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PRODUCT SALES PREDICTION SYSTEM AT REX COMPUTER STORE USING WEBSITE-BASED SINGLE EXPONENTIAL SMOOTHING METHOD

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Abstract: Estimating or predicting the amount of sales is one of the factors that determines whether a company's business is running well or not. The problem faced by Rex Computer is that it cannot predict product sales in the future with current sales data, so customers may run out of stock when they want to buy the items they want. This study aims to create a system that is able to predict sales and determine the level of accuracy of the system. This study will implement the single exponential smoothing method, which is one of the prediction algorithms. The method used is an interview with Rex Computer employees regarding product sales and sales data is obtained. As well as conducting a literature study to find data from various literatures about predictions using the single exponential smoothing method. This study produces a website-based prediction system that can predict with results for product sales in the USB Wifi category with an alpha value of 0.1, namely the prediction results of 6-7 products, MAD = 2.11, MSE = 8.16, RMSE = 2.85560831906761, MAPE = 18.52, and accuracy = 81%,

Keywords: Sales, Forecasting, Single Exponential Smoothing

1. INTRODUCTION

Sales according to (Tan, 2011) is defined as the process of offering something to others. Where the person being offered knows and is fully aware of the benefits of the product being offered. Most businesses rely on sales as their main source of income. This is very important for the continuity and growth of the company, because sales volume is positively correlated with income. While prediction is a combination of science and art that can predict future conditions through depicting data from the past to the future through the use of mathematical models or subjective predictions (Sugiyono, 2015).

There are several methods for predicting, one of which is SES (Single Exponential Smoothing). The single exponential smoothing method is a method that shows exponentially decreasing weighting of older observation values. That is, newer values are given a relatively greater weight than older observation values. This method provides an exponential weighting of the moving average of all previous observation values. This method is not influenced by trends or seasons (Hartono et al., 2012).

Rex Computer is a computer store that sells various hardware products and computer accessories. The problem faced by Rex Computer is that it has not been able to estimate product sales in the future with current sales data so that there are customers who run out of stock when they want to buy a product they want. The impact of running out of stock of this product can be detrimental to the store from the sales department because it affects the store's

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income. In addition, the impact of running out of stock can reduce the image of the store because customers will judge that the products provided by Rex Computer are incomplete. Rex Computer faces another problem where there are products that experience stock buildup. The result of this product stock buildup can reduce capital efficiency that should be used to order other product stock. In addition, product prices can fall during stock buildup. Of course, this affects Rex Computer's income.

Rex Computer recorded sales of IDR 83,496,000 in December 2023 while IDR 82,821,000 in January 2024. This shows a decrease in sales of IDR 675,000 in January 2024. With this, of course, sales are expected to increase in the following month. Research by (Chaerunnisa & Momon, 2021) in predicting cooking oil sales at PT Tunas Baru Lampung with the results of the single exponential smoothing method with an MSE (Mean Squared Error) value of 250,570,764.80, MAD of 12,922.32, and MAPE (Mean Absolute Percentage Error) of 33.55. While the moving average method has an MSE value of 438,980,942.75, MAD of 18,142.14, and MAPE of 41.37. The purpose of this study is to create a product sales prediction system on Rex Computer using the SES method and to determine the level of accuracy of the system using the MAD, MSE, RMSE, and MAPE methods.

2. METHOD

Data Collection Methods

The data collection methods used are: Interviews. This method involves questions and answers with Rex Computer employees regarding product sales and obtaining sales data. Literature Study. Searching for data from various literature on predictions using the SES method.

Data Analysis Method

In this study, the data analysis method used is the single exponential smoothing method for the data mining process. The data mining process carried out is:Data cleaning. This stage produces noise results and data that is not appropriate or unstable, namely in the form of sales data recordings on Rex Computer. Implementation process. This stage applies the SES method to predict sales and error calculations including MAD, MSE, RMSE, and MAPE. The steps for implementing the SES method are: Determining the α (alpha) value. The α value itself ranges from 0.1 - 0.9. The α value functions to smooth the predicted value.

