Forecasting the Hotel Room Reservation Rate in East Kalimantan Using Double Exponential Smoothing

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***Abstract*—Forecasting the room reservation rate is an important thing for the Central Statistics Agency of East Kalimantan Province because it can affect the income of the hotel and the existing regional economic indicators. In this study, we used Double Exponential Smoothing (DES) method to predict the reservation rate. DES Method uses an alpha constant value that randomly selected in the calculation process. To forecast the room reservation rate in January 2019, we used the data from 2014 to 2018 with the alpha values 0.1, 0.3, 0.5, 0.7 and 0.9. The error forecasting results of each alpha value are calculated using the Mean Squared Error method (MSE). The study results the forecasting alpha 0.1 with an MSE error value of 19.278478603164 and the best forecasting value of reservation rate for January 2019 is 52,263.**

***Index Terms*—Room Reservation; Double Exponential Smoothing; Mean Squared Error; East Kalimantan**

I. INTRODUCTION

East Kalimantan is one of the provinces that has many beautiful and enchanting attractions, such as the Mahakam River, Baitul Muttaqien Mosque or Islamic Center, Beras Basah Island, Kumala Island and other tour spots. Based on data that shown on the Number of Foreign Tourists and Domestic Travelers in East Kalimantan, the number of tourists visiting in 2015 was 4,320,025 and in 2016 it increased to 5,101,562 [1]. Along with the increasing of tourists visiting tourist attractions in East Kalimantan, hotels as a support for the tourism sector need to be monitored and evaluated in its development. The hotel's survival is largely determined by the high occupancy rate, the number of hotel guests and influenced by how long guests staying in it.

Star hotels are business services, lodging services, eating drinks, and other services for the public by using part or all of the building. This business is managed commercially and fulfills the requirements as a star hotel (including diamonds) stipulated in the decision letter of the agency that built it. For example five-star hotels, four-star hotels and so on [1]. The hotel reservation rate is a comparison between the numbers of nights the room is used with the number of rooms available. Room reservation rate data is used by governments and hotel investors. The Room reservation rate data is used by the government in evaluating the potential of tourists in a region, while investors use Room reservation rate as a material consideration for investing in the tourism sector in the region.

II. LITERATURE RESEARCH

A. Previous Research

Research on the implementation of the double exponential smoothing method in forecasting such as, information systems predict sales of goods with double exponential smoothing method. Data collection of goods has various types and recording transactions in a computerized manner, the system needs to be made to record every sale and purchase transaction. A double exponential smoothing method was used to predict how many items were sold in a certain time with 9 alpha constants and the best alpha results were obtained, 0.3 [2]. Next study is about implementation of forecasting double exponential smoothing method in cases of child violence at integrated service centers for women and children empowerment. This study used a double exponential smoothing method to project patterns of violence on children both physically, sexually, abuse and neglect of children for the next few years [3]. The next study is about forecasting drug sales using the single exponential smoothing method where the study contains the application of the Single Exponential Smoothing method for the forecasting drug Store sales from January 2013 to December 2014 [4].

B. Forecasting

Forecasting is knowledge and art to predict what will happen in the future at the present time. In doing forecasting, there must be past data and information. Past data and information are behaviors that occurred in the past with various conditions at the time. In practice there

are several types of forecasting. The types of forecasting in question include [5]; based on structure; subjective forecasting and objective forecasting, based on forecasting trait: qualitative forecasting and quantitative forecasting, based on time period; short-term forecasting, medium-term forecasting and long-term forecasting.

