

IMPLEMENTATION OF THE TREND MOMENT METHOD IN ESTIMATING BREAD SALES

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Abstrak

Metode trend moment adalah suatu peramalan untuk menghasilkan angka perkiraan persediaan roti pada masa yang akan datang, sehingga tidak terjadinya kelebihan maupun kekurangan stok persediaan roti di bulan yang akan datang. Di dalam penelitian ini menggunakan data penjualan roti setiap bulan, dari mulai bulan Januari sampai Desember 2021. Catatan penjualan pada setiap bulan tersebut berguna untuk melihat gambaran apakah mengalami kenaikan atau mengalami penurunan. Adapun hasil dari penelitian ini yaitu terciptanya sistem yang sudah terkomputerisasi dan mampu menghasilkan angka perkiraan dalam memprediksi penjualan untuk bulan berikutnya. sehingga mempermudah dalam mengetahui berapa banyak roti yang akan terjual dan mempertimbangkan stok barang dan berapa banyak yang akan diproduksi pada bulan berikutnya sehingga tidak mengalami kekurangan ataupun kelebihan stok roti. Hasil dari prediksi penjualan selama 12 bulan pada tahun 2021, menghasilkan prediksi pada tahun 2022 bulan Januari, pada periode ke-13 dengan Hasil MAD (Mean Absolute Deviation) 40,08% dan tingkat MSE (Mean Squared Error) 27,64%.

Kata Kunci: Peramalan, Prediksi, Penjualan Roti, Trend Moment.

Abstract

The second strategy's pattern is a gauging technique for delivering an expected number of future bread supplies so there is no abundance or lack of stock in the upcoming month. Information on bread deals is utilized in this concentration consistently from January to December 2021. Every month's deals records are valuable for deciding if sales have expanded or diminished. The review's discoveries incorporate the improvement of an electronic framework that can create rough numbers in anticipating bargains for the next month, simplifying it to decide how much bread will be sold while considering the supply of products and how much will be delivered before very long. The following month with the objective that there is no need or overflow of bread stock. The consequences of deals forecasts for a very long time in 2021 produce expectations in January 2022, in the thirteenth period with MAD (Mean Absolute Deviation) aftereffects of 40.08% and MSE (Mean Squared Error) paces of 27.64%.

Keywords: Forecasting, Prediction, Bread Sales, Trend Moment.

INTRODUCTION

One methodology in computerized reasoning that can be used for expectation is the pattern second strategy (Trend et al., 2021). Determining procedures with the pattern second is utilized to determine the number of future sales using sales data for one year or equal to 12 months (Yulian, Anggraeni, & Aini, 2020). The trend moment utilizes quantifiable, numerical assessment procedures to track down the limit of a straight line rather than a turbulent line moulded

by ongoing corporate information (Andriano Frans, Orisa, & Adi Wibowo, 2020).

Estimating is the work and investigation of expecting future open doors (Sohrabpour et al., 2021). A production head makes bread production data per month manually and then submitted to the admin section for approval by the manager. Then after it is approved, the admin section will print it. After the bread production data is published, the production head will distribute it to the respective section heads. The month-to-month bread creation information utilized as a source of perspective only

uses uncertain estimates or just guessing, and the process of calculating the data on the amount of bread per month is still manual and does not use a computerized system. In this condition, the company will suffer losses (Sutriadi, 2021).

In determining a forecast, it is better to use specific forecasting methods so that the influence of subjective elements in choosing a forecasting decision. Many forecasting methods can be utilized to decide figures, one of which is the Trend Moment strategy (Iqbal & Nugroho, 2021).

In general, the problem of lack of stock of goods often arises in the trading business sector where calculations or estimates that are still being carried out do not use forecasting methods, so actions without planning are considered ineffective, difficulties in predicting the stock that must be prepared for businesses engaged in that field. The mining sector often overwhelms corporate actors if an order is not available with all the demands, which can threaten business actors. (Heriansa & Supratman, 2021).

