HONDA MOTORCYCLE STOCK FORECASTING SYSTEM USING DOUBLE EXPONENTIAL SMOOTHING METHOD (CASE STUDY OF HONDA DEALER PT DELTA SARI AGUNG SIDOARJO)

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ABSTRACT

Stock in the warehouse of PT. Delta Sari Agung Sidoarjo is currently unstable, therefore between in and out stock is still out of control. Forecasting is estimating the state of the future through testing the state of the past. In social life, everything is uncertain and difficult to predict accurately, so forecasting is needed. In other words forecasting aims to get forecasting that can minimize forecasting errors (forecast error) which is usually measured by mean square error, mean absolute error, and so on. The Double Exponential Smoothing method is used for forecasting by determining the amount of α (alpha), as well as the smoothing process twice and this study is compared with ANN-Matlab. From the results of the comparison of the trial system forecasting and JST-Matlab there is a difference of 16 motorbikes from the remaining stock, which is for the results of forecasting 622 and JST-Matlab 638 results.

Keywords: *PT. Delta Sari Agung Sidoarjo, Honda Motorcycle, Stock Forecasting, Double Exponential Smoothing, Mean Square Error*

1. INTRODUCTION

Inventory (stock of goods) is an operational problem that is often faced by companies. Inventory can be the number of items stored in a warehouse. If the amount of inventory is too small and demand cannot be fulfilled due to lack of inventory, this will cause consumers to be disappointed and there is a possibility that consumers will not return again. Likewise if the inventory is too large, this will result in losses for the company because they have to provide a larger place, the possibility of depreciation in the value of goods, and must provide additional costs associated with inventory costs such as maintenance costs and accounting costs. Therefore, management must be able to decide how much an item must be prepared for company needs.

1.1. Background

PT. Delta Sari Agung Sidoarjo is the place to buy honda motorcycles in Sidoarjo Regency. Stock in the warehouse of PT. Delta Sari Agung Sidoarjo is currently unstable, therefore between in and out stock is still out of control. In stock motorcycle units at PT. Delta Sari Agung Sidoarjo still uses the manual method and the manual method still makes it difficult for workers to conduct unit stock. So that stock is still difficult to control in determining the number of motorcycles and every month often experiences accumulation or residual motorcycles.

Therefore, in this final project, a study entitled "Forecasting of Honda Motorcycle Stocks Using the Double Exponential Smoothing Method (Case Study of Honda Dealer PT. Delta Sari Agung Sidoarjo)". In this research, pre-processing will be done from each stock of motorcycle units which will later be used as a feature to find out the number of motorcycle stock in the warehouse. It is expected that this research can produce a system for forecasting motorcycle stock at the Dealer.

1.2. Formulation of the problem

Some issues related to research are as follows:

1) How to process motorcycle unit stock data that will be processed using the pre-processing method?
2) How to make a motorcycle unit forecasting system that can be seen from the amount of unit stock data coming and unit stock out / ordered using the Double Exponential Smoothing method?

1.3. Scope of problem

Limitation problems in this study are as follows:

1) The data used are motorcycle unit stock data at PT. Delta Sari Agung Sidoarjo in 2005 – 2016
2) The data used are only based on the number of incoming unit stock, stock unit out, and remaining motorcycle stock units
3) Data for the year 2005 - 2016 as training data, while the data in 2017 as test data
4) Forecasting this research is forecasting monthly and forecasting annually
5) The programming language used is the PHP programming language and uses the Double Exponential Smoothing method
6) Testing of this system is compared with the Artificial Neural Network - Matlab

1.4. Research purposes

The purpose of this study is to design a system to predict the data of motorcycle unit stock, making it easier for workers to know the stock of motorcycle units in the warehouse so that stock build up does not occur.

2. THEORY BASIS

The theoretical basis contains theories that support the making of research and systems.

2.1. Data Mining

[1]defines data mining as the process of obtaining useful information from large database warehouses. Data mining can also be interpreted as extracting new information taken from large chunks of data that helps in decision making. The term data mining is sometimes also called knowledge discovery. Some of the techniques often cited in the data mining literature in its application include: clustering, classification, association rule mining, neural networks, genetic algorithms and others. What distinguishes the perception of data mining is the development of data mining techniques for applications in large-scale databases. Before the popularity of data mining, these techniques could only be used for small scale data.

