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DIJKSTRA METHODE FOR OPTIMALIZE RECOMMENDATION SYSTEM OF GARBAGE TRANSPORTATION TIME IN SURAKARTA CITY

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Abstract. Major problem that often occurs in waste transportation in each region is the route of garbage transportation. Determination of this route should become a major concern because it affects fuel consumption and also the working time from the employee. Therefore, in this research we will develop an application to optimize with pigeonhole and dijsktra algorithm. Pigeonhole algorithm is used to determine which garbage trucks should be taken in a particular TPS. Time optimization is done by determining the shortest path that can be skipped for each garbage truck. Data generated from Pigeonhole then used to determine the shortest path by using Dijkstra algorithm.

1. Introduction

Environmental hygiene is a hot topic and is often a major issue. Stacking garbage especially in big cities is often a very disturbing problem. Increasing the amount of unbalanced waste by the environmentally friendly management will cause damage and environmental pollution [1]. The faster the garbage is transported by the janitor then the more cities that look beautiful, awake hygiene and health awake. Garbage that often accumulates in temporary dumps (TPS) one of them is caused by the lack of truck fleets and the right lane that truck passes. Garbage truck lanes should be tailored to the best paths that can be skipped and adjusted to the number of garbage tonnages in each different TPS. Incomplete waste management will trigger social problems, such as mass ammunition, clashes between residents, blocking of landfill facilities [2]. In addition there are some previous studies developed by Susanti et al. [3] on optimization of the transport of garbage vehicles. The problem of vehicle routing (VRP) is a combinatorial problem where its solution requires from existing algorithms and the development of new ideas [4]. The method of VRP settlement and its implementation is exemplified by Iskandar [5]. Lacomme et al. (2006) develop Memetic Algorithm (MA) for solving the capacitated arc routing problem [6].

The number of truck fleets, truck fleet lines, the location of TPS and the amount of waste tonnage is determined first. Then all truck fleets will be determined the best path from the early existence of truck fleet to TPS and from TPS to Final Disposal Site (TPA) or other TPS.

Initially from each truck fleet assigned to TPS, this election was performed using a pigeon hole algorithm. The method for determining the best path is to use the dijectstra algorithm for the selection of the shortest path on the path that the truck can pass. The purpose of moving trucks in TPS can be determined by the pigeon scheduling algorithm.

In this study it is assumed that the path has the same level of congestion and has the same speed. The time obtained is calculated based on trajectory length and time of the predetermined truck (time = distance / average velocity). The time required for preparation, transportation and waste reduction is also ignored. Start times for all trucks are also considered the same and determined at the beginning of the system. The number of trucks is determined early so that each trucking route can be determined in the system to be created so that the amount of time it takes to clean up the garbage at the TPS can be determined to a minimum.

2. Experimental

Waste transport planning uses the concept of route optimization [7] by applying the Dijkstra [8] algorithm. This method has been developed in multigraph [9]. Stages of work in this study are as follows in figure 1.

