International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

http://ijpsat.ijsht-journals.org
Vol. 10 No. 1 August 2018, pp. 134-142

Shortest Path Finding of Secondary Schools in Langkat District Based on Dijkstra's Algorithm

Husnul Khair, Herman Mawengkang, Syahril Efendi, Andria Rezki

Faculty of Computer Sciences and Information Technology
University of Sumatera Utara

***Abstract* - In the area of LangkatDistrict, there are so many secondary schools, that people have problems in finding the location and path to these secondaryschools. The web-based Geographic Information System (GIS) can make it easier for users to access information on the location of secondary schoolsin finding the shortest pathby using the Web GIS platform –Google Maps based on DjikstraAlgorithm. Geographic Information System built with programming languages that use PHP and for MySQL databases, but it cannot be used in a graph whose path is negative. The results of the Djikstraalgorithm calculation, the initial path chosen is V1, PrumnasTaman Kw Damairoad, heading to V3, Perintis Kemerdekaan road, with a distance of 5 km, then passing the Kuala Begumit road with a distance of 2 km, then passing Tengku Amir Hamzah road to the Proklamasi road, with a distance of 9 km, the shortest path is 16 km. So it can be concluded that the shortest path to get to SMA N 1 Stabat is 16 km by passing through 4 roads.**

Keywords - Secondary school's location and shortest path, Geographic Information System, Djikstra's Algorithm.

I. INTRODUCTION

District education office hold responsible for Educational, Administrative and Legal activities monitoring for schools in District. It also assigns the school district numbers in the region, keeps the map of school districts, and determines what school district boundaries were intended when the boundaries were established. However, in its assignment, the education office has problems in finding the location of the secondary schools in Langkat District.

Thus the school location mapping is very important for the education office and also the community, because the duty of the education office is to find outlocation and thedistance measurements of secondary schools in Langkat District.

In Langkat District there are a large number of secondary schools so that many people have problems in finding locations and distance measurements to the secondary schools. For this reason, it is necessary to have a web-based Geographic Information System (GIS) that makes it easier for users to access information on the location of secondary schools anywhere with a shortest distance using Djikstra's algorithm based on WebGIS provided by GoogleMaps which can be accessed anywhere, anytime and by anyone.

This system provides information about the school (National school principal number, Name, Status, Address), information on the geographical location of the secondary schools, as well as determining several routes to the school. The community wants the shortest path to the location of the schools in Langkat District so that it can save time and costs.

The method used in shortest path finding to secondary schools location is by using Djikstra Algorithm, proposed by Edsger Dijkstra in 1959.Djikstra',which also called *Greedy Algorithm,*is one of the well-known algorithms for determining the shortest that considera graph consisting of edges and nodes and a source node as inputs. The algorithm finds the shortest path between twospecific nodes as well as the shortest path between a node and all other nodes in thegraph.

Corresponding Author: Husnul Khair

Thus the results in determining the location and also the shortest distance to the secondary schools are maps with the GoogleMaps platform. So when the public wants to find the location of the secondary schools, this geographical information system will display the distance to the location of the school, about the school and also the shortest distance to the location of the secondary schools in the Langkat district.

Basically, the term geographic information system (GIS) is a combination of three basic elements, system, information and geography. With the combination of the three basic elements it is very helpful in understanding GIS.

In the Indonesian dictionary, mapping or visualization is the expression of an idea or feeling using images, writing, maps, and graphics.

According to Suprastyo in www.gunadarma.ac.id, the map is "data in relation to aspects of spatial analysis. A set of special data analyzed into maps, so that the map is information ".

So it can be stated that mapping is a process that allows to recognize elements of knowledge and configuration, dynamics, reciprocal dependence and interaction. Knowledge mapping is used for the purposes of technology management, including the definition of research programs, decisions regarding activities related to technology, design, knowledge-based structures and programming education and training. The output of mapping is images, writings, maps, and graphs that provide the relationship between elements of knowledge.

The shortest path tree is constructed edge by edge and at each step one new edge is addedto the tree. Dijkstra's algorithm does not search along a possible path direction but ratherin all directions (Harrie, 2010). Different weights can be defined for edges which can belength, traveling time or any other thing based on the purpose of application.