The calculation of the first exponential smoothing value is given the symbol (S^'t) with the equation:

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

1) *Calculate the second escalation of the smoothing value given the symbol (S ^ '' t) with the equation:*

$$S''t = \alpha.S't + (1-\alpha)\ S''t-1 \quad (2)$$

2) *Calculate the value of a constant and be given the symbol (a_t) with the equation:*

$$at = 2S't - S''t \quad (3)$$

3) *Determine the value of the slope with equal:*

$$bt = \alpha\ (1-\alpha)\ (S't-S''t) \quad (4)$$

4) *Calculate the magnitude of the predicted value with the equation:*

$$Ft + m = \alpha t + bt + m \quad (5)$$

Where:

S't = First exponential smoothing
S''t = Second exponential smoothing
S't-1 = Previous exponential smoothing value
magnitude of the constant of t period
bt = Trend value from the appropriate data
F = Predicted value for the next period
m = Prediction period
Xt = Actual period value to t
α = is the smoothing constant, or alpha, $0 \leq \alpha \leq 1$

C. Forecasting Accuracy Value

According to [6] forecasting a method is needed to determine the accuracy of forecasting results that have been calculated using the forecasting method. They are Mean Square Error and Mean Absolute Definition. The Mean Square Error (MSE) uses the square value for each difference in the calculation that occurs. The difference with Mean Absolute Deviation (MAD) is MSE for more extreme deviations than MAD [6].

$$MSE = \frac{\sum_{t=1}^{n}(y_t - \hat{y}_t)^2}{n} \quad (1)$$

Where:

Yt = Actual data at t period

Ŷt = Forecasting data at period

n = amount of data

D. Hotel Room Reservation Rate

Hotel occupancy is also the occupancy rate of a hotel where the data can be used as a comparison tool for the hotel itself to other hotels in the business context. Hotel occupancy is calculated every day. There is a formula to calculate Hotel Room Reservation Rate: The number of rooms occupied is divided by the number of rooms available, then multiplied by 100 [7].

In this analysis the front office manager must decide how occupancy can give effect to other outlets. For example, for example, if "multiple occupancy" increases, the "average daily room rate" will also increase. If "double occupancy" occupancy is high, then food and beverage sales will also increase.

$$\textbf{Reservation Rate} = \frac{\textit{Number of Room Occupied}}{\textit{Number of Room Available}} \times \mathbf{100} \quad (2)$$

III. RESULT AND DISCUSSION

A. Description of The System

This hotel room occupancy forecasting system is built using the double smoothing method as a method in forecasting calculations and uses the mean squared error (MSE) method in calculating the error value of forecasting results. This system is built based on the desktop and produces 5 forecasting values and their error values. Users are required to log in first by entering their username and password to be able to use this system, then the user can enter the room occupancy rate data monthly, after that they can forecast the condition of the data. Before the forecasting is complete and entered into the system, the system will provide output in the form of forecasting results along with the error value of the forecasting, and provide recommendations for the best forecasting results. The best forecasting results can be printed in the form of forecasting results report.

B. Forecasting of Double Exponential Smoothing

Manual testing is done on the system interface. Testing this calculation will be the double exponential smoothing method and mean squared error. There are five forecast results produced by double exponential smoothing calculations using five different alpha values. If t = 1, the first month of the S1 forecasting value is not available, then the value of S1 is set to equal to the value of data X1 in all calculations. The forecasting is carried out with monthly periods so that the value of forecasting is the result of forecasting each month. The manual calculation can be seen as follows (Table1).

TABLE I
Actual Data

Year	Month	Actual Data
2014	January	58.83
2014	February	56.05
2014	March	64.47
2014	April	56.33
2014	May	57.84
2014	June	61.43
2014	July	51.42
2014	August	51.07
2014	September	52.43
2014	October	52.43
2014	November	59.74
2014	December	58.63
2015	January	53.32
2015	February	53.92
2015	March	57.79
2015	April	58.15
2015	May	57.44
2015	June	58.04
2015	July	54.05
2015	August	57.15
2015	September	55.68
2015	October	58.12