An improvement that will by and large form (create) or (decline) over the long haul is acquired from ordinary changes over the long haul, and the worth is exceptionally level or (smooth). At last, a period series is said to have an example assuming its not unexpected worth changes after some time, with the goal that it very well may be depended on to increment or diminish over the period for an optimal gauge. The powers that can impact designs are populace change, cost, advancement, and convenience (Konsumsi et al., 2021).

The structure comes from Latin (*systema*), and Greek (*sustema*) is a unit that includes parts associated together to work with the movement of information, matter, and energy. This term is routinely used to portray the presence of components that communicate with one another in another sense. The framework is characterized as an assortment or set of features, parts, or factors that are coordinated, associated, related to one another generally, a framework is a bunch of substances (equipment, Brainware, programming) that interface, participate and team up to accomplish specific objectives (Tahmasebi, Borin, Jatowt, Xu, & Hengchen, 2021).

A framework is many interrelated parts that cooperate to accomplish some objective. Moreover, one more comprehension of the framework comprises components and information (input), (handling), and result (yield) accordingly, in a straightforward framework can be deciphered as an assortment or set of components or components that work together and are

coordinated. What's more, rely upon one another. The framework is intended to improve or upgrade data handling (Sudiatmo, 2021).

From the data on the number of bread sales for 12 months starting from January to September in 2021, then with the trend moment prediction of the optimal sales of bread production in Hoya for January to December 2021 can be seen in Figure 1.

Penjualan Roti Bulan Januari - Desember 2021														
Nama	Jenis	Jumlah Penjualan/Bulan												
		Jan	Febr	Mare	April	Mai	Juni	Juli	Agus	Sep	Okto	Nov	Des	Total
Roti-1000	Blueberry	5500	6500	4500	5000	2300	4400	3200	6500	3200	2000	4500	3200	50800
Roti-1000	Coklat	6800	5200	5000	4500	7000	6500	2000	5000	5500	7000	4500	6500	65500
Roti-1000	Durian	4000	5500	4500	8000	5600	2800	3900	4800	6000	3500	9000	4500	62100
Roti-1000	Kelapa	4000	3500	4000	2500	2500	3000	3500	4800	2800	4000	3900	3500	42000
Roti-1000	Pandan	4800	2000	5500	6800	4800	3000	3000	5500	4200	3600	1200	4800	49200
Roti-1000	MoCCA	1500	5900	4500	3000	3000	3300	5600	2800	5900	3200	2000	2500	43200
Roti-1000	Srikaya	3200	3300	4000	2000	3300	1500	4000	3500	4000	3800	1800	3000	37400
Roti-1000	Strawberry	5200	4000	3500	3000	4700	1800	3600	4500	5500	4000	3500	1200	44500
Roti Isi 8	Manis Kosong	800	650	480	880	500	500	800	680	580	700	550	400	7520
Roti Pawar	Tawar	1500	950	1500	900	1500	1500	950	950	880	800	150	13080	
Roti Kasur	Kasur Mises	700	700	700	600	650	500	500	650	650	700	700	700	7750
Roti Sobek	Sobek Coklat	500	500	500	500	400	400	350	400	400	350	350	350	5000

Figure 1. Bread Sales Data

Based on the sales data table above, for 12 months, the number of sales in January-December 2021 has a monthly recap from the sales results will be analyzed appropriately to predict future sales to increase profits and minimize losses or production shortages due to lack of forecasting or preparation of goods for the next month.

In deciding on a check, it should be tackled utilizing specific assessment strategies so the effect of theoretical parts in determining a decision of a review can be avoided by the different estimation procedures that can be used to select, one of which is the pattern second technique.

RESEARCH METHODS

Research Framework

Prepare for this research, and it is necessary to have a clear research framework structure in stages. The system is the means that will be taken in taking care of the issue, so the last objective in anticipating the deals of Hoya can be executed. The exploration structure utilized is:

There should be a defined course of action for arranging this exploration to evaluate the stages' architecture. The system is the means that will be done in settling the issue, with the goal that the last objective in foreseeing the offer of Hoya can be executed. The exploration system utilized is seen in Figure 2.



