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The Implementation of Single Moving Average and Double Exponential Smoothing Methods for Sales Forecasting at Ludin Mart Pottery Store

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Abstract

Increasing business competition driven by rapid technological development requires Micro, Small, and Medium Enterprises (MSMEs) to implement effective sales strategies. One approach was sales forecasting, which supports accurate business decision-making. This study was conducted at Toko Gerabah Ludin with the aim of applying and comparing two forecasting methods: Single Moving Average (SMA) and Double Exponential Smoothing (DES), to predict product sales. The data used consisted of monthly sales from July 2024 to May 2025. The SMA method with a period of 3 produced a sales prediction for Rice Flour in June 2025 of 108.33, with a Mean Absolute Percentage Error (MAPE) of 7.36%. Meanwhile, the DES method produced a forecast of 115.92 with a MAPE of 7.8%. Based on the accuracy evaluation using MAPE, the SMA method provided slightly more accurate results compared to DES for the given dataset. Therefore, the SMA method was considered more suitable for short-term sales forecasting in Toko Gerabah Ludin. This research was expected to serve as a reference for MSME practitioners in selecting the appropriate and efficient forecasting method to support stock planning and business strategy.

Keywords: *Sales forecasting, Single Moving Average, Double Exponential Smoothing, MAPE, MSMEs.*

1. Introduction

The advancement of science and technology has fueled increasingly fierce competition in the business world. Every Small and Medium Enterprise (SME) continuously strives to increase its product sales. This also applies to Ludin Mart, which shares the same goal: to maximize profits. A crucial aspect of the sales business is the actual sales activity itself. Sales are a crucial indicator in assessing a business's success in achieving its goals, as the number of items sold directly impacts the store's revenue and profits. Based on this, forecasting the number of items to be sold is necessary to meet consumer demand. With this analysis, Ludin Mart can obtain more accurate information to increase revenue while minimizing the risk of loss[1].

The Single Moving Average method is a forecasting technique used to estimate future conditions. According to Wijaya, predicting future periods requires a certain amount of crime data over a predetermined period. Ludin Mart can use this forecasting method as a basis for predicting sales at a specific time. The use of the Single Moving Average (SMA) method in this study is based on its simple and easy-to-apply concept. The SMA works by calculating the average sales volume over a specific period, making it suitable for pharmacy sales data that fluctuates but does not show significant trends. Furthermore, this method is time-efficient and does not require large computing resources, allowing it to provide an initial overview of sales patterns quickly and with sufficient accuracy[2].

The Double Exponential Smoothing (DES) method was used in this study because it is able to capture trend patterns in pharmacy sales data better than simpler methods. DES takes into account two main elements simultaneously: level and trend, making it suitable for application to data that shows an increasing or decreasing trend over time. While maintaining efficiency and ease of use, DES is the right choice for producing more accurate predictions to support stock planning and sales decision-making. Several previous studies have also applied the DES method, such as the one conducted by Ariyanto, Puspitasari, and Ericawati in forecasting food crop production, which produced a PE value of 2.22%[3].

Forecasting is a crucial element in the decision-making process. Essentially, forecasting is based on historical data analyzed through specific methods. This historical data is collected, analyzed, and studied to then relate it to the passage of time[4]. Good forecasting will have a positive impact on a business. Conversely, if estimates or forecasts are inaccurate, the business will be unprepared to face emerging problems, which can have detrimental consequences for the business itself. Consequences can include company losses, the loss of employees and investors, decreased sales, and even potential bankruptcy[5].

One of the strategic aspects of a company's ability to compete in the business world is planning product availability to meet market demand. Therefore, a manager's role in understanding and forecasting future business conditions is crucial. A common challenge managers face is how to forecast future sales based on previously recorded data. This forecast significantly influences managers' decisions regarding the quantity of goods the company should produce[6].

Forecasting is also a crucial part of every company and business organization's management decision-making. Some large companies even hire specialized consultants to study, analyze, and provide recommendations regarding future product demand forecasts. Production management consistently utilizes demand forecasting in planning, including meeting consumer needs, workforce planning, production capacity, facility layout, location determination, and production scheduling[7].

Maintaining and ensuring adequate stock levels is a crucial part of the sales and purchasing process. Inventory is a key commodity in trading companies and a vital need for business owners. From this perspective, inventory management in warehouses and on display serves as a focal point for sales to customers[8].

The stock recording process is still done manually, which often leads to inaccuracies in inventory control, potentially leading to overstocking or understocking. This situation can result in significant financial losses if not addressed promptly. This study aims to apply the decomposition method to predict building material sales and design a web-based sales prediction system to support decision-making [9]. This study uses a quantitative descriptive approach for data collection and analysis. Data were obtained through interviews, observations, and analysis of historical sales data. All collected data were used as the basis for designing a web-based sales forecasting system at the Ludin Mart Pottery Store, using two methods: Single Moving Average (SMA) and Double Exponential Smoothing (DES). In addition to designing the system, this study also aims to compare the accuracy of the two forecasting methods.

