

CHAPTER V

IMPLEMENTATION AND TESTING

5.1. Implementation

5.1.1. City Setting

First, to start doing the process of finding route using both algorithms, user needs to configure which cities that will be visited. In order to start configure city, click the menu “Saved City List” like below:

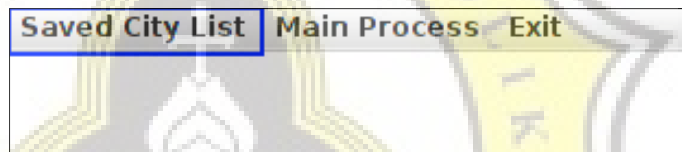


Figure 7. Saved City List menu position

After clicking Saved City List menu above, the menu will appear more like below.

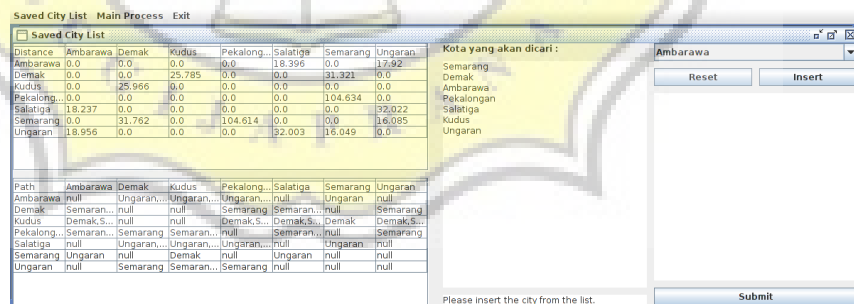


Figure 8. Interface of Saved City List menu

In the left side of Saved City List dialog box, there is saved distance and path data. In the center of dialog box there are text area that contains city that will be processed by both algorithms. And at the right side of dialog box, there

are combo box that will let user choose which city that will be visited.

In order to insert the cities, choose the option on combo box at right side. After choosing one of the cities, click the button Insert to fill the text area below combo box.

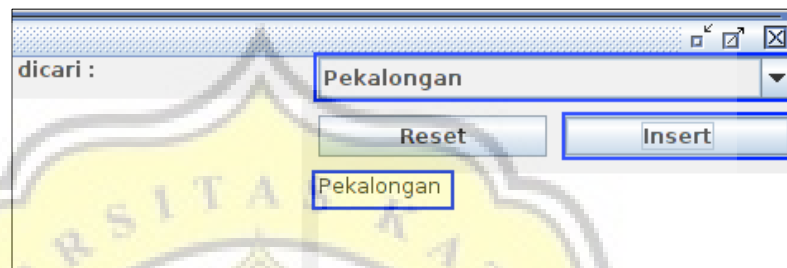


Figure 9. Interface after inserting city

When having the wrong choice in choosing the cities, then it can be reset all over, by clicking the button Reset. The position of reset button are located at the left side of insert button.

Then after done choosing the multiple city, click button Submit to insert chosen cities inside the program. The result of the execution will be like this.

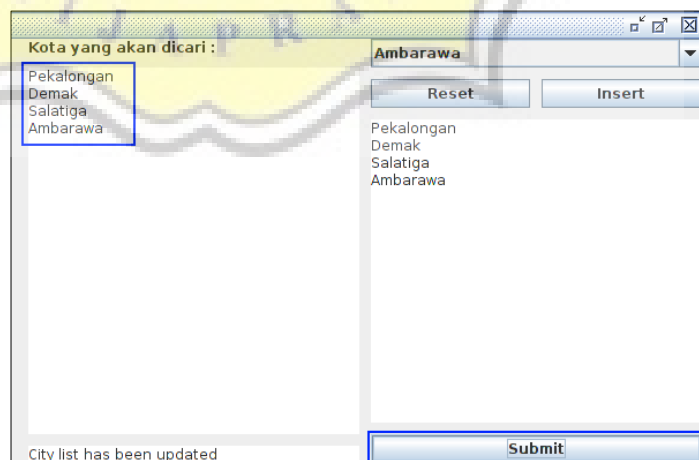


Figure 11. Result of updating inserted cities

When finished submitting chosen cities, city setting will be finished and ready to be execute with both algorithms.

