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Application of the Dijkstra Method in the Geographic Information System of the Nearest School Route Based on Android

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Abstract

Klambir V Kebon Village, Hamparan Perak District, Deli Serdang Regency is one of the villages that has a variety of and quality education locations. To advance the world of education in the village of Klambir V, it is necessary to have information media that can take advantage of android smartphones. Therefore we need a geographic information system that produces information for directions to the closest location from where you live to an Android-based school. One of the methods used to find the closest route is the Djikstra method. This method can complete the search for the shortest path from an origin vertex to a destination vertex in a weighted graph. The result of this system is that with the application of finding the shortest path, the process of finding the nearest school can be accessed more quickly and with accurate information. The Djikstra algorithm used in the process of finding the shortest path is very helpful and easy to understand by the author. Distance information at each point becomes clearer and can manage the time in the school search process.

Keywords: Geographic Information System, School, Android Smartphone, Dijkstra

1. INTRODUCTION

Geographic Information System is a component consisting of software, hardware, geographic data and human resources that work together effectively to capture, store, improve, update, manage, manipulate, integrate, analyze, and display data in a geographic-based information(Rajagukguk and Panjaitan 2020; Sitohang and Indrayati 2020).

Education is the learning of knowledge, skills, and habits of a group of people that are passed down from one generation to the next through teaching, training, or research. Klambir V Kebon Village, Hamparan Perak District, Deli Serdang Regency is one of the villages that has a variety of and quality education locations. To advance the world of education in the village of Klambir V, it is necessary to have information media that can take advantage of android smartphones. Therefore we need a geographic information system that produces information for directions to the closest location from where you live to an Android-based school. There are several algorithms that can be used to determine the shortest path. One of them uses Dijkstra's algorithm. The algorithm is used to solve the shortest distance problem for a directed graph with non-negative side weights.

With the application of finding the shortest path, the process of finding the nearest school can be accessed more quickly and with accurate information. The Djikstra algorithm used in the process of finding the shortest path is very helpful and easy to understand by the author. Distance information at each point becomes clearer and can manage the time in the school search process.

2. METHOD

2.1 Geographic Information System

According to Adam Suseno & Ricky Agus (2012), Geographic Information Systems or abbreviated GIS in English Geographic Information System is a special information system that manages data that has spatial information (spatial reference). Or in a narrower sense is a computer system that has the ability to build, store, manage and display geographically referenced information or geospatial data to support decision making in planning and managing an area, for example data identified by location, in a database.

2.2 Metode Djikstra

The dijkstra algorithm (Jogiyanto, Hm. 2015) is a well-known type of algorithm used to solve problems related to simple optimization and as a solution to the shortest path problem for a directed graph with edge weights. which is positive. This algorithm was first discovered and applied by Edger W. Dijkstra. This algorithm looks for the shortest path in a number of steps based on the smallest weight from point to point. The path from the origin node must be the shortest path among all its paths to the vertices that have not been selected. In other words, the strategy of this algorithm is to take a path that has a minimum weight that connects a node that has been selected with a node that has not been selected. The path from the original node to the new node must be the shortest path among all its paths to all nodes that have not been selected.

3. RESULTS AND DISCUSSION

3.1 The Shortest Route Using Dijkstra's Algorithm

Dijkstra's algorithm is an algorithm to determine the shortest path between nodes based on the calculation basis "from one node to all nodes". Dijkstra's algorithm is included in the type of Link State algorithm, which pays attention to the total distance and route to be traversed. Basically, there are several main notations in working on Dijkstra's Algorithm:

For the initialization process, an array/set N is formed with s members (s is the symbol for a source node). The value of D is the distance that will be available in the algorithm results table, while C is the value of the distance on the available map. So at this initialization stage the value of Dj (the distance in the table results between node s and node j, where j is not equal to s) is entered in the actual value. If it is not connected directly it will be considered undefined. For the distance Ds, of course, the value is 0. For each row, node i is included which is not included in the array/set of N for later node i is used as an "extension" of node s, with node i also being a neighboring node of node s. Node i is included in the set N based on the smallest distance from node s. And if all nodes are included in the set N, then the iteration will stop. For each node j (in the result table: each column) the smallest value is updated, namely comparing the previous Dj value with the sum (Di+Cij), namely the sum of the distance from node s to node i with the actual distance from node i to node j.

