Analysis and Implementation of graph algorithms method of traveling salesperson problem in Determining the expedition route of delivery package

Richki Hardi[*]

[*]*Departmen of Informatics Engineering*
Universitas Ahmad Dahlan, Yogyakarta, Indonesia
richkihardi@tif.uad.ac.id

Abstract — **optimization problem to find the shortest way for shipping companies wishing to deliver goods to a number of cities and return to the original departure city is highly expected to be applied, because in addition to saving energy can also save on the budget. in that case it takes the appropriate algorithms and methods to solve them. several methods have been used to resolve the issue but so far have not found a reliable algorithm to solve it. there are some easy steps that can be applied to the problem is to try all possible routes are available or looking for the best route, and it is the duty of the algorithm traveling sales person problems. in the digital era nowadays, it is necessary that the algorithm can solve the problem quickly in order to obtain a solution that approaches the optimal solution. Traveling salesperson problem algorithm can be used for solving complex and difficult optimization solved by conventional methods.**

Keywords: Algorithms, Expedition, Computing, Optimization, Travelling salesperson problem.

I. INTRODUCTION

One type of the development of science and technology is the development of the computing world, one of which is the advancement of information systems. Virtually no limits of space and time with respect to the information system, the information from distant places are physically able to quickly and easily known by us. Through information technology-based Information Systems job becomes easy, effective and efficient.

The development of science and technology more rapidly, it can be seen and felt directly or indirectly. These developments have an impact on all aspects of human life. Globalization is happening today resulted in changes that impact affects all aspects of life and occurs on an ongoing basis, including the delivery company within the national standards.

Optimization problem is a problem that often we encounter in everyday life. This is not out of human nature that always want to get as much profit as possible and obtain a minimum loss.

Indonesian shipping company is a company that provide services nationwide inter-city deliveries of goods between provinces with multiple branches located throughout Indonesia. Every expedition has several operational areas packet deliveries. To deliver packets from one city to another, each expedition must be able to do a proper route selection so that the package can get to the destination in a short time. Route selection can be determined to try all paths that can be traversed by the packet from the city sender (origin) to the city of the recipient (destination).

Expedition Indonesia as mediator company in the field of dispatch and have a tough challenge in the face of the impact of the current changes, among others, that is the shift pattern in which public trust service units still not up, but on the other hand increasing konsumenpun needs, in addition to the issues related to service facilities, freight forwarding, shipping rates, the state of goods, customer satisfaction, safety, etc. also need to get serious attention and handling.

The purpose of the expedition service unit is to increase the level of service to consumers. Each expedition in Indonesia has such authority, always strive to improve customer service optimally. So to organize the construction of service units required a reliable power source that is energy, facilities and infrastructure. Service personnel including employees, employees and other service personnel. The service infrastructure available is the headquarters, branch offices, motor vehicles, mailboxes and other facilities. Expedition Indonesia are still difficulties in providing an overview, conditions, and socialization of service delivery to the community. The data stored on the service unit is still manual, so have difficulty when they want to change the data of a service facility that still has the addition of facilities and data, as it is still in the form of books or brochures, how the implementation is less effective and efficient. Expedition Indonesia is still difficult to assess, locate and obtain information about the unit and service facilities in determining the appropriate location where the unit was built new facilities.

The problem is how to determine the exact route so that packets can get to the destination in the

shortest possible time by using the route. In other words, should determine the best path to be traversed by the packet from the sender to the recipient.

Routes or pathways that connect certain places are always associated with the graph, because the graph is a reliable representation to visualize this kind of problem. So surely graph theory can be used to solve search problems right route in the process of delivery package at the shipping company.

the process of package deliveries from one city to another course, there needs to be consideration of time and cost efficiency by the company. So that the necessary accuracy in determining the best route across a city. The results of the determination can be obtained by using algorithm approach Traveling Salesperson Problem (TSP), which is an algorithm which seek the shortest path length from point of origin to point of destination and return to point of origin in a connected weighted graph with minimal cost and approach the optimal results.