Year	Month	Actual Data
2015	November	59.52
2015	December	60.08
2016	January	46.67
2016	February	55.01
2016	March	56.87
2016	April	52.6
2016	May	52.49
2016	June	42.95
2016	July	43.96
2016	August	50.18
2016	September	50.43
2016	October	44.47
2016	November	58.12
2016	December	53.02
2017	January	49.72
2017	February	46.86
2017	March	57.56
2017	April	56.22
2017	May	53.24
2017	June	53.21
2017	July	52.2
2017	August	49.33
2017	September	53.41
2017	October	49.7
2017	November	53.19
2017	December	50.32
2018	January	56.32
2018	February	52.92
2018	March	53.19
2018	April	46.86
2018	May	49.44
2018	June	50.43
2018	July	50.68
2018	August	57.15
2018	September	44.47
2018	October	53.41
2018	November	50.32
2018	December	59.34

Data on the table will be calculated with the constant α = 0.1, 0.3, 0.5, 0.7 dan 0.9 for each month from 2015 to 2018 where:

S2 : Forecasting on February 2015

S3 : Forecasting on March 2015

1. Calculation *alpha* = 0,1 for February 2015:

$S'_2 = (\alpha \times X_2) + (1 - \alpha) \times S'_1$
$= (0,1 \times 56.05) + (1 - 0,1) \times 58.830 = 58.552$
$S''_2 = (\alpha \times S'_2) + (1 - \alpha) \times S''_1$
$= (0,1 \times 58.552) + (1 - 0,1) \times 58.830 = 58.802$
$A_2 = (2 \times S'_2) - S''_2$
$= (2 \times 58.552) - 58.802 = 58.302$
$B_2 = \frac{\alpha}{1-\alpha} \times (S'_2 - S''_2)$
$= \frac{\alpha}{1-0.1} \times (58.552 - 58.802) = -0.028$
$F_3 = A_2 + B_2 = 58.302 + -0.028 = 58.2740$

2. Calculation *alpha* = 0,1 March 2015:

$S'_3 = (\alpha \times X_3) + (1 - \alpha) \times S'_2$
$= (0,1 \times 64.47) + (1 - 0,1) \times 58.802 = 59.144$
$S''_3 = (\alpha \times S'_3) + (1 - \alpha) \times S''_2$
$= (0,1 \times 59.144) + (1 - 0,1) \times 58.802 = 58.836$
$A_3 = (2 \times S'_3) - S''_3$
$= (2 \times 59.144) - 58.836 = 59.451$
$B_3 = \frac{\alpha}{1-\alpha} \times (S'_3 - S''_3)$
$= \frac{\alpha}{1-0.1} \times (59.144 - 58.836) = 0.034$
$F_4 = A_3 + B_3 = 59.451 + 0.034 = 59.4854$

3. Calculation *alpha* = 0,3 for February 2015:

$S'_2 = (\alpha \times X_2) + (1 - \alpha) \times S'_1$
$= (0,3 \times 56.05) + (1 - 0,1) \times 58.830 = 57.996$
$S''_2 = (\alpha \times S'_2) + (1 - \alpha) \times S''_1$
$= (0,3 \times 57.996) + (1 - 0,3) \times 58.830 = 58.580$
$A_2 = (2 \times S'_2) - S''_2$
$= (2 \times 57.996) - 58.580 = 57.412$
$B_2 = \frac{\alpha}{1-\alpha} \times (S'_2 - S''_2)$
$= \frac{\alpha}{1-0.3} \times (57.996 - 58.580) = -0.250$
$F_3 = A_2 + B_2 = 57.412 + -0.250 = 57.1620$

4. Calculation *alpha* = 0,3 for March 2015:

$S'_3 = (\alpha \times X_3) + (1 - \alpha) \times S'_2$
$= (0,3 \times 64.47) + (1 - 0,3) \times 57.996 = 59.938$
$S''_3 = (\alpha \times S'_3) + (1 - \alpha) \times S''_2$
$= (0,3 \times 59.938) + (1 - 0,3) \times 58.580 = 58.987$
$A_3 = (2 \times S'_3) - S''_3$
$= (2 \times 59.938) - 58.987 = 60.889$
$B_3 = \frac{\alpha}{1-\alpha} \times (S'_3 - S''_3)$
$= \frac{\alpha}{1-0.3} \times (59.938 - 60.889) = 0.048$
$F_4 = A_3 + B_3 = 60.889 + 0.048 = 61.2966$

