calculated as follows: Confidence = P(B|A) = Σ transactions containing A and B / Σ transactions containing A.

The Apriori Algorithm is used to calculate association rules among objects, explaining how two or more objects are related to each other. In other words, the Apriori algorithm is a rule-based algorithm that analyzes whether individuals who purchase product A also tend to purchase product B. This algorithm was proposed by researchers R. Agrawal and Srikant in 1994. It is predominantly used for analyzing shopping cart data and aids in discovering products that are commonly purchased together. In data mining, the Apriori algorithm is widely employed to identify data items that appear most frequently in a database. The data items from transactions in the database form itemsets, and the Apriori algorithm selects the most frequent itemsets to establish association rules that highlight common trends in the database [2].

The Unified Modeling Language (UML) is a visual modeling language utilized to specify, visualize, build, and document the design of software systems. Modeling provides a clear representation of the system to be built, encompassing both its structural and functional aspects. UML can be applied across all development models, system lifecycle stages, and various application domains. UML offers concepts, notations, and guidelines for each type of diagram it encompasses, covering static, dynamic, scope, and organizational aspects. UML has become a standard tool in the field of object-oriented software development, allowing system developers to create standardized and easily understandable blueprints for effective communication with stakeholders [3].

2. Research Method

The system development methodology employed in this project follows the Waterfall model with the following stages:

1) Analysis
   The web design process begins with data collection through direct surveys, problem identification, and system requirements analysis, which is focused on application development.
2) Design
   The website design phase involves creating the system's structure, including navigation design, Unified Modeling Language (UML) diagrams, such as database design using class diagrams, process design through use case diagrams, activity diagrams, and input-output design as initial visuals illustrating the application's appearance. Additionally, specifications for the required software and hardware are part of the application design, with the system utilizing PHP and MySQL.
3) Implementation
   After completing the design phase, the next step is the implementation, where the concepts outlined in the design phase are translated into actual coding or programming.
4) Testing or Trial
   The system undergoes testing using Black Box Testing, which includes processes such as Functional Testing, Non-functional Testing, and Regression Testing.

This research methodology provides a structured approach to system development, ensuring that each stage is completed before moving on to the next. It includes analysis, design, implementation, and testing phases to ensure the development of a robust and functional web-based system.

3. Result and Discussion

3.1 Results

3.1.1 Analysis association rules

Association rule analysis will be carried out with an explanation of each stage of the method as follows:

1) Extraction is the process of retrieving data from a data source to continue the data processing process to the next level or to store the extracted data.
2) Data preprocessing is something that must be done in the data mining process, because not all data or data attributes in the data are used in the data mining process. This process is carried out so that the data will be used as needed.
3) Mining ready data is a data sample that is ready to be analyzed, in this case data that has gone through a data preprocessing process.

4) The algorithm used in this research is the Apriori algorithm.
   This algorithm uses knowledge about frequent itemsets.
5) Rule is the process after the frequent itemset from the analysis is obtained, the next step is to find the confidence of the frequent itemset.

Data from sales extraction and product extraction can be seen in Table 1 and Table 2 as follows:

Table 1. Sales Extraction Data

Id Details	Sales Id	Product Code
001	202306190002	VNS003,VNS005,VNS007
002	202306190002	VNS005,VNS007
003	202306190003	VNS007,VNS003
004	202306190004	VNS003,VNS005,VNS007
005	202306190004	VNS007,VNS009,VNS003

Table 2. Product Extraction Data

Product Code	Category
VNS003	AUTHENTIC
VNS005	OLDSKOOL
VNS007	SLIP ON
VNS009	ERA
VNS006	ANAHEIM

By using an a priori algorithm you can determine frequent itemsets. For example, the specified minimum support is 30%. Then to calculate the support value, use the support equation (%) = support count/total transactions x 100.

Table 3. Binary Table

T	AUTHENTIC	OLDSKOOL	SLIP ON	ERA	ANAHEIM
1	1	1	1	0	0
2	0	1	1	0	0
3	1	0	1	0	0
4	1	1	1	0	0
5	1	0	1	1	0

The results of the binary table calculation are by calculating the total transactions divided by the number of transactions per item.
Example :
Total transactions / number of transactions multiplied by 100.
The total number of AUTHENTIC transactions is 4 and the number of transactions is 5. Means 4/5 = 0.8. Results can be seen in table 4.