Same network as the one in the last Bellman-Ford post:

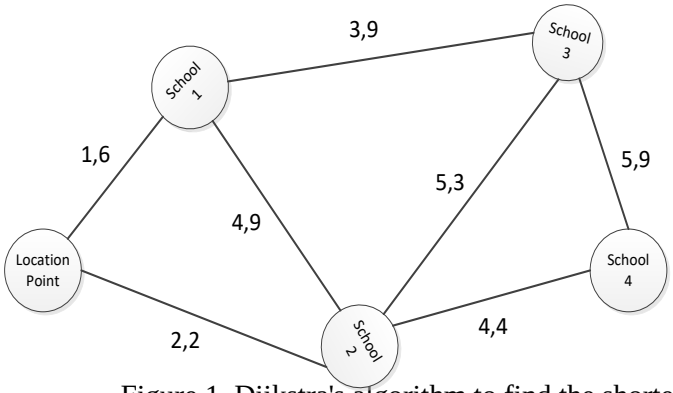

Figure 1. Dijkstra's algorithm to find the shortest path

In the dijkstra method, points or distances are used because the dijkstra method uses a directed graph in determining the shortest route.

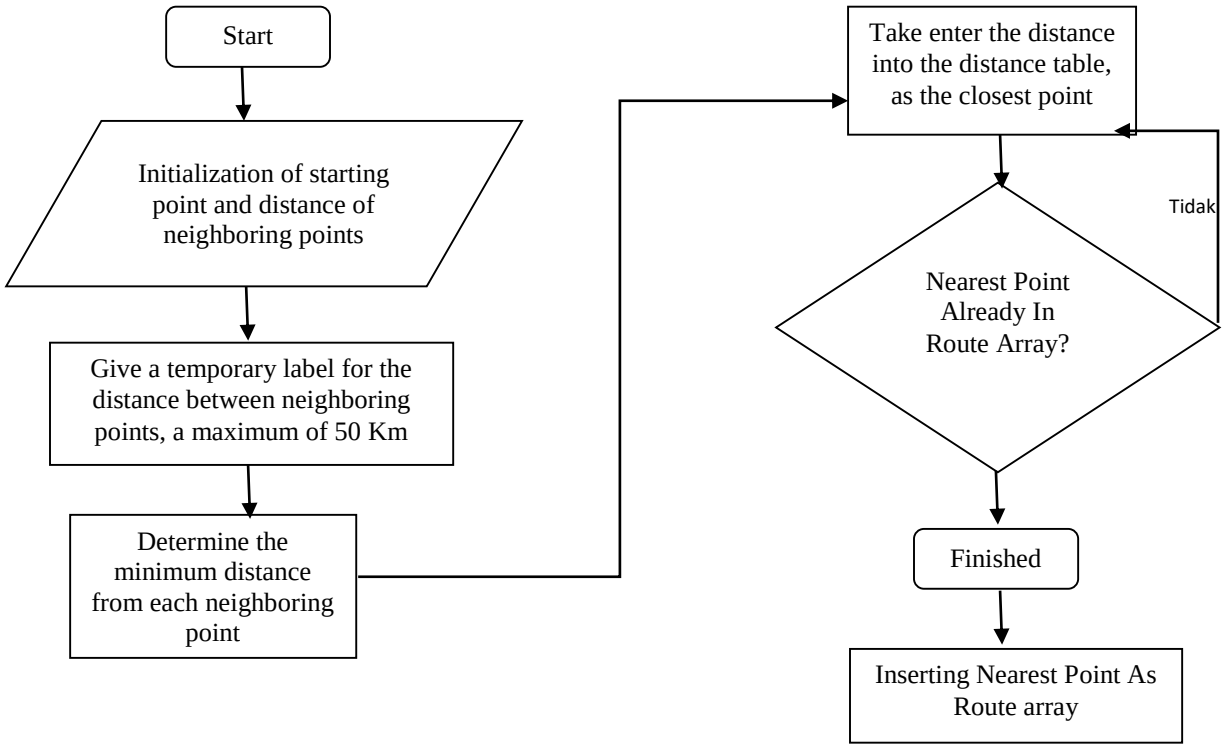

Figure 2. Dijkstra's Algorithm Flowchart

For example, we will use Dijkstra's algorithm to find the shortest path from our location point.
(The notation in the table of Dijkstra's algorithm has the closest path format, where distance indicates the route from the previous location to the next location. To make things easier, create a table like this:

1) The first line is still in the form of initialization, i.e. the user's location point will have a value if it is directly connected and has no value if it is not directly connected. Because the Location Point happens to only have 1 neighbor, namely passenger1, then the distance value = 2. The table below:

Location	Passenger 1	Passenger 2	Passenger 3	Passenger 4
Go - Jek	{Go – Jek, passenger 1}=1,6	{Go - Jek,passenger 2}= 2,2	{Go- Jek,passenger 1,passenger3} = 1,6 +3,9 =5,5	{Go - Jek,passenger 2,passenger 4}=2,2 + 4,4 = 6,6

2) The school has acted as an "extension" of my location source location, so that now the locations connected to the school can be "reached" by our location via passenger 1. It is known that passenger 2 and passenger 3 are directly connected to passenger 1, so the route is written (Point Location-passenger 1 - passenger 2) and (Go - Jek - passenger 1 - Passenger 3). can be seen in the table below:

Location	School 1	School 2	School 3	School 4
Location Point	{Location Point ,School 1}=1,6	{Location Point ,School 2}= 2,2	{Location Point ,Majestyk1,School 3}=1,6 +3,9 = 5,5	{Location Point ,School 1,School 3,School 4}= 1,6+3,9+5,9 = 11,4
Location Point ,School1	{Location Point ,School 1}=1,6	{Location Point ,School1, School2}=1,6+4,9 = 6,5	{Location Point,School1,School 3=1,6 +3,9 = 5,5	{Location Point, School 1,School 3,School ,4} = 1,6 + 3,9 +5,9 = 11,4