Research problems

1. How to design a geographic information system in finding location of secondary schools in Langkat District?
2. How to determine the shortest distance to secondary schools in Langkat District by using the Dijkstra Algorithm?
3. How to find the location of secondary schools in Langkat District with PHP applications andGoogleMap platform?
4.

II. MATERIAL AND METHOD

Data collection techniques of this research are observation, literature study, interview. .

System requirements specifications used by the author are as follows:

1. Hardware
   a. CPU: Intel*(M)* Core I3
   b. Hard disc: 360 GB
2. Software
   a. Windows 7 Operating System
   b. GoogleMap
   c. Internet Explorer

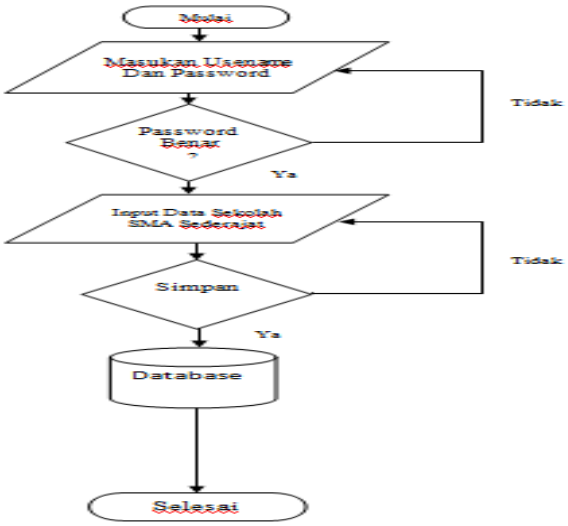


Figure 1. Flowchart Admin System SIG Location and Shortest Path Finding to Secondary Schools

III. RESULT

A. Graph Analysis of Dijkstra's Calculation

Suppose the Graph has an example graph with 6 Vertex 8 Edge as follows:

The stages of the Djikstra algorithm are as follows

1. Distance measurement starts from the first road to the last road.
2. Then a route was made between the two roads.

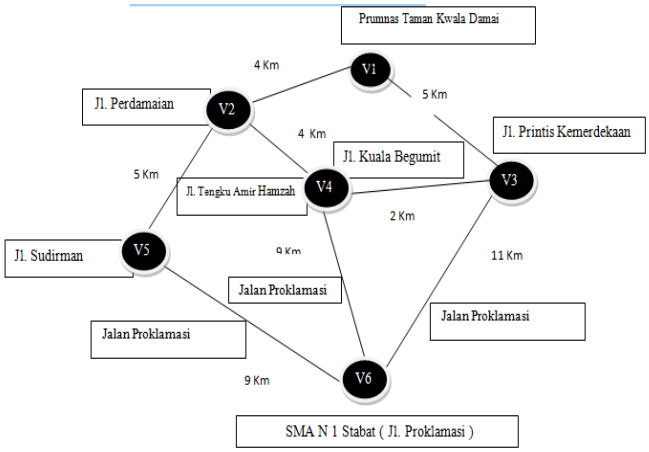


Figure 2 Weighted Graph G

3. Give the distance between the six cities as follows::

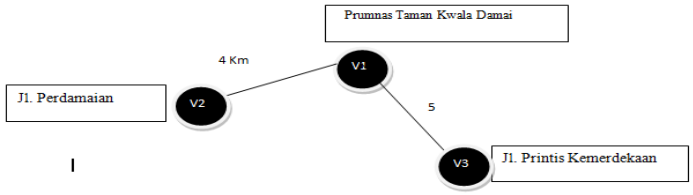
Start: Prumnas Taman Kwala Damai
End: SMA N 1 Stabat (Road Proclamation)

Table 1 Distance Measurement

Start	End	Pass Road	Distance
V1	V2	Perdamaian road	4 km
V1	V3	Printis Kemerdekaan road	5 km
V2	V4	Tengku Amir Hamzah road	5 km
V2	V5	Sudirman road	7 km
V3	V4	Kuala Begumit road	2 km
V3	V6	Proklamasi road	11 km
V4	V6	Proklamasi road	9 km
V5	V6	Proklamasi road	9 km

1. Shortest path finding calculation by using Djikstra Alogrithm:

Using the Djikstra algorithm, our first step is labeled V1 with λ (V1) = 0 and for each point V in graph G other than nodes, the point label V1 with λ (V1) = ∞ then T (V1, V2, V3, V4 , V5). We view T as a set of G points that have not been labeled permanently. So that the label from point G and set T can be seen on the label as follows.