Calculating sales predictions with the formula $F_{(t+1)}= 〖αX〗_{(t+1)}- 〖αF〗_t$

Calculating MAD, MSE, RMSE, and MAPE values. Determining the α value adjusts the error optimization process to obtain the maximum prediction results. Calculating accuracy by 100% minus the MAPE value. The results of the comparison of predictions that have the highest accuracy value become information for predicting sales of goods for the next period.

Research Flow

The research flow is the stages carried out by the author in conducting research. Problem analysis, data collection, system design, system testing, and report preparation are the stages that the author will carry out in this research.

System Development Method

The waterfall system development method is used to create a product sales prediction system at the Rex Computer store with the following stages:

1. Requirements Analysis Stage

This stage includes collecting needs such as identifying and collecting user and system needs. At this stage, interviews are also conducted with Rex Computer store employees to collect the required data.

2. Design System

At this stage, the researcher designs the system to be created, such as creating UML, and also designing a user interface design that is easy to understand and use.

3. Coding Implementation

At this stage, the researcher begins writing program code based on the previously designed interface design. And conduct individual software testing to ensure that the software created functions properly.

4. Testing

At this stage, testing is carried out on the entire system to ensure that all components function as they should and to find errors or deficiencies that can be fixed. At this stage, the researcher uses the black box testing method and conducts system accuracy testing.

5. Maintenance

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This stage involves fixing errors found so that the system can be implemented and used in the system user environment.

Single Exponential Smoothing

The single exponential smoothing method is a method that shows exponentially decreasing weighting of older observation values. That is, newer values are given a relatively greater weight than older observation values. This method provides an exponential weighting of the moving average of all previous observation values. This method is not influenced by trends or seasons (Hartono et al., 2012). According to (Margi & Pendawa, 2015) the single exponential smoothing method is more suitable for predicting things that fluctuate randomly (irregularly). Predictions with this method use the following formula:

$$F_{t+1} = \alpha X_t + (1 - \alpha)F_t \quad (2.1)$$

Where:

Ft+1 = Forecast for the next period

α = Constant parameter with a value between 0 and 1

Xt = Actual data to t

Ft = Forecast for period t

This method requires an alpha value (α) as a smoothing parameter value. To obtain the correct α value, trial and error are generally used to determine the lowest error value. The α value is determined by comparing smoothing between α 0.1 to α 0.9. This method is only able to predict a maximum of one period ahead and is suitable for data containing stationary elements (Mathori Abdul Jalil et al., 2021).

Mean Absolute Deviation

MAD is the absolute value of the average error in forecasting, the results of which ignore positive and negative signs (Chaerunnisa & Momon, 2021). The lower the MAD value, the better the prediction produced because the difference between the actual and predicted values is smaller. The formula for MAD is as follows:

$$MAD = \frac{\Sigma|Xt - Ft|}{n} \quad (2.2)$$

With:

Σ = Total

Xt = Observation data for period t

Ft = Forecast for period t

n = Total data

Mean Squared Error

MSE is the average of the squared differences between the observed values, then summed and added to the observed number. This approach amplifies the large influence because the errors are squared (Chaerunnisa & Momon, 2021). The smaller the MSE value, the more accurate the model. Here is the formula for MSE:

$$MSE = \frac{\Sigma|X_t - F_t|^2}{n} \quad (2.3)$$

With:

Σ = Total

Xt = Original data occurred

Ft = Forecast data

n = Number of forecast data

Root Mean Squared Error

RMSE is used as a differentiator between a value to be predicted and the actual value. The higher the RMSE value produced, the lower the level of accuracy, and the lower the RMSE value produced, the higher the level of accuracy (Sautomo & Pardede, 2021). The following is the formula for determining the RMSE value.

$$RMSE = \sqrt{\Sigma_{i=1}^{n} \frac{(y_i - \hat{y}_i)^2}{n}} \quad (2.4)$$

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With:
y_i = value of observation i
(y_i)ˆ= forecast result value
n = amount of data

