

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Implementation

Implementation of this project is using php and laravel framework. In this chapter will describe how this program work. There are a step to make prediction using this program.

5.1.1 Import

In this step data must be imported to database before calculated using double exponential smoothing. To do this step data must be as csv or excel file. The data where is will be imported to database just passenger flight.

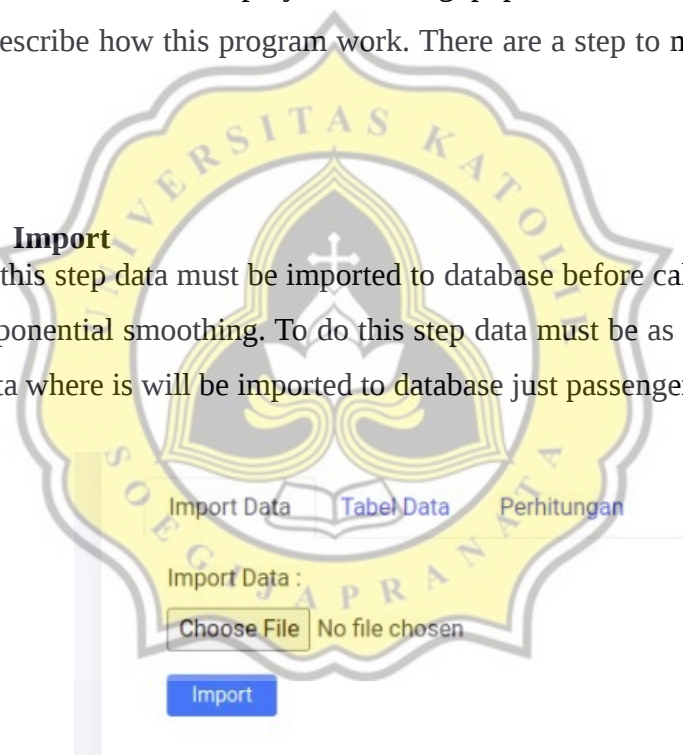


Figure 5.1 : Import Menu

Figure 5.1 First step to do which will be imported data to database. Data where is will imported to database must be as a csv format or excel. The data where is chosen to make prediction is data from flight history of PT. Angkasa Pura.

```
1. public function collection(Collection $collection) {
```

```

2.     $collection->shift();
3.
4.     $data = [];
5.
6.     foreach($collection as $index => $dataset) {
7.         $data[$index]['bulan'] = $dataset[0] ?? null;
8.         $data[$index]['nama_bulan'] = $this-
>namaBulan[$dataset[0]] ?? null;
9.         $data[$index]['tahun'] = $dataset[1] ?? null;
10.        $data[$index]['jumlah'] = $dataset[2] ?? null;
11.        $data[$index]['created_at'] = now();
12.        $data[$index]['updated_at'] = now();
13.    }
14.
15.    Datasets::insert($data);
16. }
17. }

```

The code in above is used to import data in mysql database (line 15). Line 6 until line 12 is used to declare data where is will be imported to database. This code is used in first step before the program can make a prediction.

5.1.2 Summary data

Data summary will be show as result from import process. In this step will show data from 2018-2020. As can see, the summary data had 4 coloumn the coloumn where is contain in summary data is No, Months name, Years, and passenger amount.



No	Bulan	Tahun	Jumlah
1	Januari	2018	197353
2	Februari	2018	175933
3	Maret	2018	198285
4	April	2018	205759
5	Mei	2018	180250
6	Juni	2018	212456
7	Juli	2018	252677
8	Agustus	2018	219813
9	September	2018	209064
10	Oktober	2018	210794
11	November	2018	192851
12	Desember	2018	191073

Figure 5.2 : Summary data

Figure 5.2 image in above show a result from import process. That is a summary data which show when process import is successfully. In this step we will see data summary where is has been imported. The data in above had four parameter like a number, months name, years, and total value.

5.1.3 Calculating process

Calculating process in this project using double exponential smoothing algorithm. The Double exponential smoothing method is the most widely used method to determine the trend equation for the second smoothing data through a smoothing process. This forecasting system captures patterns from past data and then uses it to project future data.

```
18. public function hitungSt1($jumlah, $st1) {
19.     return ($this->alpha * $jumlah) + ((1-$this->alpha) *
    $st1);
20. }
21.
22. public function hitungSt2($st1, $st2) {
23.     return ($this->alpha * $st1) + ((1-$this->alpha) *
    $st2);
24. }
25.
26. public function hitungAt($st2, $st1) {
27.     return round(2 * $st2 - $st1,0);
28. }
29.
30. public function hitungBt($st2, $st1) {
31.     return abs (round(($this->alpha / (1-$this->alpha)) *
    ($st2 - $st1),0));
32. }
33.
34. public function hitungYt($at, $bt) {
35.     return ($at + ($bt * 1));
36. }
37.     public function hitungMape($jumlah, $yt) {
```

```

38.         return abs((( $jumlah - $yt ) / $jumlah)) *100 ;
39.     }

```

Code in above is a set of code that contains the formula. The formula is used to forecast the previously imported data. It can be seen that the code does seven times the calculation process to get the prediction result. In line 18-20 there is shown method to calculate single smoothing. In line 22-24 is method to calculated double smoothing. Line 26-27 is method to calculate smoothing constant. Line 30-32 is method to calculate smoothing trend. Line 34-36 is used to calculate the prediction. And the last line 37-39 is used to calculate of percentage error

5.2 Testing

5.2.1 Result from Calculating Process

This project will make nine calculating result. This all of calculating result from alpha 0.1 until alpha 0.9. The data that will be calculated is data starting from 2018 to 2020. From the many result of calculating, its will be compared each result to do comparison to find where is the best alpha.