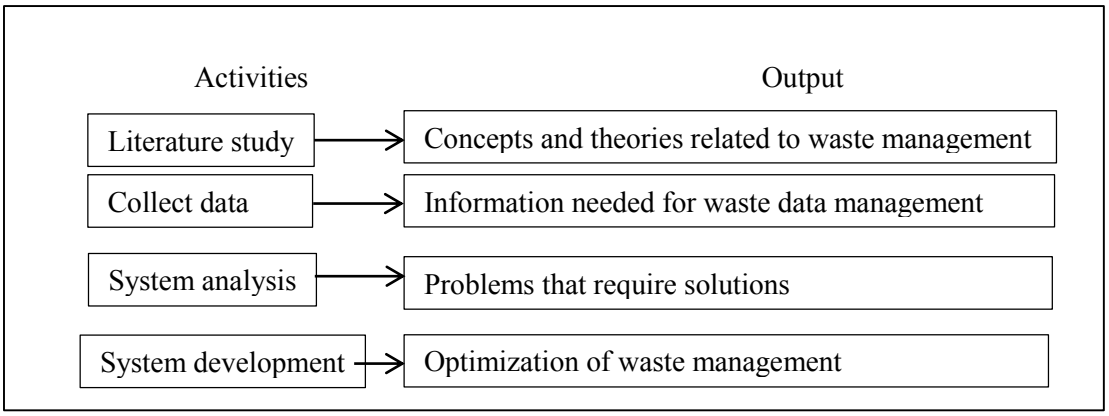


Figure 1. Research flow for optimize system

In accordance with the stages of the research in this study using two methods of pigeonhole method to determine the placement of the fleet at the TPS location of the destination algorithm dijkstra to determine the shortest path / trajectory of trucking. The optimization calculation by using dijkstra method is applied for rail optimization [10].

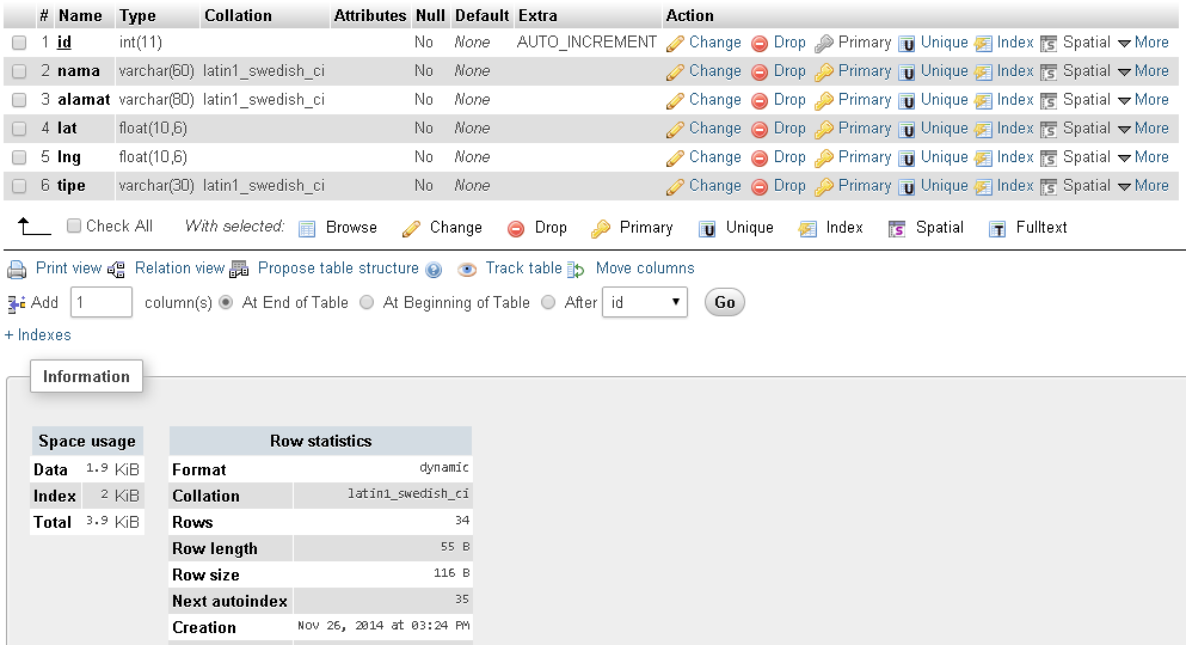
The same has also been done by Arinalhaq, Imran, and Fitria (2013) determination of Waste Transportation Vehicle Routes but Using the Nearest Neighbor Method [11].

The location of research observation is Surakarta area which has an area of about 44 Km^2, according to geographic location Surakarta City split and flowed by 3 (three) big river that is river of Bengawan Solo, Kali Jenes and Kali Pepe. Observations are devoted to the disposal site of the Surakarta region covering the districts of Banjarsari, jebres, Pasar kliwon, laweyan, serengan. And conducted data collection is by using the method of interviews, field surveys and also use data from the city cleanliness agency.