Table 4. First Literacy Table

Category	Support
AUTHENTIC	0,8
OLDSKOOL	0,6
SLIP ON	1
ERA	0,2
ANAHEIM	0

Because the minimum support value required is 30%, the ERA and ANAHEIM items are eliminated. And this is the result of the binary table calculation by calculating the total item combination transactions divided by the number of combination transactions per item.

Example:
Total item combination transactions / number of item combination transactions multiplied by 100.
The total transaction combination of AUTHENTIC and OLDSKOOL is 2. Means 2/5 = 0.4. Results can be seen in table 5.

Table 5. Second Literacy Table

Category	Support
{AUTHENTIC, OLDSKOOL}	0,4
{AUTHENTIC, SLIP ON}	0,8
{OLDSKOOL, SLIP ON}	0,6

Because the minimum support value required is 30%, no one is eliminated. And this is the result of calculating the binary table by calculating the remaining items combined and then calculating the total transactions divided by the number of transactions.
Example :
Total transactions / number of transactions multiplied by 100.
Total transactions for AUTHENTIC, OLDSKOOL and SLIP ON are 2. Means 2/5 = 0.4. Results can be seen in table 6

Table 6. Third Literacy Table

Category	Support
{AUTHENTIC, OLDSKOOL, SLIP ON}	0,4

After the frequent itemset from the analysis is obtained, the next step is to find the confidence of the frequent itemset. By using the following equation:

$$Coefidence\ (A \rightarrow B) = P\left(\frac{B}{A}\right) = Support\ count \frac{A \cup B}{Support} Count\ (A)$$

Next, look for the confidence of each candidate from the 2-itemset that has been obtained as in Table 7.

Table 7. Product Confidence Table

Rules	*Confidence*
{AUTHENTIC) → {OLDSKOOL}	0,5
{OLDSKOOL} → {AUTHENTIC}	0,67
{AUTHENTIC} → {SLIP ON}	1
{SLIP ON} → {AUTHENTIC}	0,8
{OLDSKOOL} → {SLIP ON}	1
{SLIP ON} → {OLDSKOOL}	0,6
{AUTHENTIC, OLDSKOOL} → {SLIP ON}	1
{AUTHENTIC, SLIP ON} → {OLDSKOOL}	0,5
{OLDSKOOL, SLIP ON} → {AUTHENTIC}	0,67

Example :
Conf (AUTHENTIC, SLIP ON)
=sup(AUTHENTIC,SLIP ON) / sup(AUTHENTIC)
= 0.8 / 0.8 = 1
If the minimum confidence is 70%, then only candidate:

$\{AUTHENTIC \rightarrow SLIP\ ON\}100\%$
$\{SLIP\ ON \rightarrow AUTHENTIC\}80\%$
$\{OLDSKOOL \rightarrow SLIP\ ON\}100\%$
$\{AUTHENTIC, OLDSKOOL\} \rightarrow \{SLIP\ ON\}100\%$

Which is a strong candidate so that product recommendations can be used using the rules:
1) If a customer buys AUTHENTIC then the customer will 100% buy SLIP ON too.
2) If customers buy SLIP ON then 80% of customers will buy AUTHENTIC too.
3) If a customer buys OLDSKOOL then the customer will 100% buy SLIP ON too.
4) If customers buy AUTHENTIC and OLDSKOOL then customers will 100% buy SLIP ON too.

3.1.2 System Design

Navigation Structure is the structure or flow of a system, the navigation structure used is a mixed navigation structure, because a mixed navigation structure is considered better in conveying the relationship of information between pages. This navigation structure will show what information can be displayed [5]. Figure 1 is the admin navigation structure that the admin page is useful for viewing, adding, changing, deleting, and printing data which can only be done by the admin to avoid data damage on the website. Admin must log in before accessing the homepage. After successful login the admin can access the home page. On the admin homepage there are several monitors that are used to organize data, namely item data, brand data, type data, user data, transaction data, reports, profiles, promos, birthdays, reviews and exits.