A. Problem Formulation

The problems in this study can be formulated as follows:
1. How to determine the exact center point for package deliveries from origin city to the destination city and then back to home town using the algorithm.
2. How to implement graph algorithms traveling salesperson problem in determining the best route in the conduction process packets.
3. How best can these be applied to save and budget tanaga freight forwarders

B. Authenticity Research

Rif'an (2002) find the shortest path by utilizing the genetic algorithm. The study was conducted by making a graph based on data obtained from the Department of Transportation in Yogyakarta municipality, such as the average speed of motor vehicles, road length, as well as the travel time of each link. As performed by Rif'an (2002), this study will also use a graph to model a path to find the optimum path algorithm applied but not Prim's algorithm but rather a genetic algorithm.

Mulyadi (2002) investigated the distance vector routing algorithm using the Delphi programming language. The study was conducted to simulate the route or path with the help of a program. Mulyadi (2002) stated that the simulation program can be expanded further by using other algorithms. This study is similar to studies conducted Mulyadi (2002) in terms of the optimum path finding and using the Delphi programming language, but the algorithms used instead of a distance vector algorithm but Prim's algorithm.

C. Benefits of Research

The benefits of the study is expected to be a reference to the shipping company in Indonesia to determine the delivery route packets from one city to another. So it can save time in the process of package delivery. Expected to contribute to the development in the field of computer science and informatics as well as take advantage of advances in technology for the betterment of society.

D. Research Objectives

The purpose of this research is to design and implement a package tracking system that can provide convenience for a tracking problem using the TSP algorithm approach to the delivery Lhokseumawe.

E. Limitations

Based on the background of the problem, so that the results of this study, the maximum is only limited discussion on the issue:
1) shortest route search packet delivery using Graph TSP algorithm.
2) These in these systems refers to the point specified by ekspedisi as a means to provide a report.

II. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

A. Review of Literature

This study also draws on research conducted by Vitello (2005), with the title of GIS for mapping transceiver stations BTS. Telkom Flexi PT.Telkom Bantul branch. In the study researchers used ArcView software but its use has not been using hotlink to display more detailed information so that the information is generated only in the form of attributes of an existing theme. ArcView has a hotlink facilities that can help to display the information more complete and exciting. And this study the authors have used the hotlink that can display information that is more extensive and more detailed. Due to hotlink facility can accept input in the form of text files, images, and doc files, so it can display information more widely and more interesting.

Previous research conducted Mukti (2005) with the title of building geographic information system for mapping billboard in Yogyakarta. In these studies still use additional software macromedia flash as the interface so that the files generated with ArcView programmed digitization should be exported into a file with extension * .dxf so do twice the work in addition to the digitized onscreen in ArcView program if exported into dxf file be less than perfect. ArcView software in the design it actually already quite complete even ArcView interface can make your own using a customized facilities and do not need to use another device. Here the authors use ArcView software and Microsoft Access database to store the data.

Of the final project by Arleadi (2002) Analysis of E-Commerce Design at the online bookstore just designing the design process from the producer to the consumer bookseller who would buy the book from the site were made, does not display the information in detail and interesting as well as on research this author. The final

task of the information system of ordering products online with ASP applications in Timboel Ceramic Kasongan Bantul, Yogyakarta by Pamujianto (2004), it appears that the system that made the extent of information and product order not include online sales that can be accessed directly by prospective customers through a certain web address .

B. Basis Theory

Analisis Penyelesaian TSP dengan Algoritma Heuristik

Algorithm to solve TSP problems for the conditions above are as follows:

1. Find the minimum spanning tree that connects each of n nodes of a graph. Search results minimum spanning tree is called A.
2. Determine the graph vertices of odd degree, if k is the number of vertices of odd degree graph of n vertices then k must have an even number. We attach k vertices so that the length of the branch connecting the vertices of the minimum. K knot with each branch obtained from each pair of vertices that node k form a network called B. Networks A and B which have been formed we combine it into a network C.
3. Now the network C has no odd vertices. We can describe the network C. Euler circuit Euler circuit is an approximation solution of the Traveling Salesman Problem.
4. Check each of the nodes in the network C are visited more than once and the Traveling Salesman Problem repair solution from step 3 by applying the following inequality: $l\,(a, b) < l\,(a, c) + l\,(c, b)$