3. Result and Discussion

Solving waste management problems is an optimization problem where routes with high optimization values will be determined [12].

Implementation Database system is a database of applications built. In this program only used one table as storage of TPS data throughout Surakarta and longitude and latitude Google Maps. Tables are then called markers with detail structures as shown in Figures 2.



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Information

Space usage	
Data	1.9 KiB
Index	2 KiB
Total	3.9 KiB

Row statistics	
Format	dynamic
Collation	latin1_swedish_ci
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Figure 2. Table used for TPS data collection in Google Maps

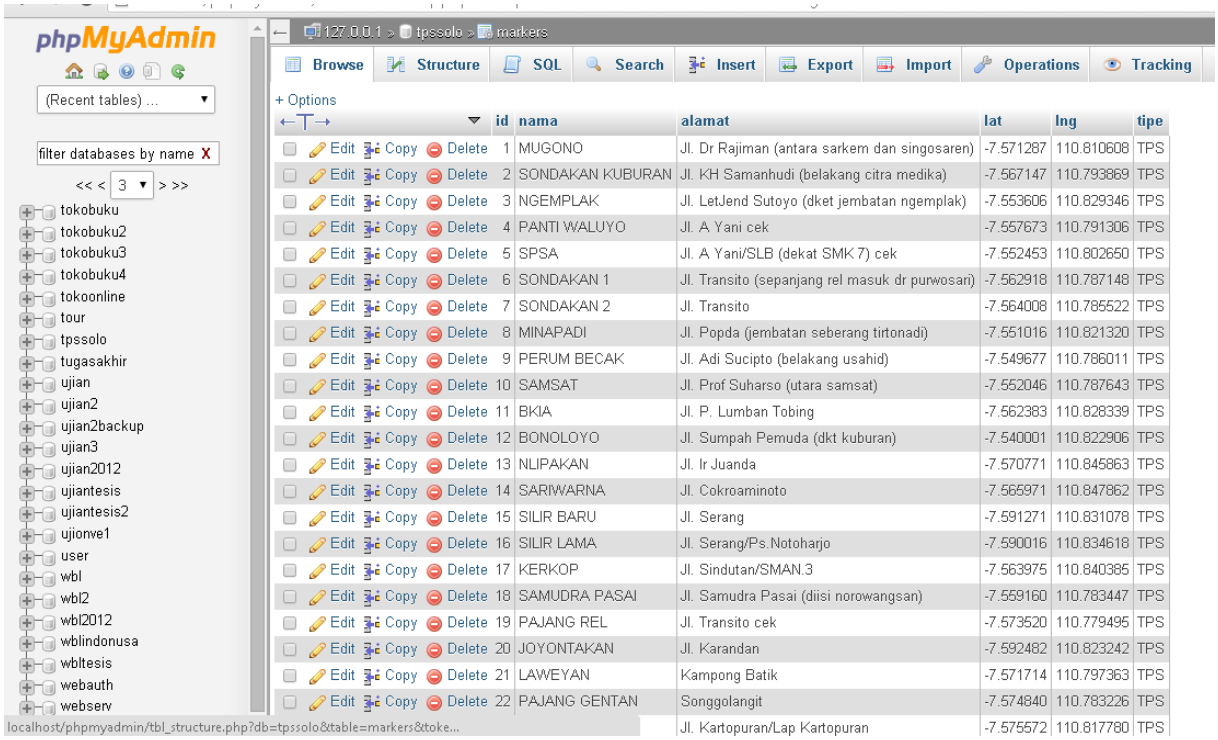

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Figure 3. Sample Data on Table Markers for TPS data collection

Based on these data, then by using coordinates google Maps obtained the point Terminal, TPA and TPS-TPS in the city of Surakarta as in Figure 4.