5.1.2. Starting Main Process

After done configuring city setting, then program can be started by opening the main process dialog box. In order to open the dialog box, click the menu Main Process to open dialog box of the process.

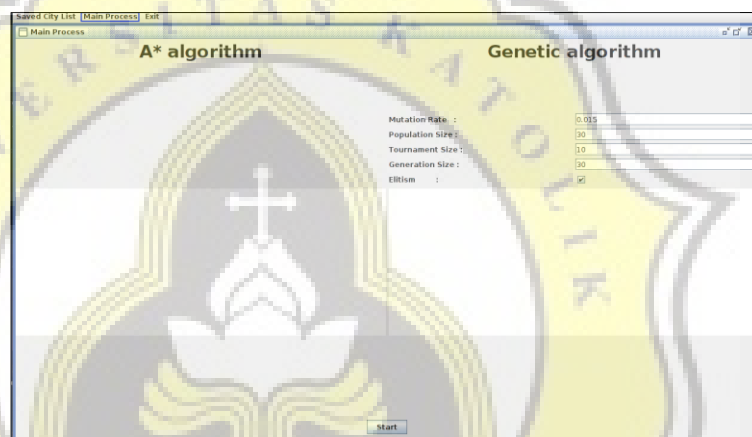


Figure 12. Interface of Main Process menu

After finished giving required parameters for Genetic algorithm, then click the button Start to starts the process, the result of the process will be more like this.

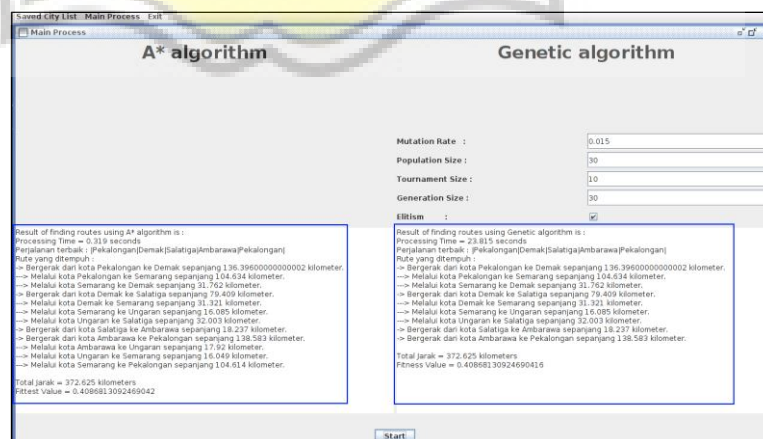


Figure 13. Result of Algorithms

5.2. Testing

5.2.1. Using 4 cities

Testing will be using Pekalongan, Demak, Salatiga, and Ambarawa as cities that needs to be visited.