TABLE I. 8 VERTICLES

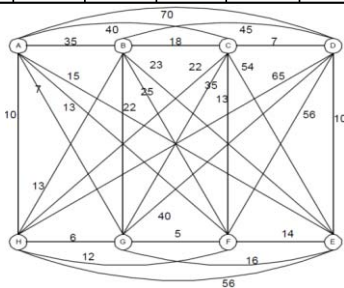|	A	B	C	D	E	F	G	H
A	0	35	40	70	15	13	7	10
B	35	0	18	45	23	25	22	13
C	40	18	0	7	54	13	35	22
D	70	45	7	0	10	56	40	65
E	15	23	54	10	0	14	16	56
F	13	25	13	56	14	0	5	12
G	7	22	35	40	16	5	0	6
H	10	13	22	65	56	12	6	0

Figure 1. Complete graph of the problems listed in the table

Step 1 of the above algorithm is to find the minimum spanning tree of the graph. In this discussion will be used Kruskal algorithm. The number of possibilities for the determination of the TSP with 8 inputs there are (8-1)! / 2 = 2520 so that the enumeration process and the possibility of

comparing the total weight would be very complicated. Heuristic methods into one solution that can be applied to this case. The initial process of the resolution of this case is to establish the minimum spanning tree of all the nodes. As shown below:
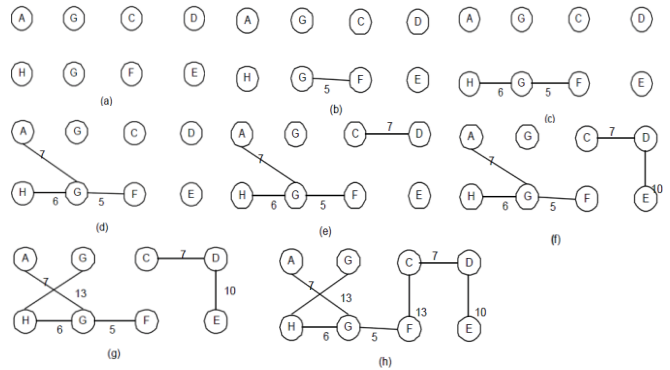
Figure 2. Complete graph of the problems listed in the table

After the Kruskal algorithm is executed it will form a minimum spanning tree. Minimum spanning tree has given path will visit the whole city with the most minimal total path distance. However, the results of this algorithm yet form a circuit.
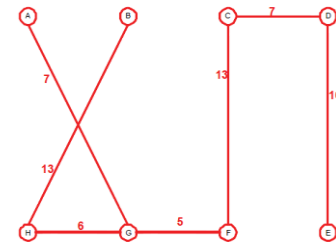
Figure 3. Minimum spanning tree (network A)

After the minimum spanning tree is formed, the process continues to find the odd degree vertices. Odd vertices will be connected so that it becomes an even degree with a minimum weight of additional side.
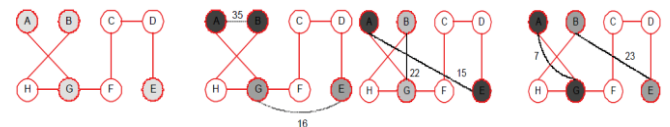
Figure 4. Minimum spanning tree

Once this process is completed then formed an Eulerian circuit. This circuit is an approximation of the solution of TSP. In this process the results of the A and G, and B and E into network B. The third process, network C is formed with all the even-numbered vertices is Eulerian circuit. This circuit is an approximation of the desired solution of TSP.
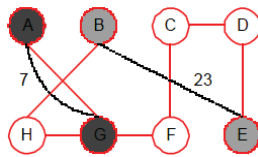
Figure 5. Network C is formed Eulerian circuit

The next step is to check whether there is a node that is visited more than once and we do process improvement journey traveling salesman problem by checking the inequalities:

$$l\,(a,b) < l\,(a,c) + l\,(c,b)$$

Examination of the graph implies examination of the way from node A to node H.
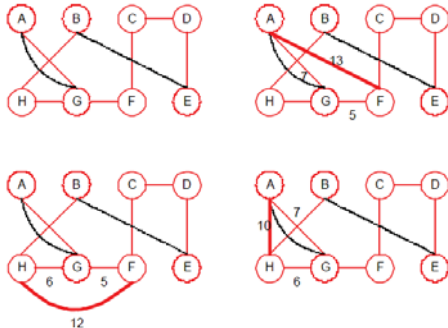
After the process ends, it sets a minimum or a Hamilton circuit permasalhan solution of traveling salesman problem. In order to obtain the following picture.
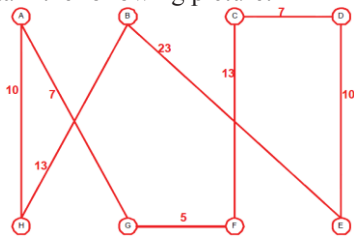
Figure 6. The final process of TSP solutions

III. RISEARCH METHODOLOGY

A. Location Research

Location of the study is shipping company, Lhokseumawe branch offices, the Department of Transportation North Aceh, North Aceh and Bapeda Lhokseumawe.