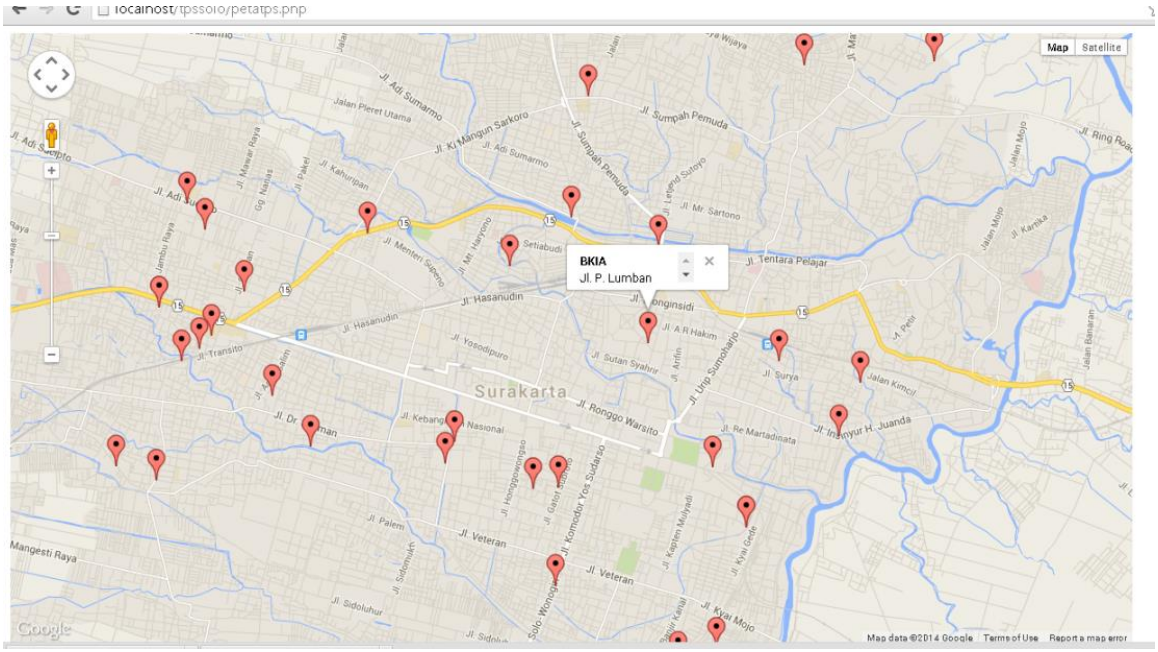

Figure 4. Location of all polling stations in Surakarta.

In this application is divided into 4 transportation processes namely Transport 1 (P1), Transport 2 (P2), Transport 3 (P3), Transport 4 (P4). And obtained the results of them for the location Ngemplak. On Results in the program using the Google MAPS route a visualization of the path as will be drawn on one of the routes on the truck 15 (longest route) with route TERMINAL-TPS NGEMPLAK-TPS SAMSAT-TPA-TPS BONOLOYO-TPA-TPS BKIA-TPA with 45 km distance. The depiction of routes one by one as in the picture in figure 5.

