Implementation of Trend Moment Method in Gasoline Stock Forecasting (Case Study : SPBU Rest Area 25 - Sidoarjo)

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ABSTRACT

Sales Forecasting is the activity of estimating products to be sold at a future time under certain circumstances and is made based on data that has occurred and or is unlikely to occur. One of the forecasts needed is gasoline stock forecasting carried out at Rest Area 25 Gas Station - Sidoarjo. The purpose of this study is to determine how fuel sales forecasting with the use of the Trend Moment Method in the Rest Area 25 - Sidoarjo gas station case study can help predict uncertain fuel demand. Data collection techniques used observation, documentation and literature study methods and data analysis techniques are quantitative data. The data used in this study is gasoline sales data in 2017-2018. Implementation of the program using the VB programming language. NET programming language and SQL Server. The results of this study obtained an average error value using APE of 18.63% with an accuracy of 81.36% which is good value.

Keywords: *Trend Moment, Forecasting, APE, VB. NET*

1. INTRODUCTION (Book Antiqua, 11pt, Bold)

Competition in the business sector in the current era of globalization is getting tighter, making several companies to encourage their employees to be able to meet sales targets. (Agustine, 2017). Many strategies are needed to meet the varied needs of customers. (Sabilirrasyad et al., 2023). With different patterns and lifestyles. The success of a company must also be supported by the level of sales made (Muliawan et al., 2022). The survival and development of the company is the main goal that every company wants to realize (Isa & Hartawan, 2017). All activities All activities carried out to achieve this must be supported by good management conditions. as a manager. Besides being needed to achieve organizational goals, management is also needed to maintain a balance between goals, goals, objectives, and conflicting activities of interested parties in the organization, such as using Machine Learning techniques such as data cleaning, data transformation, feature extraction, and data labeling (Wiranto, Sabilirrasyad, et al., 2023). interested parties in the organization (Muliawan et al., 2023). Another objective of management is to achieve efficiency and effectiveness, which are the two main conceptions for measuring management performance (Fauziah et al., 2023).

One of the companies that wants to achieve efficiency and effectiveness in its managerial is Sidoarjo Rest Area Gas Station. The gas station is located on a strategic road connecting the Sidoarjo and Surabaya areas so that it accommodates erratic gasoline usage. This is because some times the demand is high but some times it is also normal because it is seen in several seasons such as the long holiday season which incidentally the number of vehicles is quite

high so that the demand is getting bigger. Based on these unsettled conditions, gas stations need a good plan related to gasoline demand to existing distributors so that there is no shortage of gasoline in the area.

Based on this background, researchers are interested in applying the Trend Moment Method in Gasoline Stock Forecasting at Rest Area 25 Gas Station - Sidoarjo. The Trend Moment method is a method used to assist in forecasting sales for sales in the following months and years (Safitri & Sianturi, 2021). To build a system that is desired, researchers use the Trend Moment method which is a method that is included in the forecasting / prediction section. The result of this research is a digital product in the form of a desktop-based system that provides prediction results in the future to the management of SERA 25 Service Station - Sidoarjo.

2. METHODS

The methodology used for software engineering in this research is a model with a systematic and sequential approach starting from the level of system requirements to the implementation of the software. (Zoromi et al., 2023)

2.1 Requirements analysis and definition

Before doing software development, a developer must know and understand how information on user needs for a software (Fauziah, Muliawan, & Dimyati, 2023). This method of collecting information can be obtained in various ways including discussions, observations, surveys, interviews, and so on.

2.2 System and software design

Information about requirement specifications from the Requirement Analysis stage is then analyzed at this stage and then implemented in the development design. The design of the design is carried out with the aim of helping to provide a complete picture of what must be done (Hermansyah, Fauziah, et al., 2023). This stage will also help developers to prepare hardware requirements in creating the overall architecture of the software system to be created.

2.3 Implementation and unit testing

The implementation and unit testing stage is the programming stage. Software development is divided into small modules that will be combined in the next stage. In addition, this phase also tests and checks the functionality of the modules that have been made, whether they meet the desired criteria or not.

2.4 Integration and system testing

After all units or modules are developed and tested in the implementation stage, they are then integrated into the overall system. After the integration process is complete, the overall system is checked and tested to identify possible system failures and errors.