B. Equipment and Materials Research

1) Research Tool
   a. Hardware
   The hardware used in this study are: hardware specifications (hardware) used in this study is a high specification Laptop with Intel Core2Duo, 2GB memory, and a 512MB Nvidia Graphic, And Canon MP450 printer tools to facilitate researchers in conducting research
   b. Software
   The software used in this study are:
   a) Microsoft Windows and Linux

In this case the researchers mengguankan software operating system Microsoft Windows Vista Basic and Ubuntu Linux for application programs operate in carrying out this research.
b) PHP
PHP is a PHP Hypertext Preprocessor, created by Rasmus Lerdoff (1994) is a form of scripting language that is placed in the server and processed on the server, which is specifically designed for dynamic web form. Meaning that it can form a view based on current demand ..
c) MySQL
MySQL is a multiuser database that uses language Structured Query Language (SQL) to access and manage the data. MySQL is able to handle a large enough data, capable of storing more than 40 databases, 10,000 tables and 7 million lines, with a capacity of 100 Gigabyte.

C. Method of Data Collection

The methodology used is the structured analysis and design stages as follows:

1) Field Research (Field Research)
   a. In conducting this research the author conducted observations, ie the method of data collection using direct observation and systematic recording with the associated symptoms or phenomena without asking questions.
   b. interview with the Head of Data Processing and head of the information center at the shipping company Lhokseumawe. Engineering analysis of existing systems or ongoing
   c. Implementation, That is the method by way of implementing the results of the design which has been made into an attractive display to facilitate the learning of the research object.
   d. Test method, ie a method in which the design has been implemented into the program can be tested truth to others who want to learn.

2) Research Library (Library Research)
   This method is a method of data collection by studying literature, package modules and guides, handbooks, library books and any other literature that is deemed necessary and support.

3) Research Steps
   The steps in conducting this study are as follows
   a. Stage Design System
   b. The system is designed to use DFD (Data Flow Diagram) is to determine the input and output processes in the system.
   c. Designing graphs and algorithms for the TSP
   - Determine the graph that will be used.
   - Describe the graph correspond to the entire Street map of Aceh.
   - Determine the points in the graph.
   - Entering the weight values in the graph.

- Determining the routes that can be passed to the delivering packets from the starting point to the next points.
- Determining the shortest route or the minimum value by using the TSP algorithm.

d. Making Stage System

The steps used to create the system are as follows:
- Specifies the programming language to be used.
- Creating database tables.
- Designing interface menu system.
- Implementing a system into a programming language.

e. Stage Testing System

The steps used in the test system are as follows:
- Perform Test Case
- Provides Black Box type test test
- Provide type Alpha test test

IV. RESULTS AND DISCUSSION

A. 4.1.2 Calculation of adjacency matrix graph

Adjacency matrix of the graph above is:

TABLE II. NEIGHBORHOOD ROUTE CALCULATION MATRIX GRAPH OPTIMAL FOR THE SHIPPING COMPANY IN ACEH:

j=A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
i=A	0	40	∞	∞	∞	56	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
B	∞	0	60	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
C	∞	60	0	40	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	140	∞	∞	∞	∞
D	∞	∞	40	0	30	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
E	∞	∞	∞	30	0	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
F	∞	∞	∞	∞	∞	0	106	∞	∞	∞	70	∞	∞	∞	∞	∞	∞	∞	∞
G	∞	∞	∞	∞	∞	106	0	102	112	∞	∞	211	∞	∞	∞	∞	∞	∞	∞
H	∞	∞	∞	∞	∞	∞	102	0	60	80	∞	∞	140	∞	∞	∞	∞	∞	∞
I	∞	∞	∞	∞	∞	∞	112	60	0	156	∞	∞	∞	∞	∞	∞	∞	∞	∞
J	∞	∞	∞	∞	∞	∞	∞	80	156	0	∞	∞	89	∞	∞	∞	∞	∞	∞
K	∞	∞	∞	∞	∞	70	∞	∞	∞	∞	0	40	∞	∞	∞	∞	∞	∞	∞
L	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	40	0	160	∞	162	∞	∞	∞	∞
M	∞	∞	∞	∞	∞	∞	211	∞	∞	89	∞	∞	0	45	∞	∞	∞	∞	∞
N	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	45	0	140	∞	81	∞	∞
O	∞	∞	140	∞	∞	∞	∞	∞	∞	∞	162	∞	140	0	106	∞	∞	∞	∞
P	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	106	0	∞	∞	160	∞
Q	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	81	∞	∞	0	74	∞	∞
R	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	74	0	200	∞
S	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	160	∞	200	0	60
T	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	60	0