Mean Absolute Percentage Error

MAPE is a calculation using the absolute error in each period then divided by the actual observation value for that period. The smaller the MAPE value, the more accurate the results or forecasting techniques used and vice versa (Chaerunnisa & Momon, 2021). The following is the formula for determining the MAPE value:

$$\text{MAPE} = \frac{100}{n}\sum_{t=1}^{n}\frac{|X_t - F_t|}{Xt} \qquad (2.5)$$

With:

Xt = Actual value at time period t

Ft = Forecast value for time period t

n = Number of forecast data results

Table 1. MAPE Percentage Category

Nilai MAPE	Kategori
< 10%	Sangat Baik
10% - 20%	Baik
20% - 50%	Layak
> 50%	Kurang Baik

3. RESULT AND DISCUSSION

Data Collection

Interviews were conducted by researchers to obtain data and conduct literature studies related to the implementation of the SES algorithm to predict product sales at the Rex Computer store. From the results of interviews and literature studies, sales data needed to perform calculations were obtained. The data obtained is in the form of a list of products, categories, and sales for each month. And the data is used as a sample of test data in creating a prediction system.

Needs Analysis

Data Cleaning

From the data that has been collected, cleaning is carried out by taking several important data parts for system needs so that the data in the table above becomes as follows.

Table 2. Results of Cleaning Sales Data Samples

No	Product	Month	Year	Group	Sold Qty
1	Baterai Cmos	May	2023	Baterai	3
…	…	…	…	…	…

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255	Tp Link 823n	May	2023	Usb Wifi	1
256	Usb Wifi Tp Link 722n	May	2023	Usb Wifi	1
257	Usb Wifi 802 Antena	May	2023	Usb Wifi	2
258	Usb Wifi Tp Link Wn725	May	2023	Usb Wifi	1
259	Tp Link 727	May	2023	Usb Wifi	1
521	Usb Wifi Tp Link 722n	Jun	2023	Usb Wifi	3
522	Usb Wifi 802 Antena	Jun	2023	Usb Wifi	2
523	Usb Wifi Tp Link Wn725	Jun	2023	Usb Wifi	3
…	…	…	…	…	…
2733	Webcam Inforce 720p	April	2024	Webcam	1

Implementation Process

At this stage, sample data from product sales in the USB Wifi category is used. The data tested uses sales data from May 2023 - April 2024. The trial will use an alpha value of 0.1 - 0.9 to determine which value is best to use. The following is sales data for USB Wifi category products from May 2023 - April 2024.

Table 3. USB Wifi Product Sales Data May 2023 - April 2024

No.	Month	Year	Sold Qty
1	Mei	2023	6
2	Juni	2023	8
3	Juli	2023	9
4	Agustus	2023	9
5	September	2023	7
6	Oktober	2023	5
7	November	2023	7
8	Desember	2023	7
9	Januari	2024	11
10	Februari	2024	6
11	Maret	2024	0
12	April	2024	9

The following is an implementation of the prediction calculation using the SES method. For the calculation using the formula equation $Ft+1 = \alpha Xt + (1 – \alpha)Ft$ with an alpha value of 0.1

a. Prediction Calculation

1. June Predictions 2023

$$F_2 = 0,1 * 6 + (1 – 0,1) * 6$$

$$= 6$$

2. July Predictions 2023

$$F_3 = 0,1 * 8 + (1 – 0,1) * 6$$

$$= 6,2$$

3. August Predictions 2023

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$F_4 = 0,1 * 9 + (1 – 0,1) * 6,2$