2. Methodology

The quantitative forecasting approach using the time series method will determine the input data values from a series of serial or periodic data originating from transactions in a certain time period[10]. This study uses a quantitative descriptive approach for data collection and analysis. Data were obtained through interviews, observations, and analysis of historical sales data. All collected data were used as the basis for designing a web-based sales forecasting system at the Ludin Mart Pottery Store, using two methods: Single Moving Average (SMA) and Double Exponential Smoothing (DES). In addition to designing the system, this study also aims to compare the accuracy of the two forecasting methods.

3. Results and Discussion

All paragraphs must be justified alignment. With justified alignment, both sides of the paragraph are straight.

3.1. Observation Data

The data in this study were obtained through three main methods: observation, interviews, and literature review. Direct observation was conducted at the Ludin Mart store to obtain a concrete picture of sales activities and inventory management. Furthermore, interviews were conducted with relevant parties, such as the store owner, to obtain more in-depth information regarding sales patterns and challenges faced in inventory management. Literature review was also used to strengthen the theoretical basis and understand forecasting methods relevant to this study. The sales data used is presented in the following table, where the researcher utilized 12 months of purchase data as analytical material in developing the forecasting system.

Table 1 : Ludin Mart sales from July 2024-May 2025

		Mie Goreng	Mie Soto	Minyak Goreng	Gula
1	July 2024	240	200	120	200
2	August 2024	220	220	100	210
3	September 2024	225	250	130	230
4	October 2024	235	225	80	225
5	November 2024	250	230	125	215
6	December 2024	300	215	115	220
7	January 2025	234	215	115	200
8	February 2025	250	200	135	217
9	March 2025	212	235	150	235
10	April 2025	245	240	90	240
11	May 2025	230	210	100	220
12	June 2025	210	250	110	250

3.2. Application of Forecasting

The sales prediction system was tested using two methods: a Single Moving Average (SMA) with a period of 3 and Double Exponential Smoothing (DES) with an alpha of 0.1 and a beta of 0.7. In this test, sales data was used as input to generate sales predictions for the following period. This process aimed to assess the accuracy of each method in projecting sales trends. Calculation results from July 2024 to June 2025 :

a. Calculating Single Moving Average

In the June 2025 period, the Single Moving Average (SMA) method with a 3-month moving average was used as a reference in the prediction calculations. A Single Moving Average (SMA) is a forecasting method in time series analysis used when historical data shows no trends or seasonal patterns. This method aims to reduce random elements by calculating the average of multiple data points simultaneously, thus minimizing both positive and negative errors[11].

$$St + 1 = \frac{Xt + Xt - 1 \ldots Xt - n + 1}{n}$$

Description:
St + 1: Forecast for period t + 1
Xt: Data for period t
n: Moving Average time period

Table 2: Manual Single Moving Average Calculation of Mie Goreng

No	Month	Mie Goreng	Single Moving Average Prediction	APE
1	July 2024	240	-	-
2	August 2024	210	-	-
3	September 2024	230	-	-
4	October 2024	245	226,67	7,48
5	November 2024	212	228,33	7,70
6	December 2024	250	229,00	8,40
7	January 2025	234	235,67	0,71
8	February 2025	300	232,00	22,67
9	March 2025	250	261,33	4,53
10	April 2025	235	261,33	11,21
11	May 2025	225	261,67	16,30
12	June 2025	220	236,67	7,58
13	July 2025	-	226,67	-

Based on the results of the Fried Noodle sales forecast using the Single Moving Average (SMA) method, it can be concluded that the resulting predictions are quite close to the actual data for most periods, although there are still differences when there are significant spikes or declines in sales. Overall, this method is quite effective for short-term forecasting with a relatively stable sales pattern, and the July 2025 prediction result of 226.67 can be used as an initial reference in inventory planning.

Table 3: Manual Single Moving Average Calculation of Mie Soto

No	Month	Mie Soto	Single Moving Average Prediction	APE
1	July 2024	200	-	-
2	August 2024	220	-	-
3	September 2024	250	-	-
4	October 2024	225	223,33	0,74
5	November 2024	230	231,67	0,72
6	December 2024	215	235,00	9,30
7	January 2025	215	223,33	3,88
8	February 2025	200	220,00	10,00
9	March 2025	235	210,00	10,64
10	April 2025	240	216,67	9,72
11	May 2025	210	225,00	7,14
12	June 2025	250	228,33	8,67
13	July 2025	-	233,33	-

Based on the results of Mie Soto sales forecasting using the Single Moving Average (SMA) method, it can be concluded that the resulting predictions are quite close to the actual data for most periods, although there are still differences when sales experience significant changes. In general, the SMA method is quite effective for short-term forecasting with relatively stable sales patterns, and the July 2025 prediction result of 233.33 can be used as an initial reference in inventory planning.

