Android GIS-Based Information System Applying Dijkstra Algorithm For Finding The Nearest Tourist Spots in Sumenep District

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***Abstract*— Sumenep is listed in the eastern end of Madura Island. It takes more than four hours to reach Sumenep by bus or taxi from Surabaya. Sumenep has some interesting sites to visit. Besides historical sites like Kraton, Traditional Art and Cultural Attractions as Mask Dance and Bull Race, it also has beautiful beaches to see, such as; Lombang beach, Slopeng beach, Sembilan beach, Gili Labak and Gili Iyang which have the best oxygen levels in the world. However, mostly first visitors have a little bit difficulty to get information about it because the lack of detail information and schedule when the even held. In order to give brief information about it, researcher conduct the study which build an Android-based Geographic Information System using the *Dijkstra Algorithm*, which is expected to help them in displaying routes from one tourist spot to another. The Author applied the shortest route search algorithm, Dijkstra's algorithm, because this method can calculate the closest distance, both the distance between one tourist spot to another tourist spot, as well as the distance between the position of the user to the tourist place in the city of Sumenep.**

Keywords : Dijkstra Algorithm, Geographic Information System, Graph Method

I. INTRODUCTION

Tourism sector in Sumenep is one of the mainstay sectors of economic activity which oriented to expanding employment opportunities. In line with the efforts of Sumenep city, government builds insfrastuctures in achieving development goals. It is now to be one the most desirable city in Tourism in East Java, and it is estimated that the number of tourists who are accessing tourism places and businesses will increase every year. However, travelers from others places have a little bit difficulty in accessing the tourist attractions because they do not know them in detail. So that, we need to design an information service which can be accessed through android media and give information about tourism events. Sumenep, generally has interesting variety of tourism objects, including: racing bull, Asta Tinggi Lombang Beach, Slopeng Beach, Gili Genteng Island, Ambunten Beach, Bukit Kapur, and the most recommended places like Sembilan beach, Gili Labak Island, Gili Iyang Island. The application of Android-based mobile Geographic Information System (GIS) is one of the steps or ways to help tourists in accessing tourist attractions. This application will be designed as a useful technology; so that, users can access and obtain navigation of tourist routes in Sumenep easily, through an Android mobile device by implementing the Dijkstra algorithm.

II. LITERATURE REVIEW

A. Android

Android is a mobile operating system developed by Google, based on a modified version of the Linux kernel and other open source software and designed primarily for touchscreen mobile devices such as smartphones and tablets. Android operating system is one of the most widely used operating system based on the Linux kernel and currently developed by Google. Android is a software bunch comprising not only operating system but also middleware and key applications [6]. Variants of Android are also used on game consoles, digital cameras, PCs and other electronics. Android is also associated with a suite of proprietary software developed by Google, called Google Mobile Services (GMS) that very frequently comes pre-installed in devices, which usually includes the Google Chrome web browser and Google Search and always includes core apps for services such as Gmail, as well as the application store and digital distribution platform Google Play, and associated development platform. These apps are licensed by manufacturers of Android devices certified under standards imposed by Google, but AOSP has been used as the basis of competing Android ecosystems, such as Amazon.com's Fire OS, which use their own equivalents to GMS.

B. *Global Positioning System*

A GPS receiver shows where it is. It may also show how fast it is moving, which direction it is going, how high it is, and maybe how fast it is going up or down. Many GPS receivers have information about places. GPSs for automobiles have travel data like road maps, hotels, restaurants, and service stations. GPSs for boats contain nautical charts of harbors, marinas, shallow water, rocks, and waterways. Other GPS receivers are made for air navigation, hiking and backpacking, bicycling, or many other activities. The majority are in smartphones. Most GPS receivers can record where they have been, and help plan a journey. While traveling a planned journey, it predicts the time to the next destination. GPS system, whose real name is NAVSTAR GPS (Navigation Satellite Timing and Ranging Global Positioning System), has three segments, namely: satellite, controller, and receiver / user. GPS satellites that orbit the earth, with orbits and fixed positions (exact coordinates), totaling 24 in which 21 active works and the remaining 3 are reserves. A GPS unit takes radio signals from satellites in space in orbit around the Earth. There are about 30 satellites 20,200 kilometres (12,600 mi) above the Earth. The orbital period is 11 hours and 58 minutes. Each circle is 26,600 kilometres (16,500 mi) radius due to the Earth's radius. Far from the North Pole and South Pole, a GPS unit can receive signals from 6 to 12 satellites at once. Each satellite contains an atomic clock which is carefully set by NORAD several times every day. The radio signals contain information about the time and position of the satellite, including its ephemeris. The GPS receiver subtracts the current time from the time the signal was sent. The difference is how long ago the signal was sent. The time difference multiplied by the speed of light is the distance to the satellite. The GPS unit uses trigonometry to calculate where it is from each satellite's position and distance. Usually there must be at least four satellites to solve the geometric equations. A GPS receiver can calculate its position many times in one second [10].