= 6,48

4. September Predictions 2023

$F_5 = 0,1 * 9 + (1 – 0,1) * 6,48$

= 6,732

5. October Predictions 2023

$F_6 = 0,1 * 7 + (1 – 0,1) * 6,732$

= 6,7588

6. November Predictions 2023

$F_7 = 0,1 * 5 + (1 – 0,1) * 6,7588$

= 6,58292

7. December Predictions 2023

$F_8 = 0,1 * 7 + (1 – 0,1) * 6,58292$

= 6,624628

8. January Predictions 2024

$F_9 = 0,1 * 7 + (1 – 0,1) * 6,624628$

= 6,6621652

9. February Predictions 2024

$F_{10} = 0,1 * 11 + (1 – 0,1) * 6,6621652$

= 7,09594868

10. March Predictions 2024

$F_{11} = 0,1 * 6 + (1 – 0,1) * 7,09594868$

= 6,986353812

11. April Predictions 2024

$F_{12} = 0,1 * 0 + (1 – 0,1) * 6,986353812$

= 6,2877184308

12. May Predictions 2024

$F_{13} = 0,1 * 9 + (1 – 0,1) *6,2877184308$

= 6,55894658772

So we get a prediction for May 2024, namely by rounding down and up the predicted value to 6 - 7 products..

b. Error Calculation

To calculate the error, an error value is needed by subtracting the actual value from the predicted value to obtain

Table 4. Prediction Error Value of USB Wifi Category Products with Alpha Value 0.1

Data Ke-	Error	Absolute Error	Sequence Error	Absolute Percent Error
1	0	0	0	0
2	2	2	4	25
3	2,8	2,8	7,84	31,11111111
4	2,52	2,52	6,3504	28
5	0,268	0,268	0,071824	3,828571429
6	-1,7588	1,7588	3,09337744	35,176
7	0,41708	0,41708	0,173955726	5,958285714
8	0,375372	0,375372	0,140904138	5,362457143

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9	4,3378348	4,3378348	18,81681075	39,43486182
10	-1,09594868	1,09594868	1,201103509	18,26581133
11	-6,986353812	6,986353812	48,80913959	0
12	2,712281569	2,712281569	7,356471311	30,13646188
Jumlah		**25,27167086**	**97,85398646**	**222,2735604**

1. MAD Error Calculation

$$MAD = \frac{\Sigma|Xt - Ft|}{n}$$

= 25,27167086 / 12
= 2,1059725717667

2. MSE Error Calculation

$$MSE = \frac{\sum|X_t - F_t|^2}{n}$$

= 97,85398646 / 12
= 8,1544988719281

3. RMSE Error Calculation

$$RMSE = \sqrt{\Sigma \frac{n}{i=1} \frac{(y_i - \widehat{y_i})^2}{n}}$$

$= \sqrt{97,85398646 / 12}$
$= \sqrt{8,154498871928}$
= 2,855608319067585

4. MAPE Error Calculation

$$MAPE = \frac{100}{n} \sum_{t=1}^{n} \frac{|X_t - F_t|}{Xt}$$

= 222,2735604 / 12
= 18,522796702362

c. Accuracy Calculation

The accuracy value is obtained by subtracting 100% from the rounded MAPE value..
Accuracy = 100% - MAPE Rounded Value
= 100% - 19%
= 81%

The same method and formula are used to calculate the other alpha values, and the results are as follows.
Table 5. Comparison of Prediction Error Values and Accuracy of USB Wifi Category Products

Alpha	MAD	MSE	RMSE	MAPE	Accuracy
0,1	2,1059725717667	8,1544988719281	2,85560831906761	18,522796702362	81%
0,2	2,15952091306667	8,68061581811329	2,94628848182137	19,3611368083886	81%
0,3	2,2742600094	9,29405910350064	3,04861593243567	21,07593647443	79%
0,4	2,3912201216	9,97453292833861	3,15824839560453	22,8085661272535	77%
0,5	2,4996744791667	10,7121747334798	3,27294588001082	24,432259725229	76%
0,6	2,5919992576	11,4892858066438	3,38958490181966	25,8715424073882	74%
0,7	2,6636944664	12,2856560342228	3,50509001799137	27,086953205695	73%
0,8	2,71318760106667	13,0808024575413	3,61673920231211	28,0691052793843	72%

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0,9	2,7412327391	13,8539205844589	3,7220855154683	28,833405368355	71%

By using several different alpha values, its effect on the forecast accuracy value can be seen. By trying several values, the optimal alpha value that best matches the sales data of USB Wifi category products can be identified. From the table above, the alpha value of 0.1 is the value with the highest accuracy of 81%. So it can be concluded that the calculation with an alpha value of 0.1 is the value with the highest accuracy so that it can be selected for forecasting.