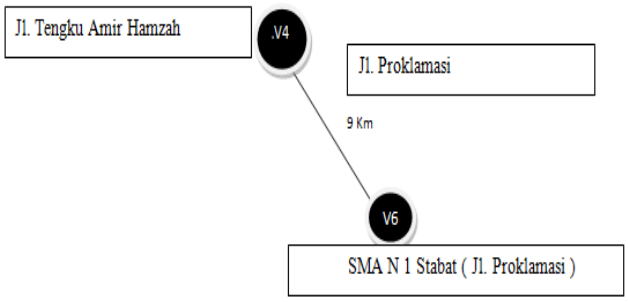
Vi Point	V1	V2	V3	V4	V5	V6
λ (v)	0	**4**	5	∞	∞	∞
T	-	V2	V3	V4	V5	V6

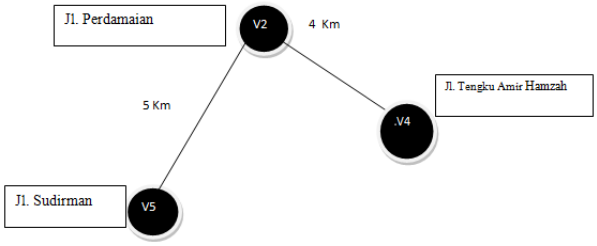
Vi	V1	V2	V3	V4	V5	V6
λ (v)	0	∞	∞	∞	∞	∞
T	V1	V2	V3	V4	V5	V6

Seen in the picture above, that point T which has a minimum label is V1 (Prumnas Taman KwalaDamai).

λ (V2: Perdamaianroad) = { ∞, 0 + 4 } = min{∞,4} = 4.
λ (V3 : Printis Kemerdekaan road) = { ∞, 0 + 5 } = min{∞,5} = 5.

So V1 as starting point, Prumnas Taman Kwala Damai, will pass V2, Perdamaian road, V3, Printis Kemerdekaan road. V2with infinity (∞) because the process is still not passed by V2 and V3. The value of 0 is the value of V1 which will be added to the distance that V2 will pass, with a distance of 4 km and V3, with a distance of 5 km. Min smallest infinity comparisonwith V2, 0 plus 4 is 4 km and and V3, 0 plus 5 is 5 km. Then the comparison results min the smallest value of V3 and V2, so the results of the calculation above are V1, Perdamaian road, with a distance of 4 km, as iteration 1 below:

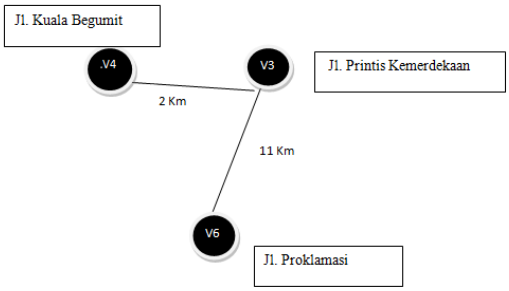




λ (V4) = { ∞, 4 + 4 } = min{∞,8} = 8 .
λ (V5) = { ∞, 4 + 5 } = min{∞,9} = 9.

So the V2, Perdamaian road will pass V4 , Tengku Amir Hamzah road, and V5 , Sudirman road. V2 with infinity because V4 and V5 have not passed. The value of V2 is 4, from the smallest value of path finding of V1, then summed with the distance that V4 will pass, with a value of 4 km and V5, with a value of 5 km it will get the results addition is equal to min infinity which is still empty. So min the comparison of infinity value of V4 is 4 plus 4 is 8 km and the infinity value of V5 is 4 plus 5 is 9 km. Then the result of the min comparisonbetween the V4 and the V5 is the V4, Perdamaian road, with a distance value of 8 km, as shown in the iteration 2:

Vi Point	V1	V2	V3	V4	V5	V6
λ (v)	0	4	**5**	8	9	∞
T	-	-	V3	V4	V5	V6



λ (V4) = { 8, 5 + 2 } = min{8,7} = 7.
λ (V6) = { ∞, 5 + 11 } = min{∞,16} = 16.