Table 4: Manual Single Moving Average Calculation of Minyak Goreng

No	Month	Minyak Goreng	Single Moving Average Prediction	APE
1	July 2024	120	-	-
2	August 2024	100	-	-
3	September 2024	130	-	-
4	October 2024	80	116,67	45,83
5	November 2024	125	103,33	17,33
6	December 2024	115	111,67	2,90
7	January 2025	115	106,67	7,25
8	February 2025	135	118,33	12,35
9	March 2025	150	121,67	18,89
10	April 2025	90	133,33	48,15
11	May 2025	100	125,00	25,00
12	June 2025	110	113,33	3,03
13	July 2025	-	100,00	-

Based on the results of forecasting cooking oil sales using the Single Moving Average (SMA) method, it can be concluded that the prediction accuracy is still unstable due to significant differences in several periods, especially when there are sharp sales fluctuations. Nevertheless, this method is still able to provide a general overview of sales trends and can be used for short-term forecasting, with the July 2025 prediction result of 100.00 as an initial reference for inventory planning.

Table 5: Manual Single Moving Average Calculation of Gula

No	Month	Gula	Single Moving Average Prediction	APE
1	July 2024	200	-	-
2	August 2024	210	-	-
3	September 2024	230	-	-
4	October 2024	225	213,33	5,19
5	November 2024	215	221,67	3,10
6	December 2024	220	223,33	1,52
7	January 2025	200	220,00	10,00
8	February 2025	217	211,67	2,46
9	March 2025	235	212,33	9,65
10	April 2025	240	217,33	9,44
11	May 2025	220	230,67	4,85
12	June 2025	250	231,67	7,33
13	July 2025	-	236,67	-

Based on the results of sugar sales forecasting using the Single Moving Average (SMA) method, it can be concluded that the predictions are quite close to the actual data, with a relatively small error rate in most periods. This method has proven quite effective for short-term forecasting with stable sales patterns, and the July 2025 prediction of 236.67 can be used as an initial reference for inventory planning.

b. Calculating Double Exponential Smoothing

The Double Exponential Smoothing method has the advantage of being able to model trends and rates of change in time series data more efficiently than other methods. This method requires relatively little data and only one parameter. Furthermore, this method can dynamically adjust predictions to changing data patterns, resulting in more accurate results in the short term. Due to its simplicity, this method is suitable for practitioners who need quick solutions[12].

$$S't = \alpha . Xt + (1 - \alpha) S't{-}1$$

Description:

$S't$ = is the first exponential smoothing value

α = exponential smoothing parameter with a value of $0 < \alpha < 1$

$S't{-}1$ = previous exponential smoothing value

Xt = real value of period t

Table 6: Manual Double Exponential Smoothing Calculation of Mie Goreng

No	Month	Mie Goreng	Double Exponential Smoothing Prediction	APE
1	July 2024	240	-	-
2	August 2024	210	240,00	14,29
3	September 2024	230	234,90	2,13
4	October 2024	245	231,97	5,32
5	November 2024	212	231,74	9,31
6	December 2024	250	226,85	9,26
7	January 2025	234	227,88	2,62
8	February 2025	300	227,62	24,13
9	March 2025	250	239,06	4,37
10	April 2025	235	245,13	4,31
11	May 2025	225	248,37	10,39
12	June 2025	220	248,66	13,03
13	July 2025	-	246,41	-

Based on the results of Fried Noodle sales forecasting using the Double Exponential Smoothing (DES) method, it can be concluded that the resulting prediction is quite close to the actual data, especially in periods with stable sales patterns, although there is still a significant difference when there is a sales spike such as February 2025. Overall, the DES method is better able to follow trends than the simple method, so it is suitable for short-term forecasting on data that has an upward or downward trend. The predicted result for July 2025 of 246.41 can be used as an initial reference in inventory planning.

Table 7: Manual Double Exponential Smoothing Calculation of Mie Soto

No	Month	Mie Soto	Double Exponential Smoothing Prediction	APE
1	July 2024	200	-	-
2	August 2024	220	200,00	9,09
3	September 2024	250	203,40	18,64
4	October 2024	225	212,72	5,46
5	November 2024	230	219,47	4,58
6	December 2024	215	226,78	5,48
7	January 2025	215	231,04	7,46
8	February 2025	200	233,75	16,87
9	March 2025	235	232,32	1,14
10	April 2025	240	234,72	2,20
11	May 2025	210	237,76	13,22
12	June 2025	250	235,54	5,78
13	July 2025	-	238,56	-

Based on the results of Mie Soto sales forecasting using the Double Exponential Smoothing (DES) method, it can be concluded that the resulting predictions are quite close to the actual data in most periods, although there are still quite large differences when sales experience sharp fluctuations, such as in September 2024 and February 2025. Overall, the DES method is quite

effective because it is able to follow sales trend patterns better than simple methods, so it is suitable for use in short-term forecasting. The predicted results for July 2025 of 238.56 can be used as an initial reference in inventory planning.