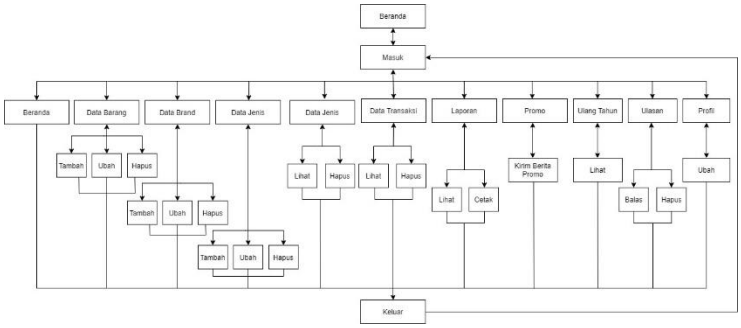


Figure 1. Admin Navigation Structure

The customer navigation structure in Figure 1 explains that when a customer successfully logs in, the customer will go to the home menu, product and category menu to place an order or add to the basket and see details of the brands and products offered by second_oldshoes, the purchase history menu to view payment receipts, data order, input payment receipt and delete history, basket menu to see products that have been entered into the basket and customers can carry out several processes, namely canceling the purchase, continuing shopping, and payment, after making the payment (transaction) customers can provide reviews about the product, menu contact to see the service number and shop address, search menu is used to quickly search for the product you are looking for, and exit is used by customers to exit the customer page and return to the user page.

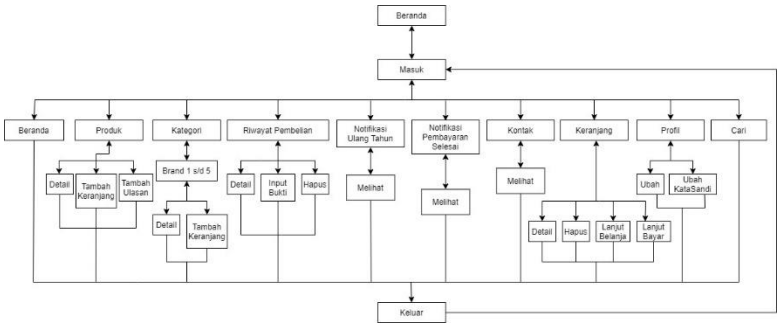


Figure 2. Customer navigation structure

Figure 2 is the Admin Sequence Diagram, admin as actor. Meanwhile, the login features, homepage, item data, brand data, type data, user data, transaction data, report data, birthdays, promos, review data, birthday data, profile data, change password and exit are objects. The actor and object symbols interact, the interaction that occurs is the admin interaction with the system.

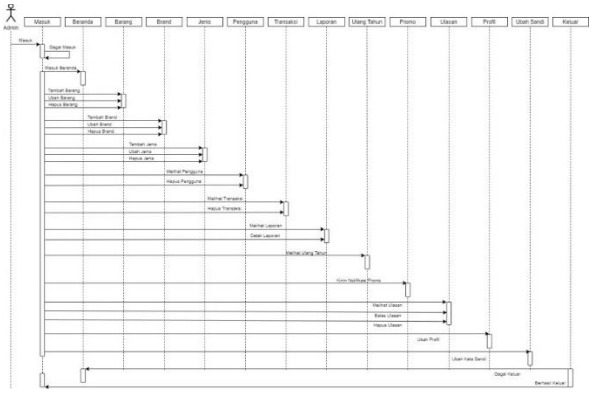


Figure 3. Admin Sequence Diagram

In Figure 4 Customer Sequence Diagram, the customer is the actor. While the login features, products, categories, purchase history, birthday notifications, payment completed notifications, search, basket (shopping & transactions), profile, change password, contact about and exit are objects.

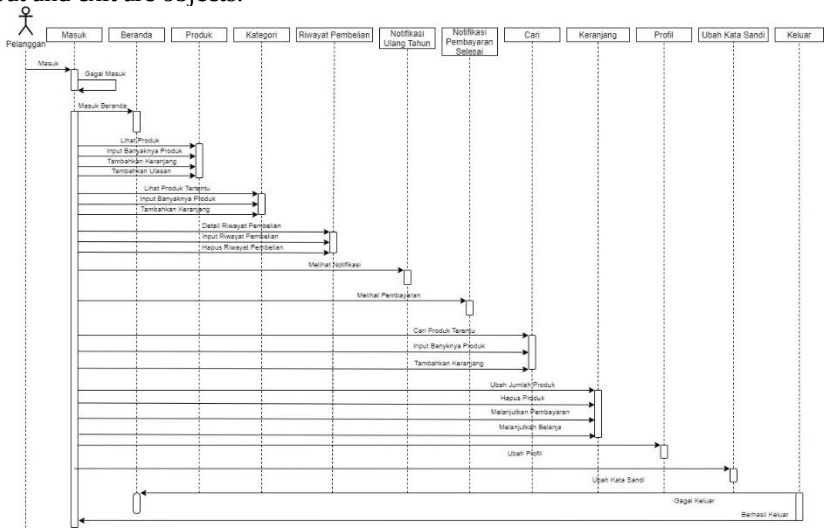


Figure 4. Customer Sequence Diagram

In Figure 5 the Class Diagram consists of 7 classes, namely tb_transaksi_jual, tb_user, tb_cart, tb_transaksi_jual_detail, tb_product, tb_type and tb_brand.