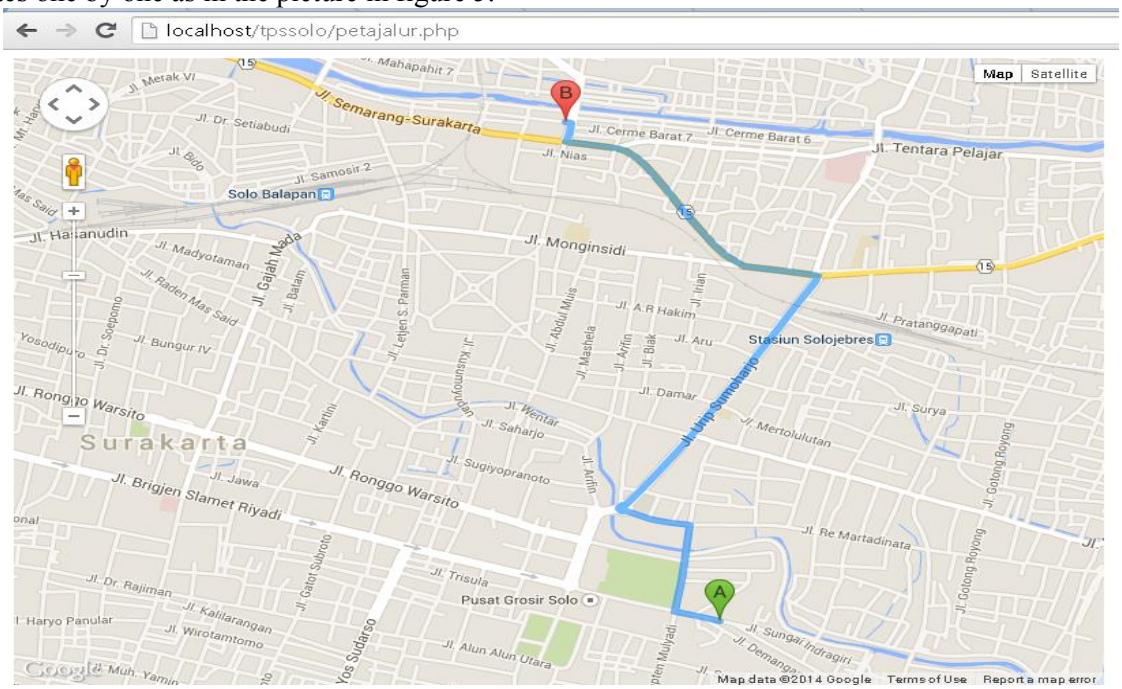

Figure 5. Terminal of Garbage Truck Terminal - TPS Ngemplak

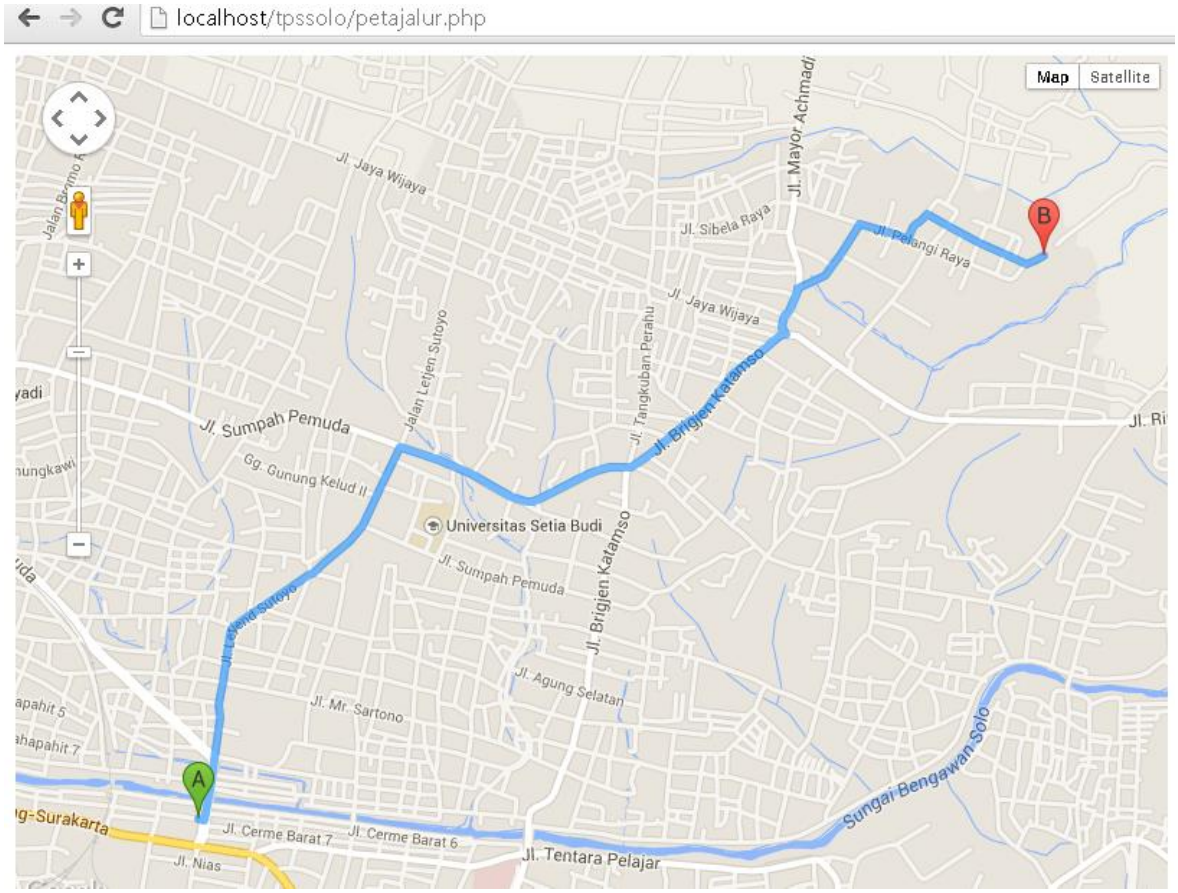

Figure 6. TPS rute of ngemplak-TPA

Dan this process will be repeated for other areas. Based on the total area of Surakarta city, there are 23 optimum pathways, namely:

i. Rute-1 : TERMINAL-TPSBKIA-TPA-TPSSONDAKAN 1-TPA-TPSMOJOSONGO-TPA-TPSBKIA-TPA with mileage 39,9km
ii. Rute-2 : TERMINAL-TPSBONOLOYO-TPA-TPSSILIR LAMA-TPA-TPSDAWUNG-TPA with mileage 41 km
iii. Rute -3 :TERMINAL-TPSDAWUNG-TPA-TPSSAMPANGAN BARAT-TPA-TPSSAMSAT-TPA with mileage 42.6 km