<p>Result of finding routes using A* algorithm is :</p> <p>Processing Time = 0.319 seconds</p> <p>Perjalanan terbaik : [Pekalongan]Demak[Salatiga]Ambarawa[Pekalongan]</p> <p>Rule yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Pekalongan ke Demak sepanjang 136.39600000000002 kilometer. -> Melalui kota Pekalongan ke Semarang sepanjang 104.634 kilometer. -> Melalui kota Semarang ke Demak sepanjang 31.752 kilometer. -> Bergerak dari kota Demak ke Salatiga sepanjang 79.409 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.321 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.085 kilometer. -> Melalui kota Ungaran ke Salatiga sepanjang 32.003 kilometer. -> Bergerak dari kota Salatiga ke Ambarawa sepanjang 18.237 kilometer. -> Bergerak dari kota Ambarawa ke Pekalongan sepanjang 138.583 kilometer. -> Melalui kota Ambarawa ke Ungaran sepanjang 17.62 kilometer. -> Melalui kota Ungaran ke Semarang sepanjang 16.059 kilometer. -> Melalui kota Semarang ke Pekalongan sepanjang 104.614 kilometer. <p>Total jarak = 372.625 kilometers</p> <p>Fittest Value = 0.4086813092469042</p>	<p>Result of finding routes using Genetic algorithm is :</p> <p>Processing Time = 23.815 seconds</p> <p>Perjalanan terbaik : [Pekalongan]Demak[Salatiga]Ambarawa[Pekalongan]</p> <p>Rule yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Pekalongan ke Demak sepanjang 136.39600000000002 kilometer. -> Melalui kota Pekalongan ke Semarang sepanjang 104.634 kilometer. -> Melalui kota Semarang ke Demak sepanjang 31.752 kilometer. -> Bergerak dari kota Demak ke Salatiga sepanjang 79.409 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.321 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.085 kilometer. -> Melalui kota Ungaran ke Salatiga sepanjang 32.003 kilometer. -> Bergerak dari kota Salatiga ke Ambarawa sepanjang 18.237 kilometer. -> Bergerak dari kota Ambarawa ke Pekalongan sepanjang 138.583 kilometer. <p>Total jarak = 372.625 kilometers</p> <p>Fitness Value = 0.40868130924690416</p>
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Figure 14. Result using 4 cities

From the multiple attempts, both algorithms always resulted in total distance 372.625 kilometers with the same pathways. The route path is Pekalongan – Demak – Salatiga – Ambarawa – Pekalongan. But the difference is A* algorithm (0.319 seconds) have better processing time than Genetic algorithm (23.815 seconds). So in this 4 cities input, A* algorithm are better than Genetic algorithm because of its short processing time.

5.2.2. Using 5 cities

Testing will be using Semarang, Ungaran, Pekalongan, Kudus, and Salatiga as cities that needs to be visited.

<p>Result of finding routes using A* algorithm is :</p> <p>Processing Time = 0.697 seconds</p> <p>Perjalanan terbaik : [Semarang]Pekalongan[Kudus]Salatiga[Ungaran]Semarang</p> <p>Route yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Semarang ke Pekalongan sepanjang 104.614 kilometer. -> Bergerak dari kota Pekalongan ke Kudus sepanjang 162.181 kilometer. -> Melalui kota Pekalongan ke Semarang sepanjang 104.634 kilometer. -> Melalui kota Semarang ke Demak sepanjang 31.782 kilometer. -> Melalui kota Demak ke Kudus sepanjang 25.785 kilometer. -> Bergerak dari kota Kudus ke Salatiga sepanjang 105.37500000000001 kilometer. -> Melalui kota Kudus ke Demak sepanjang 25.966 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.721 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.049 kilometer. -> Melalui kota Ungaran ke Salatiga sepanjang 32.003 kilometer. -> Bergerak dari kota Salatiga ke Ungaran sepanjang 32.022 kilometer. -> Bergerak dari kota Ungaran ke Semarang sepanjang 16.049 kilometer. <p>Total jarak = 420.241 kilometers</p> <p>Fittest Value = 0.31764305349979627</p>	<p>Result of finding routes using Genetic algorithm is :</p> <p>Processing Time = 19.536 seconds</p> <p>Perjalanan terbaik : [Ungaran]Semarang[Pekalongan]Kudus[Salatiga]Ungaran</p> <p>Route yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Ungaran ke Semarang sepanjang 16.049 kilometer. -> Bergerak dari kota Semarang ke Pekalongan sepanjang 104.614 kilometer. -> Bergerak dari kota Pekalongan ke Kudus sepanjang 162.181 kilometer. -> Bergerak dari kota Semarang ke Semarang sepanjang 104.634 kilometer. -> Melalui kota Semarang ke Demak sepanjang 31.782 kilometer. -> Melalui kota Demak ke Kudus sepanjang 25.785 kilometer. -> Bergerak dari kota Kudus ke Salatiga sepanjang 105.37500000000001 kilometer. -> Melalui kota Kudus ke Demak sepanjang 25.966 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.721 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.049 kilometer. -> Melalui kota Ungaran ke Salatiga sepanjang 32.003 kilometer. -> Bergerak dari kota Salatiga ke Ungaran sepanjang 32.022 kilometer. <p>Total jarak = 420.24100000000004 kilometers</p> <p>Fitness Value = 0.31764305349979627</p>
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Figure 15. Result using 5 cities