2.2. Double Exponential Smoothing

This method was proposed by Brown's to overcome the differences that arise between actual data and forecast values if there is a trend in the pattern. The rationale for Brown's exponential linear writing is similar to the linear moving average (Linear Moving Average), because both the single and double smoothing values lag from the actual data whenever there is a trend element, the difference between the single and double smoothing values is added to the smoothing value and adjusted for trends. And is used for forecasting by determining the amount of α (alpha) in trial and error between 0 to 1, and the smoothing process is done twice.

The following is the equation used in the Double Exponential Smoothing calculation:

a) Determine the first smoothing (S't)

$$S't = \alpha Xt + (1- \alpha) S't-1 \quad (2.1)$$

Explanation:
Xt : actual value of the t-period
α : *smoothing* parameter

b) Determine the second *Smoothing* (S"t)

$$S"t = \alpha S't + (1- \alpha) S"t-1 \quad (2.2)$$

Explanation:
α : *smoothing* parameter

c) Determine The Magnitude Of The Constant (at)

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at = 2S't–S"t……..…….....(2.3)

d) Determine The Amount of *Slope* (bt)

$$bt = \frac{\alpha}{1-\alpha}(S't - S''t) \quad \text{……..……...……..…...(2.4)}$$

Explanation:

α : *smoothing* parameter

e) Determine The Amount of *forecast* (St+m)

St+m = at + bt m…….……...……....(2.5)

Explanation :

m : number of predicted advance periods

2.3. MSE

The Mean Squared Error (MSE) is another method for evaluating forecasting methods. Each error or remainder is squared. Then added up and added to the number of observations. This attachment regulates large forecasting errors because they are squared. The method produces medium errors which are probably better for small mistakes, but sometimes make a big difference. The purpose of statistical optimization is very often to choose a model for minimum MSE, but this measure has two weaknesses. First, this measure shows the matching of a model to historical data. Matching using high-order polynomy or an appropriate Fourier transform. A model that fits too well with a meaningful series of data is the same as entering random elements as part of the angkitan process. This is as bad as the failure to recognize non-random patterns, in the data.

MSE (Mean Squared Error) is the average of the square of the difference between the predicted value and the observed (actual value). Following the MSE formula.

$$\text{MSE} = \frac{1}{n}\sum_{i=1}^{n}(Y_1 - Y_t\hat{})^2$$

Y_1 = nilai data asli

$Y_1\hat{}$ = nilai data peramalan

3. ANALYSIS AND DESIGN

3.1. System analysis

This stage of system analysis has the task of defining the system problem, conducting a feasibility study, analyzing the system requirements and related elements such as administrators, and everything needed in the process of forecasting the Honda Motorcycle Stock at PT. Delta Sari Agung Sidoarjo.

3.2. System planning

Context diagram that aims to facilitate modelling and functions in system development and provide a general description of the system being built. Context diagram / level 0 diagram can be seen in Figure 1.

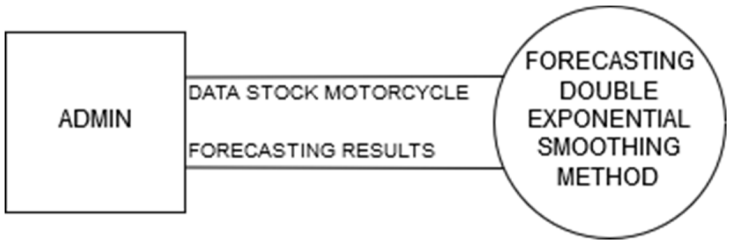

Figure 1 Display DFD Level 0

An explanation of DFD level 0 images is as follows:

The explanation of this context diagram is that only one party has the right to use the application system, namely the admin.