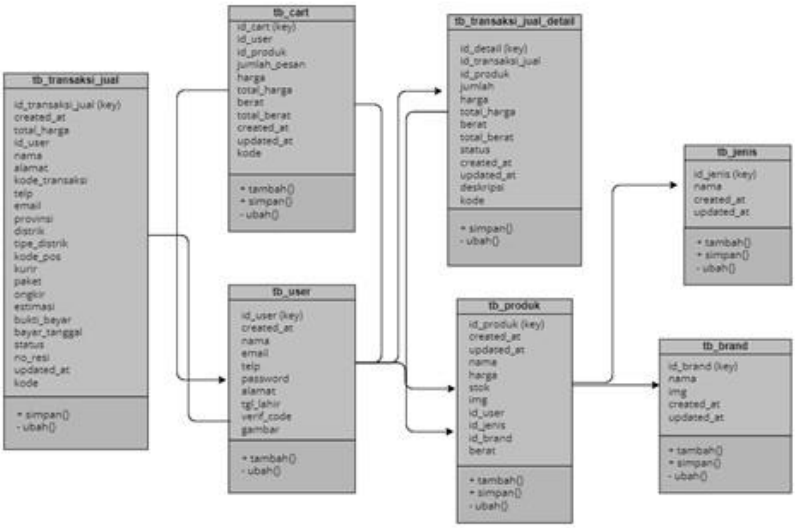
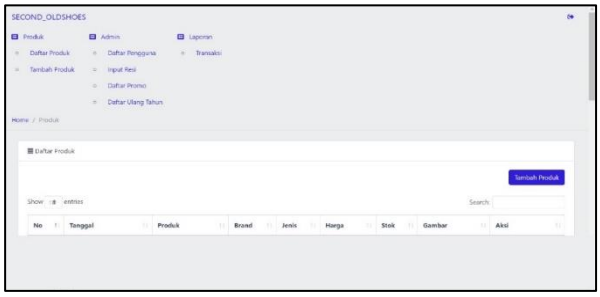


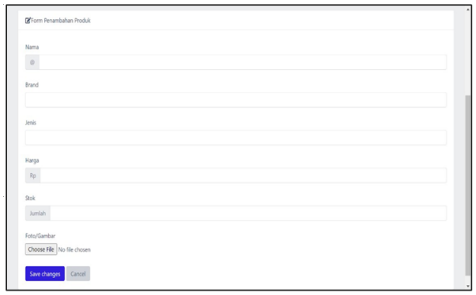
Figure 5. Class Diagram

3.1.3 Web Page Display

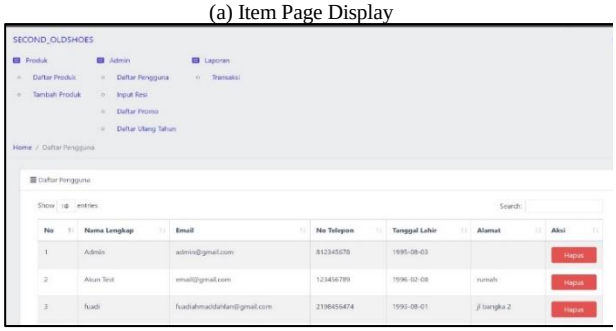
The web page display is divided into two due to the different uses and functions of each page, namely the admin page and the customer page. In the admin display there is a goods page, an add goods page, a user page, a receipt input page, a birthday page, a promo page and a report page. Meanwhile, in the customer view there is a registration page, home page, birthday notification page, promo message notification page, basket page, checkout page, order details page, payment method page, payment confirmation page, payment receipt page, purchase history page and receipt input page. payment. The item page display is a page that displays item data tables such as item name, item type, item brand, item stock and item images. On this page the admin can also add items, the following is a display of the item data page which can be seen below.