5. Calculation *alpha* = 0,5 for February 2015:

$S'_2 = (\alpha \times X_2) + (1 - \alpha) \times S'_1$
$= (0,5 \times 56.05) + (1 - 0,5) \times 58.830 = 57.440$
$S''_2 = (\alpha \times S'_2) + (1 - \alpha) \times S''_1$
$= (0,5 \times 57.440) + (1 - 0,5) \times 58.830 = 58.135$
$A_2 = (2 \times S'_2) - S''_2$
$= (2 \times 57.440) - 58.135 = 56.745$
$B_2 = \frac{\alpha}{1-\alpha} \times (S'_2 - S''_2)$
$= \frac{\alpha}{1-0.5} \times (57.440 - 58.135) = -0.695$
$F_3 = A_2 + B_2 = 56.745 + -0.695 = 56.0500$

6. Calculation *alpha* = 0,5 for March 2015:

$S'_3 = (\alpha \times X_3) + (1 - \alpha) \times S'_2$
$= (0,5 \times 64.47) + (1 - 0,5) \times 57.440 = 60.995$
$S''_3 = (\alpha \times S'_3) + (1 - \alpha) \times S''_2$
$= (0,5 \times 60.995) + (1 - 0,5) \times 57.440 = 59.545$
$A_3 = (2 \times S'_3) - S''_3$
$= (2 \times 60.995) - 59.545 = 62.365$
$B_3 = \frac{\alpha}{1-\alpha} \times (S'_3 - S''_3)$
$= \frac{\alpha}{1-0.5} \times (60.995 - 59.545) = 1.410$
$F_4 = A_3 + B_3 = 62.365 + 1.410 = 63.7750$

7. Calculation *alpha* = 0,7 for February 2015:

$S'_2 = (\alpha \times X_2) + (1 - \alpha) \times S'_1$
$= (0,7 \times 56.05) + (1 - 0,7) \times 58.830 = 56.884$
$S''_2 = (\alpha \times S'_2) + (1 - \alpha) \times S''_1$
$= (0,7 \times 56.884) + (1 - 0,7) \times 58.830 = 57.468$
$A_2 = (2 \times S'_2) - S''_2$
$= (2 \times 56.884) - 57.468 = 56.300$
$B_2 = \frac{\alpha}{1-\alpha} \times (S'_2 - S''_2)$
$= \frac{\alpha}{1-0.7} \times (56.884 - 57.468) = -1.365$
$F_3 = A_2 + B_2 = 56.300 + -1.365 = 54.9380$