So V3, Perdamaian road will pass V4, Kuala Begumit road, V6, Perintis Kemerdekaan road. V4 with a value of infinity (8) because V2 has passed V4, so the smallest value of the iteration 1 has passed V4. V3, with a value of 5, summed with V4, with a value of km and V6, with a value of 11 km, the sum of the results is equal to min infinity V4, with a value of 8, because V4 was passed by V2. While infinity V6 has never been passed by V2, so the infinity is empty. So min comparisonof the smallest with value of infinity V4, with infinity value of 8, 5 plus 2 equals 7 km and the comparison of the smallest value of infinity V6, 5 plus 11 equals to 16 km. Then the min comparison of the smallest values of V4 and V5 is V4, Perdamaian road, with a distance value of 7 km. As shown in iteration 3 below:

Vi Point	V1	V2	V3	V4	V5	V6
λ (v)	0	4	5	**7**	9	∞
T	-	-	-	V4	V5	V6

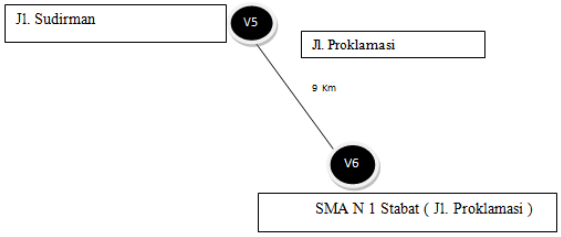
λ (*V6*) = { 16, 7 + 9 } = min{16, 16} = 16.

So V4 with a distance value of 7 km, the smallest value of the iteration 2, the V4 that has been passed by V3 only passes V6, with a distance of 9 km. Then V4 only passes V6. So infinity V4 already has value of 16, the smallest value of iteration 2 min comparison of the smallest value and V5, with infinity of 16, from 7 plus 9 equal to 16 km, because it cannot be compared because V4 only passes V6. Then the comparison results min the smallest value of infinity, with a value of 16 with V4 with the sum of 16, so the calculation above {min infinity equals 16, V4 = 16}, Tengku Amir Hamzah road, with a distance of 16 km with the same infinity as V4. So that iteration 4 is obtained as follows

Vi Point	V1	V2	V3	V4	V5	V6
λ (v)	0	4	5	7	**9**	16
T	-	-	-	-	V5	V6

IV. DISCUSSION

A. Interface



Because the point associated with V5 is permanent, then V5 is permanent. So that it gets the iteration 5, as follows:

Vi Point	V1	V2	V3	V4	V5	V6
λ (v)	0	4	5	7	9	**16**
T	-	-	-	-	-	V6

Because the point associated with V6 is permanent, the V6 label is permanent. As shown in iteration 5:

Vi Point	V1	V2	V3	V4	V5	V6
λ (v)	0	4	5	7	9	**16**
T	-	-	-	-	-	-

From the last table above we see that each point G has a Permanent label. Because the permanent label of V6 is λ (V6) = 16, the shortest pathfrom V1 to V6 in the weight graph G is 16. To determine the shortest path from V1 to V6 can be done with the return path finding, from V6 to V1.

λ (V6 : SMA N 1 Stabat(Proklamasi road) = 16 = 7 + 9 = λ (V4) + W (V4 V6),

λ (V4 : Tengku Amir Hamzah road) = 7 = 5 + 2 = λ (V3) + W (V3 V4),λ (V3 : Printis Kemerdekaan road) = 5 = 0 + 5 = λ (V1) + W (V1 V3),

That, λ (SMA N 1 Stabat (Proklamasi road) = W (V1 V3) + (V3 V4) + W (V4 V6)

So that we get a shortest path with a length of 16 from V4 to V6 in the weight graph G (V1, V3, V4, V6).

