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In my opinion, it should be published with no revision although implication to the research needs to be explicit.



An Application Of Double Exponential Method For Forecasting Drug Sales Stock

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Article Info	ABSTRACT
Keywords: Double Exponential Smoothing, Information Systems, Forecasting, Sales	The Drug Stock Forecasting Application using a web-based Double Exponential Smoothing method is designed to optimize drug inventory management, particularly at Romora Drugstore. Modern computing technology plays a crucial role in supporting the operational activities of various business sectors, providing quick, precise, and accurate information. This efficiency is especially important in drugstores, where computers assist employees in managing tasks, such as drug inventory. Romora Drugstore, like many others, faces fluctuating monthly drug demands, making accurate forecasting essential to avoid stockouts or overstock situations. To address this challenge, this research proposes the Double Exponential Smoothing method as a forecasting tool. This method predicts future stock requirements based on historical data, enabling better management of drug supplies. By analysed past sales transactions, the application can forecast future demand, helping the drugstore ensure optimal stock levels, prevent financial losses, and enhance overall operational efficiency.
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INTRODUCTION

A Current computer technology is very helpful in supporting the operational activities of a business sector to make it easier for humans to obtain data on information quickly, precisely and accurately so that work effectiveness and efficiency are achieved and there are also in every institution such as pharmacies or drug stores. Computers are tools to facilitate the performance of every worker who is on duty, especially in managing drug stocks.

The Romora Drug Store, established in 2017 in Klambir V street, Medan, North Sumatra, faces challenges in managing its drug inventory due to manual data management practices. The fluctuating monthly demand for drugs leads to frequent issues of stock shortages and overstocking, causing inefficiencies in its business operations. As a solution, this research aims to implement the Double Exponential Smoothing method for forecasting future drug inventory needs, improving accuracy in stock management.

The Double Exponential Smoothing (DES) method, a time series forecasting technique, is well-suited for predicting trends in data that include both level and trend components. Developed by Robert G. Brown in the late 1950s, DES is particularly effective for handling data with inherent trends and seasonality, which is often the case in inventory management.

The effectiveness of the DES method has been demonstrated in several prior studies. For instance, Hülya and Selçuk (2017) applied Brown's DES to predict Turkish dried grape exports and found that raisin exports would decrease due to adverse weather conditions. This research, through time series analysis, indicated a downward trend in raisin exports from 2013 onward. Similarly, this method can be applied to the fluctuating demand of drug stocks at Romora Drug Store, allowing for more accurate inventory predictions and avoiding inefficiencies caused by stock imbalances.

By utilizing past sales data, this study seeks to improve the drugstore's ability to forecast drug demand for future periods, ensuring that stock levels remain optimal and that business processes become more efficient. The adoption of DES will allow the store to move away from manual systems and better anticipate demand trends, minimizing the risks of stockouts and overstocking, thus improving overall business operations.

METHOD

A Flowchart so that in determining the right data, the author conducted research by collecting data in the form of Drug Stock results at Romora Drug Store. Because in conducting this research, researchers must be able to see and obtain information accurately without any opinions or reviews from the owner of the information.

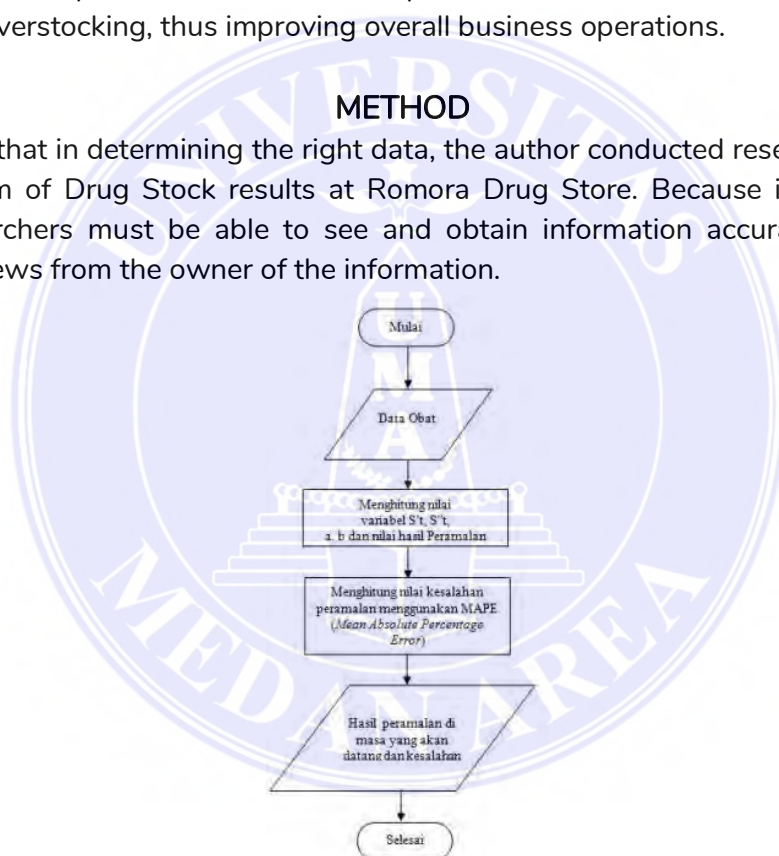


Figure 1. Research Flowchart

Flowchart Explanation:

1. In the initial process of a system, we will input Drug Stock data in 2022.

Table 1. Data Of Stock Drug

Data ke	Nama Obat	Jan	Feb	Maret	April	mei	Juni	Juli	Agustus	September	Oktober	November	Desember
1	Molexhu Pe	90	30	60	180	90	30	60	180	90	30	60	180
2	IMboostforce	40	30	50	120	40	30	50	120	40	30	50	120
3	Asiklovir 200 mg Tablet	120	100	20	240	120	100	20	240	120	100	20	240
4	Scandexon	50	30	50	130	50	30	50	130	50	30	50	130
5	Asiklovir salap kulit 5%	50	20	50	120	50	20	50	120	50	20	50	120
6	Ambroksol syrup 15 mg/ml, 60 ml	130	70	20	220	130	70	20	220	130	70	20	220
7	Pronicy 4 mg	50	30	60	140	50	30	60	140	50	30	60	140
8	Ranitidin 150 mg	100	60	40	200	100	60	40	200	100	60	40	200
9	Amlodipin 5 mg	200	80	40	220	200	80	40	220	200	80	40	220
10	Amlodipin 10 mg	60	30	100	190	60	30	100	190	60	30	100	190
11	Amoxicillin Trihydrate 500 mg	300	100	90	490	300	100	90	490	300	100	90	490
12	Betamol 500mg	200	80	50	330	200	80	50	330	200	80	50	330
13	Amoksisilin Sirup kering 125 mg/5ml	100	20	80	200	100	20	80	200	100	20	80	200
14	Mefenamic Acid 500mg	300	80	100	480	300	80	100	480	300	80	100	480
15	Novagesic 500mg	60	20	90	170	60	20	90	170	60	20	90	170

2. Calculating the values of variables S'_t , S''_t , a , b and the results of the Forecast. This type of initialization problem occurs in every exponential smoothing method. If the smoothing parameter α is not close to zero, the effect of this initialization process quickly becomes less significant over time. However, if α is close to zero, the initialization process can play a significant role over a long period of time. The following will use exponential smoothing forecasting with $\alpha = 0.1$ to $\alpha = 0.9$ where the value of the parameter α is between $0 < \alpha < 1$ with trial and error (in accordance with the steps taken in solving the one-parameter linear method from Brown). Forecasting calculation with Double Exponential Smoothing from Holt's with parameter $\alpha = 0.1$, Month 2 (January 2022), = 90, Paracetamol data Single Exponential Calculation

$$S'_t = aX_t + (1-\alpha)S'_{t-1}$$

$$\begin{aligned} S'_t &= 0.1 (90) + 0.9 (25) \\ &= 9 + 22.5 \\ &= 31.5 \end{aligned}$$

Double Exponential Calculation:

$$S''_t = aX_t + (1 - \alpha)S'_{t-1}$$

$$\begin{aligned} S'_t &= 0.1 (31.5) + 0.9 (25) \\ &= 3.15 + 22.5 \\ &= 25.65 \end{aligned}$$

Calculation Value α

$$\alpha_t = 2S'_t - S''_t$$

$$\alpha_2 = 2 (31.5) - 25.65$$

$$= 63 + 25.65$$

$$= 37,35$$

Calculationa Value b

$$b_t = a (S'_t - S''_t) 1-a$$

$$= 0.1 (31.5 - 25.65) 0.9$$

$$= 0.1 (5.85) 0.9$$

$$= 0.64$$

Forecast Results for the First Month: January 2022 $m = 1$

$$F = a + b m t + m t t$$

$$\alpha_2 = 37.35 + (0.64)1 = 38$$

An Use case diagram is a diagram that presents the interaction between use case and actor can be a person, equipment or other system that interacts with the system being built. Use case describes the functionality of the system or the requirements that must be met by the system from the user's perspective. The system process flow is depicted in Figure 2.