Figure 2. Research Framework

Forecasting Systems

Determining frameworks are a significant device for settling on informed business choices. Despite organization size and profile, estimating assists authoritative administration by demonstrating assumptions in procedures fundamental exchanging presumptions exchanging or purchaser conduct. Estimating is a significant resource yet requires extraordinary abilities and the correct information. A method for forming informed expectations that use factual knowledge to determine future heading patterns. Businesses use gauging for various purposes, including forecasting future expenditures and selecting how to allocate their spending plans.

Method Trend moment

Pattern second is a development that will, in general, build (growth) or decline (decrease) in the long haul acquired from the average change after some time, and the worth is very level or (smooth). A period series is said to have a pattern assuming its regular worth changes every once in a while, so it is customary to increment or decline during the period for the ideal conjecture.

The powers that can impact patterns are changes in the populace, costs, innovation, and usefulness. The second pattern is one of the

strategies in estimating, which has one advantage: how to know the projected benefit and loss of deals of an object of merchandise that will happen in the next year (Ilyas, Marisa, & Purnomo, 2018).

The trend moment uses mathematical and statistical calculations to determine a straight line function such as a line dotted formed by a company's historical data. Only in this way can the influence factors be avoided.

The trend moment method is a technical pattern that varies from strategies, determining that information X verifiable should even be odd or even because the worth of X generally begins with 0 request first the design. The system has a blend of measurable as examination techniques, practices, and time. In utilizing the pattern technique, this should be possible utilizing the authentic information of the variable while the recipe is used to plan. Condition 1 is used to ascertain the pattern or change in esteem. The condition is used to work out the incline or coefficient of a trend line. Condition 3 is utilized to work out the consistent (Fernández-Naranjo et al., 2021).

Procedure

There is a mix of factual investigation right now as pattern examination and second techniques. In the use of the pattern second strategy, it tends to be finished utilizing chronicled information from one variable, while the recipe utilized in the arrangement of the pattern condition method with the moment method is as follows, description:

y = value to be predicted.

a = Constant number.

b = Slope or coefficient of inclination of the trend line.

x = time index, starting from 0, 1, 2, and so on.

To find the values of a and b from the above formula, you can use the substitution and elimination method mathematically, namely:

Description:

y = Total sales data

x = Total time

xy = Total sales data times time

n = Total data

After getting the value from the forecast obtained from the aftereffects of anticipating the pattern, the second strategy will be corrected aided by the consequences of estimating with the pattern second technique will be adjusted again against the effect of using seasonal sales. The calculation of the seasonal sales index is:

To get the final forecast results after being influenced by the sales index, the following calculation will be used:

$y^* = \text{Sales Index} \times Y$

Where:

y^* = The forecast results using the trend moment method are influenced by the season index.

y^* = Prediction results using the trending moment.

The accuracy of the forecasting measurement results measures the error level of the difference between the forecasting results and the actual demand. Three commonly used steps are referred to in (Yulian et al., 2020), namely:

1. Average absolute deviation (Mean Absolute Deviation = MAD)

Mean Absolute Deviation (MAD) is a method for testing or evaluating forecasting methods that use the total number of errors. MAD is the first stage of the overall model estimation error. The formula used to calculate MAD is:

$$MAD = \frac{\Sigma(\text{absolut dari errors})}{n} \dots\dots\dots (1)$$

Where:

X_t = Actual demand in t-period.

F_t = Forecasting demand in period t.

N = number of forecasting periods involved.

2. MSE Mean Square Error (MSE) is a method with another technique to test the error rate of the forecasting method. Each error is squared. This approach technique determines the significant forecast error due to the squared error. MSE is the second way to measure the magnitude of the overall forecast error. MSE is the average squared differences between the predicted and actual values. The formula used to calculate MSE is:

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

Where:

X_t = Actual demand in t-period.

F = Forecasting demand in period t.