iv. Rute -4 :TERMINAL-TPSJOYONTAKAN-TPA-TPSSAMBENG-TPA-TPSSONDAKAN 1-TPA with mileage 43.1 km
v. Rute -5 :TERMINAL-TPSJURUG-TPA-TPSSILIR BARU-TPA-TPSSARIWARNA-TPA with mileage 36.9 km
vi. Rute -6 :TERMINAL-TPSKARTOPURAN-TPA-TPSMUGEN LEPAS-TPA-TPSSILIR LAMA-TPA with mileage 41.6 km
vii. Rute -7 :TERMINAL-TPSKEDUNG TUNGKUL-TPA-TPSSONDAKAN KUBURAN-TPA-TPSBONOLOYO-TPA with mileage 35.5 km
viii. Rute -8 :TERMINAL-TPSKERKOP-TPA-TPSSAMUDRA PASAI-TPA-TPSBKIA-TPA with mileage 37.9 km
ix. Rute-9 :TERMINAL-TPSLAWEYAN-TPA-TPSJURUG-TPA-TPSBKIA-TPA with mileage 36.7 km
x. Rute-10 :TERMINAL-TPSMAKRO-TPA-TPSSARIWARNA-TPA-TPSSONDAKAN 2-TPA with mileage 44.3 km