8. Calculation *alpha* = 0,7 for March 2015:

$S'_3 = (\alpha \times X_3) + (1 - \alpha) \times S'_2$

$= (0{,}7 \times 64.47) + (1 - 0{,}7) \times 56.884 = 62.194$

$S''_3 = (\alpha \times S'_3) + (1 - \alpha) \times S''_2$

$= (0{,}7 \times 62.194) + (1 - 0{,}7) \times 57.468 = 60.776$

$A_3 = (2 \times S'_3) - S''_3$

$= (2 \times 62.194) - 60.776 = 63.612$

$B_3 = \frac{\alpha}{1-\alpha} \times (S'_3 - S''_3)$

$= \frac{\alpha}{1-0.7} \times (52.194 - 60.776) = 3.308$

$F_4 = A_3 + B_3 = 63.612 + 3.308 = 61.9206$

9. Calculation *alpha* = 0,9 for February 2015:

$S'_2 = (\alpha \times X_2) + (1 - \alpha) \times S'_1$

$= (0{,}9 \times 56.05) + (1 - 0{,}9) \times 58.830$

$= 56.328$

$S''_2 = (\alpha \times S'_2) + (1 - \alpha) \times S''_1$

$= (0{,}9 \times 56.328) + (1 - 0{,}9) \times 58.830$

$= 56.578$

$A_2 = (2 \times S'_2) - S''_2$

$= (2 \times 56.328) - 58.578 = 56.078$

$B_2 = \frac{\alpha}{1-\alpha} \times (S'_2 - S''_2)$

$= \frac{\alpha}{1-0.9} \times (56.328 - 56.578) = -2.2518$

$F_3 = A_2 + B_2 = 56.078 + -2.2518 = 53.8260$

10. Calculation *alpha* = 0,9 for March 2015:

$S'_3 = (\alpha \times X_3) + (1 - \alpha) \times S'_2$

$= (0{,}9 \times 64.47) + (1 - 0{,}9) \times 56.328 = 63.656$

$S''_3 = (\alpha \times S'_3) + (1 - \alpha) \times S''_2$

$= (0{,}9 \times 63.656) + (1 - 0{,}9) \times 56.578 = 62.948$

$A_3 = (2 \times S'_3) - S''_3$

$= (2 \times 63.656) - 62.948 = 64.364$

$B_3 = \frac{\alpha}{1-\alpha} \times (S'_3 - S''_3)$

$= \frac{\alpha}{1-0.9} \times (63.656 - 62.948) = 6.36984$

$F_4 = A_3 + B_3 = 64.364 + 6.36984 = 70.7334$

The calculation process of the DES method from alpha above is continued with the calculation of each alpha 0.3, 0.5, 0.7 and 0.9 from February 2015 to January 2019 (Tabel II).

TABLE II
Forecasting Result

Year	Month	Forecasting Result ($\widehat{Y_t}$)				
		α = 0.1	**α = 0.3**	**α = 0.5**	**α = 0.7**	**α = 0.9**
2014	February	58.83	58.83	58.83	58.83	58.83
2014	March	58.274	57.162	56.05	54.938	53.826
2014	April	59.4854	61.2966	63.775	66.9206	70.7334
2014	May	58.88848	58.72416	57.74	55.40224	51.17712
2014	June	58.68139	58.15419	57.38875	56.93419	57.87339
2014	July	59.2232332	60.0006276	61.00375	62.5419124	64.3753068
2014	August	57.68219386	55.02802554	52.0040625	48.48777034	44.03662746
2014	September	56.30133006	52.05672823	49.258125	48.16969009	49.18377242
2014	October	55.40251707	51.32798701	50.38460938	51.46621472	53.21108821
2014	November	54.64475339	51.07008498	51.17757813	52.23515673	52.61867992
2014	December	55.47081727	55.45210534	58.99892578	62.63383471	65.6179251
2015	January	55.96062084	57.31920583	60.02953125	60.59773672	58.98879822
2015	February	55.32205552	55.16605655	54.6272998	52.01629691	49.07388039
2015	March	54.90479706	54.30486831	53.54991699	52.72278184	53.4940881
2015	April	55.33096974	56.17024793	57.24309204	58.79100238	60.84927882
2015	May	55.77275991	57.44606163	58.66311279	59.35065106	59.09281488
2015	June	56.01238235	57.70856479	58.17983978	57.81870042	57.03357019
2015	July	56.3407527	58.17302051	58.47406158	58.33526166	58.98879822
2015	August	55.82572516	55.99463197	54.44910164	52.65107396	58.42218589
2015	September	56.01079559	56.6122047	56.44308624	57.16497082	50.94450148
2015	October	55.87809469	56.08121692	55.64831083	55.50588584	58.96517844
2015	November	56.25662602	57.24892339	57.89753927	58.85788413	54.92909067
2015	December	56.86187013	58.73949645	59.91546156	60.75800075	59.88896635
2016	January	57.49069916	59.87612257	60.88107675	61.10639088	60.82545081
2016	February	55.34394368	52.40541834	47.51221135	41.86081446	36.08163314
2016	March	55.18633231	53.23258561	52.29944217	54.1612135	59.42277212
2016	April	55.42890377	54.91386487	56.03388933	58.2881548	59.42983809
2016	May	54.78579762	53.35174387	52.90652879	51.98668366	49.6704399
2016	June	54.22102366	52.45264763	51.93805646	51.56607627	51.7477896
2016	July	51.83824652	46.29145219	42.29392426	38.62494423	35.19775352
2016	August	50.02131457	43.57773572	41.05691014	40.99351967	43.12957281
2016	September	49.73298654	46.01441844	47.69342908	51.36826682	55.07753703
2016	October	49.55391097	47.73329531	50.22420154	52.06974332	51.68001168
2016	November	48.22562066	45.2422484	44.94834427	42.98540198	39.90552697
2016	December	49.84214929	52.14213306	57.15979389	62.00526429	68.05500528
2017	Januari	50.21431599	53.00108457	55.35270782	54.6732724	54.6732724
2017	Februari	49.88382786	51.44367319	51.01775935	48.58328965	51.10914579
2017	Maret	49.0424942	48.80941103	46.74958239	44.58817928	46.5474791
2017	April	50.47918898	53.76317558	56.41014256	60.3218115	43.92360436
2017	Mei	51.44571987	55.72823441	57.77274696	58.50855076	65.53584608
2017	Juni	51.6803527	54.94737214	54.74521132	53.05196742	56.87953317
2017	Juli	51.88000175	54.39308613	53.58202458	52.61101089	50.89474817
2017	Agustus	51.85301747	53.40900824	52.18822175	51.45082946	52.6805543