a. Designing Data Flow Diagrams Level 1

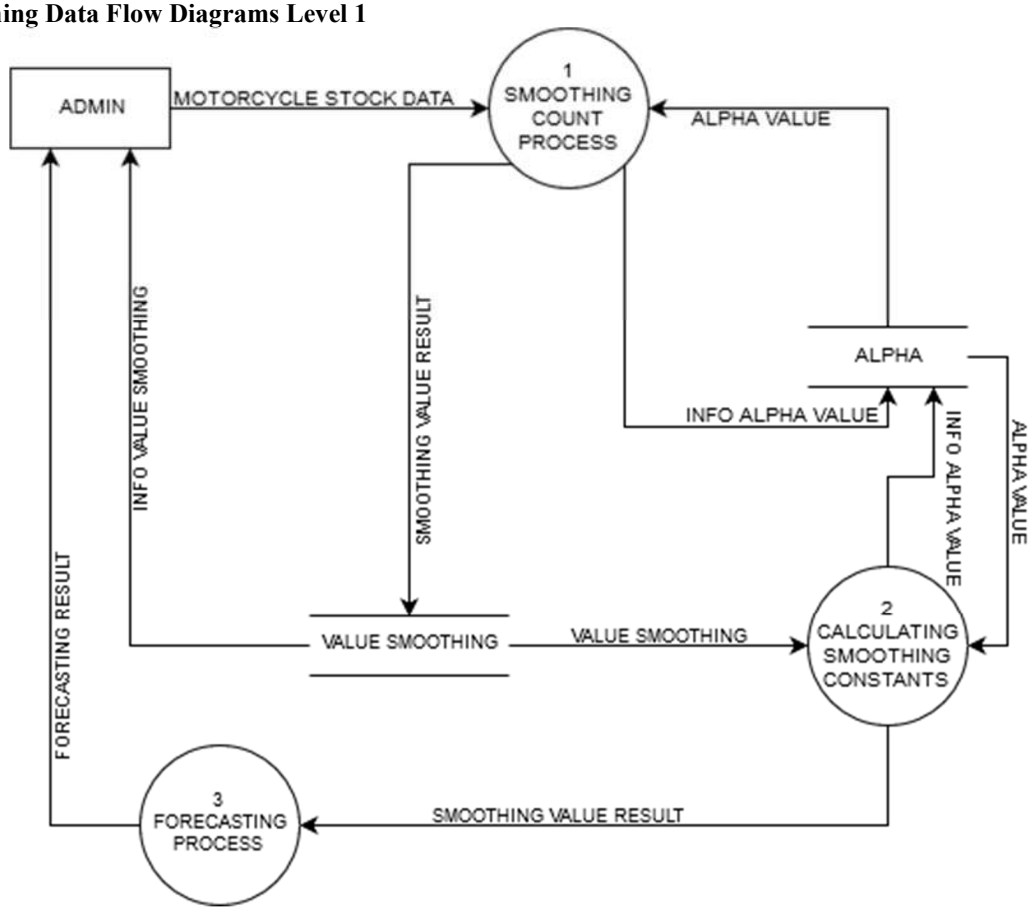

Figure 2 Display DFD Level 1

Explanation of DFD level 1 images is as follows:

a) Calculate Smoothing Process
   This process is a process of processing stock data to find a single smoothing (S't) and double smoothing (S "t) of stock data
b) Smoothing Constant Process
   The process after calculating smoothing to find the results of the constants At and Bt that will be used for forecasting.
c) Forecasting Process
   The calculation process uses a smoothing value and a smoothing constant that will produce a stock forecast value for the admin

