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Clothing Inventory Forecasting System at Kagas Using the Weighted Moving Average Method

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Article Info	ABSTRACT
	Information systems are made in stores so that they can easily process data and produce the information needed quickly, accurately, precisely, effectively and efficiently in spending costs. Kagas is a clothing store engaged in fashion that has been established since 2020. The purpose of this study is to apply the Weighted Moving Average method to the forecasting system in determining sales of robe clothes. The results of calculating the stock of gamis clothes manually and calculating using a forecasting system using the previous year's data from May 2023 to April 2024 are the same. Forecasting of gamis clothes for the May 2024 period is 175 with a MAD value of 8.04, an MSE value of 135.33 and a MAPE value of 4.7%. With a forecasting system using the weight moving average method, it makes it easier for Toko Kagas to forecast the stock of gamis clothes inventory in the following month. *Copyright © 2025 Puzzle Research Data Technology*

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1. INTRODUCTION

At this time information technology is developing very quickly. Not a few people use applications as a tool in decision making and the application is used as a material to obtain search results from a subject matter [1]. Every agency always faces the future in its activities, in order to achieve its vision and mission. [2]. In achieving optimal decisions on the activities of an agency, an appropriate, systematic and accountable method is needed [3]. Forecasting is important in making plans and serves as input in making other business decisions. The decision will be better by using proper forecasting [4].

The fashion business itself is like a part of people's lives that cannot be separated from all forms of daily activities because clothes are a must have [5]. Especially for the younger generation who like to try out various styles or the latest fashion trends that are being discussed so that they look more stylish and support their appearance to look cooler and not outdated [6]. Kagas is a business engaged in fashion that has been established since 2020, which is located on Jalan Protokol Air Joman, Binjai Serbangan District, Asahan Regency. The product marketed by Kagas is gamis clothes. With a large enough demand for gamis clothes, Kagas Stores often experience a shortage of clothing inventory so that customer demand cannot be fulfilled. Because store management has not been able to show the precise amount of stock [7], this problem can affect customer confidence in Kagas and can experience a decrease in sales and result in losses [8].

Based on the above problems, an inventory management is needed by predicting the level of future customer demand or increasing the amount of clothing stock for the future using a certain method so that there is no longer a shortage or accumulation of the number of clothes that can harm the trader [9]. One method that can be used in estimating the amount of clothing inventory is to use the Weighted Moving Avarege (WMA) method to predict how much clothing inventory should be provided in the next period to meet customer demand [10] [11].

The Weighted Moving Average (WMA) method is a forecasting method used to forecast or predict how many stocks of goods we want to buy for the upcoming period [12] [13]. The WMA method is a method that uses a technique of giving different weights to the available data with the thought that the most recent data is the most relevant data for forecasting so that it is given a greater weight [14]. With the forecasting method applied to the system, it is hoped that it can maximize the amount of clothing inventory in the next period, in order to achieve maximum profit and not harm the trader [15].

Here are some previous studies that the authors made as references in this study namely research conducted by Nurhayati and Syafiq in 2022 [16] To determine the amount of shirt production using weighted moving average, they concluded that the prediction system using the WMA method produces an error value of 21% so that the method can be used to predict the amount of production. From the results of system testing, functionally the system has run according to the analysis of functional requirements made. Likewise, the system user response gets a value of 92%, which means that the system user user states that the user strongly agrees that the system can be used properly so that it can help in making decisions to determine the amount of shirt production to be produced in the next period.

Next research conducted by Hamidy and Yasin in 2023 [17] about the application of forecasting using codeigniter. Researchers concluded that the results of inventory forecasting in 2023 had an average of 192 for 116 BR animal feed items. Based on the results of the calculation of the average amount, a satisfaction level of 3.825 is obtained and if you follow the Kaplan and Norton satisfaction level reference, the conclusion that can be drawn is that the level of user satisfaction with the inventory application is in the satisfied category. So that the indication shown is positive from the PIECES model, namely users are satisfied with this inventory application. And next research researched by Martantoh and Agustiina in 2021 [18] about predicting stock of goods at Trx Clothing using the weight moving average method. The researcher concluded his research that the weight moving average method can predict how much stock of goods to buy for the next period. Forecasting calculations for future periods are carried out based on the calculation of previous quarterly data and can also be carried out based on the selection of the desired period. With the inventory forecasting system can help facilitate the owner's service process in providing goods for the future, using the Weighted Moving Average Method. The results showed that the WMA method can be used to help shop owners predict the ideal inventory of goods.