N = number of forecasting periods involved.

3. Average absolute percentage error (Mean Absolute Percentage Error = MAPE)

Mean Absolute Percentage Error (MAPE) measures the error in the forecasting method with the absolute error technique in each period divided by the real observed value for that period. Then the result is calculated as the average value of the fundamental percentage error. MAPE is an error test that looks for the percentage difference

between the actual and estimated data. The formula used to calculate MAPE is:

$$MAPE = (100/n) \sum (X_t - F_t) / A_t$$

Where:

X_t = Actual demand in t-period.

F_t = Forecast of demand (forecast) in period-t.

N = Number of forecasting periods involved.

Bread Sales Prediction

The forecast is a course of deliberately assessing something probably going to occur later on in light of various data, with the goal that blunders are limited. While the strategy used to quantify a variable in what's to come depends on instinctual reflection from the past time (Iqbal & Nugroho, 2021).

1. Emotional estimation depends on the individual's instincts that shape it.

2. Forecasting objective will anticipate depending on important information in the past by utilizing procedures and strategies in checking information (Sari, 2017).

3. Long-term guess.

4. Medium-term guess.

5. Provisional estimates.

System Development Live Cycle (SDLC)

As per Krismiaji, SDLC (Systems Development Life Cycle) is one of the most widely recognized when a new evolution is completed by experts and software engineers to fabricate data frameworks. This is an image of SDLC (Muhammad & Raharja, 2022). SDLC (Systems Development Life Cycle) is software design, processes development, and trying. This technique depicts the general programming advancement cycle to create quality programming and measure up to clients' assumptions. (Hidayat, 2021).

System Analysis and Planning Aids.

There must be a system design tool that the author has implemented to achieve optimal analysis results in designing information systems. The creator's information system design tools are UML (Unified Modeling Language), movement charts, class graphs, arrangement outlines, use case graphs, and flowcharts.



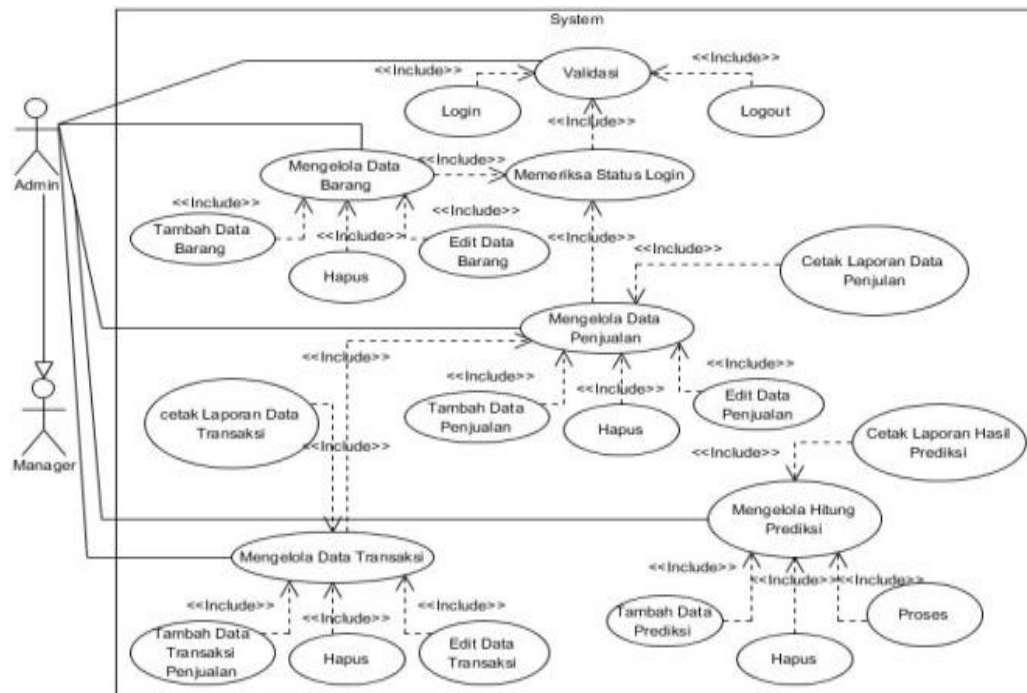


Figure 3. Unified Modeling Language

Figure 3 explains several activities that run this system, namely the login process, item data, sales data, transaction data, calculate predictions, and sales transactions to predict sales.