System Design

Usecase Diagram

A usecase diagram is used to describe the interaction between actors or users and the system. In the sales prediction system for goods at the Rex Computer store, the usecase diagram is depicted as follows:

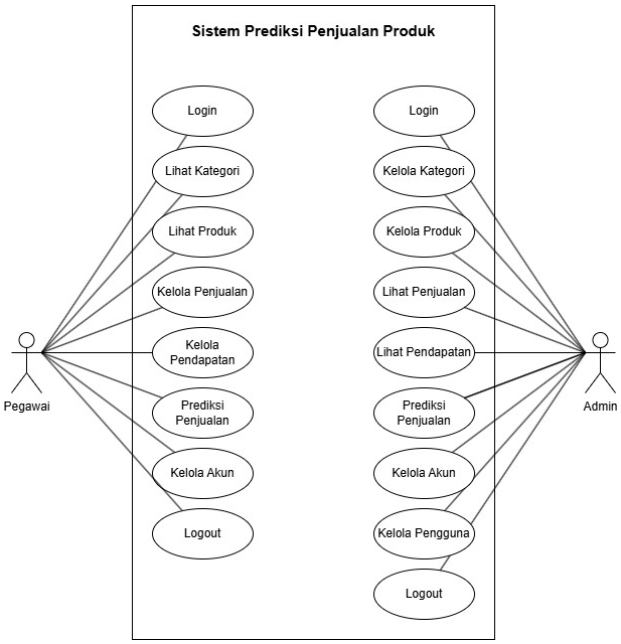

Fig 1. Usecase Diagram

User Interface Design

To build a product sales prediction system, the user interface must be designed first. This is done so that the development process becomes easier and more structured. The following is a user interface design for a product sales prediction system.

1. Landing Page User Interface Design

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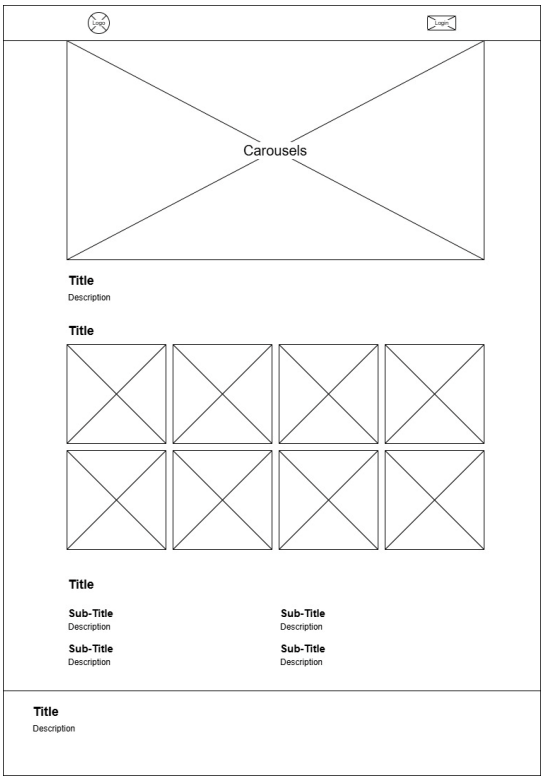

Fig 2. Landing Page User Interface Design

The first page that a user sees before entering an account is the landing page. On this page there is a carousel, information about the store, and products sold at Rex Computer

.

