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FORECASTING THE NUMBER OF FOREIGN TOURISTS WHO VISIT TO EAST JAVA USING *MONTE CARLO* METHOD

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ABSTRACT

Indonesia has many islands and there are beautiful inland areas, interesting historical and cultural ruins, beaches, mountains, and more. Especially in the tourism sector is one of the largest industries that are very influential and grow very fast. The advancement of the tourism industry in a region is very dependent on the number of tourists who come both domestic and foreign tourists. The large number of foreign tourists that come push and accelerate economic growth. So that directly leads to an increase in demand for goods and services. To meet the needs and demands of tourists, it is necessary to predict the number of visits of foreign tourists. One method that can be used in forecasting is Monte Carlo. From the results of Monte Carlo research can work well, From the stage of the prediction system implementation that has been built using the initial parameter 12 months 100x simulation and delta-t = 0.001, then get sigma = 52.2650054, Mu = -0.0398. And the simulation is more accurate in predicting the number of foreign tourist visits in East Java, which has a small error value. To get a smaller error value is by reducing or delta-t value.

Keywords: *Amount, Visiting, Foreign Tourists, Forecasting, Monte Carlo, East Java.*

1. INTRODUCTION

Travelers are people who travel to vacation, seek treatment, do business, exercise and study and visit beautiful places or a particular country. The word tourist comes from Sanskrit, from the origin of the word "tourist" which means the trip is added with the suffix "wan" which means people who travel. In English, the person who travels is called a traveler. Whereas people who travel for tourist destinations are called Tourist. Foreign tourists are foreigners who travel, who come to another country which is not the country where they usually live. Foreign tourists are also called foreign tourists or abbreviated as foreign tourists.

In the tourism sector is one of the largest industries that are very influential and grow very fast. The development of tourism is encouraging and accelerating economic growth. The advancement of the tourism industry in a region is very dependent on the number of tourists who come both domestic and foreign tourists. so that it directly raises the demand for goods and services. In an effort to meet tourist demand, investment in transportation and communication, hospitality and other accommodation, the handicraft industry and the consumer product industry, service industries, restaurant restaurants and others are needed. So from that research is needed to help the above problems in predicting foreign tourist visits.

The Monte Carlo method of the term in the simulation was introduced by compte de buffon in 1997. It is a computational algorithm to simulate various behaviors in the systems of physics and mathematics. This method is used to evaluate integrals, calculus, and other numerical methods. This method is proven to be efficient in solving differential terrain radians, so this method is used in global illumination calculations that produce photorealistic images of three-dimensional models, which are applied in video games, architecture, design, computer-generated films, special effects in film, business, economics, and other fields. Based on the description above, this study

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ISSN: 2528-0260
P.479-488

aims to predict foreign tourist visits using the Monte Carlo simulation method.SYSTEM ANALYSIS AND DESIGN.

At this stage of system analysis, which has the task of conducting a feasibility study, analyzing system requirements in the form of processing tourist data, forecasting calculations of tourist visits and forecasting report results. The data used in this final project is data on the number of visits of foreign tourists visiting East Java.

1.1. Flowchart system

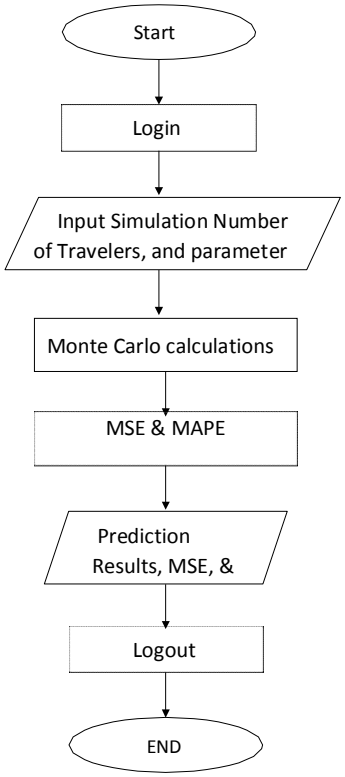

Figure 1. Tourist Visit System Flowchart

In the flowchart image above can be explained to start a computing system that is by logging in first by the user / admin, then inputting the data to be predicted. The next stage of Monte Carlo calculations input many months and the number of simulations then calculates the delta-t (Δt) variable, deviation (s), sigma (σ), Mu (μ). So as to produce forecasting the number of visits. Then calculate errors using MSE and MAPE.