Table 7: Manual Double Exponential Smoothing Calculation of Minyak Goreng

No	Month	Minyak Goreng	Double Exponential Smoothing Prediction	APE
1	July 2024	120	-	-
2	August 2024	100	120,00	20,00
3	September 2024	130	116,60	10,31
4	October 2024	80	117,48	46,85
5	November 2024	125	110,64	11,48
6	December 2024	115	110,00	4,35
7	January 2025	115	108,77	5,42
8	February 2025	135	108,10	19,93
9	March 2025	150	111,38	25,75
10	April 2025	90	118,53	31,70
11	May 2025	100	116,97	16,97
12	June 2025	110	115,38	4,89
13	July 2025	-	114,58	-

Based on the results of forecasting Cooking Oil sales using the Double Exponential Smoothing (DES) method, it can be concluded that the resulting predictions are still less stable because there are quite large differences in periods with sharp sales fluctuations, such as October 2024 and April 2025. Nevertheless, the DES method still provides an overview of general sales trends and is more responsive to changes than the simple method, so it can be used as an initial reference for inventory planning, with the predicted results for July 2025 being 114.58.

Table 8: Manual Double Exponential Smoothing Calculation of Gula

No	Month	Gula	Double Exponential Smoothing Prediction	APE
1	July 2024	200	-	-
2	August 2024	210	200,00	4,76
3	September 2024	230	201,70	12,30
4	October 2024	225	207,21	7,91
5	November 2024	215	212,92	0,97
6	December 2024	220	217,20	1,27
7	January 2025	200	221,75	10,87
8	February 2025	217	222,32	2,45
9	March 2025	235	224,16	4,61
10	April 2025	240	228,38	4,84
11	May 2025	220	233,49	6,13
12	June 2025	250	235,14	5,94
13	July 2025	-	240,67	-

Based on the results of sugar sales forecasting using the Double Exponential Smoothing (DES) method, it can be concluded that the resulting predictions are quite close to the actual data with a relatively low error rate in most periods. The DES method has proven effective in following sales trends, making it suitable for short-term forecasting. The July 2025 prediction result of 240.67 can be used as an initial reference in inventory planning.

c. Calculating Mean Absolute Percentage Error

The Mean Absolute Percentage Error (MAPE) is calculated by dividing the absolute error for each period by the actual observed value for that period. The average of these absolute percentage errors is then calculated. MAPE is a measure of error that indicates the percentage deviation between actual data and forecasted data. The MAPE value can be calculated using the following equation[13].

$$MAPE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{\hat{y}i - yi}{yi}\right| \times 100$$

Description:
n = number of data
y = actual result value
y^ = predicted result value

Table 9: MAPE Calculation Results

No	Product	Single Moving Average		Double Exponential Smoothing	
		Forecast Results	MAPE (%)	Forecast Results	MAPE (%)
1	Mie Goreng	226,67	9,62	246,41	9,0
2	Mie Soto	233,33	6,76	238,56	8,2
3	Minyak Goreng	100,00	20,08	114,58	18,0
4	Gula	236,67	5,95	240,67	5,6

Based on the MAPE calculation, the best predictions were obtained using the Single Moving Average (SMA) method at 5.95% and Double Exponential Smoothing (DES) at 5.6%. These values indicate excellent prediction accuracy, as a MAPE below 10% is considered highly accurate. These results confirm that the forecasting model used is capable of producing accurate predictions. Furthermore, the relatively small difference in MAPE between the two methods indicates that both methods are equally effective for forecasting sales data.

3.3. System Design

This process design is a system design created for this research using a process-based approach. In the system design, the researchers used Data Flow Diagram (DFD) to model the data flow and processes within the system. The design included the creation of flowcharts and level 0 and level 1 diagrams.

a. Flowchart System

The following are the system stages that illustrate the entire process, from the initial stage to the final result in the form of predicted data. This process consists of several important steps that must be completed to achieve the desired results. The first stage is collecting data that will be used as system input. This data is then processed using specific methods to produce accurate predictions. Each step in this process is designed to ensure the system operates efficiently and produces output as required. The flowchart serves not only as a guide but also as a tool to ensure each step is carried out correctly according to predetermined procedures.

Fig. 1: Flowchart Single Moving Average

The calculation process begins by entering sales data from several previous periods. The user then determines the number of periods (n) to be used in the average calculation. Next, the sales data from the last n periods are summed and divided by the number of periods to obtain a simple moving average (SMA). This SMA value is used to predict sales for the next period. After obtaining the prediction results, the next step is to calculate the accuracy level using the Mean Absolute Percentage Error (MAPE) evaluation method, which is the average absolute percentage error relative to the actual value.

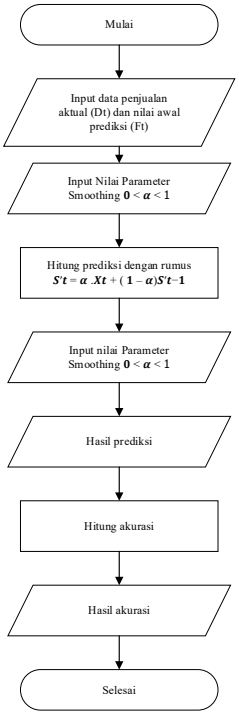

Fig. 2: Flowchart Single Exponential Smoothing

The Double Exponential Smoothing (DES) method uses two main components, namely level and trend, to produce more accurate predictions. The process begins with historical sales data and two smoothing parameters, α for level and β for trend. The initial prediction is calculated from the average of the data, while the initial trend is from the average change between periods. Next, the level (Lt) and trend (Tt) are updated each period, and the prediction is calculated using the formula Ft+1 = Lt + Tt. Prediction accuracy is evaluated using the Mean Absolute Percentage Error (MAPE) to ensure the reliability of the prediction results.

