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COMPARISON OF DJIKSTRA ALGORITHM AND SPANNING CYCLE DETERMINING SHORTEST PATH

Erwin Panggabean[1*], Desi Vinsensia[2], Wanra Tarigan[3], Logaraj [4], Tiara W Pratiwi[5]
[1]Information Technology, STMIK Pelita Nusantara
[2] Management Of Informatics, STMIK Pelita Nusantara
[3]Information Systems, Universitas Mandiri Bina Prestasi
[4]Software Engineering, STMIK Pelita Nusantara
[5]Informathics of Engineering, STMIK Pelita Nusantara Medan
email:*erwinpanggabean9@gmail.com

Abstract: Problems that often occur in people with the growth and development of urban areas that change very quickly cause the movement of people or road users to become chaotic as in the Municipality of Medan. People in carrying out their daily activities are directly influenced by irregular patterns of human movement, in this case what is meant is an increase in congestion, delays, and others. Therefore we need a system that can make it easier for humans to use road facilities, namely a geographic information system to determine the shortest path using the djikstra method and spanning cycle using graphs as a branch of mathematics and computer science. This research activity plan is carried out in the Medan city area using spatial image data from the Medan city map, spatial data based on google maps, and attribute data. a branch of mathematics and computer science. This research activity plan is carried out in the Medan city area using spatial image data from the Medan city map and spatial data based on google maps. The final result of the research that is expected is that the results of the comparison of the two algorithms are obtained according to the spatial data used, and the results of the research will be published in an accredited national journal article with sinta 4 or better.

Keywords: comparative of djikstra and spanning cycle method; shortest path; spatial data

Abstrak: Permasalahan yang sering terjadi pada masyarakat dengan pertumbuhan dan perkembangan kawasan perkotaan yang berubah sangat cepat menyebabkan pergerakan masyarakat atau pengguna jalan menjadi semrawut seperti di Kotamadya Medan. Masyarakat dalam melakukan aktivitasnya sehari-hari secara langsung dipengaruhi oleh pola pergerakan manusia yang tidak teratur, dalam hal ini yang dimaksud adalah peningkatan kemacetan, keterlambatan, dan lain-lain. Oleh karena itu diperlukan suatu sistem yang dapat mempermudah manusia dalam menggunakan fasilitas jalan yaitu sistem informasi geografis untuk menentukan jalur terpendek dengan menggunakan metode djikstra dan spanning cycle menggunakan graf sebagai cabang dari matematika dan ilmu komputer. Rencana kegiatan penelitian ini dilakukan di wilayah kota Medan dengan menggunakan data citra spasial dari peta kota Medan, data spasial berbasis google maps, dan data atttributnya. Hasil akhir dari penelitian yang diharapkan adalah diperoleh hasil perbandingan kedua algoritma sesuai dengan data spasial yang digunakan, dan luaran hasil penelitian akan dipublish pada artikel jurnal nasional terakreditasi sinta 4 atau yang lebih baik.

Kata kunci: data spasial ; jalur terpendek;perbandingan metode djikstra dan spanning cycle

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INTRODUCTION

In the shortest path routing process to find a path through the path of the road with the minimum distance, globally it is fundamental for road users to take advantage of current information systems about roads [1]. Computer science is a branch of science that discusses the utilization and use of geographic information systems (GIS) where in integrating GIS embraces and represents several other types of computer-based systems.GIS uses computer technology, remote sensing, and databases to integrate, store, display, delete, and update information that exists in an area, environment, and characteristics that follow a geographic area [2].GIS is very useful and can be utilized by various occupations, or events such as archeology [3], On the types of agriculture [4],[5], defense and security [6], health [7], forestry [8], and others, also can be used especially for road project developers and changes in certain urban areas in Indonesia and many other cities.GIS can answer common questions and complexities that occur in an agency, because GIS has been able to support better decision making. For example, what can be made on the basis of GIS is to find out information about the location of the shortest path in an area. The shortest path problem is to find a path between two vertices on a certain path [9] [ENTROPY]. An example that we can see in everyday life is the distribution of goods to agents and wholesalers in distributor companies can be described as an iterative cycle. A path graph is said to be the best path if there is a cycle or path that visits exactly every point once (except the starting point is the same as the end point) and must be a connected or closed graph path [10].