a. Scenario Use Case Login

Name Use Case : Login
Actor : Admin
Purpose : Gaining access to use the system
Description : Use Case is used for the Login process

b. Scenario Use Case Goods Data

Name Use : Goods Data
Actor : Admin
Purpose : Entering goods data and attributes predicting sales
Description : Admin uses this use case to input goods data and goods attribute data for the process of predicting sales.

c. Scenario Use Case Sales Data

Name Use : Sales Data
Actor : Admin
Purpose : Enter sales data and predict sales attributes.
Description : The admin uses the case to input sales data and sales data attributes to predict sales.

d. Scenario Use Case Transaction Data

Name Use Case : Transaction Data
Actor : Admin
Purpose : Entering transaction data and attributes predicting sales
Description : case is used by admin to input data and attributes of transaction data to predict sales.

e. Scenario Use Case Data Calculate Prediction

Name Use Case : Prediction Count Data
Actor : Admin
Purpose : Entering predictive count data and predicting sales attribute
Description : case is used by admin to input predictive count data and attribute data for the sales predicting process.

UML (Unified Modeling Language) is a visual language for displaying and imparting a framework by utilizing graphs and supporting texts that function to perform modelling. UML (Unified Modeling Language) can picture, characterize, develop, and record a product's concentrated framework's antiquities (Abdalazeim and Meziane, 2021).

RESULTS AND DISCUSSION

This stage is the stage for analyzing the data needed in system design, as for the data required for input, namely the data on the number of sales of bread each week, even though production is weekly, but the stock carried out by the Hoya factory is monthly, so it is done sales predictions perpetual, as for the number of sales of bread for a week, among others:

Table 1. Sales Data

Month	Weekly Sales
October	9625
November	9675
December	9670
January	9420
February	9062
March	7300
April	7987
Mey	10020
June	9920
July	8432
Agusty	8200
September	7700

Analysis of the Calculation Process of the Trend Moment Method

The second strategy's pattern is one of the techniques utilized in determining deals. In making deals gauging utilizing the pattern second strategy, we take the example of bread forecasting using sales data for the last year, namely sales data for 12 months in 2021 from January to December.

The calculation should be possible with the accompanying advances:

1. Calculating the total sales data (y) in 2021 for 12 months which we call $y = 428050$.
2. Determine the Value of the parameter (y), where (x) is a time index starting from zero (0), so the sum of the time index ($\sum x$) is 66
3. Determine the Value (xy) and x^2 , step. It is necessary to determine the value of "a" and "b" used in the trend moment equation.
4. Determining the Value (xy) is done by multiplying the historical data (y) and the time index (x). Then $xy = 2280170$
5. The subsequent stage is to decide the worth of x^2 by squaring the time index (x). x^2 is 506
6. The results of calculating the values of y , x , xy , x^2 can be seen in table 4.2, entering the step of determining the importance of "a" and "b" in the following table.

Table 2. Criteria

Month	year	Sales	X	X ²	X*Y
October	2021	38500	0	0	38500
November	2021	38700	1	1	38700
December	2021	38680	2	4	77360
January	2021	37680	3	9	113040
February	2021	36250	4	16	145000
March	2021	29200	5	25	146000
April	2021	31950	6	36	191700
Mey	2021	40080	7	49	280560
June	2021	39680	8	64	317440
July	2021	33730	9	81	303570
Agusty	2021	32800	10	100	328000
September	2021	30800	11	121	338800
Total		428050	66	506	2280170