C. *Dijkstra's Algorithm*

Dijkstra's algorithm is a greedy algorithm for solving single source shortest path problem that provides us with the shortest path from one particular source node to all other nodes in a given graph. This algorithm can be applied for both directed and undirected graph, but graph must be connected and no negative weight must exist. In this case, the algorithm is quite efficient. Since there are no non-negative weight cycles, there will be a shortest path whenever there is a path [5]. The workings of the Dijkstra algorithm are almost the same as the way the BFS algorithm works by using the principle of queuing, but the queue used by the Dijkstra algorithm is the priority queue. So only the node that has the highest priority will be traced. In determining priority nodes, this algorithm compares each value (weight) of nodes at one level. Furthermore, the value (weight) of each node is saved to be compared with the value to be found from the newly discovered route, and so on until the node found is found. This algorithm was chosen in this study because it can determine the shortest path from the graph and can provide the right solution in finding the fastest route to get to tourist sites in Sumenep.

III. METHODOLOGY

In this paper, Dijkstra algorithm is been used to search the shortest route location of tourist attractions in Sumenep. Dijkstra algorithm is a greedy algorithm for solving single source shortest path problem that provides us with the shortest path from one particular source node to all other nodes in a given graph. This algorithm can be applied for both directed and undirected graph, but graph must be connected and non-negative weight must exist. In this case, the algorithm is quite efficient. Since there are no non-negative weight cycles, there will be a shortest path whenever there is a path[5]. The flowchart to find shortest path using

Dijkstra algorithm are as follows :

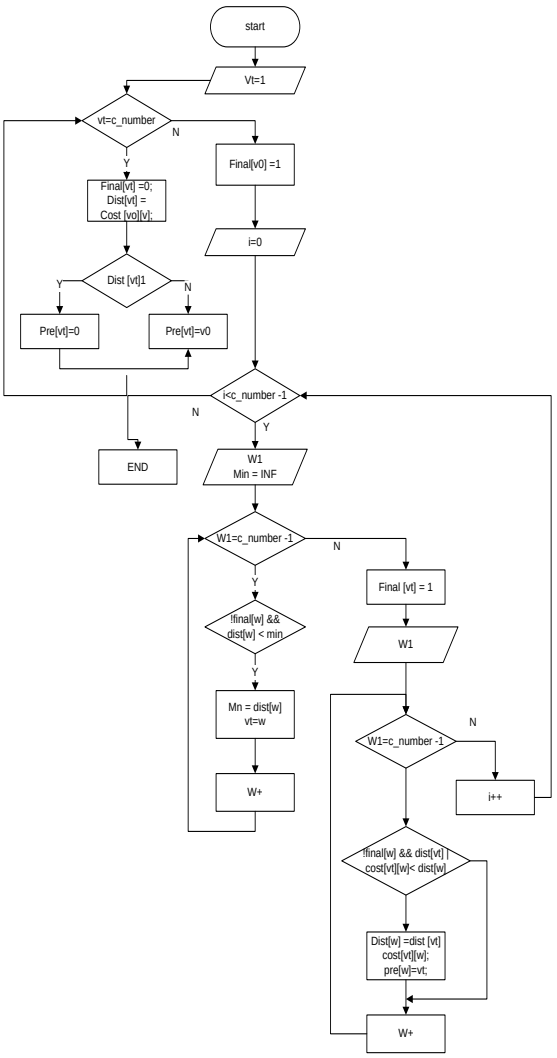

Fig. 1. Flowchart of Dijkstra Algorithm [9]

Example of solving a guide case for the nearest tourist location in Sumenep Regency, shown in Fig.2:

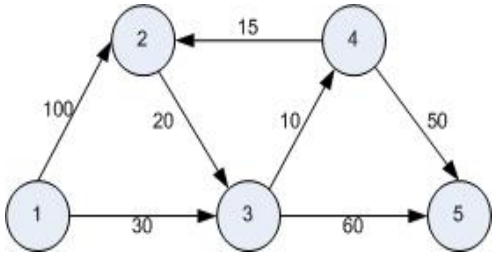

Fig. 2. Shortest path for Sumenep Tourism Locations

The following is a description of Fig. 2 about solving a guide case for the nearest tourist location in Sumenep Regency :

node 1 = Daramista High Hill
node 2 = Telaga Kermata Tourism
node 3 = C-One Hotels
node 4 = Asta Tinggi Tourism
node 5 = Lombang beach

With the Location Guide using Dijkstra's algorithm to go Bukit Tinggi Daramista to Telaga Kermata Tourism (1 to 2) is selected with the shortest route 1-3-4-2.