2.4 Operation and Maintance

The final stage of the waterfall method is to perform maintenance on the system that has been created. The maintenance referred to is updating or repairing if the system experiences an error or error. Figure 1 shows the stages of the Waterfal method (Hermansyah, Sabilirrasyad, et al., 2023)
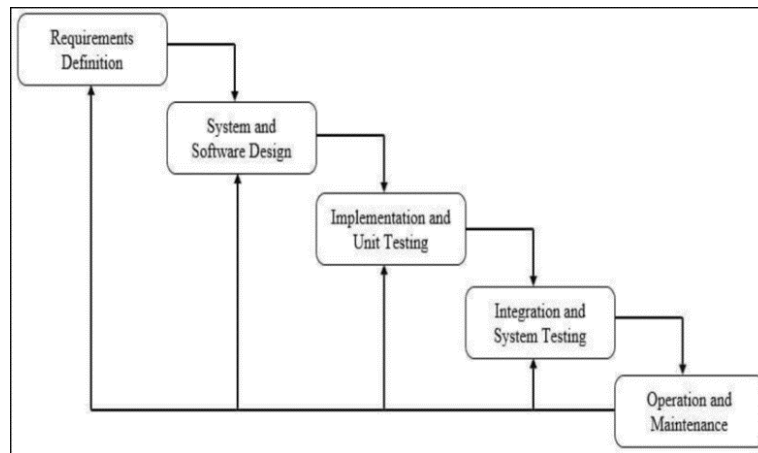
Fig 1. Waterfall Method

3. RESULTS AND DISCUSSION (Book Antiqua, 11pt, Bold)

By using the waterfall method as a method of developing. Then the results and discussion are obtained as follows:

3.1 Requirements analysis and definition
Analysis and search for system requirements is carried out. Obtained problems, supporting data requirements, functional and non-functional requirement. Berikut merupakan data yang digunakan dalam penelitian ini :

Table 1. Data

No	Periode	Year	Frequency/ 100.00 liter
1	January	2017	18
2	February	2017	12
3	March	2017	11
4	April	2017	13
5	May	2017	14
6	June	2017	18
7	July	2017	18
8	August	2017	17
9	September	2017	20
10	October	2017	15
11	November	2017	16
12	December	2017	19
13	January	2018	19
14	February	2018	16
15	March	2018	16
16	April	2018	14
17	May	2018	16
18	June	2018	19
19	July	2018	19
20	August	2018	17
21	September	2018	17
22	October	2018	16
23	November	2018	17

24	December	2018	20

3.2 software design

Software design is made as a stage to prepare the software implementation process desired by the user. In this research, software design uses the Unified Model Language (UML) to describe all existing processes and objects Modeling used in this research is modeling with the Unified Modeling Language (UML) used to make analysis and design of software with object-oriented programming (Asnal et al., 2022). The following is an application design using a use case diagram :
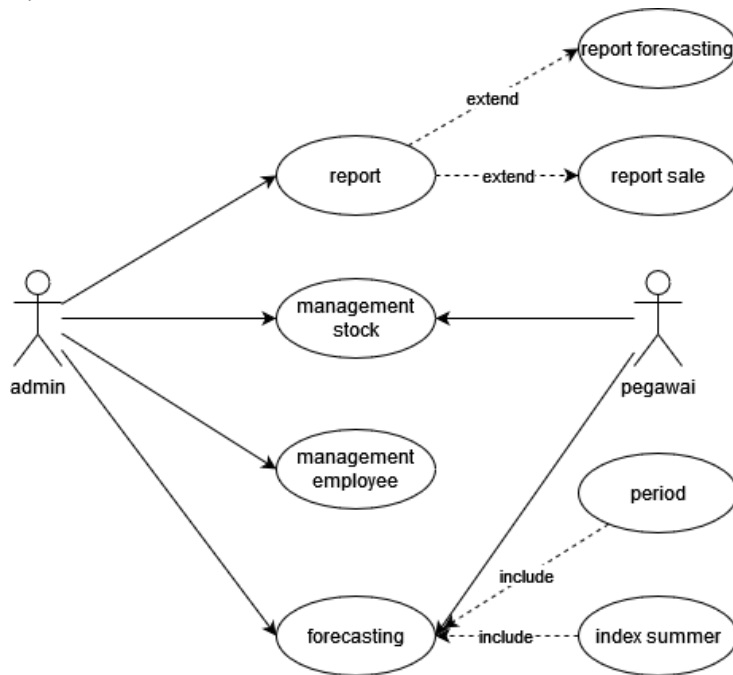
Fig 2. Use Case Diagram

3.3 Calculation

System analysis is the system design steps represented in the stages carried out in the research case study using the Trend Moment method with the following stages (Ulfa et al., 2019) :

1. Determine the amount of sales data to be used as stock sales forecasting
2. Determining the X value, Y value, X×Y value and X2 value
3. Determines the total number of X values, Y values, X×Y values and X2 values based on sales data
4. Determining the average X value, Y value, X×Y value and X2 value based on sales data
5. Determining the b value using the formula

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - (\sum X)^2}$$

6. Determining the a value using the formula

$$a = \frac{(\sum Y) - b(\sum X)}{n}$$

7. Determine the season index value using the formula

$$im = \frac{rata - rata\ penjualan\ bulan\ yang\ akan\ diramalkan}{rata - rata\ penjualan\ keseluruhan}$$

8. Find the Y value to be predicted using the formula

$$Y = a+bx$$

Trend Moment is a method for finding trend lines with certain statistical and mathematical calculations to determine the function of a straight line instead of a broken line formed by the company's historical data. The next step is to determine the X value where the X value is time made in the form of a value and starts with a value of 0 while the Y value is gasoline sales data. Then multiply between X and Y and then raise the value of X. The following is a calculation table of the trend line