2017	September	51.26063003	51.09599933	48.9727156	47.6955067	51.30926338
2017	October	51.5774899	52.25168502	52.33816017	53.87042937	46.85104713
2017	November	51.1104715	50.69621936	49.73748127	49.00656202	56.15841679
2017	December	51.41608188	51.93838144	52.56794122	53.79459857	47.34727289
2018	January	51.10736547	50.93768653	49.91126856	49.91126856	48.53380135
2018	February	52.04943152	53.99175424	58.16204726	58.16204726	60.71149157
2018	March	52.17521071	53.65778954	53.24201419	53.24201419	51.1561603
2018	April	52.33853974	53.58974577	53.01942426	53.01942426	52.97531714
2018	May	51.21335086	49.72242721	44.22097328	44.22097328	41.77340183
2018	June	50.77441436	49.11782266	48.33423578	48.33423578	50.42552719
2018	July	50.60353165	49.4445624	50.63225388	50.63225388	51.49577142
2018	August	50.51338134	49.84335425	51.0899711	51.0899711	51.09319901
2018	September	51.73602577	53.99606038	59.98827981	59.98827981	62.40048209
2018	October	50.24450751	48.70674094	41.64637049	41.64637049	35.43666443
2018	November	50.76663264	51.09766774	53.89517711	53.89517711	58.57602806
2018	December	50.59798767	50.62333177	50.43383292	50.43383292	49.06093897

The process of calculating error values at alpha 0.1 using the mean squared error method is done by means of actual data minus fore-casting results and then squared, the process is carried out at alpha 0.1 from January to December so all alpha values have a compari-son, after all the results of the comparison of alpha 0.1 are summed then divided by the number of data that is 59 after that it will get an error value of alpha 0.1.

$$MSE = \frac{\sum_{t=1}^{n}(y_t - \hat{y}_t)^2}{n} \quad (2a)$$

$$= \frac{1137.430238}{59} \quad (2b)$$

$$= 19.2784786031643 \quad (2c)$$

The result of the calculation of the MSE error for α = 0.1 is 19.27847860331634. The calculation of MSE was calculated for alpha 0.1 0.3 0.5 0.7 0.9. by replacing using the actual data and forecasting data on alpha 0.1 0.3 0.5 0.7 0.9. Here is result of each alpha that was gained by calculating every actual data, forecasting data and all amounts of data.