IV. RESULT

A. Testing Program

This trial to test the applications made in this study can be seen in Fig. 3.

Fig. 3. Main Menu

Figure 3 this is starting the application to run. Users must register first to be able to access this application. After successfully logged in, the tourists will go to the home page which has a contain some menu and select them options, namely Culinary Tourism, Hotels, Tourism Objects, Beach Tourism and a Madura souvenir center, which can be seen in Fig. 4.

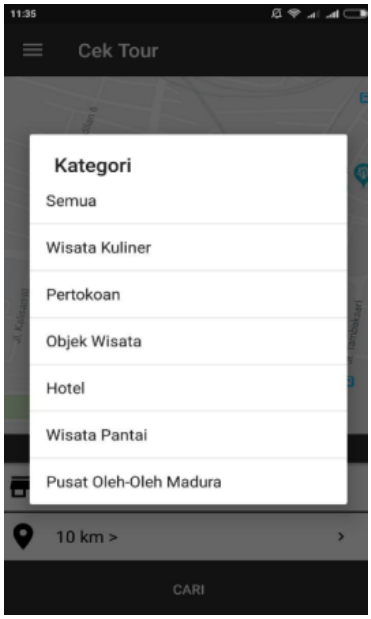

Fig. 4. Tour Menu

Further, in this information on the tourist category will be displayed and searched based on the closest radius. After pressing the search button, the application will automatically display tourist data on maps, as shown in Fig. 5.

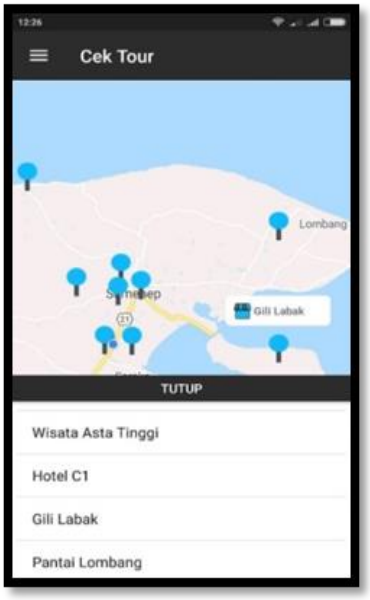

Fig. 5. Tourist Location Information

After the image of the tourist icon is selected, it will display tourism objects or beach tourism rides which available in them, if tourists want to know the package information available in the tour such as Gili Labak tourist attraction, they

can click on the Gili Labak tourist icon image in the application, then it will be displayed as in Fig. 6 below.

Fig. 6. Gili Labak Information

B. *Simulation Result*

The results are made to prove and show that the application which developed has accordance with the goal of development and able to fulfil user needs. Besides that, this test also shows that the application has passed the error according to the case at the testing stage. following is the result of route validation For the Tourist Location Guide base on comparison with Using the Dijkstra Algorithm and Googgle Maps view.

1) Comparison of Routes from Surabaya to Asta Tinggi (Sumenep Religious Tourism Objects) using Maps Googgle view & Dijkstra Algorithm

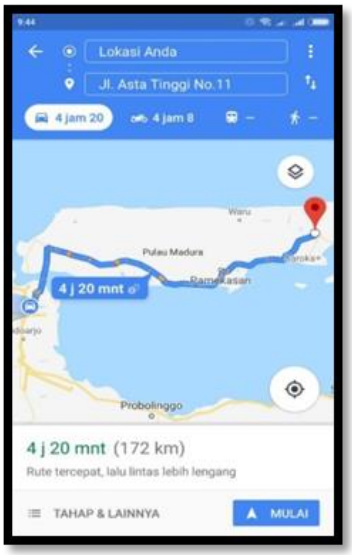

Fig. 7. Route of The Map View

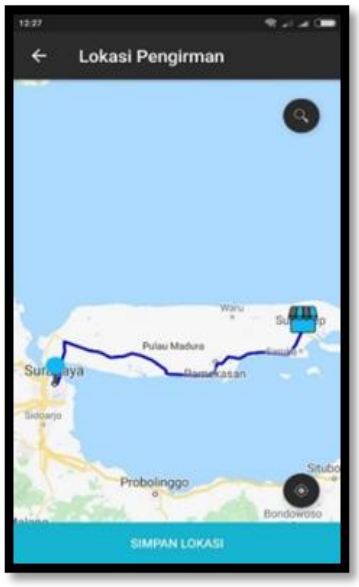

Fig. 8. Route Route of Djikstra

2) Positioning Comparison of Routes from Highway Lenteng Square to Asta Tinggi Religious Tourism using Maps Googgle view and Dijkstra Algorithm.