These Algorithm Using Shortest TSP

TABLE III. CALCULATION OF OPTIMAL THESE INITIAL NODE A = A (LSM) ALL OTHER VERTICES. (FOR S VALUE):

Lelaran	Simpul yang dipilih	Lintasan	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Inisial	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A	A	A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B	B	A,B	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C	F	A,F	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D	C	A,B,C	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	K	A,F,K	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
F	D	A,B,C,D	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	G	A,F,G	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
H	L	A,F,K,L	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
I	E	A,B,C,D,E	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
J	O	A,B,C,O	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
K	H	A,F,G,H	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
L	M	A,F,K,L,M	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0
M	I	A,F,G,H,I	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
N	P	A,B,C,O,P	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
O	N	A,F,K,L,M,N	1	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0
P	J	A,F,K,L,M,J	1	0	0	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0
Q	Q	A,F,K,L,M,N,Q	1	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	1	0	0	0
R	S	A,B,C,O,P,S	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0
S	T	A,B,C,O,P,S,T	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
T	R	A,B,C,O,P,S,R	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0

TABLE IV. CALCULATION OF OPTIMAL THESE INITIAL NODE A = A (LSM) ALL OTHER VERTICES. (FOR VALUE D)

Lelaran	Simpul yang dipilih	Lintasan	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
Inisial	-	-	0	40	∞	∞	∞	56	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
A	A	A	∞	40	∞	∞	∞	56	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
B	B	A,B	∞	40	100	∞	∞	56	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
C	F	A,F	∞	40	100	140	∞	56	162	∞	∞	∞	126	∞	∞	∞	∞	∞	∞	∞	∞	∞
D	C	A,B,C	∞	40	100	140	∞	56	162	∞	∞	∞	126	∞	∞	328	∞	∞	∞	∞	∞	∞
E	K	A,F,K	∞	40	100	140	∞	56	162	∞	∞	∞	126	∞	∞	328	∞	∞	∞	∞	∞	∞
F	D	A,B,C,D	∞	40	100	140	∞	56	162	∞	∞	∞	126	166	∞	328	∞	∞	∞	∞	∞	∞
G	G	A,F,G	∞	40	100	140	170	56	162	274	∞	∞	126	166	∞	328	∞	∞	∞	∞	∞	∞
H	L	A,F,K,L	∞	40	100	140	170	56	162	274	∞	∞	126	166	326	328	∞	∞	∞	∞	∞	∞
I	E	A,B,C,D,E	∞	40	100	140	170	56	162	274	∞	∞	126	166	326	371	328	434	∞	∞	∞	∞
J	O	A,F,K,L,O	∞	40	100	140	170	56	162	274	∞	∞	126	166	326	371	328	434	∞	∞	∞	∞
K	H	A,F,G,H	∞	40	100	140	170	56	162	274	334	∞	126	166	326	371	328	434	∞	∞	∞	∞
L	M	A,F,K,L,M	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	∞	∞	∞	∞
M	I	A,F,G,H,I	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	∞	∞	∞	∞
N	N	A,F,K,L,M,N	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	452	∞	∞	∞
O	P	A,F,K,L,O,P	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	452	∞	∞	∞
P	J	A,F,K,L,M,J	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	452	∞	594	∞
Q	Q	A,F,K,L,M,N,Q	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	452	∞	594	∞
R	S	A,F,K,L,O,P,S	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	452	∞	594	∞
S	T	A,F,K,L,O,P,S,T	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	452	794	594	654
T	R	A,F,K,L,O,P,S,R	∞	40	100	140	170	56	162	274	334	415	126	166	326	371	328	434	452	794	594	654