Further research by Erdianita et al in 2023 [19] about sales prediction using the weight moving method at Mariah's Store. Researchers concluded that the calculation of predictions using the WMA method for the next month is based on the calculation of data per previous quarter. The average value of prediction accuracy test results using MAD, MSE and MAPE for 5 item sales prediction data is 4.48; 33.04 and 10.76%. The smaller the MAD, MSE and MAPE values, the higher the prediction accuracy. So that the accuracy test results using MAPE have results between 10% and 20% which can be concluded that the prediction ability is good. In other research researched by Chan et al in 2024 [20] about forecasting sales of gamis clothes at the Fashion Gallery Store. From the research that has been done, it is concluded that forecasting using the weighted moving average method can forecast the number of requests for gamis for the next period (January). Forecasting calculations for future periods are carried out based on the calculation of previous quarterly data and can also be carried out based on the selection of the desired period. With the gamis demand forecasting system in the fashion gallery, it can help facilitate the owner's service process in providing goods for the future. The weighted moving average method can be used to help fashion gallery owners predict the ideal inventory.

2. RESEARCH METHOD

In this study, the object of research is Kagas, which is a business engaged in fashion which is located at Jalan Protokol Air Joman. In this research, several stages of research will be carried out, as shown in Figure 1.

There are several stages to this research: (1) Problem identification: is the first step where at this stage looking for problems that occur in the field through direct observation to the Kagas store. (2) Literature Study: this stage is looking for literature in the form of journals or references regarding the same method that can provide the information needed for this research and can help strengthen existing theories. (3) Data collection: carried out by conducting direct interviews with Kagas store employees and owners, the data collected is product data and product sales data. (4) Data Analysis: namely analyzing the data that has been obtained using the WMA method. (5) Designing the System: is a pattern or description of the user interface of the application to be made using Microsoft Visio and using a use case diagram as a system user design. (6) Implementation: is the stage of converting the results of the previously made design. For system implementation using the php programming language and mysql database and using the Visual Studio Code application as an editor.
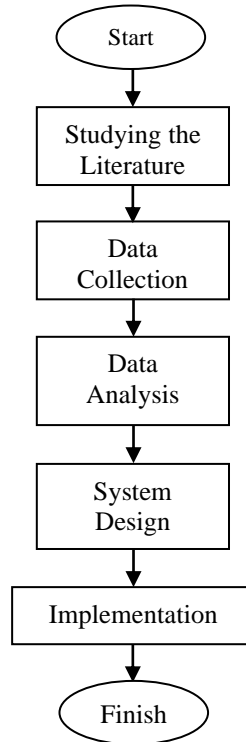
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Figure 1. Stage of Research

2.1 Weight Moving Average

This method is generally used to find the trend of a time series. This method is used for data that has characteristics that do not change quickly, and do not have seasonal data characteristics. fast, and does not have seasonal data characteristics. In the use of Weighted Moving Average method of giving weight to each different period, it is It is assumed that the most recent or recent historical data will have a greater weight than the greater weight than the old historical data because the latest data is considered to be more relevant so that it is more responsive to changes [21]. WMA is calculated using the equation 1.

$$\text{WMA (n)} = \frac{\sum (X_t)(W)}{\sum W} \tag{1}$$

2.2 Mean Absolute Deviation (MAD)

Represents the average absolute error over a given period. The absolute value is useful to avoid the existence of positive deviation and negative deviation values. Mathematically, MAD is formulated 2.

$$\text{MAD} = 1/n \sum_{t=1}^{n} |e_t| \tag{2}$$

2.3 Mean Sequence Error (MSE)

Is the center square error or the average squared forecasting error, the smaller the MSE value, the smaller the prediction error. Mathematically, MSE can be formulated 3.