b. Designing Data Flow Diagram Level 2 Double Exponential Smoothing

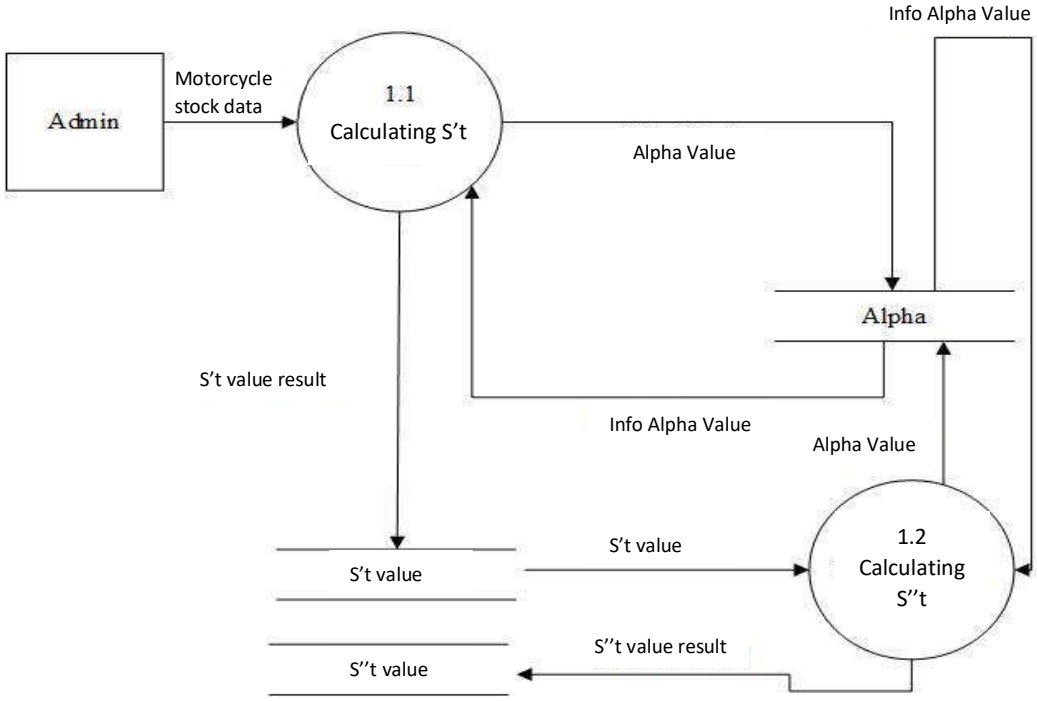

Figure 3 Display DFD Level 2 Double Smoothing

Explanation of DFD level 2 Double Smoothing images and their processing:

a. The counting process isn't
   This process is a process of processing stock data to find a single smoothing of the stock data
b. Calculating Process S "t
   This process is a process of processing stock data to find double smoothing (S "t) from stock data

4. RESULTS & DISCUSSION

Experiments conducted on a Motorcycle Stock Forecasting system is to forecast stock using the system with the Double Exponential Smoothing method, to prove the system runs well, therefore it needs to be tested. Of course in testing will be done with test data.

Tests carried out with total data from 2005 to 2016 data that has gone through a constant calculation process and smoothing will be ready to do as many trials by testing 3 stocks namely stock in, stock out and remaining stock

4.1. Results of Experiments on Entry Stock in 2005-2016

The data to be calculated is the total of each year and the results can be seen in the figure

- Forecasting Process (DES) Entry Stock

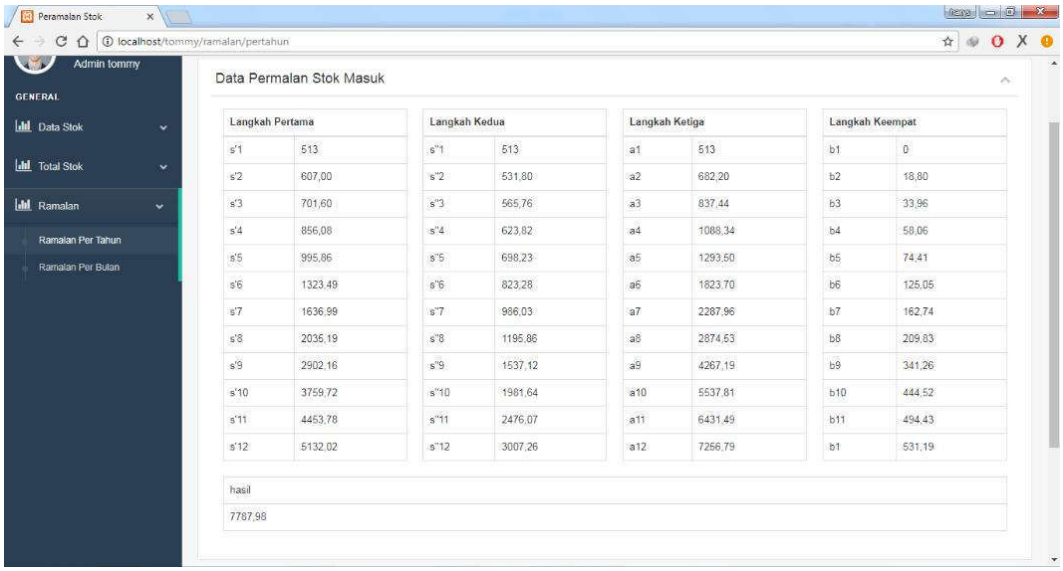

Figure 4 forecasting incoming stock 2005-2016

The results of calculating the smoothing value for incoming stock using $\alpha = 0.2$ are as follows:

St+m = At + Bt m

St+m = 7256,79 + 531,19

= 7787,98

- Forecasting Process (DES) Stock Out

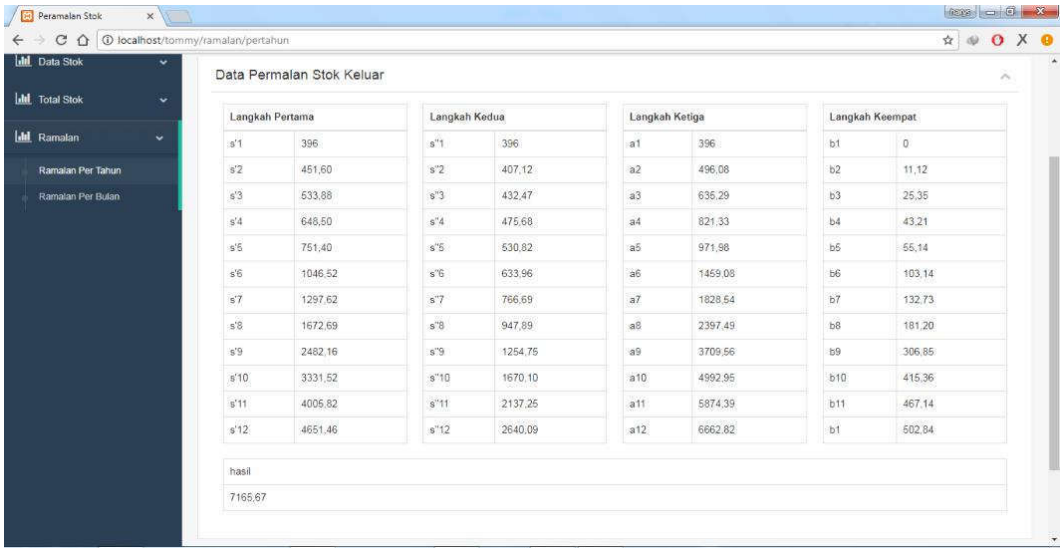

Figure 5 forecasting out of stock 2005-2016

The results of calculating the smoothing value for outgoing stock using $\alpha = 0.2$ are as follows:

St+m = At + Bt m

St+m = 6662,83+502,84

= 7165,67

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- Forecasting Process (DES) Remaining Stock

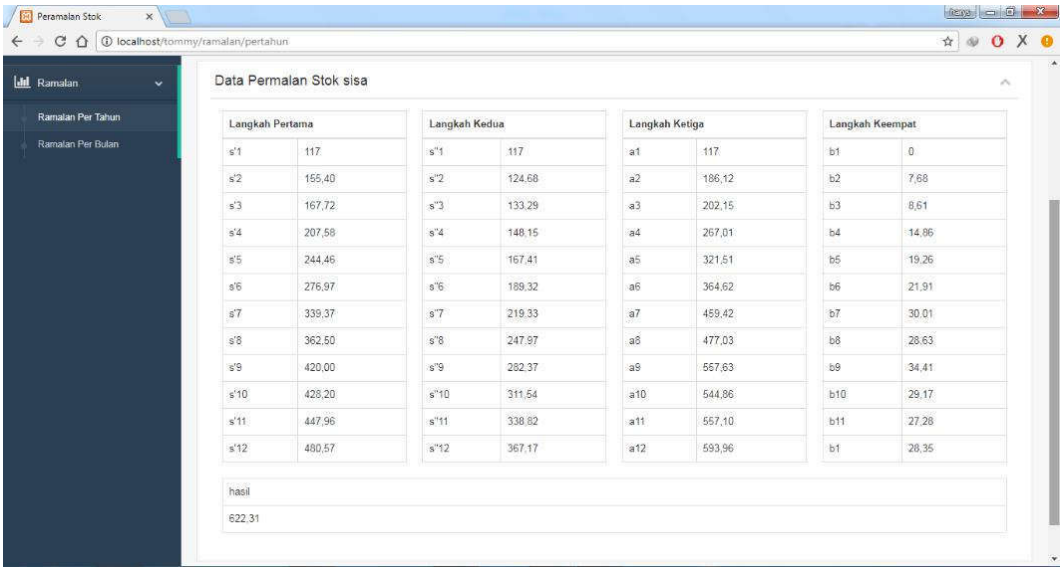

Figure 6 forecasting the remaining stock in 2005-2016

The results of calculating the smoothing value for the remaining stock using α = 0.2 are as follows:

Ft+m = At + Bt m

Ft+m = 593,96 + 28,35

= 622,31

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