By describing the spanning cycle of the graph can be obtained the path of goods distribution activity above. It can also be used in other fields, such as travel of a mailman, transportation route, the construction of telephone network or computer network and others. On the basis of that the researcher took the topic of "Analyze the comparison of methods djikstra and spanning cycle method to determine the shortest path".

METHOD

To get a comparison of the djikstra algorithm with the spanning cycle, determine the shortest path, experimental design with a science approach approach is used, and apply the trajectory calculation formulas into program codes according to the research form_project used in accordance with the selected programming language. The flow chart of the research plan in image 1 includes: The process of identifying spatial data and attribute data from the thematic terrain of the terrain, Tracing research on the use of the shortest path with various methods or algorithms, Creating research concepts, Creating research architecture, Making journal articles and Publishing journal articles to a nationally accredited journal, or better.

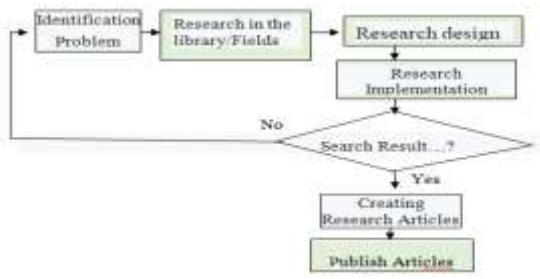

Image 1 Research Method Flowchart

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Djikstra's shortest path system design, and spanning cycle.

The design of the system built in accordance with the research conducted consists of:

Designing for the Dijkstra's Algorithm project form design.

Form_project design is the first step in the development stage of computer-based systems engineering, and is the process of using various principles and techniques to define a device or system of input, process and output data to a certain detail to enable its physical realization, to be formed as a whole. Form_project design is also an activity that emphasizes basic and often structural decision making, but in this research semi-structural or semi-object-based research is used. The design of the continuous form_project system will experience changes depending on the programming language tools used, and also marked by the use of new methods, better analysis and broader concept understanding. In general, the GIS form_project design can be divided into two main components: the GIS software design on the spatial data side and the GIS systems design on the attribute data side. To design GIS software requires extensive technical knowledge of data structures, computer programming data models, and databases.

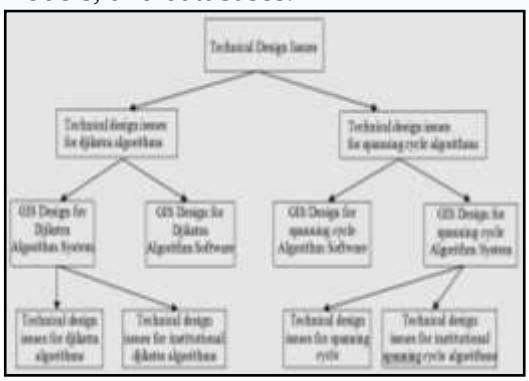

Image 2. GIS Design Component

The design of geographic information systems emphasizes the interaction factors that occur between humans as individuals, groups and computers as system components, each of which has its own function [14]. GIS design can be divided into two component parts, namely internal technical design and external design. Internal design is concerned with database and system functionality (see image 2). The system designer must ensure that the system functions according to the structure of the geographic information system design components that are built.

Technical design cannot be separated from the functionality contained in the composition of the GIS design components in image 2. In the previous section, the graph problem and the shortest path have been explained, that in some problems with the shortest path, GIS can be said to be successful in terms of technical design although it may still fail to get support from its internal or external environment. To solve the problem of the shortest route in particular, and the problem of finding the shortest path, it turns out that technical design problems can also be applied to mapping problems, where when looking at a map you want to find the starting location and then look for the final location to get the shortest path to the intended end point [15]. In the previous explanation that the system used in this study inputs the distance value from the starting point to the end point, then adjusts to the map data of the Medan city area, the system will calculate and display the data for the shortest path or path from the selected road. In accordance with the address, street name and also the path or path as well as the length of the path that is processed by a system that applies the dijkstra method

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or and spanning cycle algorithm. To get the desired result, for example to get the shortest path from a certain road location and the length of the road you want to know, this can be obtained easily because the system will be connected directly to mapinfo professional and visual/map-basic programming that supports the operation of geographic information systems that used. In this system, paths or roads and maps will be displayed as interactive displays that can be directly clicked by the user in an area that is known for the distance value on the map, namely as the result of finding the shortest path from the desired path. In this system, nodes or points are representations of trajectory, so that in the use of road trajectory data, the system requires the input of a starting point and an end point, to form a graph. After the graph is formed, by clicking and dragging on each inputted vertex, the next step is to determine the weight of each edge by filling in each existing GridInput field as in the example data table 1.