3) For the next step, the distance that has been connected to other distances is selected but has not been included in the set of distances. It is known that Schools and Schools 3. The distance chosen is School2 to School3. So it can be seen in the following table:

Location	School 1	School 2	School 3	School 4
Location point	{Location Point ,School1}=1,6	{Location Point,School2}= 2,2	{Location Point,School1,School3}=1,6 +3,9 = 5,5	{Location Point,School1,School3,School4}= 1,6+3,9+5,9 = 11,4
Location Point,School1	{Location Point,School1}=1,6	{Location Point,School 1, School2}=1,6+4,9 = 6,5	{Location Point ,School1,School3=1,6 +3,9 = 5,5	{Location Point,School1,School3,School4}= 1,6+3,9+5,9 = 11,4
School2,School3	{School1,School2,School3}= 4,9+5,3 = 10,2	{School1,School2,School3}= 4,9+5,3 = 10,2	{School1,School2,School3}= 4,9+5,3 = 10,2	{School1,School2,School3,School4}= 4,9+5,3+5,9 = 16,1

School1→ School3= 3,9
School2 →School3= 5,3
Location School ke School2 = the path {Location School,School1,School2}1,6+4,9=6,5
Location School ke School3 = the path chosen is the minimum {Titik Lokasi,School1,School3}1,6+3,9=5,5
While the closest location is School 1.6 because the distance between Location School to School {Location School,School1} = 1.6 is the closest distance.

4. CONCLUSIONS

Based on the results of the application of the shortest path search design using the Dijkstra algorithm, several conclusions were obtained as follows:.

1) In accordance with current technological developments, the development of information systems has led to a more accurate geographic information system
2) Dijkstra's algorithm used in the process of finding the shortest path is very helpful and easy to understand
3) Information on the distance of each point becomes clearer and can set the time in the process of searching for the nearest school

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