From the multiple attempts, both algorithms total distance resulted around 420.241 kilometers with the same pathways. The route path is using Semarang – Pekalongan – Kudus – Salatiga – Ungaran – Semarang, but in different start city. The difference of processing time, A* algorithm are about 0.697 seconds and Genetic algorithm is about 19.536 seconds. So in this 5 cities input, A* algorithm are yet better than Genetic algorithm because of its short processing time.

5.2.3. Using 6 cities

Testing will be using Demak, Kudus, Ambarawa, Salatiga, Pekalongan, and Semarang as cities that needs to be visited.

<p>Result of finding routes using A* algorithm is :</p> <p>Processing Time = 4.379 seconds</p> <p>Perjalanan terbaik : [Demak Kudus Salatiga Ambarawa Pekalongan Semarang Demak]</p> <p>Route yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Demak ke Kudus sepanjang 25.785 kilometer. -> Bergerak dari kota Kudus ke Salatiga sepanjang 105.37500000000001 kilometer. -> Melalui kota Kudus ke Demak sepanjang 25.966 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.321 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.085 kilometer. -> Bergerak dari kota Ungaran ke Salatiga sepanjang 32.003 kilometer. -> Bergerak dari kota Salatiga ke Ambarawa sepanjang 18.237 kilometer. -> Bergerak dari kota Ambarawa ke Pekalongan sepanjang 138.583 kilometer. -> Melalui kota Ambarawa ke Ungaran sepanjang 17.92 kilometer. -> Melalui kota Ungaran ke Semarang sepanjang 16.049 kilometer. -> Melalui kota Semarang ke Pekalongan sepanjang 104.614 kilometer. -> Bergerak dari kota Pekalongan ke Semarang sepanjang 104.634 kilometer. -> Bergerak dari kota Semarang ke Demak sepanjang 31.762 kilometer. <p>Total Jarak = 424.37600000000003 kilometers</p> <p>Fitness Value = 0.3170823791115878</p>	<p>Result of finding routes using Genetic algorithm is :</p> <p>Processing Time = 20.261 seconds</p> <p>Perjalanan terbaik : [Ambarawa Pekalongan Semarang Demak Kudus Salatiga Ambarawa]</p> <p>Route yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Ambarawa ke Pekalongan sepanjang 138.583 kilometer. -> Melalui kota Ambarawa ke Ungaran sepanjang 17.92 kilometer. -> Melalui kota Ungaran ke Semarang sepanjang 16.049 kilometer. -> Melalui kota Semarang ke Pekalongan sepanjang 104.614 kilometer. -> Bergerak dari kota Pekalongan ke Semarang sepanjang 104.634 kilometer. -> Bergerak dari kota Semarang ke Demak sepanjang 31.762 kilometer. -> Bergerak dari kota Demak ke Kudus sepanjang 25.785 kilometer. -> Bergerak dari kota Kudus ke Salatiga sepanjang 105.37500000000001 kilometer. -> Melalui kota Kudus ke Demak sepanjang 25.966 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.321 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.085 kilometer. -> Melalui kota Ungaran ke Salatiga sepanjang 32.003 kilometer. -> Bergerak dari kota Salatiga ke Ambarawa sepanjang 18.237 kilometer. <p>Total Jarak = 424.37600000000003 kilometers</p> <p>Fitness Value = 0.3170823791115878</p>
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Figure 16. Result using 6 cities

From the multiple attempts, both algorithms total distance resulted around 424.376 kilometers with the same pathways. The route path is using Demak – Kudus – Salatiga – Ambarawa – Pekalongan – Semarang – Demak, but in different start city. The difference of processing time, A* algorithm are about 4.379 seconds and Genetic algorithm is about 20.261 seconds. So in this 6 cities input, A* algorithm are yet still better than Genetic algorithm because of its short processing time. Even though, A* processing time has started to get slower, and Genetic still keeps around 20 seconds processing time.