TABLE III
Forecasting Result

Alpha	MSE
0.1	19.27847860331643
0.3	23.0745028944835
0.5	30.5634155905048
0.7	43.0713936772593
0.9	65.3110328593280

C. Implementation

The login page is the start page that is displayed when the user runs the system. Users must enter their username and password correctly in order to enter the system. The home page that is displayed after the user has logged in.

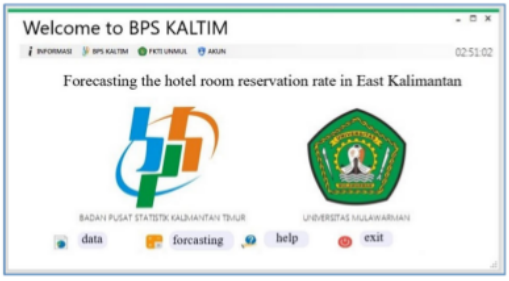

Fig. 1. Main Menu

The workflow of this forecasting system has been made in the form of flow diagrams (Fig.2).

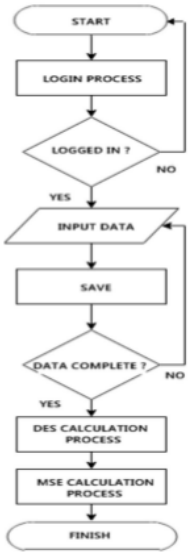

Fig. 1. Flow Diagram

Hotel reservation is a page that contains the actual data of the room occupation rate. The room occupation rate data will be added in here before processed to forecasting calculation. Data TPK page can be seen in Fig.2.

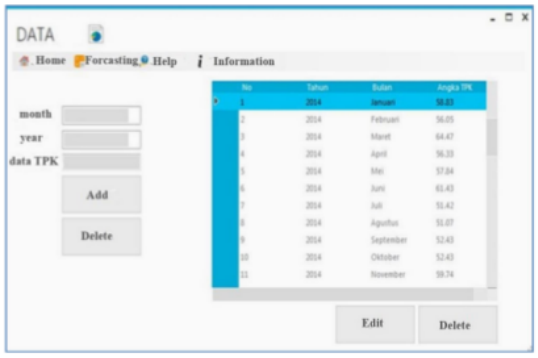

Fig. 3. Data TPK

Forecasting page on Fig. 4 is a page to process the forecasting calculation with double exponential method and calculation of error with mean squared error. In here, user also can see the result of forecasting. This page also contains the result of forecasting of alpha 0.1, 0.3, 0.5, 0.7, 0.9 and error values of alpha 0.1, 0.3, 0.5, 0.7 and 0.9 that been calculated along with forecasting calculation process.

Fig. 4. Forecasting Page

Fig. 5 and Fig. 6 is a page that contains the summary of the forecasting results, including the best alpha information and details about calculated data. It contains information of year, month, actual data and forecasting result from 2014 to January 2019.

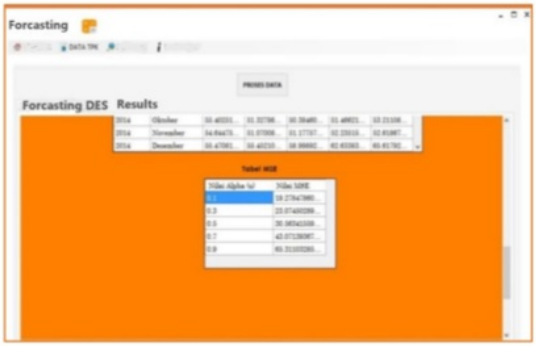

Fig. 5. MSE Results page

Fig. 6. Forcasting Result

Print page is a page to print result of the forecasting that been done before. The print out us contain calculation summary and detail of forecasting result just like result page was that can be seen in Fig. 7.