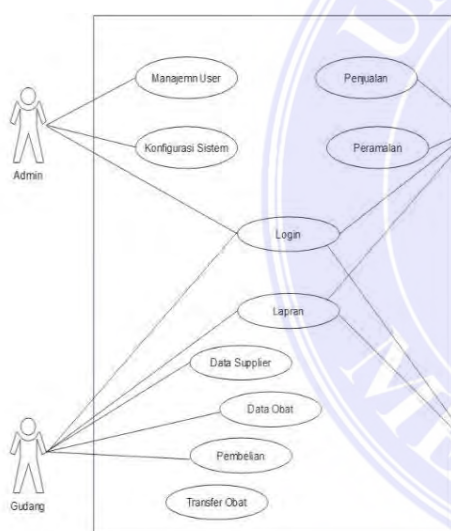


Figure 2. Use Case Diagram

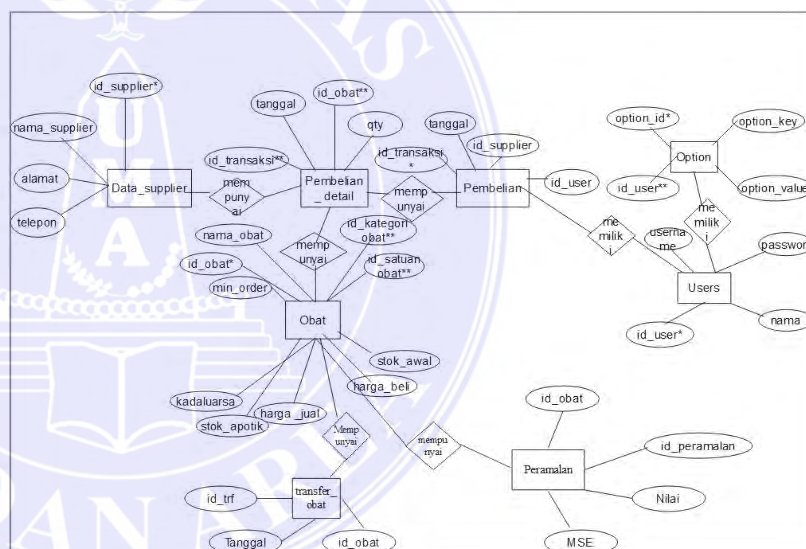


Figure 3. Entity Relationship Diagram (ERD)

RESULT

Menu Login

On the login form, those who can log in are Admin, Drugstore Owner and warehouse section who have been registered by entering their username and password in the column provided, then pressing the Sign In butto

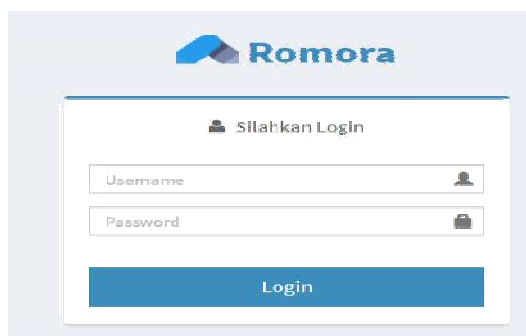


Figure 4. Login Page.

If the user does not enter a username and password and then presses sign in, the application will display the notification "Please fill in this field", the notification can be seen in Figure 5.

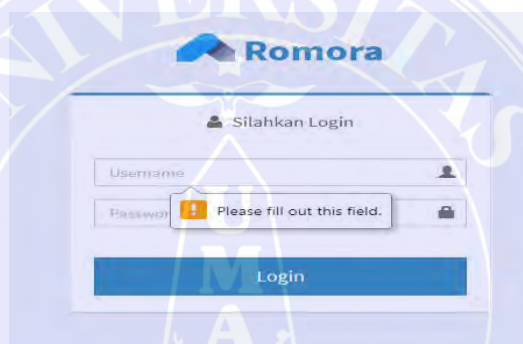


Figure 5. Notification

If the user is not registered on the application, the system displays the information "Login Failed", this information is shown in Figure 6.



Figure 6. Information Not Yet Registered

Admin Dashboard Page

On the Admin Officer instrument page, Admin can see Drug data, Incoming drug data, drug stock reports and incoming drugs, Drug stock forecasting, user management. The Pharmacy Panel page is shown in Figure 7.