$$\text{MSE} = 1/n \sum_{t=1}^{n} |e_t|^2 \tag{3}$$

2.4 Mean Absolute Perentage Error (MAPE)

MAPE is a measure of relative accuracy used to determine the percentage deviation of forecasting results. The greater the MAPE value, the greater the prediction error, conversely the smaller the MAPE value, the smaller the prediction error. The results of a forecasting method have good forecasting ability if the MAPE value is between 10% and 20% and has excellent ability if the MAPE value is < 10%. Mathematically [22], MAPE can be formulated 4.

$$\text{MAPE} = 1/n \sum_{t=1}^{n} |e_t / x_t| \text{ x } 100\% \tag{4}$$

2.5 Data Analysis

The results of the needs analysis obtained are the input data needed in predicting the amount of clothing inventory from May 2023 to April 2024. The input data will be processed using the WMA method to calculate data using manual methods and system calculations. Meanwhile, the analysis of output needs in the form of a web-based program display that can be used when you have activated the local server, namely XAMPP. The interface design of this application program uses Microsoft Visio 2010 supporting software.

This is the initial stock data, namely data for the previous 1 year from May 2023 to April 2024 where from this data we will forecast the stock for May 2024.

Table 1. Gamis Cloth Stock

Period	Stock
May 2023	140
June 2023	144
July 2023	158
August 2023	160
September 2023	168
October 2023	162
November 2023	159
December 2023	160
January 2024	153
February 2024	155
March 2024	185
April 2024	175
May 2024	?

2.2.1 Forecasting (Ft)

Forecasting can be calculated using the formula (1):

Then the gamis clothes forecasting result :
WMA = ((175 * 3) + (185 * 2) + (155 * 1)) / 6 = 175,00

Table 2. Forecasting May 2024

Period	Stock	Ft
May 2023	140	-
June 2023	144	-
July 2023	158	-
August 2023	160	150,33
September 2023	168	156,67
October 2023	162	163,67
November 2023	159	163,67
December 2023	160	161,50
January 2024	153	160,00
February 2024	155	156,33
March 2024	185	155,17
April 2024	175	169,67
May 2024	?	175,00

3. RESULTS AND ANALYSIS

3.1 System Design

The results of the use case diagram design aim to help identify and document the main functionality of the system. In addition, it provides an overview of how users or actors will interact with the system. This use case has an actor, namely the admin to manage the system. The system design can be seen in Figure 2.

In the design of the forecasting system created, the system is used by one user, namely the admin. The admin's job for this forecasting system is to manage the system starting from entering data, changing and deleting data, calculating forecasts, viewing forecasting results and printing forecasting results to be archived.
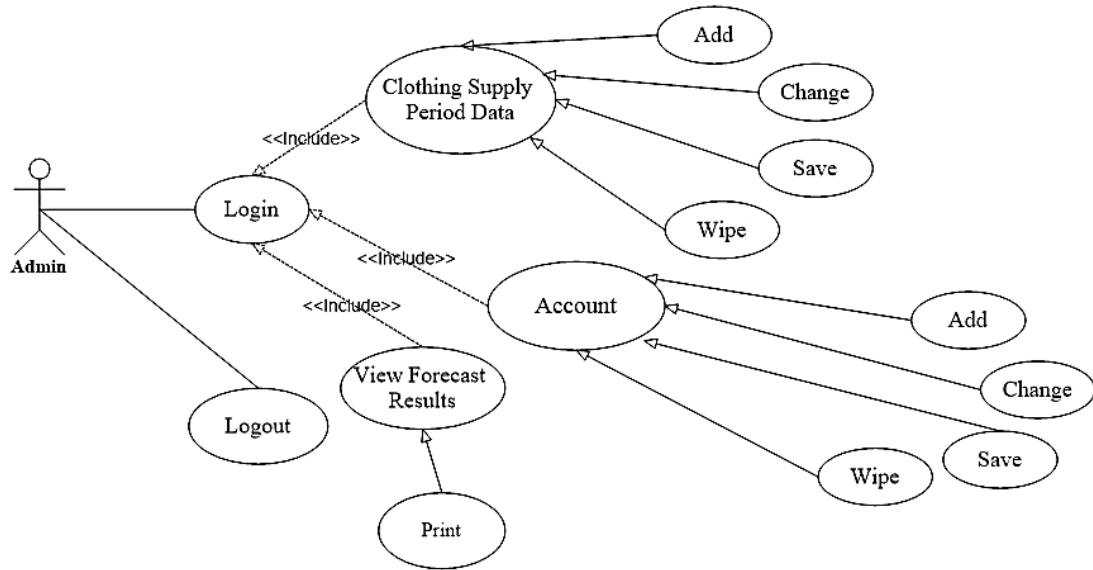
Figure 2. Use Case Diagram

3.2 Implementation

The result of the implementation of the forecasting system created is a web-based forecasting system.