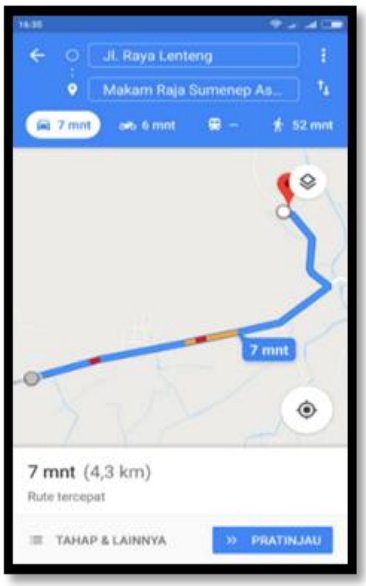

Fig. 9. Route of The Map View

C. *Test Result*

Testing "Application Guide for Searching for Nearest-Based Android Gis Tourists With the Dijkstra Algorithm" will be tested by a comparison method between the distance of the nearest route using the dijkstra and using map view as shown in Table 1 below.

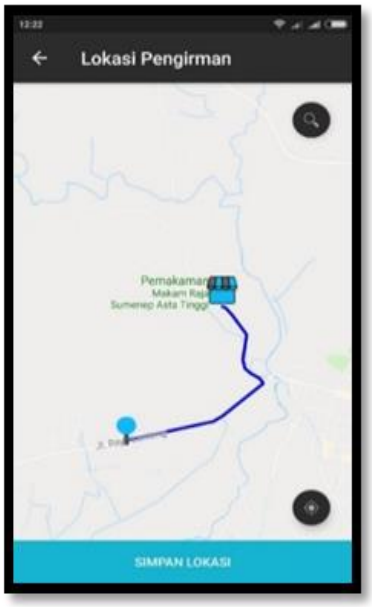

Fig. 10. Route of The Dijkstra Algorithm

TABLE 1. Recapitulation of System Test Results

No	Search The Nearest Tourist route	Distance of The Dijkstra Algorithm	Distance of The View Map
1	From Surabaya To Asta Tinggi	172 km	173 km
2	From Highway Lenteng Square to Asta Tinggi Religious	4.2 km	4.1 km
3	From C1 Hotel to Daramista High Hill	5.4 km	5.2 km
4	From Lombang Beach to Musdalifah Hotel	11 km	10.9 km
5	From Telaga Kermata To Sembilan Beach	24 km	24 km

From the test results can show that the application is suitable for tourist or visitor from other places to give route to get the tourism spots. And give alternative tourism where do not know before. The search of nearest tourist route by Dijkstra algorithm and map view. Comparing the distance of two algorithms, Dijkstra's algorithm is more least distance than view map. Result From Comparisions of the such method shown with comparative graphics that can be seen in Fig. 11.

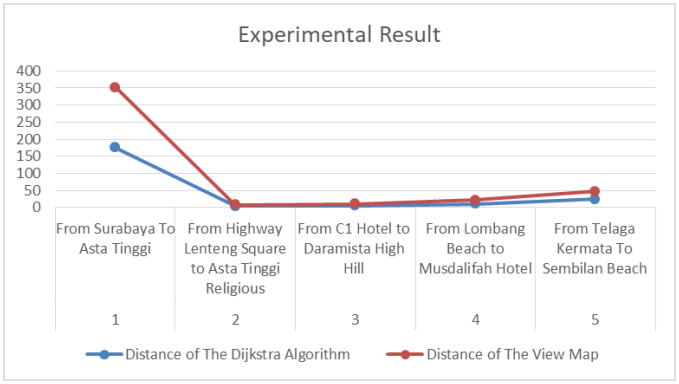

Fig. 11. Comparative Analysis of Algorithm

V. CONCLUSION

Based on the results of the evaluation of the research on the Making of Android Applications for the Nearby Tourism and Culinary Guide in the Sumenep, that was developed, it can be concluded that this application is very helpful for tourists in knowing tourist locations and other service information products.

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