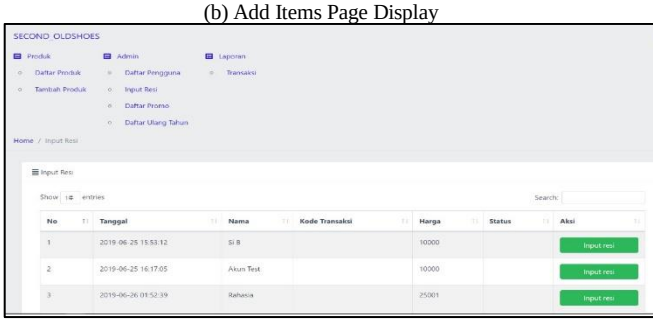
(a) Item Page Display



(b) Add Items Page Display

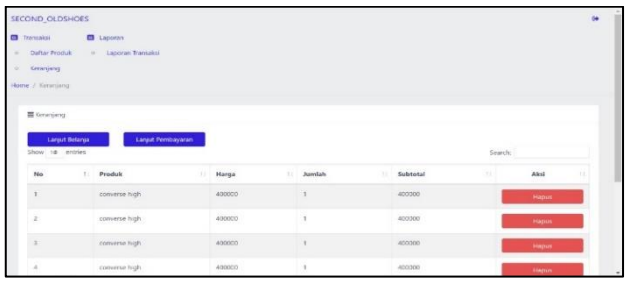


(c) User Page Views

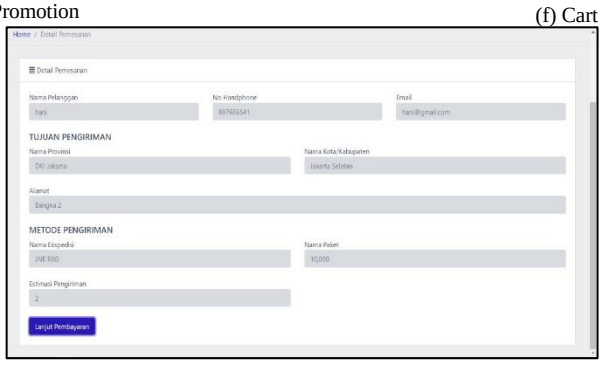


(d) Receipt Input Page Display

(e) Page View Promotion



(f) Cart Page View



(g) Order Details Page Display

Figure 6. Web Page Display

The add item page display is a page that displays input item data, such as item name, item type, item brand, item price, item stock and item image. The following is a display of the add item page which can be seen in Figure 6.1. The user page display is a page that displays a table of user data, the user's telephone number, the user's date of birth, and the user's residence address. On this page the admin can also delete users. The following is a display of the user page which can be seen in figure 6.b. The receipt input page display is a page that displays the receipt data input form for transaction data that has been entered from the customer. The following is a display of the receipt input page which can be seen in figure 6.c. The promo page display is the main page of promo data in which there is activity of sending messages in the form of notifications via email containing notices of discounts or promos on a product sold at the second_oldshoes store. The following is a display of the promo page which can be seen in figure 6.d. The basket page display is a page that displays several selected products and can change the number of products. The following is a display of the basket page which can be seen in figure 6.e. The order details page display is a page that displays several delivery destination data and delivery method data. The following is a display of the order details page which can be seen in figure 6.f. System testing is carried out by running all elements to ensure all functions run well. Testing begins by running the account registration form, ordering a product with the condition of completing the data on the profile page, then making a payment transaction. Then testing is carried out by entering some product data, carrying out tests, and purchasing a number of existing products as samples. Black Box Testing is carried out based on website details such as the appearance

of the website, the functions on the website and the suitability of the function flow of the second_oldshoes website. Testing is carried out on functional testing, non-functional testing, and regression testing [6]. This test aims to check the results of the web creation, whether it functions well and serves users efficiently.