1. The formula used in the preparation of this method. To find the values of a and b from the above formula, use a mathematical way with the solution using the substitution method and the elimination. The equations are. Based on the data in calculation of trend moment, using the following equation:

multiplied elimination

$$y = na + b \cdot \sum x \quad 428050 = 12 \cdot a + b \cdot 66 \quad \times 66$$

$$428050 = 12a + 66b \quad \times 12$$

$$xy = a \cdot x + b \cdot x^2 \quad 2280170 = a \cdot 66 + b \cdot 506$$

$$2280170 = 66a + 506b$$

Solution:

method Substitution and elimination:

$$28251300 = 428458a + 396b$$

$$27362040 = 428458a + 27363b$$

$$889260 = 26967b$$

$$b = 889260/26967$$

$$b = 32,97585$$

The equation describes the elimination to get value b. It is known that $y = 428050$, then n is the number of sales data, namely 12 data, and $\sum x = 66$ of the total number of time indexes. Likewise with the Value of $\sum xy = 2280170$

which is the sum of the sales data times the time index. After knowing the values of the equations, then the elimination by multiplying 66 in equation one and multiplying by 12 in the second equation. The result of the elimination is to get a b value of 32,97585, which can then be used to obtain the a value with equation one changing the b value to 32,97585 as follows:

$$y = na + b \cdot \sum x \quad 428050 = 12a + 66b$$

$$428050 = 12a + 66(32,97585)$$

$$428050 = 12a + 105.84$$

$$12a = 1176.40$$

$$a = 98.03$$



2. After the values of a and b are known, the next step is to enter the process of determining the value of Y or Trend with the equation: $Y = a + bx$.

In the equation below, the sales forecasting calculation process will be carried out in January-December 2021 using the results of previous calculations. It is known that the value of $a=98.03$ and $b=32.97585$, and the value of $x=25$ (September), which is the time index.

$$Y = a + bx$$

$$Y = 98.03 + 32.97585 (x)$$

$$Y = 98.03 + 32.97585 (25)$$

$$Y = 98.03 + 824,39625$$

$$Y = 922.42$$

Then the forecasting results for January 2022 will increase by 922.42.

3. Calculate errors using the MSE (Mean Squared Error) method. The actual data in January 2022 was a 922.42 sales increase, then the results of the forecast using the trending moment to get the MSE value, the difference between the actual data and the forecast data was calculated, then the results were divided by the existing data and multiplied by 100%. The calculation using MSE is as follows:

$$\text{MSE} = (\text{actual data} - \text{forecast data}) / \text{actual data} \times 100\%$$

$$= ((30800 - 922.42) / 30800) \times 100\%$$

$$= 0.97005 \times 100\%$$

$$= 97.005\%$$

Where MSE is absolute

$$\text{Accuracy} = 100\% - \text{Error}$$

$$= 100\% - 97.005\%$$

$$= 2.995\%$$

After obtaining the value of the trending moment above, it will be calculated using the season index. Based on the season index formula, the following calculation results will be obtained:

Season index = Average demand for a particular month.

Average demand per month

Note:

$$\text{Average demand for a particular month} = 35670.83$$

$$\text{Average demand per month} = 190014,167$$

$$\text{Season index} = 1$$

After being influenced by the season index, the final forecast's outcomes will use the following calculation:

$$Y = \text{Season Index} \times Y$$

$$Y^* = 1068.3$$

As a result of the sample test stage forecasting, the number of bread sales forecasted in January 2022 was 1068.3 or equivalent to 1068.3. If the amount of bread inventory is less than the forecast number, then Hoya's party must re-produce so that there is no shortage of stock of bread to be distributed to consumers

Algorithm (Trend Moment)

The flowchart in Figure 4 describes the flow in the system. This flowchart also understands how the system can direct the system. The following is an explanation:

1. admin and manager start
2. Log in to the trend moment application Home
3. Admin/manager Login enter username and password
4. Bread sales data recap per month
5. of sales Input sales data that you want to forecast
6. Input data to be predicted in the next three months
7. Conduct three sales forecasts next month
8. See the results of the forecast, then print a report
9. Count again if you want to make predictions
10. admin log out when you have finished forecasting sales