Alpha 0.4

No	Bulan	Tahun	Jumlah	St	St*	At	Bt	Hasil Prediksi	MAPE
1	Januari	2018	197353	197353	197353	197353	0	197353	0 %
2	Februari	2018	175933	197353	197353	197353	0	197353	10.85 %
3	Maret	2018	198285	188785	193926	197353	0	197353	0.47 %
4	April	2018	205759	192585	193389	199067	3427	202494	1.61 %
5	Mei	2018	180250	197855	195176	194194	536	194730	7.44 %
6	Juni	2018	212456	190813	193430	192496	1786	194282	9.35 %
7	Juli	2018	252677	199470	195846	196048	1745	197793	27.75 %
8	Agustus	2018	219813	220753	205809	192222	2416	194638	12.93 %
9	September	2018	209064	220377	211636	190865	9963	200828	4.1 %
10	Oktober	2018	210794	215852	213322	202895	5827	208722	0.99 %
11	November	2018	192851	213829	213525	210793	1686	212479	9.24 %
12	Desember	2018	191073	205438	210290	213221	203	213424	10.47 %
13	Januari	2019	160675	199692	206051	215142	3235	218377	26.42 %

Figure 5.3 : Result Calculated process

Figure 5.3 show the result in above of the process a prediction. The calculation process will run repeatedly to perform calculations until the data runs out. The alpha value used in the calculation process can be seen at the top left. This process will continue until all data has been calculated using a different alpha value. Each alpha will give different result. The smaller MAPE value means the estimated value closer to the true value. The calculating process has a very good performance if the MAPE value is below 10%, and has good performance good if the MAPE value is between 10% and 20%

5.2.2 Fluctuating data

In this project, data with very significant value will give high percentage error. While data that does not have a significant difference will get low percentage error. This is because the way the algorithm works is to make the results of the data in the previous month as a parameter in the calculation

2020	1	1556	1541	1537.7	1544.356	30	1574	2.14
	2	1479	1554.5	1552.8	1556.182	15	1571	1.06
	3	1282	1486.6	1493.2	1479.923	-60	1420	4.48
	4	407	1302.5	1321.5	1283.383	-172	1112	14.62
	5	53	496.55	579.04	414.0473	-742	-328	166.06
	6	231	97.355	145.52	49.18564	-434	-384	494.43
	7	414	217.64	210.42	224.8467	65	290	33.25

Figure 5.4 : Case of fluctuating data

Figure 5.4 show case of high percentage error. This caused the data where is calculated very significant difference. Double exponential smoothing will get high error if it's happened because the data where is calculated using from old data. Because of that, the prediction will get high percentage error. While for data where is not fluctuating will get percentage error average of below 10%.

5.2.3 Result of Prediction

The result of the calculation process above is a prediction. The predictions that will be displayed are the results of the next four months. The prediction will be displayed when we have found the best alpha.

Prediksi	Januari	2021	45101
Prediksi	Februari	2021	47611
Prediksi	Maret	2021	50121
Prediksi	April	2021	52631

Figure 5.5 : Prediction Result

Figure 5.5 in this picture can be seen is the result of a prediction in the future. The results that will be displayed in this project are the results of the next 4 months. Because the last data that was successfully obtained in December 2020, this program is only able to display until April 2021.

5.2.4 Chart of Comparison

Because the calculation process that has been carried out gives many results. So that the results are more pleasing to the eye, a diagram is formed to facilitate the calculation process. This diagram can show the amount of data obtained from the results of calculations that have been done.

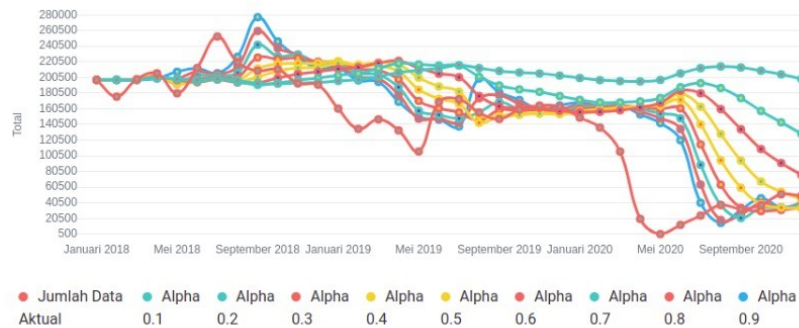


Figure 5.6 : Chart Comparison

Figure 5.6 Image illustration in above is a comparison from calculating result with alpha value from 0.1 until 0.9. The data on the horizontal line is the month and year. While the data on the vertical line is the number of passengers. The best result from this process can see where the result reached the lowest distance with actual data is alpha 0.1.

5.2.1 Table of Mape Comparison

Of all the existing counting processes. The process of calculating the average percentage error will be carried out for comparison. The results given from the counting process show that alpha 0.1 has the best results. While the results with other alpha still have a slightly higher error rate.

Table 5.1 Table Double Exponential Smoothing

	ALPHA								
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Percentage	12.12 %	14.92 %	15.03 %	14.62 %	14.80 %	16.39 %	18.37 %	20.76 %	26.01 %

Table 5.1 from table in above get the best result from alpha 0.1. Alpha 0.1 give the lowest summary result among others. From this result we can get conclusion alpha 0.1 is the best result. While the result with highest percentage error is from alpha 0.9.

Result from alpha 0.1 give percentage error 12.12% and percentage error from alpha 0.9 is 26.01%. its show that very good because alpha 0.1 had value 12.12%.