ISSN: 2528-0260
P.479-488

1.2. Flowchart Program

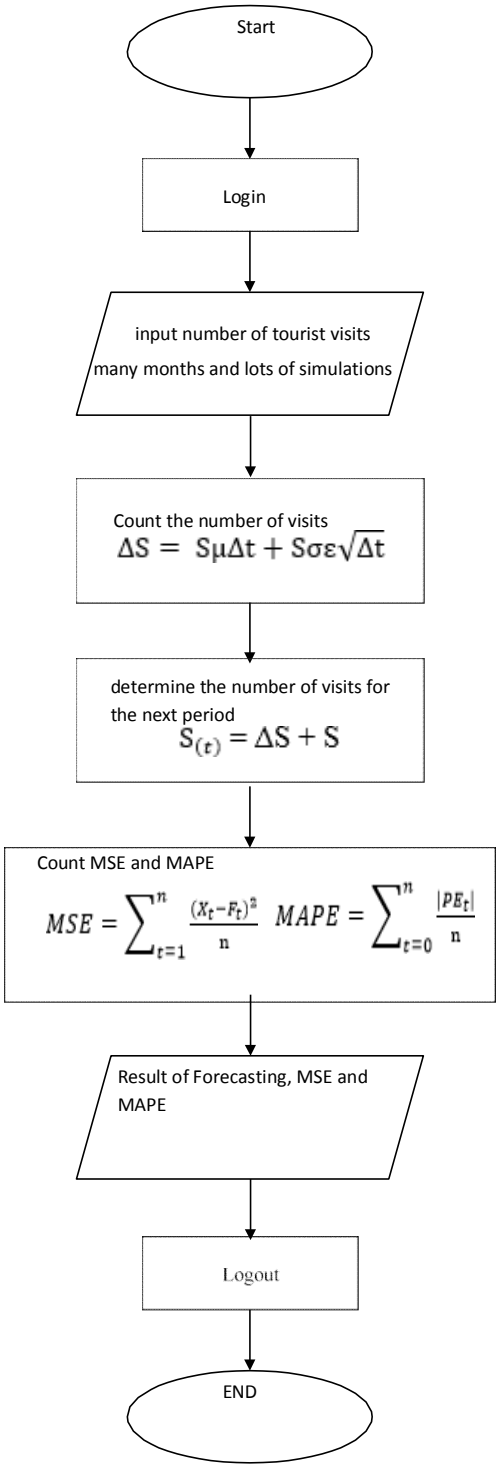

Figure 2. Tourist Visit Program Flowchart

ISSN: 2528-0260
P.479-488

1.3. Calculation of Monte Carlo Number of Foreign Tourist Visits

The following is an example of calculating the forecasting of foreign tourist visits using the Monte Carlo method, using 2016 test data and 12 months input and carrying out 50 simulations:

Data Real(S) = 11674

$\Delta t = \frac{1}{12} = 0.083$

$\text{Return} = \ln\frac{S_i+1}{S_i} = 0{,}00009$

$\text{Deviasi(s)} = \frac{\sqrt{\frac{12(144.01632-12.00136)}{11}}}{\sqrt{0.083}} = 0.0000608$

$\text{Sigma}(\sigma) = \frac{12.00136}{0.08333} + \frac{1728.19585}{2} = 0.00021062$

$\text{Mu}(\mu) = = 0.00000053,$

$\varepsilon = 0.920578$

Calculating the number of visits of foreign tourists, then the following forecasting results can be obtained:

$\Delta S = (11674 \times 0.00000053 \times 0.083) + (11674 \times 0.00021062 \times 0.920578 \times \sqrt{0.083})$

$= 0.00053 + 0.65239$

$= 0.65392$

After obtaining the results of the calculation, then further predict the stock price for the next period:

Harga Saham (S_1) $= 0.65392 + 11674$

$= 11674.65392$

1.4. Program Design Planning

Based on the above, an interface design is created and generated as shown below:

1.4.1 Login Page Design

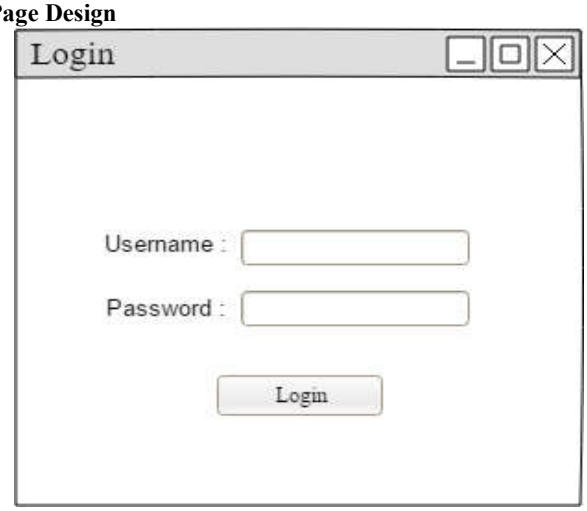

Figure 3. Login Page Design

ISSN: 2528-0260
P.479-488

1.4.2 Main Page Design

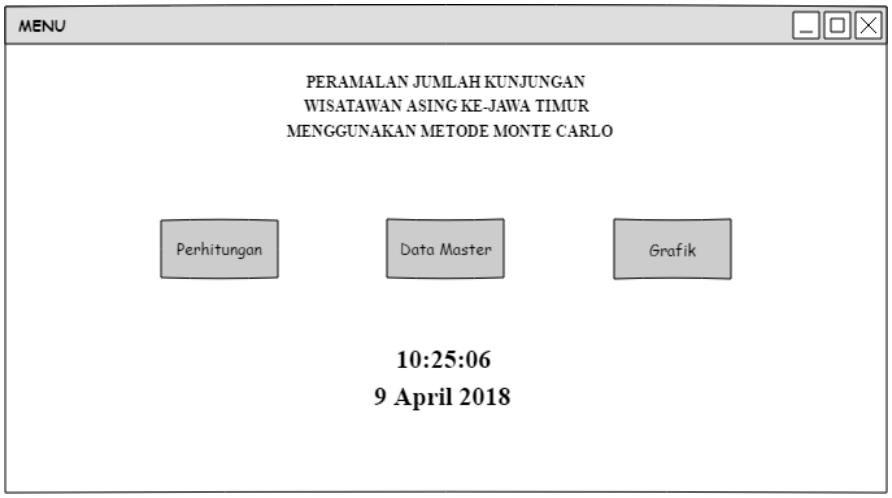

Figure 4. Main Page Design

1.4.3 Forecast Page Design

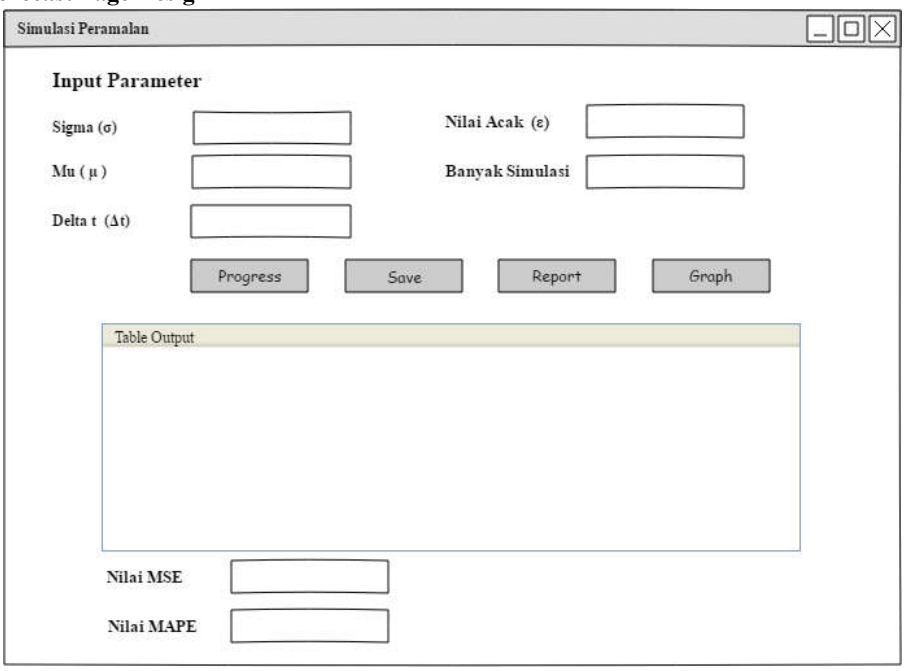

Figure 5. Forecast Page Design

ISSN: 2528-0260
P.479-488

1.4.4 Master Page Design

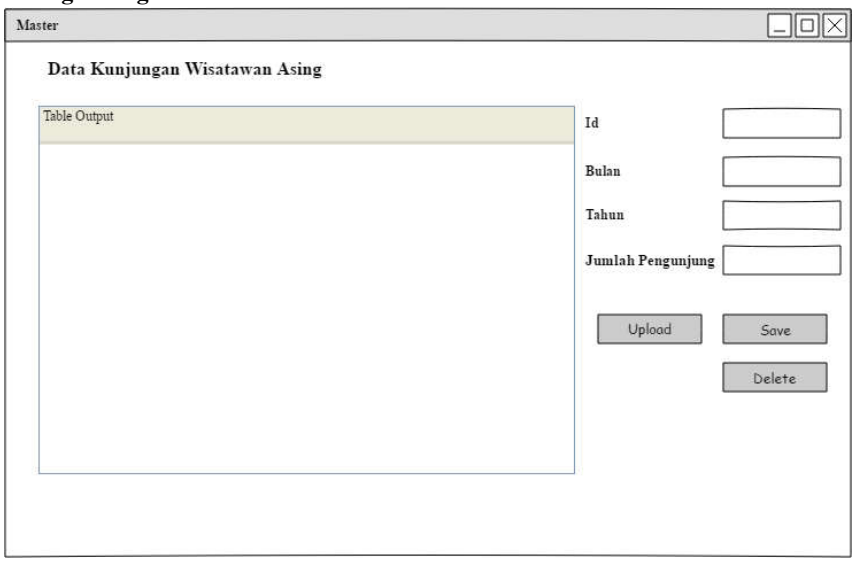

Figure 6. Master Page Design

1.4.5 Graphic Page Design

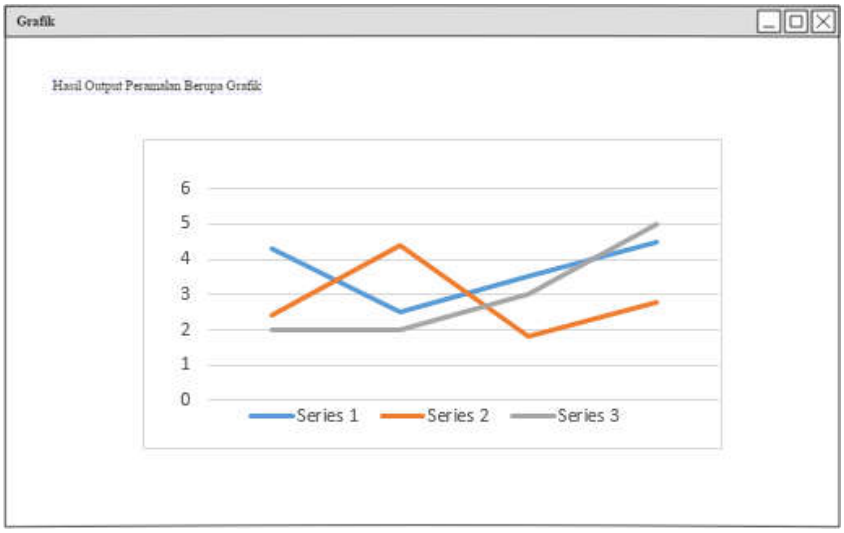

Figure 7. Graphic Page Design

2. RESULTS AND DISCUSSION

2.1 Test Predictions

First try:

The initial value of 12 months by simulating as much as 50x gets sigma value = 0.00021062, Mu = 0.00000053, delta-t = 0.08333, deviation = 0.0000608, and gets a random value = 0.920578. The following forecasting data can be seen in table 6.1 and figure 6.1 obtaining MSE = 1.09008 and MAPE = 0.005601.

ISSN: 2528-0260
P.479-488

Table 1. Forecasting Result in 2017 on the first try

Month	Year	number of visitors	Prediction results	(Data forecast) ^ 2	(Data forecast) / Divination
January	2016	11674	11674.65392	0.42761	0.000056
Februari	2016	14955	14955.8377	0.70175	0.000056
March	2016	17894	17895.00233	1.00467	0.000056
April	2016	18186	18187.01869	1.03772	0.000056
May	2016	18386	18387.02989	1.06067	0.000056
June	2016	14755	14755.8265	0.68310	0.000056
July	2016	20424	20425.14405	1.30885	0.000056
August	2016	19029	19030.06591	1.13616	0.000056
September	2016	19907	19908.11509	1.24342	0.000056
October	2016	20819	20820.16617	1.35996	0.000056
November	2016	23126	23127.2954	1.67806	0.000056
December	2016	21415	21416.19956	1.43894	0.000056
Total Error Value				13.08091	0.000672
MSE = Total error data / Lots of data				1.09008	
MAPE = (Total error value of the phone / lot of data) x100					0.005601

The following is the result of the first trial screenshot in Figure 8:

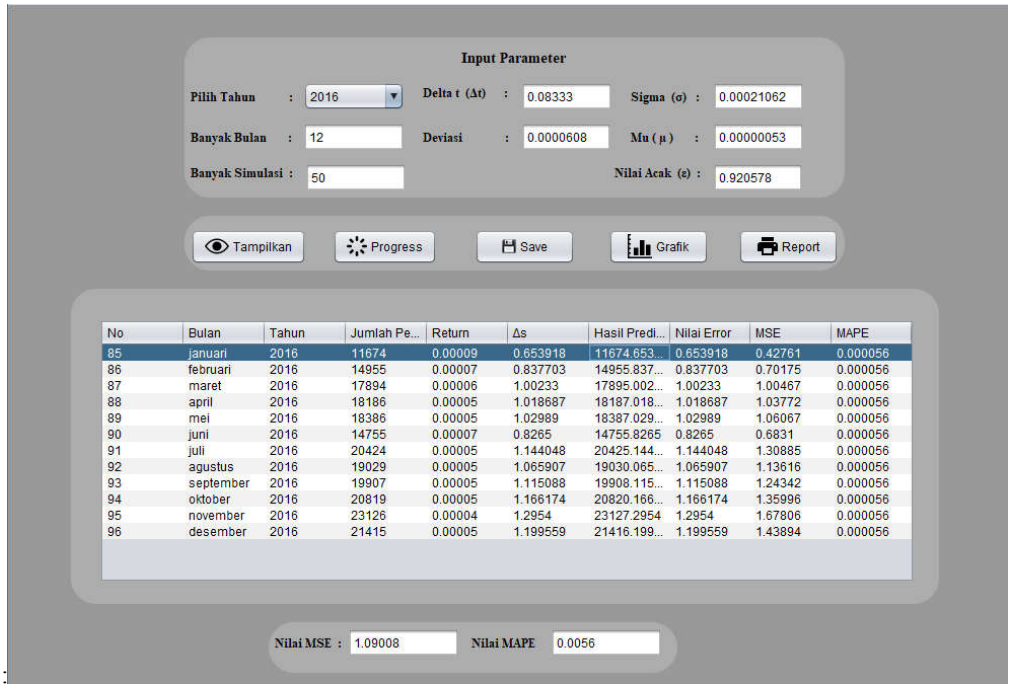

Figure 8. Results of the First Trial Program

2.2 Experiment Analysis

From the 5x results the experiment uses the initial value of the 12-month parameter by simulating 50x, 100x, 150x, 200x, 250x and getting a sigma value = 0.00021062, deviation = 0.0000608, delta-t = 0.083333, Mu = 0.00000053 and produces a different random value.

ISSN: 2528-0260
P.479-488

2.3 Test Results

From several experimental results obtained, it can be concluded that using 12-month input parameter values and 250x simulations obtain an overall predictive value of 220571.9145. Based on the comparison of the value of MSE = 0.02617 with MAPE = 0.00087, it can be concluded that using the MAPE method to find a better error value in this study. To overcome the increasing number of visitors in the coming year, socialization is needed for the needs of goods and services.

Table 2. Test Results from several experiments

Many simulations	Total Prediction Results In 2017	MSE	MAPE
50x	220571.9145	1.09008	0.00560
100x	220571.9616	0.02748	0.00089
150x	220572.5313	0.04575	0.00115
200x	220582.4192	1.10140	0.00563
250x	22580.4845	0.02617	0.00087

3. CONCLUSION

3.1 Conclusions

The conclusions obtained in this study are:

(1) The implementation of the system results in a prediction of the number of visits of foreign tourists visiting East Java using the Monte Carlo method to reference the accuracy of the forecasting process.

(2) Implementation of the system using the Monte Carlo method can work well to predict the number of visits of foreign tourists.

(3) From the 5x results the experiment uses the initial value of the 12-month parameter by performing a simulation of 50x, 100x, 150x, 200x, 250x. And get a sigma value = 0.00021062, deviation = 0.0000608, delta-t = 0.083333, Mu = 0.00000053, and produce different random values.

(4) From several experimental results obtained, it can be concluded that using 12-month input parameter values and 250x simulations obtain an overall predictive value of 220571.9145. Based on the comparison of the value of MSE = 0.02617 with MAPE = 0.00087, it can be concluded that using the MAPE method to find a better error value in this study.

3.2 Suggestion

From the results of research conducted by the author, there are shortcomings and suggestions given by the authors for further research as follows:

(1) It is expected that the next application can add data on tourist visits in other provinces, not only data on visits in East Java.

(2) It is expected that the system can then use other methods or simulations so that in doing forecasting it can obtain more accurate values

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ISSN: 2528-0260
P.479-488