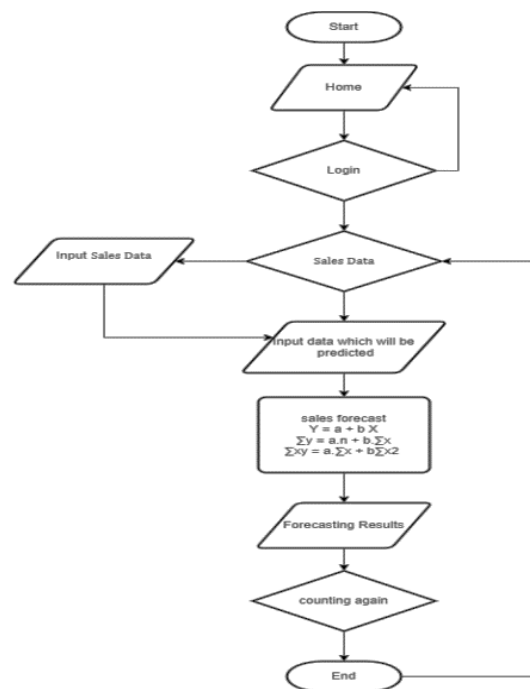


Figure 4. Algorithm Trend Moment

Where :

Y = trend value or variable to be predicted

a = constant number

b = Slope of trendline coefficient

X = time index (starting from 0,1,2,...,n)

y = the number of sales data

x = the number of time periods

xy = the number of sales data multiplied by the time period

n = the number of data

System Result

The Trend's second strategy to anticipate Hoya bread sales consists of displaying the login form, main form, profile form, item data form, sales data form, prediction calculation form, prediction result data form, change password form, and report form.

Login Form Display, coming up next is the administrator login structure shown from the Trend second strategy to foresee bread sales:

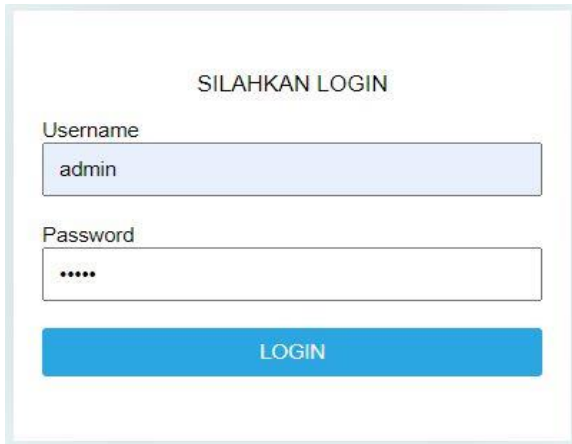


Figure 5. Login Form

Figure 5 shows that structure login is the underlying presentation that seems when the administrator runs the application framework. If you desire to enter the framework, the administrator should enter your username and secret phrase. In this framework, just the administrator approaches privileges to have the option to run the application framework. If successful, you will enter the system, as shown in Figures 6, 7, and 8.