Table 1. Input data grid

Nomor	Path	Input Bobot
1.	D < -- > E	7
2.	A < -- > E	4
3.	A < -- > B	6
4.	B < -- > C	9
5.	C < -- > G	12
6.	F < -- > G	5
7.	D < -- > F	10
8.	B < -- > E	12
9.	E < -- > G	12
10.	C < -- > E	13
11.	E < -- > F	7
12.	A < -- > D	8
13.	B < -- > D	6
14.	C < -- > D	5

This means that if the user inputs trajectory distance data and selects or clicks on the trajectory on the system application map, then the user has selected the trajectory or Road object which is located in accordance with the object above the earth's surface to be worked on and processed by the computer.

To match user expectations for a system that applies the djikstra method or and spanning cycle algorithm, the system will respond to the user's actions by displaying a thick green line, which is a line that occupies the location of the user-selected path on a road or on a map, and retrieves further road data such as length and connects it to another road which will be processed according to the user's request.

The djikstra and spanning cycle geographic information system will find out what the user wants, the system will read the selected cursor position, then the system will print the path data to the shortpath file one by one, whether the position selected by the user is the same as the data position row (each data consists of start point and end point). More specifically, the gradient (slope = y(x)) of the starting and ending points must be the same as the gradient of the starting point selected by the user on the map display on the computer screen, that the cursor position must lie in the polygon plane formed from the area corresponding to the point. on a map that is processed by the djikstra and spanning cycle methods. The parameters used are taken from the variable containing the trajectory in the form of the side (vertex) to be compared. Each side of this route is a pair of vertices(u,v) representing the relationship from node u to node v. The set of all edges we call E. The weights of

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all sides are calculated by the djikstra method or the algorithm formula:

W : E → ∅0 ……(1)

Math formula 1 Calculation of weights in the dijkstra algorithm.

So, w(u,v) is the non-negative distance from vertex u to vertex v. The cost of an edge can be thought of as the distance between two vertices, i.e. the sum of the distances of all sides in the path[9]. For a pair of vertices s and t in V, this algorithm calculates the shortest distance from s to t [16]. Spanning Cycle is a method or algorithm that can be used to calculate the shortest path between two vertices and an arc which is generally expressed as G = (V, E), where: G = Graph V = Node, or Point, or Vertex, or Node. E = Arc, or Side, or Edge, or arc Or Graph is a pair of V[G] and E[G], where V[G] is a non-empty set whose members are vertices and E[G] is a set whose members are The lines are called sides or sides.

RESULT AND DISCUSSION

The results and discussion were obtained through testing and applying the djikstra system and the spanning cycle to determine the shortest path, The explanation can be seen in image 3, image 4, image 5, image 6 and image 7.

Result and Implementation of Djikstra Algorithm.

Image 3 describes the implementation of the Djikstra algorithm using the Jln. Gaperta data spasial as the starting point and the Jln. Diponegoro the end point.

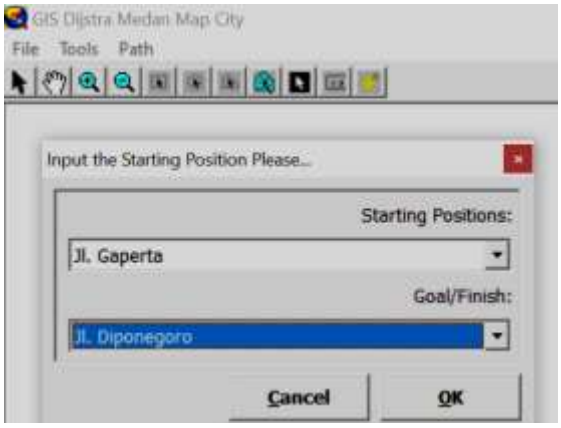

Image 3. Implementation of djikstra algorithm.