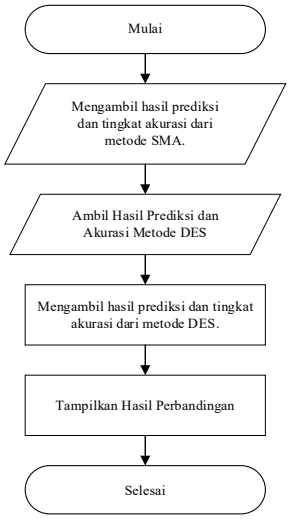

Fig. 3: Accuracy Comparison Flowchart

The process flow for comparing the accuracy of two forecasting methods, namely the Simple Moving Average (SMA) and Double Exponential Smoothing (DES). The process begins by collecting prediction data and accuracy values from the SMA method. After that, the same is done for the DES method. Next, the accuracy of each method is calculated using the Mean Absolute Percentage Error (MAPE). The resulting MAPE values are then compared to determine which method provides the most accurate prediction results. The final results of this comparison serve as the basis for drawing conclusions regarding the performance of the two methods used.

b. Data Flow Diagram (DFD)

Data Flow Diagram (DFD) is a model that presents a visual display to describe the flow of data and information in a system[14]. A Data Flow Diagram (DFD) is also known as a visual representation that illustrates how a system works, whether computer-based, manual, or a combination of both. A DFD shows the system's components interconnected according to established rules.

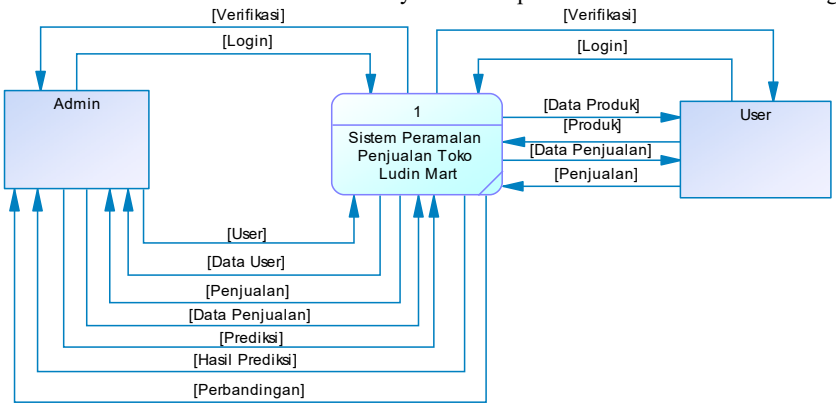

Fig. 4: Data Flow Diagram Level 0

Level 0 diagram of the web-based sales forecasting system at Ludin Mart, depicting the overall data flow. This system interacts with two external entities: the admin and the employees. The admin is responsible for managing user data and sales data to be processed by the system. In addition, the admin can also forecast sales by selecting one of two available methods: Single Moving Average (SMA) or Double Exponential Smoothing (DES). After the system generates forecast results from both methods, the admin can compare the accuracy levels of each to determine the most appropriate method.

The system will present forecasting results and a comparison of their accuracy to the admin for further analysis. Meanwhile, employees can enter or update sales data into the system. The provided input, such as sales IDs and related information, will be used as the basis for the forecasting process. The data is then stored and processed by the system to generate more accurate sales predictions.

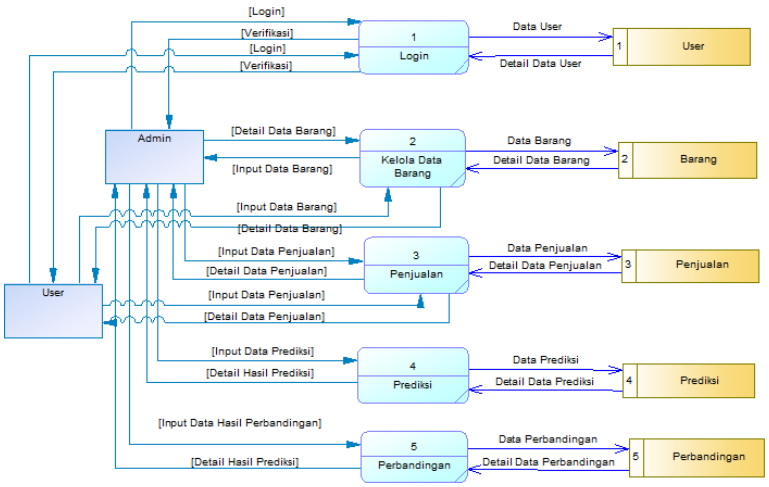

Fig. 5: Data Flow Diagram Level 1

The figure shows the workflow of the sales forecasting system at Ludin Mart Pottery Store, which consists of five main processes: login, product data management, sales, prediction, and comparison. Login verifies user identity, product data management allows admins to add or edit products, and the sales process records transactions. Predictions are made using the SMA and DES methods, with the results stored in a prediction table. While the comparison process assesses the accuracy of both methods and is stored in a comparison table. All processes are interconnected, forming a structured system to support sales analysis and decision-making.

c. Conceptual Data Model (CDM)

A Conceptual Data Model (CDM) is a database design concept consisting of several entities. The CDM describes the overall logical structure of the data model, as well as the data flow and relationships between entities. In its creation, primary and foreign keys are also defined. A valid CDM can then be translated into a Physical Data Model (PDM)[15].