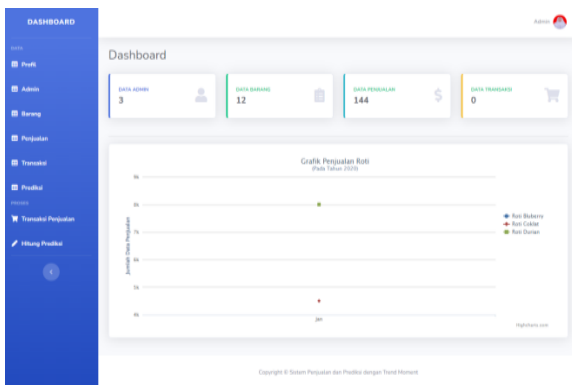


Figure 6. View Form Main

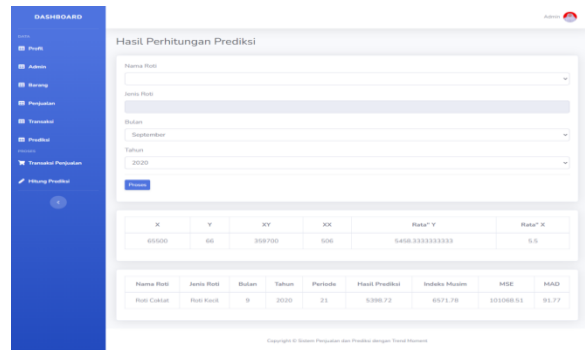


Figure 7. Prediction Calculation Results

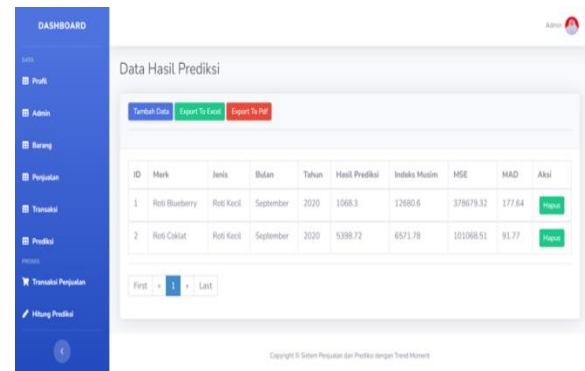


Figure 8. Prediction Result Data

Coming up next, Figure 9 is a presentation structure from the use of the Trend second to foresee deals of Hoya bread:

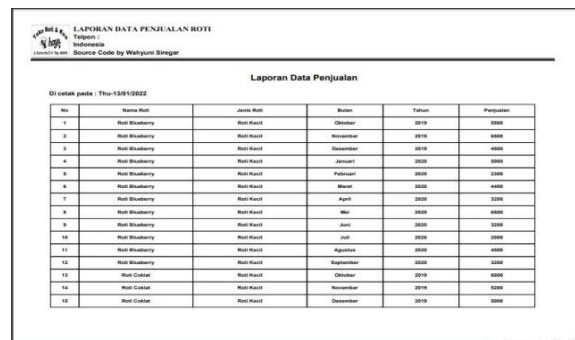


Figure 9. Sales Data Report

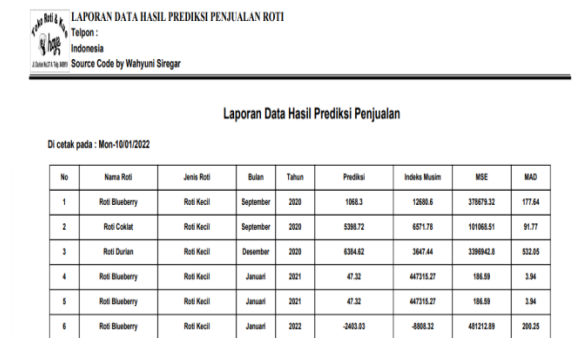


Figure 10. Prediction Result Data Report



Figure 10 displays the *form* of the sales prediction data reports the *output* of the prediction calculations performed by the admin. This report displays the predicted number of future sales based on the acquisition of goods sold from 2019 to 2020.

CONCLUSIONS AND SUGGESTIONS

Conclusion

By predicting bread sales using the Trend moment, it is known that the stock of bread that must be provided in January 2022 is 296, with MAD (Mean Absolute Deviation) 40.08% and MSE (Mean Squared Error) 27.64%. The based forecasting system is designed website where the system can simplify and expedite parties in predicting bread sales for the following month. Estimating frameworks can function admirably in giving answers for keeping away from hoarding or overselling bread to be distributed to customers/buyers. This system can be used to make predictions about bread sales.

Suggestion

To improve system performance in the future to be accessed online. Users' access rights are still generated, so a more significant difference in access rights is needed. The level of security needs to be increased if the system is online to avoid unauthorized parties' access. The system should be implemented in a local network intranet to improve team performance (teamwork) to complete the design. It can be developed with other linear regression or least square methods.

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