Image 4. Results Map or Display of the Djikstra Algorithm Shortest Path System

Image 4 explains the results of the calculation process by the djikstra system on the road spatial data that to be used, then displays it in the form of a thick green line, so that it is different from other lines on the map.

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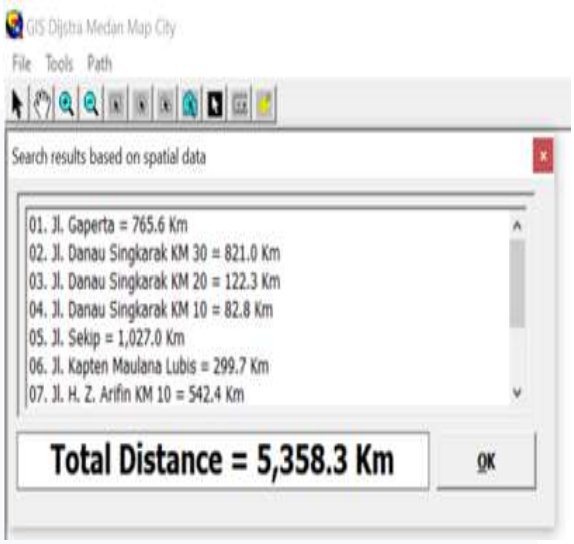

Image 5 describes the results of calculating the shortest path from the starting point of Jln. Gaperta to the end point of Jln. Diponegoro, Medan City. Which is = 5,358.3 KM

Spanning Cyce Algorithm Results:

Non directional graph test

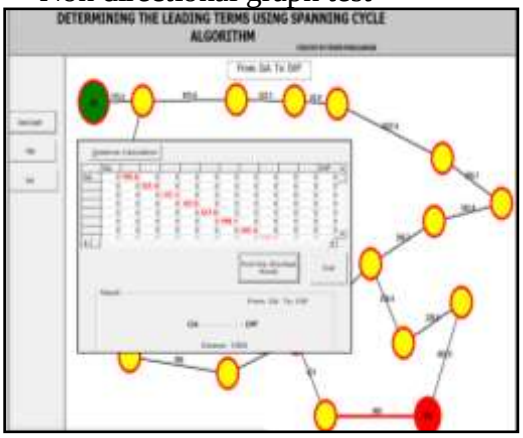

Image 6. The test on the graph is not directional

The result obtained from image 6 is 12,832 Km, between points or the same spatial data in the djikstra algorithm as data sampling throughout the city of Medan.

Test on directed graph

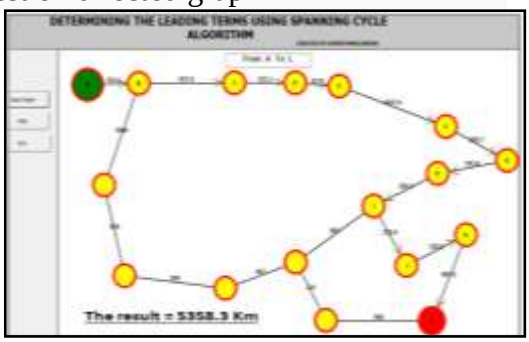

Image 7. Implementation of the spanningcycle algorithm with a graph that has direction and weights.

In Figure 7, it can be seen that, if the data used is the same spatial data in the image 5 directed and weighted djiktra algorithm, the calculation result of the spanning cycle system is 5,358 Km.

Information:

=A = Jl. Gaperta Medan,
=L = Jl. Diponegoro Medan.

CONCLUSION

The djikstra algorithm and the spanning cycle algorithm can be used properly to determine the shortest path on a path in the city of Medan, Indonesia. The results of the calculation of the shortest path search using GIS spatial data from Jl. Gaperta to Jl. Diponegoro city of Medan using the djikstra algorithm, and spanning cycle on a directed graph obtained the same results, namely 5,358 Km, If the graph is not directed then the calculation results using the spanning cycle algorithm = 12,832 Km, So that the comparison of the djiktra algorithm with the spanning cycle is obtained when calculating the shortest path distance or the shortest path of an undirected graph.

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