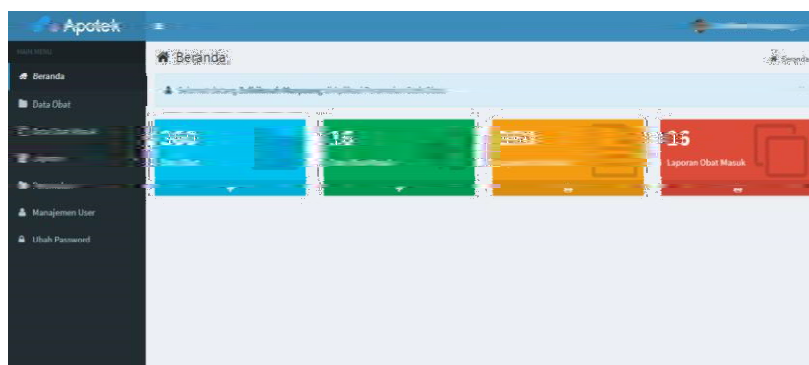
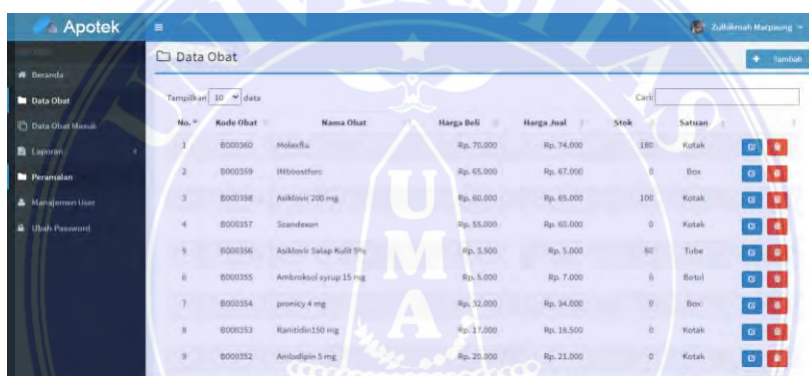


Figure 7. Admin Dashboard View

Drug Data Page

On the drug data input page, the admin can see the drug name, drug purchase price, drug selling price and drug stock, input drug data, change drug data and delete drug data, the drug master page can be seen in Figure 8.



No.	Kode Obat	Nama Obat	Harga Beli	Harga Jual	Stok	Satuan
1	B000360	Molexlla	Rp. 75.000	Rp. 74.000	180	Kotak
2	B000359	Mitoxofur	Rp. 65.000	Rp. 67.000	0	Box
3	B000388	Auklovir 200 mg	Rp. 60.000	Rp. 65.000	100	Kotak
4	B000357	Scandexon	Rp. 55.000	Rp. 60.000	0	Kotak
5	B000356	Auklovir Salap Kulit 5%	Rp. 5.500	Rp. 5.000	80	Tube
6	B000355	Ambroxol sirup 15 mg	Rp. 5.000	Rp. 7.000	8	Botol
7	B000354	promicy 4 mg	Rp. 32.000	Rp. 34.000	0	Box
8	B000353	Ranitidin 150 mg	Rp. 17.000	Rp. 18.500	0	Kotak
9	B000352	Amidoglin 5 mg	Rp. 20.000	Rp. 21.000	0	Kotak

Figure 8. Drug Data Page View

Add Drug Data Page

Admin enters drug information by pressing the add button, a display appears as below, then the officer enters the drug code, drug name, selling price, purchase price and unit and presses the save button. If successful, a successful data message will be displayed as in Figure 4.9. The add drug page is shown in Figure 9.

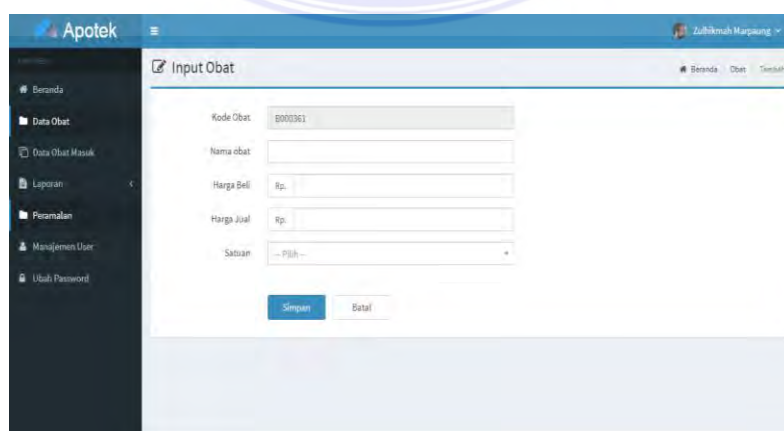


Figure 9. Add Drug Data View

CONCLUSION

The use of forecasting applications drug sales using the double exponential method can work to forecast the amount of drug inventory in the coming period. The results of This forecasting application helps the Romora drugstore in predicting the amount of drug inventory, so as to minimise shortages or excess drug supplies each month based on the accuracy comparison that has been made. made. The results of using the forecasting application decreased the error to 7.26%. to 7.26%, which before the application the error rate was 29%.

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