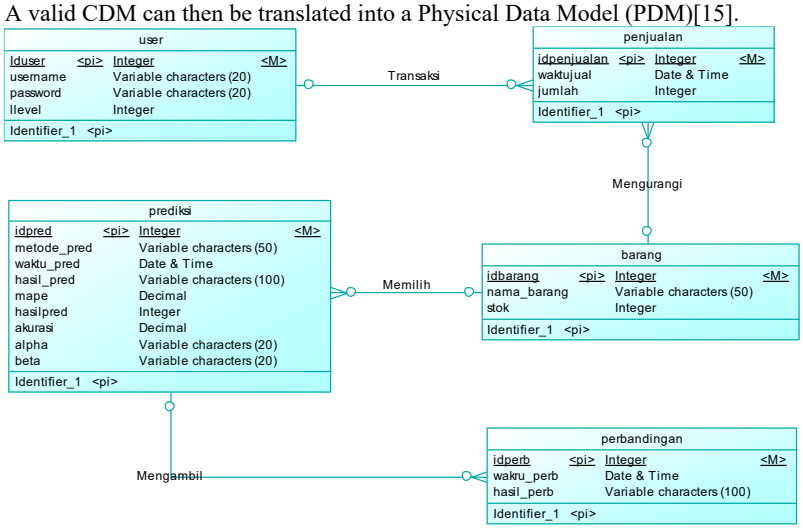

Fig. 6: Conceptual Data Model

This figure shows the relationships between tables in the database used in the sales forecasting system at the Ludin Mart Pottery Store. This system uses two methods: Single Moving Average (SMA) and Double Exponential Smoothing (DES). Each table is interconnected and serves its own purpose, including product, sales, prediction, and user tables. The entered sales data is used for the forecasting process, and the prediction results are stored in a dedicated table. This structure allows the system to manage data more efficiently, from input and processing to presentation. Furthermore, the relationships between tables facilitate data accuracy and consistency, as well as simplify future system management.

d. Physical Data Model (PDM)

Database Design (PDM) is a concept that details how data is stored in a database. At this stage, the database design has been physically implemented and is ready to be implemented in the DBMS. The table names used also correspond to the names of the tables that will be used in the system. Furthermore, the index structure and relationships between tables have been defined to ensure fast and efficient data access. This design also considers data integrity so that each transaction can be processed accurately and consistently. Data security is also considered by setting user access rights according to their respective roles. Thus, PDM not only supports system performance but also maintains data confidentiality and reliability as a whole.

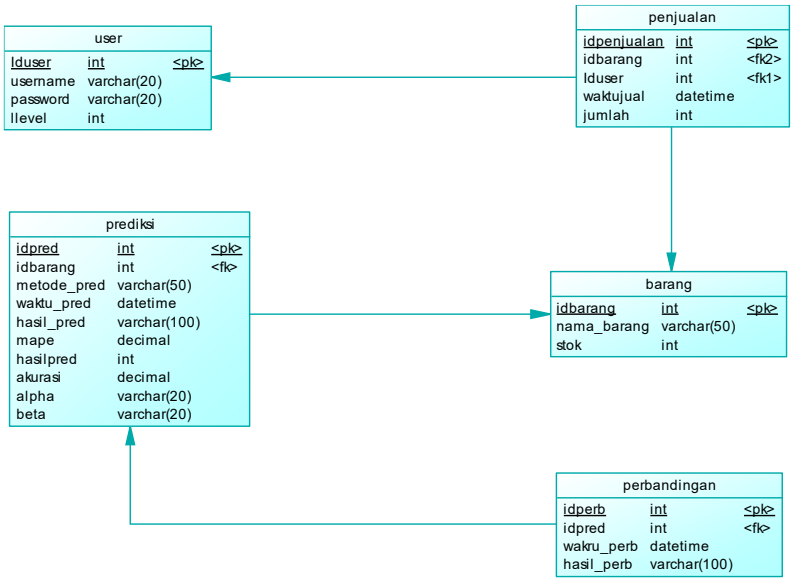

Fig. 7: Physical Data Model

The database structure of the sales forecasting system at the Ludin Mart Pottery Store shows the relationships between tables that support the Simple Moving Average (SMA) and Double Exponential Smoothing (DES) methods. The user table stores user data with different access rights, the item table contains product information, and the sales table records transactions related to users and products. Forecasting results are stored in the prediction table, which contains details of the method, time, results, accuracy, MAPE value, and alpha and beta parameters for DES. A comparison table is used to assess the results of SMA and DES based on idpred. This structure ensures that the forecasting process runs smoothly, data is stored neatly, and facilitates accuracy analysis between methods.