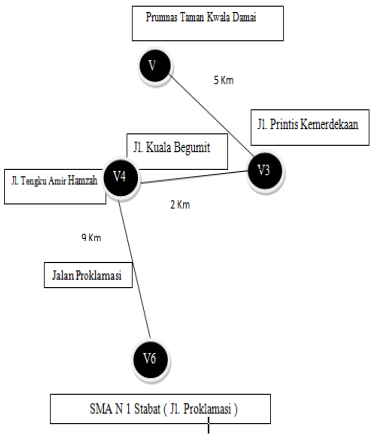


Figure 4 Shortest Path

So the result of the calculation of Djikstra Algorith, the initial path chosen was V1, Perumnas Taman Kw Damai road to V3, Perintis Kemerdekaan road, with a distance value of 5 km then passed Kuala Begumit road, with a distance value of 2 km, then passed Tengku Amir Hamzah road goes to the Proklamasi road, with a distance value of 9 km, that make the shortest distanceto get to SMA N 1 Stabat is 16 km by passing 4 roads to get to SMA N 1 Stabat.

B. Implementation

To search for the shortest path, what needs to be known is to know which path will be passed to get to the destination, which will be the starting position. Implementation is a continuation of system design. The steps in this stage are the sequence of activities from beginning to end of the system that has been designed.

The implementation of the system that was built from the writing of this article is a Geographic Information System for shortest path finding to get to secondary schools. This Geographic Information System has several forms, login for admin, main menu for users, secondary school data input for admin to manage new data.

C. Geographical Information System Main Page

This main page is the start page when the user uses a Geographic Information System to find the shortest path to get to secondary schools.

Figure 5 Geographical Information System Main Page

D. Data page for secondary schools.

This page is a data page for secondary schools in the district in the Geographic Information System to find the shortest path to get to the secondary schools.

Figure 6 The Main Page of a Geographic Information System

E. Secondary schools Shortest Path Search page

.

Figure 7 Secondary schools Shortest Path Search page

This page is the shortest path to get to secondary schools search page.

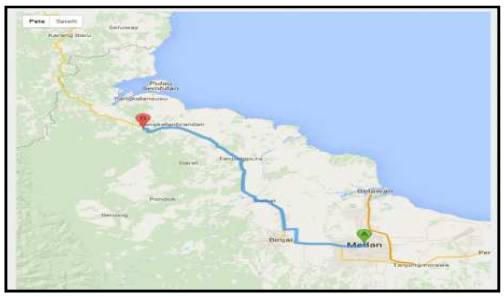


Figure 8 Shortest Path to get to secondary schools Search Results pageLogin Form

This form is an admin form to login to the page and for data entry, that only the admin has a username and password. The following is the login interface designed by the author:

Figure 9 Admin Login page

F. Data Input Secondary schools page

This page is a data input page for secondary schools in the designated district in the Geographic Information System to search for the shortest path to get to secondary schools.

Figure 10 Data Input page

V. Conclusions And Suggestions

A. Conclusion

Based on the analysis of the problem, the conclusion is as follows:

1. The dijkstra algorithm can be used to find the shortest distance optimally and the geographic information system has been analyzed using the Djikstra algorithm, only one path chosen is the shortest path to secondary schools.

2. By using this program can accelerate in determining the shortest path to the location of the Langkat district secondary schools.
3. This geographical information system application has provided some convenience in compiling maps dynamically so that if there is a change in conditions on the map, the program can adjust to new conditions.
4. This application is expected to be able to facilitate users who will go to the secondary schools efficiently and know which paths to go through.
5. With a map that can explain which paths to go through, this application is more appropriate to use.

B. Suggestions

From the conclusions above, the writer can provide suggestions that can be useful for the community and the authors are as follows:

1. For further research can be developed to make the user
   interface using touch screen technology, in the sense that the user can directly choose the location on the monitor.
2. We recommend adding more detailed information from each location and better information in the Geographic Information System to the shortest path finding of secondary schools of Langkat district.

REFERENCE

[1] .Eddy Prahasta, 2014. Sistem informasi Geografis Konsep-Konsep Dasar (Perspektif Geoesi & Geomatika), Edisi Revisi, Penerbit Informatika, Bandung

[2] http://repository.usu.ac.id/bitstream/123456789/11850/1/09E00045.pdf pukul 12.40 tanggal 14 Juli 2015

[3] http://www.gunadarma.ac.id/ pukul 12.20 tanggal 13 Juli 2015