From the above calculation, the optimal These delivery package at the shipping company Lhokseumawe objectives are as follows:

TABLE V. OPTIMAL TRACK OF THE ORIGIN NODE TO THE DESTINATION NODE:

	B (Lhoksukon)	A,B	40 Km
	F (Bireun)	A,F	56 Km
	C (Idi)	A,B,C	100 Km
	K (Simpang Tiga)	A,F,K	126 Km
	D (Langsa)	A,B,C,D	140 Km
	G (Sigli)	A,F,G	162 Km
	L (Takengon)	A,F,K,L	166 Km
	E (Kuala Simpang)	A,B,C,D,E	170 Km
	O (Blangkejren)	A,F,K,L,O	240 Km
A (Lsm)	H (Jantho)	A,F,G,H	274 Km
	M (Meulaboh)	A,F,K,L,M	326 Km
	I (BandaAceh)	A,F,G,H,I	334 Km
	N (Janarata)	A,F,K,L,M,N	371 Km
	P (Kutacane)	A,F,K,L,O,P	434 Km
	J (Calang)	A,F,K,L,M,J	415 Km
	Q (Blang Pidie)	A,F,K,L,M,N,Q	452 Km
	S (Subulussalam)	A,F,K,L,O,P,S	594 Km
	T (Singkil)	A,F,K,L,O,P,S,T	654 Km
	R (Tapak tuan)	A,F,K,L,O,P,S,R	794 Km

TABLE VI. CALCULATION OF ECCENTRICITY:

D	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	Sol
0	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	(*,-)	1
			140,O										162,O		140,O	106,O				C
													162,O	185,N	140,O	106,O	221,N			N
													162,O	185,N		106,O	221,N	295,Q		P
													162,O	185,N			221,N	295,Q	266,P	L
														185,N			221,N	295,Q	266,P	326,S	M
		200,C		180,C													221,N	295,Q	266,P	326,S	D
		200,C				210,D											221,N	295,Q	266,P	326,S	B
	240,B				210,D												221,N	295,Q	266,P	326,S	E
	240,B																221,N	295,Q	266,P	326,S	Q
	240,B					272,K						202,L						295,Q	266,P	326,S	K
	240,B					272,K					274,M							295,Q	266,P	326,S	A
						272,K					274,M							295,Q	266,P	326,S	S
						272,K	378,F		414,H	274,M								295,Q		326,S	F
							378,F	354,J	414,H	274,M								295,Q		326,S	J
							378,F	354,J	414,H										295,Q		326,S	R
							378,F	354,J	414,H										295,Q		326,S	T
							378,F	354,J	414,H												H
							378,F		414,H												G
									414,H												I

So Based on the calculation, point O worthy of being the city center because eksentrisitasnnya smaller services: e (O, O-N-M-J-H-I) = 414
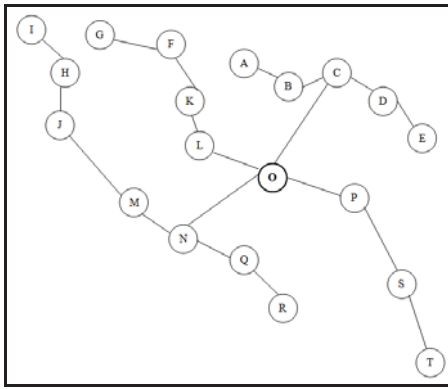
Figure 7. S Graf O serve the city if the city service center,
the eccentricity is: e (O, O-N-M-J-H-I) = 414

V. Results and Discussion

A. Conclusion

After creating an application package delivery tracking system by using TSP algorithm on shipping company Persero Lhokseumawe, it can be concluded as follows:

1) The system can find a sequence of visits locations (one location only visited one time) the total "value" of the optimum (minimum or maximum can depend goal). "Value," here could be distance, cost, convenience, and so on. Goal is to find a sequence of packet delivery location of the minimum total distance.

2) Application Tracking system This package can be used to improve search and route determination package in package delivery and to shorten delivery time routing packets effectively and efficiently as well as providing information quickly and easily.

3) Packets Tracking System is very effective in giving accurate results and updates on the status and condition of the package.

4) Tracking System This package provides data security for each branch office and the central office also has a right of access, ie by providing a user ID and password can be encrypted.