2. Login User Interface Design

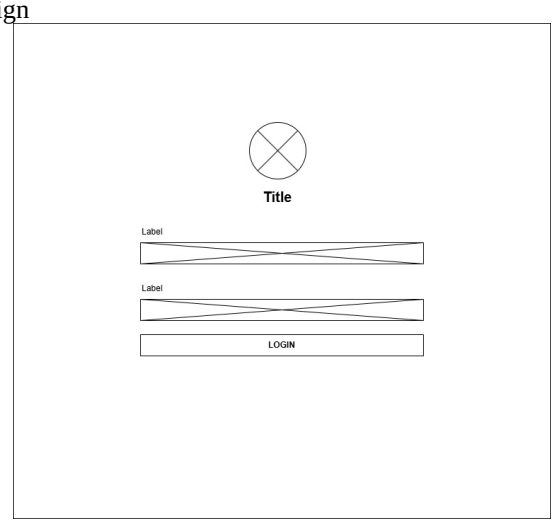

Fig 2. Login User Interface Design

On this page there is a logo at the top, 2 input fields, and one button..

3. Dashboard User Interface Design

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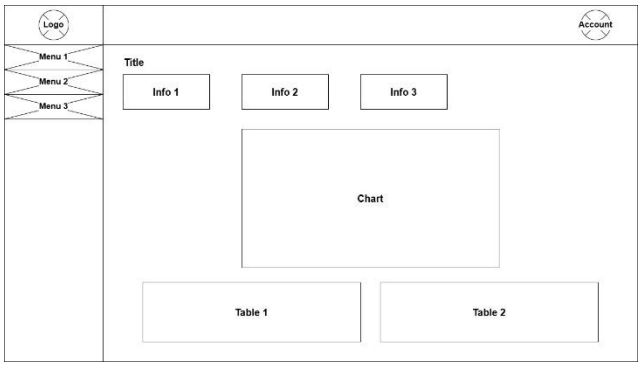

Fig 3. Dashboard User Interface Design

On the left side of this page there is a logo at the top and menus below it. At the top there is a button to go to the account page. The contents of this page are some summary information that can be directly accessed by the user.

4. Forecast User Interface Design

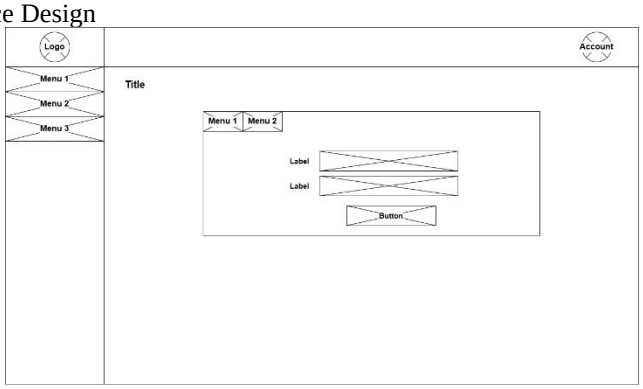

Fig 4. Forecast User Interface Design

On this page there are 2 menus, namely to predict products and categories. There are also several inputs and buttons to predict.

5. Forecast Result User Interface Design

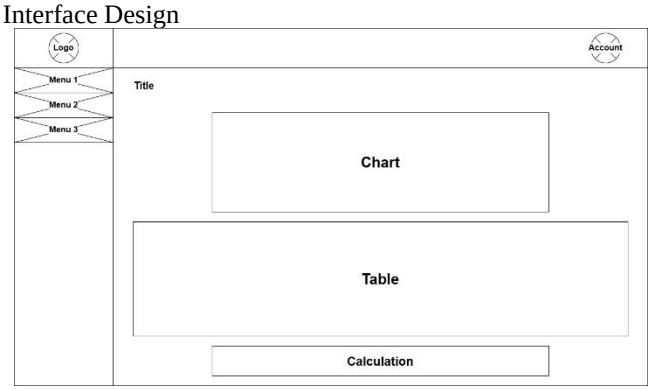

Fig 5. Forecast Result User Interface Design

On this page there is a graph that displays the data used to predict and also the results of the prediction for the next period. There is a table of data calculations and also calculations for the prediction of the next period and the calculation of prediction errors.

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Coding Implementation

The results of the system implementation according to the design that has been made are shown below.