3.2. Discussion

The results obtained from association rule analysis explain patterns and relationships in sales and product data, thereby offering valuable insights into customer behavior and preferences. Association rule analysis allows us to identify sets of frequently used items and their associated levels of trust, providing a deeper understanding of customer purchasing patterns. Specifically, Researchers observed that certain product combinations had high levels of trustworthiness, indicating a strong relationship. For example, if a customer buys a "REAL" product, they will likely also buy a "SLIP ON" product. These insights can be leveraged for personalized product recommendations and targeted marketing strategies, improving the overall shopping experience. Additionally, the analysis revealed that some items, such as "ERA" and "ANAHEIM," did not meet the minimum support threshold of 30%, so they were eliminated from the association rule results. This information is valuable because it helps us focus on promoting and managing products with higher customer demand, optimizing inventory and marketing efforts. The system design section outlines the navigation structure for the admin and customer interfaces. Structured navigation ensures that users, whether administrators managing the platform or customers shopping for products, can easily access the features and information they want. Sequence diagrams provide insight into the flow of interactions between the user and the system, emphasizing the importance of user-friendly interfaces and smooth interactions. These diagrams serve as a blueprint to ensure that user actions are aligned with system responses, ultimately increasing user satisfaction and operational efficiency. Additionally, class diagrams highlight the relationships between different classes in the system, emphasizing data organization and functionality. This structured approach to data management ensures that information is accessible, organized and used efficiently across various aspects of our business operations. The system testing phase ensures that the website functions as intended. By conducting Black Box Testing and assessing functional, non-functional and regression aspects, Researchers aim to identify and fix potential problems, ultimately providing a reliable and smooth online shopping experience for customers. As progress continues, researchers realize that technology and user preferences continue to evolve. Therefore, we must remain committed to continuing to make improvements. This includes regular updates to the website, monitoring customer feedback, and staying abreast of industry trends to adapt and improve the system. The association rule analysis findings and system design considerations presented offer a comprehensive understanding of business strategy. By leveraging insights gained from data analysis and ensuring a user-friendly system design, it is ready to provide an exceptional shopping experience for customers while optimizing business operations.

4. Related Work

Related research in the field of association rules and data mining includes various studies and research efforts in various domains. Several important works explain the practical application and importance of association rule mining. Cholifah *et al.* (2018) conducted research on black box testing for Android applications using PhoneGap technology, showing the importance of testing methods in software development [6]. Zulfikar *et al.* (2016) explored the application of association rules with the Apriori algorithm to improve promotional quality, emphasizing the role of data mining techniques in improving marketing strategies [7]. Ananda *et al.* (2020) investigated determining sales data patterns using the Apriori Association Rules Method, which shows the relevance of association rules in analyzing sales data [8]. Suchacka and Chodak (2017) investigated the use of association rules to assess purchase probability in online stores, highlighting the application of data mining in understanding consumer behavior and decision-making processes [9]. Chiang (2011) proposed a data mining procedure with an improved model to explore customer value association rules, emphasizing the importance of association rule mining in customer analysis and segmentation [10]. Tarigan *et al.* (2021) conducted research on FP_Tree Association Rule Mining for e-commerce product advertising efforts to improve product brand sales strategies in Indonesia, highlighting the importance of association rules in improving e-commerce marketing strategies [11]. Chen and Gunawan (2023) focused on improving retail transactions through data-driven recommendation systems using Modified RFM Analysis and Association Rules Mining, highlighting the role of association rules in optimizing retail and customer recommendation systems [12].

This research is related to several related studies in the domain of data mining and association analysis. However, what differentiates this research is its focus on applying the Apriori algorithm to analyze sales patterns in the context of the second_oldshoes online store. Some important points that differentiate this study include. First, the specific business, where this research focuses on sales of shoe products in the second_oldshoes online store, makes it relevant and specific for understanding sales patterns of certain products, different from general research on association analysis. Second, practical implementation in real businesses, by looking for the potential application of bundling promotions based on sales patterns, shows the relevance and practical application of research findings in improving business performance. Third, the use of the Apriori algorithm as a special technique in association analysis, but implemented on shoe sales data, presents unique challenges such as processing transaction data and selecting relevant attributes. Lastly, the research

includes an in-depth analysis of the results, including calculations of support and trustworthiness for each resulting association rule, assisting in understanding sales patterns and potential promotions that can be implemented. This research, although related to other research in the field of data mining, characterizes itself by focusing on its practical application in the online shoe business and in-depth analysis of the results.

5. Conclusion

Based on the results of the research and discussion, it can be concluded that: the web-based sales system at the second_oldshoes store makes it easy for sellers and buyers to carry out product ordering transactions at the second_oldshoes store without meeting or face-to-face. The system provides a user page, basket page and transaction history page so that admin can analyze what items are often sold and bought by whom by applying association rules, and so that admin can create bundling promos for frequently sold items.

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