5.2.4. Using 7 cities

Testing will be using Semarang, Demak, Ambarawa, Pekalongan, Salatiga, Kudus, and Ungaran as cities that needs to be visited.

<p>Result of finding routes using A* algorithm is :</p> <p>Processing Time = 53.182 seconds</p> <p>Perjalanan terbaik : (Semarang)Pekalongan(Demak)Kudus(Salatiga)Ambarawa(Ungaran)Semarang</p> <p>Rute yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Semarang ke Pekalongan sepanjang 104.634 kilometer. -> Bergerak dari kota Pekalongan ke Demak sepanjang 136.3960000000002 kilometer. -> Melalui kota Semarang ke Demak sepanjang 31.762 kilometer. -> Bergerak dari kota Demak ke Kudus sepanjang 25.785 kilometer. -> Bergerak dari kota Kudus ke Salatiga sepanjang 105.3750000000001 kilometer. -> Melalui kota Kudus ke Demak sepanjang 25.766 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.321 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.085 kilometer. -> Melalui kota Ungaran ke Salatiga sepanjang 32.003 kilometer. -> Bergerak dari kota Salatiga ke Ambarawa sepanjang 18.237 kilometer. -> Bergerak dari kota Ambarawa ke Ungaran sepanjang 17.92 kilometer. -> Bergerak dari kota Ungaran ke Semarang sepanjang 16.049 kilometer. <p>Total Jarak = 424.3760000000003 kilometers</p> <p>Best Value = 0.3126866456613438</p>	<p>Result of finding routes using Genetic algorithm is :</p> <p>Processing Time = 21.444 seconds</p> <p>Perjalanan terbaik : (Kudus)Demak(Pekalongan)Ambarawa(Salatiga)Ungaran(Semarang)Kudus</p> <p>Rute yang ditempuh :</p> <ul style="list-style-type: none"> -> Bergerak dari kota Kudus ke Demak sepanjang 25.966 kilometer. -> Bergerak dari kota Demak ke Pekalongan sepanjang 135.935 kilometer. -> Melalui kota Demak ke Semarang sepanjang 31.321 kilometer. -> Melalui kota Semarang ke Pekalongan sepanjang 104.634 kilometer. -> Bergerak dari kota Pekalongan ke Ambarawa sepanjang 139.67499999999998 kilometer. -> Melalui kota Pekalongan ke Semarang sepanjang 104.634 kilometer. -> Melalui kota Semarang ke Ungaran sepanjang 16.085 kilometer. -> Melalui kota Ungaran ke Ambarawa sepanjang 18.396 kilometer. -> Bergerak dari kota Ambarawa ke Salatiga sepanjang 18.396 kilometer. -> Bergerak dari kota Salatiga ke Ungaran sepanjang 32.022 kilometer. -> Bergerak dari kota Ungaran ke Semarang sepanjang 16.049 kilometer. -> Bergerak dari kota Semarang ke Kudus sepanjang 57.547 kilometer. <p>Total Jarak = 425.5950000000003 kilometers</p> <p>Fitness Value = 0.30949361237276295</p>
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Figure 17. Result using 7 cities

From the multiple attempts, total distance of A* algorithm resulted in 424.376 kilometers and Genetic algorithm with 425.59 kilometers. The best route path is using Semarang – Pekalongan – Demak – Kudus – Salatiga – Ambarawa – Ungaran – Semarang found by A* algorithm. The difference of processing time, A* algorithm are about 53.182 seconds and Genetic algorithm is about 21.444 seconds. So in this 7 cities input, Genetic algorithm becomes better than A* algorithm because of its short processing time. Even though, A* has better minimum cost than Genetic algorithm, but that problem can be set by changing Genetic parameters to get the same minimum cost with A* algorithm.