1. Landing Page

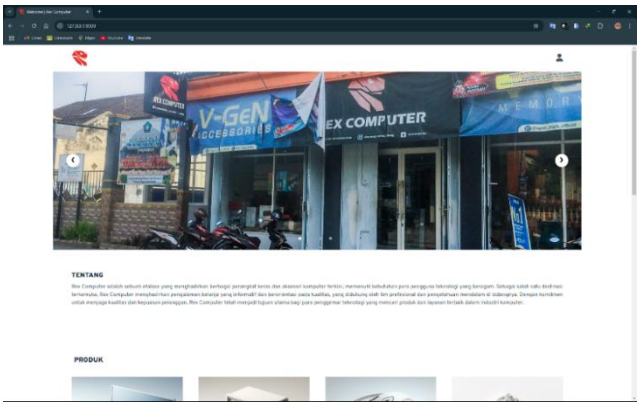

Fig 6. Landing Page

On this page there is a carousel containing photos of the shop, information about the shop, and products sold at Rex Computer.

.

2. Login Page

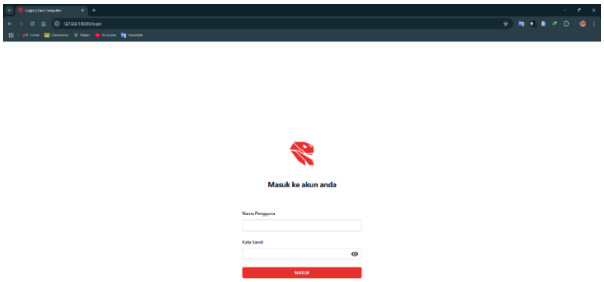

Fig 7. Login Page

There are 2 inputs, namely username and password. Users can display the password being entered using the eye symbol..

3. Dashboard Page

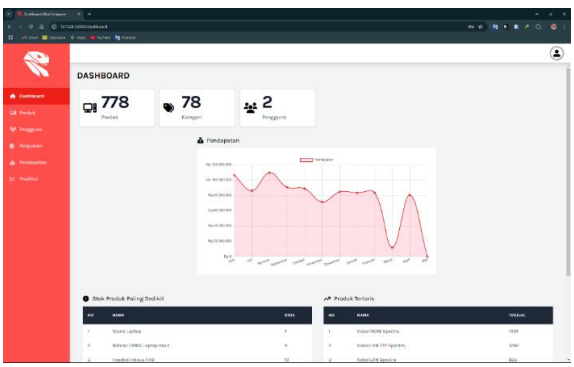

Fig 8. Dashboard Page

There is some brief information that can make it easier for users on this page..

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4. Forecast Page

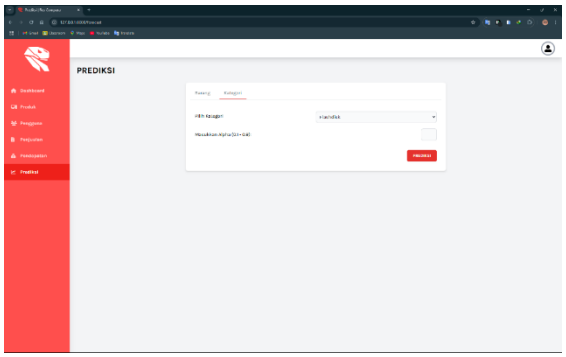

Fig 9. Forecast Page

On this page there are 2 menus, namely predictions for products and categories. There are 2 inputs that must be filled in, namely the product or category and the alpha value to be used.

5. Forecast Result Page

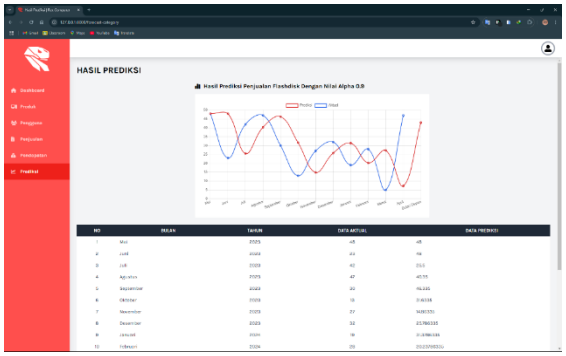

Fig 10. Forecast Result Page

On this page there are graphs of the calculation results, calculation tables, and also error calculation results..