B. Suggestions

Some advice that can be given to the development of this tracking system is as follows:

1. Tracking System package only provides the determination of the optimal trajectory delivery package, a list of the tariff, the expedition package, criticisms and suggestions, profiles, and news. For further development of this system, you can add other modules that support this system

2. In determining the optimal route TSP algorithm is not always able to provide the minimum value, because the principles used by the TSP algorithm here is all the way trying to find the optimal route, to be able to get the optimal route search are either going forward in the search for the shortest route can use algorithm broader scope of work.

References

[1] Boykov, O. Veksler, and R. Zabih, "Markov Random Fields with Efficient Approximations," *Proc. IEEE Conf. Computer Vision and Pattern Recognition*, pp. 648-655, 1998.

[2] Y. Boykov, O. Veksler, and R. Zabih, "Fast Approximate Energy Minimization via Graph Cuts," *Proc. IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 23, no. 11, pp. 1222-1239, Nov. 2001.

[3] H. Ishikawa and D. Geiger, "Segmentation by Grouping Junction," *Proc. IEEE Conf. Computer Vision and Pattern Recognition, pp. 125-131*, 1998.

[4] C.-H. Lee, D. Lee, and M. Kim, "Optimal Task Assignment in Linear Array Networks," IEEE Trans. Computers, vol. 41, no. 7, pp. 877-880, July 1992

[5] D. Snow, P. Viola, and R. Zabih, "Exact Voxel Occupancy with Graph Cuts," *Proc. IEEE Conf. Computer Vision and Pattern Recognition*, pp. 345-352, 2000.

[6] H.S. Stone, "Multiprocessor Scheduling with the Aid of NetworkFlow Algorithms," *IEEE Trans. Software Eng.*, pp. 85-93, 1977.

[7] A. Amini, T. Weymouth, and R. Jain, "Using Dynamic Programming for Solving Variational Problem is Vision", *IEEE Trans. Pattern Analysis and Machine Intelligence*, vol. 12, no. 9, pp. 855-867, Sept. 1990.

[8] S.B. Akers, ''Binary Decision Diagrams'', *IEEE Transactions on Computers*, Vol. C-27, No. 6, June 1978,pp. 509-516

[9] R. Brayton, et al, ''Fast Recursive Boolean Function Manipulation'', *International Symposium on Circuits and Systems, IEEE*, Rome, Italy, May 1982, pp. 58-62.

[10] C.E. Shannon, ''A Symbolic Analysis of Relay and Switching Circuits'', *Transactions of the AIEE*, Vol. 57, 1938, pp. 713-723.

[11] C.S. Wallace, ''A Suggestion for a Fast Multiplier'', *IEEE Transactions on Electronic Computing*, Vol. EC-13, No. 1, January 1964, pp. 14-17

[12] R.P. Brent, and H.T. Kung, ''The Area-Time Complexity of Binary Multiplication'', *Journal of the ACM*, Vol. 28, No. 3, July 1981, pp. 521-534.

[13] M.R. Garey and D.S. Johnson, *Computers and Intractibility: A Guide to the Theory of NP-Completeness*, Freeman, New York, 1979.

[14] H. Abelson, and P. Andreae, ''Information Transfer and Area-Time Trade-Offs for VLSI Multiplication'', Communications of the ACM, Vol. 23, No. 1, January 1980, pp. 20-23.

[15] Richki, H, "*Implementasi Algoritma Tsp Dalam Penyelesaian Tracking Paket Pada Unit Processing Center Pos Indonesia Kota Lhokseumawe Aceh*" Jurnal Telematika, Vol. 11, No. 1, Juli 2014,Program Studi Teknik Informatika Universitas Pembangunan Nasional "Veteran" Yogyakarta, ISSN: 1829-667X I

Richki Hardi

as a lecturer Multimedia, Networking, and software engineering. and as a researcher at the faculty of industrial technology, Department of informatics engineering, Ahmad Dahlan University Yogyakarta. two topics of my research before this is about Genetic Algorithm in Solving the TSP on Route Distribution of Mineral Water, Prosiding International Conference On Green World In Business And Technology 2014 and Development of Client Server-Based Antivirus, Proceedings of the National Symposium on SNTT FGDT-PTM, 27 November 2013, University of Muhammadiyah Surabaya.