3.4. Sysem Implementation

The discussion of the results of this application provides an explanation of each page of the application that has been designed and successfully implemented.

a. Login Page Menu
This login page has several input fields and buttons, each of which has a specific function.

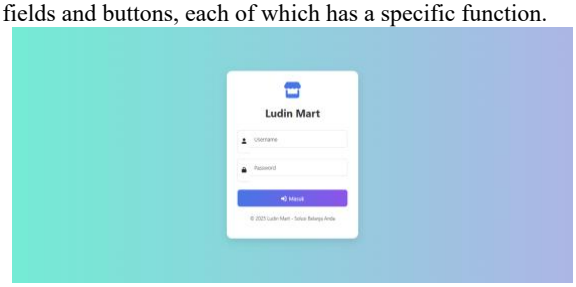

Fig. 8: Login Page Menu

Figures and tables must be centered in the column. Large figures and table can be in one column in order to see them more clearly and avoid placing them in the middle of columns. Any table or figure that takes up more than 1 column width must be positioned either at the top or at the bottom of the page

b. Product Data Page Menu
The Product Page displays a number of inputs and buttons, each of which has its own function.

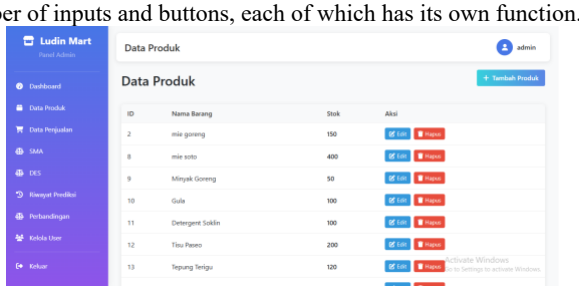

Fig. 9: Product Data Page Menu

The Product Data page in the Ludin Mart Store sales forecasting system is intended for admins to manage product information. This page displays the "Product Data" heading, a "+ Add Product" button, and a table containing the ID, Item Name, Stock, and Action. The Action column provides "Edit" and "Delete" buttons for data management. The simple interface facilitates admins' product management, and the displayed data is used in the sales forecasting process using the SMA and DES methods.

c. Sales Data Page Menu

This Sales Data Page displays a number of inputs and buttons, each of which has its own function.

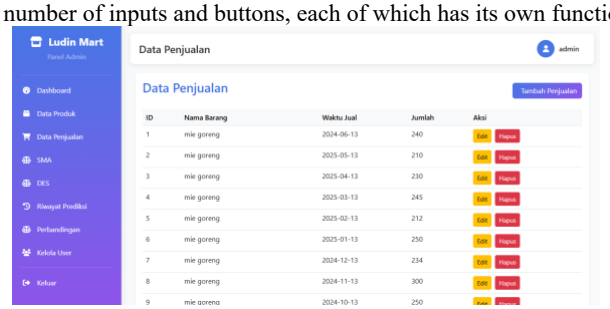

Fig. 10: Sales Data Page Menu

Displays the Sales Data page in the Ludin Mart Store sales forecasting system, which records and manages transactions. This page contains the title "Sales Data," an "Add Sales" button, and a table with columns for ID, Item Name, Sale Time, Quantity, and Action. The Action column provides "Edit" and "Delete" buttons for data management. The clean interface makes it easy for admins to manage sales, and the recorded data is used as the basis for predictive calculations using the SMA and DES methods.

d. Single Moving Average Sales Prediction Page Menu

This Sales Prediction page contains several inputs and buttons for predicting sales using the Single Moving Average method.

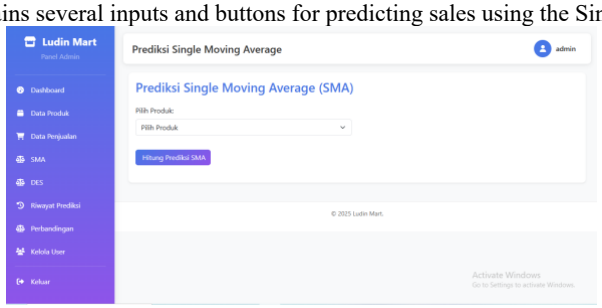

Fig. 11: Single Moving Average Sales Prediction Page Menu

The Sales Prediction menu page in the Ludin Mart Store system allows admins to make forecasts based on previous sales data. This page contains the title "Sales Prediction," the input "Select Product," and the Single Moving Average (SMA) and Double Exponential Smoothing (DES) method options via radio buttons. After selecting the product and method, admins can press the "Calculate Prediction" button to process the calculation or "Save Prediction" to save the results. This feature is a key component of the system because it supports decision-making based on estimates of future sales trends.

e. Double Exponential Smoothing Sales Forecast Page Menu

This Sales Prediction page contains several inputs and buttons to predict sales using the Double Exponential Smoothing method.