System Testing

The test results of the product sales prediction system at Rex Computer are as follows:

1. Testing the Calculation of the Single Exponential Smoothing Method

The calculation for this test will take data samples from the USB Wifi category. This test will use an alpha value of 0.1 which is the best alpha value from the calculations that have been done previously. The results of the single exponential smoothing method calculation test are as follows.

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Fig 11. USB Wifi Category Prediction With Alpha Value 0.1

2. Black Box Method Testing

The following are the results of testing the Rex Computer store's website-based product sales prediction system using the black box method.

Table 6. Black Box System Testing

No	Test Scenario	Test Case	Expected results	Test Results
1	*Login* – valid	Enter the username and password that matches the database.	Successful login and redirect to dashboard page	In accordance
2	*Login* – *invalid*	Entering a username and password that does not match the database	Display error message and redirect to login page	In accordance
3	Product prediction	Predicting sales of selected products	The predicted value for the next period is calculated according to the single exponential smoothing method.	In accordance
4	Category prediction	Predict product sales according to selected categories	The predicted value for the next period is calculated according to the single exponential smoothing method.	In accordance

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4. CONCLUSION

The research on the product sales prediction system at the Rex Computer store using the single exponential smoothing method has the following conclusions: Produces a system that is able to predict product sales for the next period at the Rex Computer store using the single exponential smoothing method, The level of accuracy of the Rex Computer store product prediction using the SES method can be determined using the MAD, MSE, RMSE, and MAPE methods. For the case of predicting sales of USB Wifi category products with an alpha value of 0.1, it produces a prediction of 6-7 products with a MAD value = 2.1059725717667, MSE = 8.1544988719281, RMSE= 2.85560831906761, MAPE = 18.522796702362, and an accuracy value of 81%, According to the description and discussion that has been done, there are suggestions from the researcher as follows, To obtain a higher level of accuracy, additional research is needed such as using other newer methods, There needs to be additional features that can make it easier for users to use the system, The system can be developed into a mobile application so that its use is more varied

5. REFERENCES

Chaerunnisa, N., & Momon, A. (2021). PERBANDINGAN METODE SINGLE EXPONENTIAL SMOOTHING DAN MOVING AVERAGE PADA PERAMALAN PENJUALAN PRODUK MINYAK GORENG DI PT TUNAS BARU LAMPUNG. Jurnal Rekayasa Sistem Industri, 6(2), 101–106.

Hartono, A., Dwijana, D., & Handiwidjojo, W. (2012). PERBANDINGAN METODE SINGLE EXPONENTIAL SMOOTHING DAN METODE EXPONENTIAL SMOOTHING ADJUSTED FOR TREND (HOLT'S METHOD) UNTUK MERAMALKAN PENJUALAN. STUDI KASUS: TOKO ONDERDIL MOBIL "PRODI, PURWODADI." EKSIS, 5(1), 8–18.

Margi, K., & Pendawa, S. (2015). Analisa dan Penerapan Metode Single Exponential Smoothing untuk Prediksi Penjualan pada Periode Tertentu (Studi Kasus : PT. Media Cemara Kreasi). Prosiding SNATIF Ke-2 Tahun 2015.

Mathori Abdul Jalil, M., Chotijah, U., Aiyiyah Rakhma Devi, P., Bu Ipung Lamongan Jl Dokter Wahidin Sudiro Husodo No, C., Lamongan, K., Lamongan, K., & Tmur, J. (2021). SISTEM PREDIKSI PENJUALAN DENGAN METODE SINGLE EXPONENTIAL SMOOTING (STUDI KASUS CV. BU IPUNG LAMONGAN). INDEXIA: Informatic and Computational Intelegent Journal, 3(2), 16–22.

Sautomo, S., & Pardede, H. F. (2021). Prediksi Belanja Pemerintah Indonesia Menggunakan Long Short-Term Memory (LSTM). Rekayasa Sistem Dan Teknologi Informasi, 5, 99–106.