Table 2. Table Value Trend

No	Periode - year	X	Y	X x Y	X²
1	January - 2017	0	18	0	1
2	February - 2017	1	12	12	4
3	March - 2017	2	11	22	9
4	April - 2017	3	13	39	9
5	May - 2017	4	14	56	16
6	June - 2017	5	18	90	25
7	July - 2017	6	18	108	36
8	August - 2017	7	17	119	49
9	September - 2017	8	20	160	64
10	October - 2017	9	15	135	81
11	November - 2017	10	16	160	100
12	December - 2017	11	19	209	121
13	January - 2018	12	19	228	144
14	February - 2018	13	16	208	169
15	March - 2018	14	16	224	196
16	April - 2018	15	14	210	225
17	May - 2018	16	16	256	256
18	June - 2018	17	19	323	289
19	July - 2018	18	19	342	324
20	August - 2018	19	17	323	361
21	September - 2018	20	17	340	400
22	October - 2018	21	16	336	441
23	November - 2018	22	17	374	484
24	December - 2018	23	20	460	529
	Total	276	397	4734	4333
	Average	11,5	16,54		

Next, we will determine the value of bThe next step after getting the average value is to determine the value of b using the formula:

$$b = \frac{n(\sum XY) - (\sum X)(\sum Y)}{n(\sum X^2) - (\sum X)^2}$$

Value :
n = 24
X = 276
Y = 397
X x Y = 4734
X² = 4333

The formula above produces a value of b of 0.28. After the value of b is obtained, the next step is to find the value of a using the formula:

$$a = \frac{(\sum Y) - b(\sum X)}{n}$$

So as to produce a value of a of 13.21. After obtaining the values of a and b, to forecast the number of sales of stock items that will calculate the 25th x value season index for January. The next step is to find the season index value with the formula:

$$IM = \frac{average\ sales\ of\ the\ forecasted\ month}{overall\ sales\ average}$$

From the formula above, the value for the season index is 1.11. The last step of the Trend Moment method is to find the Y value to be forecasted below:

$$Y = a+bx$$

So that the January 2019 forecasting value is obtained:
Y = 13,21 + (0,28 x 25)
Y = 22,54

From the results of these calculations then carried out error accuracy testing using APE (absoult percent error) with the following formula:

$$APE = \frac{Real - forecast}{Real} \times 100\%$$
$$APE = \frac{19 - 22,54}{19} \times 100\%$$
$$APE = 18,63$$

So that the accuracy result is 100% - 18,63% = 81,36%

3.4 Implementation Application

Furthermore, the application stage of the trend moment method in fuel stock prediction. In this study, researchers built a program using VB.NET with MySQL Server database. The following is an application display with the application of trend moment

a. Homepage Apps

The initial display is the home page, in this form the user can log into the system.

Fig 3. Homepage Apps

b. Management User Page

In the employee form admin can add employees, who are employees who can log into the system
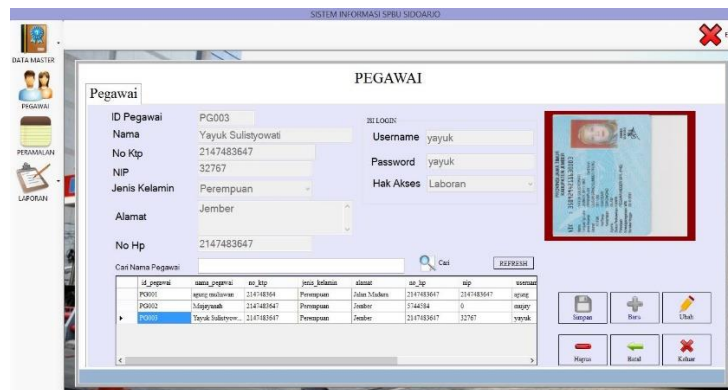

Fig 4. Management User Page

c. Input Data BBM

The following is the fuel data input page that is input by employees, the data will later be processed to the forecasting page.

Fig 5. Input data BBM

d.Forecasting Page

Forecasting form by selecting the year to be forecast along with the period. The fuel revenue data that we entered earlier will be processed using the Trend Moment calculation.

Fig 6. Forecasting Page

Fig 7. Result Forecasting

e. Report Menu

In the report menu, we can print fuel revenue data according to the month and year we specify as well as the forecasting value.

Fig 8. Report Page

4. CONCLUSION

Based on the results of research and discussion of the Application of the Treng Moment Method on fuel prediction at SERA 25 gas stations - Sidoarjo can help predict the number of fuel needs. The program that is built can run smoothly in accordance with the manual calculation of the trend moment method. The results of the calculation of fuel sales predictions using 2 years of fuel data (2017 - 2018) for 2019 get an average error value using APE of 18.63% with an accuracy of 81.36% which is good value.

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