Fig. 7. Print Page

The entire process on this system is tested by the black box method so that it can be known whether there are still errors in the room occupancy rate forecasting system [8-10].

```
Dim s1(banyakdata), s2(banyakdata), a(banyakdata), b(banyakdata), hasil(banyakdata), nilaiperamalan1(banyakdata), nilaiperamalan0(banyakdata)
For i = 0 To 4
    For j = 0 To banyakdata - 1
        If j = 0 Then
            s1(j) = datatpk.Rows(0)(3)
            s2(j) = datatpk.Rows(0)(3)
        Else
            s1(j) = (alpha(i) * datatpk.Rows(j)(3)) + ((1 - alpha(i)) * s1(j - 1))
            s2(j) = (alpha(i) * s1(j)) + ((1 - alpha(i)) * s2(j - 1))
        End If
        a(j) = (2 * s1(j)) - s2(j)
        b(j) = (alpha(i) / (1 - alpha(i))) * (s1(j) - s2(j))
        hasil(j) = a(j) + b(j)
        If i = 0 Then
            DataGridView21.Item(2, j).Value = hasil(j)
        ElseIf i = 1 Then
            DataGridView22.Item(2, j).Value = hasil(j)
        ElseIf i = 2 Then
            DataGridView23.Item(2, j).Value = hasil(j)
        ElseIf i = 3 Then
            DataGridView24.Item(2, j).Value = hasil(j)
        ElseIf i = 4 Then
            DataGridView25.Item(2, j).Value = hasil(j)
        End If

    Next
Next
```

Fig. 8. DES Program Code

```
Dim sigmaerroralpha0(4) As Double
For i = 0 To 4
    sigmaerroralpha0(i) = 0
Next

''Menghitung dan Mengisi nilai ke tabel MSE
For i = 0 To DataGridView26.Rows.Count - 2
    sigmaerroralpha0(0) = sigmaerroralpha0(0) + ((datatpk.Rows((i + 1))(3) - DataGridView26.Item(2, (i)).Value) ^ 2)
    sigmaerroralpha0(1) = sigmaerroralpha0(1) + ((datatpk.Rows((i + 1))(3) - DataGridView26.Item(3, (i)).Value) ^ 2)
    sigmaerroralpha0(2) = sigmaerroralpha0(2) + ((datatpk.Rows((i + 1))(3) - DataGridView26.Item(4, (i)).Value) ^ 2)
    sigmaerroralpha0(3) = sigmaerroralpha0(3) + ((datatpk.Rows((i + 1))(3) - DataGridView26.Item(5, (i)).Value) ^ 2)
    sigmaerroralpha0(4) = sigmaerroralpha0(4) + ((datatpk.Rows((i + 1))(3) - DataGridView26.Item(6, (i)).Value) ^ 2)
Next

For i = 0 To 4
    DataGridView27.Rows.Add()
    DataGridView27.Item(0, i).Value = alpha(i)
    DataGridView27.Item(1, i).Value = sigmaerroralpha0(i) / (banyakdata - 1)
Next
```

Fig. 9. MSE Program Code

TABLE II
Forecasting Result

No	Proccess	Input	Output	Result
1	Login	Username & Password	Homepage	✓
2	Change Password	Password	Password Changed	✓
3	Input	Occupancy Data	Data Added	✓
4	Edit Data	New Data	Data Changed	✓
5	Forecasting	Click Proccess Button	Forecasting Result	✓
6	Print	Click Print Button	Print Page	✓

IV. Conclusion

Based on the results of research that uses a double exponential smoothing method has some conclusions. The system built has applied the double exponential smoothing method as a forecasting method and the mean squared error method as a calculation of error forecasting results from January to December. And the value of the α constant used in this system is 0.1, 0.3, 0.5, 0.7, and 0.9 so that it can produce five different forecasting results and provide information on the best 5 forecasting results. The best forecasting results for January 2019 are 52,263 with an alpha value of 0.1. Alpha 0.1 value is used because based on the test results by calculating the actual mean squared error data, forecasting data and the amount of data available, alpha 0.1 produces the smallest error value compared to other alpha values.

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