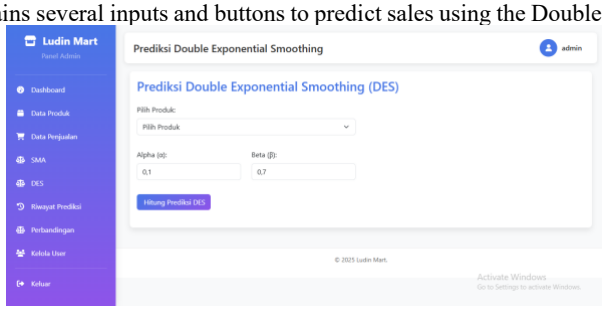

Fig. 12: Double Exponential Smoothing Sales Forecast Page Menu

The Double Exponential Smoothing (DES) sales prediction page on the Ludin Mart Store system allows admins to select products, enter alpha (α) and beta (β) values, then calculate and save the prediction results. The calculation results are displayed in a table containing monthly data, actual values, levels (Lt), trends (Tt), predicted results, and APE. The simple display makes it easy for admins to analyze sales, while the α and β settings provide flexibility in adjusting the model and comparing parameter combinations for the best accuracy. The navigation menu on the left side provides access to key features such as Product Data, Sales Data, Prediction History, and Method Comparison.

f. Prediction History Page Menu

The image below displays a history of sales predictions performed using either the Single Moving Average (SMA) or Double Exponential Smoothing (DES) method. This makes it easier for users to evaluate the performance of each prediction method. By reviewing this history, users can assess whether the method produced consistent and accurate results.

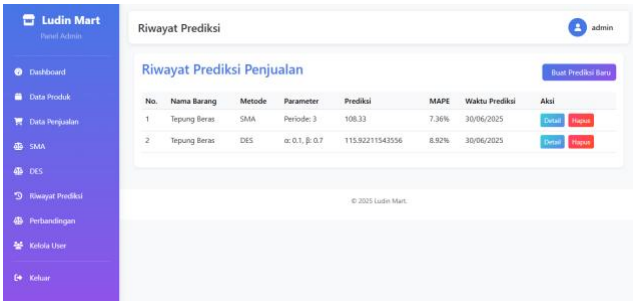

Fig. 13: Prediction History Page Menu

The Prediction History page in the Ludin Mart system displays a list of past prediction results. The table contains columns for Item No., Item Name, Method, Parameters, Prediction, MAPE, Prediction Time, and Action. The information displayed includes the predicted product, method (SMA or DES), parameters, prediction result, MAPE value, and prediction time. In the Action column, there are "Details" buttons to view complete information and "Delete" to delete the data. This page makes it easy for users to review previous prediction results, check method accuracy, and efficiently compare results between methods.

g. Comparison Page Menu

Comparison page to compare the SMA (Single Moving Average) method and the DES (Double Exponential Smoothing) method.

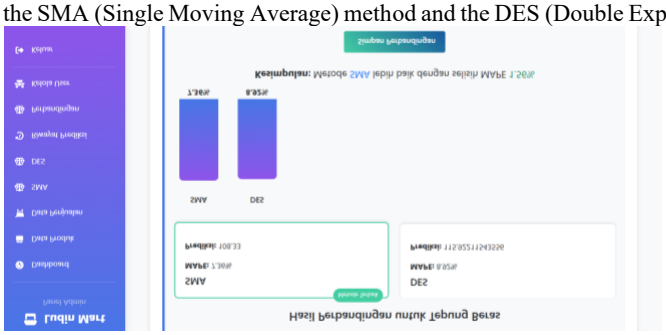

Fig. 14: Comparison Page Menu

The Prediction Method Comparison page in the Ludin Mart Store system is used to compare two prediction results to determine which method is more accurate. This page displays the title "Compare Prediction Methods," two inputs "Select Prediction 1" and "Select Prediction 2," and a "Compare Methods" button. There is also a "Return to Predictions" button in the upper right corner. The Comparison History section displays a table containing the Item No., Comparison ID, Comparison Time, and Comparison Results, including the item name, method, MAPE value, and the conclusion of the more accurate method.

4. Conclusion

This study applies and compares the Single Moving Average (SMA) and Double Exponential Smoothing (DES) methods for sales forecasting at the Ludin Pottery Store. The SMA method with a 3-month period produces fairly accurate short-term predictions with a MAPE value of 5.95%, while the DES method with $\alpha = 0.1$ and $\beta = 0.7$ produces a slightly higher error rate of 5.6%. Both methods demonstrate excellent accuracy with MAPE values below 10%, but the DES method is proven to provide results that are more appropriate for the sales data used. In addition, the web-based forecasting system successfully integrates the two methods and provides features for sales data management, prediction history, and method comparison to support business decision-making. Overall, the DES method is useful when sales data has a trend pattern, while the SMA method is more suitable for short-term forecasting at the Ludin Pottery Store. This study proves that the application of appropriate forecasting techniques can help MSMEs manage inventory, reduce the risk of overstocking or understocking, and support more effective sales strategies.

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