xi. Rute-11 :TERMINAL-TPSMINAPADI-TPA-TPSDAWUNG-TPA-TPSSILIR BARU-TPA with mileage 41.6 km
xii. Rute-12 :TERMINAL-TPSMOJOSONGO-TPA-TPSSONDAKAN 2-TPA-TPSBKIA-TPA with mileage 38.3 km
xiii. Rute -13 :TERMINAL-TPSMUGEN LEPAS-TPA-TPSMUGONO-TPA-TPSMINAPADI-TPA with mileage 36.6 km
xiv. Rute -14 :TERMINAL-TPSMUGONO-TPA-TPSSAMPANGAN TIMUR-TPA-TPSSPSA-TPA with mileage 42.2 km
xv. Rute-15 :TERMINAL-TPSNGEMPLAK-TPA-TPSSAMSAT-TPA-TPSBONOLOYO-TPA-TPSBKIA-TPA with mileage 45 km
xvi. Rute-16 :TERMINAL-TPSNLIPAKAN-TPA-TPSSPSA-TPA-TPSSAMPANGAN BARAT-TPA with mileage 39.3 km
xvii. Rute -17 :TERMINAL-TPSNOROWANGSAN-TPA-TPSBKIA-TPA-TPSSAMPANGAN BARAT-TPA with mileage 40.2 km
xviii. Rute -18 :TERMINAL-TPSPAJANG GENTAN-TPA-TPSBONOLOYO-TPA-TPSBKIA-TPA with mileage 37.6 km
xix. Rute-19 :TERMINAL-TPSPAJANG REL-TPA-TPSKEDUNG TUNGKUL-TPA-TPSBONOLOYO-TPA with mileage 35.1 km
xx. Rute -20 :TERMINAL-TPSPANTI WALUYO-TPA-TPSMINAPADI-TPA-TPSJURUG-TPA with mileage 36.8 km
xxi. Rute -21 :TERMINAL-TPSPERUM BECAK-TPA-TPSNGEMPLAK-TPA-TPSBKIA-TPA with mileage 37.1 km
xxii. Rute-22 :TERMINAL-TPSSAMBENG-TPA-TPSNLIPAKAN-TPA-TPSSAMUDRA PASAI-TPA with mileage 44.4 km
xxiii. Rute-23 :TERMINAL-TPSSAMPANGAN BARAT-TPA-TPSSOLO SQUARE-TPA-TPSSILIR BARU-TPA with mileage 42.9 km.

Based on the result of application of Dijkstra method there are several route options which can be used as recommendation for garbage transportation in Surakarta city.

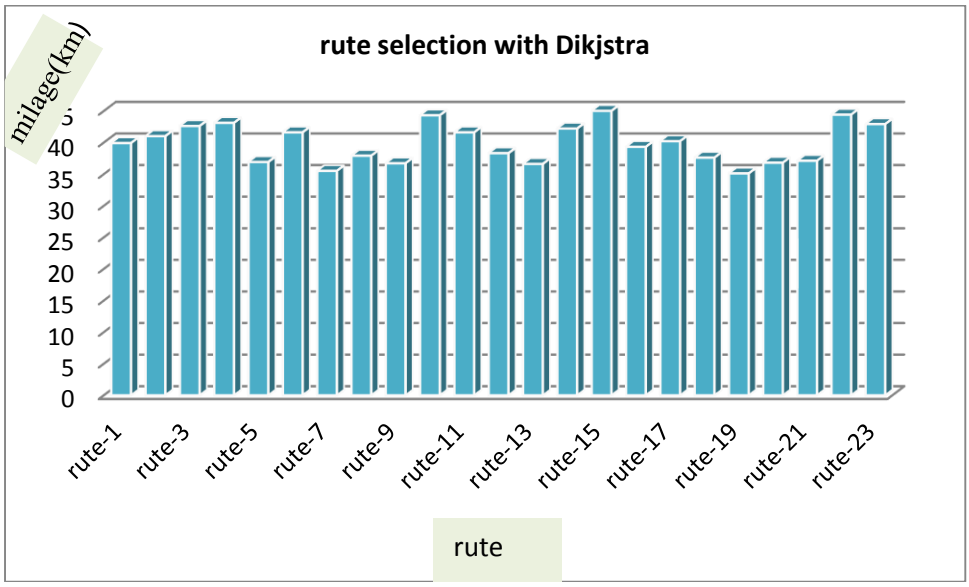

Figure 7. Rute selection with dikjstra

4. Conclusion

The simulation of pigeon hoel and dijkstra algorithm was used to optimize the garbage collection time in Surakarta City by using the distance between the TPS and the garbage tonnage at each TPS as the main parameter of determination. Generated precision of distance utilization which will optimize the time of garbage transportation and indirectly the target of city cleanliness can be achieved. From this research we get 23 optimal route for garbage transportation in Surakarta city.

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