Before entering the system, the admin logs in first to clarify user rights to enter the system processing. Users who have a valid username and password are entitled to enter the system through the login page as shown in Figure 3. After the Admin has successfully logged in, the forecasting application will open. Admins have the right to access the menus in the system and process data according to their functions as in Figure 4 is the home page of the forecasting system.

In the system after input the desired data, then calculations are carried out to predict the stock of gamis clothes in the next month period as shown in Figure 5. In Figure 5 is the result of the calculation on the stock of gamis clothes every month in 2023, then gives the results of the MAPE calculation of 4.70%. The system calculation results are the same as the manual calculation results as shown in table 3.

Table 3. System Forecast Calculation

Period	Stock	Ft	Error	Abs Error	Error^2	MAPE (%)
May 2023	140	-	-	-	-	-
June 2023	144	-	-	-	-	-
July 2023	158	-	-	-	-	-
August 2023	160	150,33	-9,67	9,67	93,44	6%
September 2023	168	156,67	-11,33	11,33	128,44	7%
October 2023	162	163,67	1,67	1,67	2,78	1%
November 2023	159	163,67	4,67	4,67	21,78	3%
December 2023	160	161,50	1,50	1,50	2,25	1%
January 2024	153	160,00	7,00	7,00	49,00	5%
February 2024	155	156,33	1,33	1,33	1,78	1%
March 2024	185	155,17	-29,83	29,83	890,03	16%
April 2024	175	169,67	-5,33	5,33	28,44	3%
May 2024	Prediction	175,00				
	MAD	8,04				
	MSE	135,33				
	MAPE (%)	4,70%				

3.2.1 Forcast Report

After the system displays the forecasting calculation for the supply of gamis clothes in the following month with graphics, the results can be printed to archive.
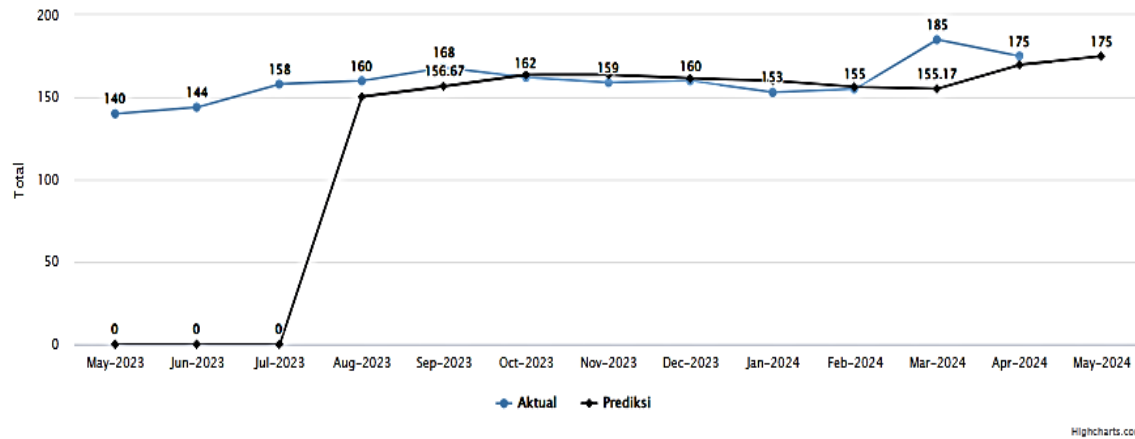
Figure 3. Graphics Forecast

4.   CONCLUSION

The results of calculating the stock of gamis clothes manually and calculating using a forecasting system using the previous year's data from May 2023 to April 2024 are the same. Forecasting gamis clothes for the May 2024 period is 175 with an MAD value of 8.04, an MSE value of 135.33 and a MAPE value of 4.7%. With the forecasting system using the weight moving average method, it makes it easier for Toko Kagas to predict the stock of clothing inventory in the following month.

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