Development of The Nearest Tourism Determination Application using Dijkstra Algorithm

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ABSTRACT

By applying information and communication technology, an application can be developed that can help tourists determine the fastest route to reach tourist destinations, to avoid wasting time on trips. This study aims to create a prototype mobile application that can help tourists determine the path with the shortest route to tourist attractions. The research was carried out by using the Dijkstra algorithm and web service to access the tourism database in Bantul Regency, Yogyakarta Special Region as a case study. The fastest route generated by this application is compared to the route suggested by Google Map with a result of 7.24 km and 7.4 km. From the results of these comparisons it can be concluded that the application can determine the closest route from the various alternatives available.

Keywords: dijkstra algorithm, nearest route, tourist destination, web service

INTRODUCTION

The development of the tourist industry is fast now. Information and communication technology (ICT) has made it easy for all parties to disseminate information about the beauty and attractiveness of tourist attractions. There are so many tourist objects and places that can be visited and enjoyed by tourists, often not worth the free time they have. This problem is compounded by heavy traffic that blocks and increases travel time to tourist attractions. So it needs an effort to better manage travel timeThe need to get the shortest route is felt by tourists who will want to get to the tourist attractions in the middle of the crowded city traffic. There is an urgent need to improve management efficiency and modernize the tourism industry standard by implementing a geographic information system (GIS). The application of GIS will affect the management of tourist trips carried out effectively (Wei Wei, 2012).

GIS is an emerging science that unites geography, computer science, mathematics, statistics, management, surveys, and mapping knowledge into one. Based on geospatial data, supported by computer hardware and software, GIS collects, manages, models, and displays spatial data. A GIS is designed to work with data referenced by spatial or geographic coordinates (Ram Jethmalani C. Hemparuva, Sishaj P. Simon, Sundareswaran Kinattingal, and Narayana Prasad Padhy, 2018). GIS can analyze and visualize information related to Geography (Yusuke Kakumoto, Yuki Koyamatsu[a], Atsushi Shiota, Yaser Qudaih[a], and Yasunori Mitani, 2016).

The shortest route search is included in graph theory to determine the route to be traversed by comparing existing vertices. One of the most used methods to solve the shortest path problem is the Dijkstra algorithm (Yi-zhou Chen, Shi-fei Shen, Tao Chen & Rui Yang, 2014). The Dijkstra algorithm is an iterative algorithm that is used to find the shortest path from a certain point of the graph called the source point to all other points of the graph (Sunita & Deepak Garg, 2018).

The Dijkstra algorithm, also known as the "Algorithma Label" proposed in 1959 is one of the best short path algorithms. This algorithm has a variety of applications, such as: multi-point routing, science surveys and mapping, the shortest logistics and transportation routes, intelligent transportation systems, toll network toll collection, and so on (Wang Shu-Xi, 2012).

Bantul Regency is one of the Regencies in the Special Region of Yogyakarta, Indonesia. There are a lot of very interesting tourist attractions, ranging from natural beach tourism, waterfalls, hills, culture, to culinary tourism. This research was conducted using an example of a tourist spot in Bantul Regency as a node that will be the destination and route chosen.

This research will produce a prototype application that can determine the route and the closest distance from tourist attractions from the user's position.

METHOD

By using Dijkstra's algorithm, it is done weighting the distance to the first node to the closest node one by one, also carried out the development of searches from one point to another and to the next point. The distance from each point to another must be weighted, then set the value 0 to the initial node and infinite value to the other nodes that have not been filled. Set all nodes "untouched" and set the initial node as "departure node". From the departure number, consider the untouched neighbor node and calculate the distance from the departure point. If this distance is smaller than the previous distance (previously recorded), delete the old data, save the distance data with the new distance. When we are finished considering each distance to the neighboring node, mark the node that has been touched as "Touchable Node". Touchable nodes will never be checked again, the distance saved is the last distance and the least weight. Set "Untouched Nodes" with the smallest distance (from the departure node) as the "Departure Node" then continue by returning to step 3.

Fig.1 exemplifies the search steps for the shortest path in detail starting from the first node 1 to the destination node 5. After each node is assigned a value (a), then (b) a neighbor node is connected to the initial node (node 1). , and the results obtained are node 2 because the weight of the value of node 2 is the smallest compared to the value of the other node, value = 7 (0 + 7).

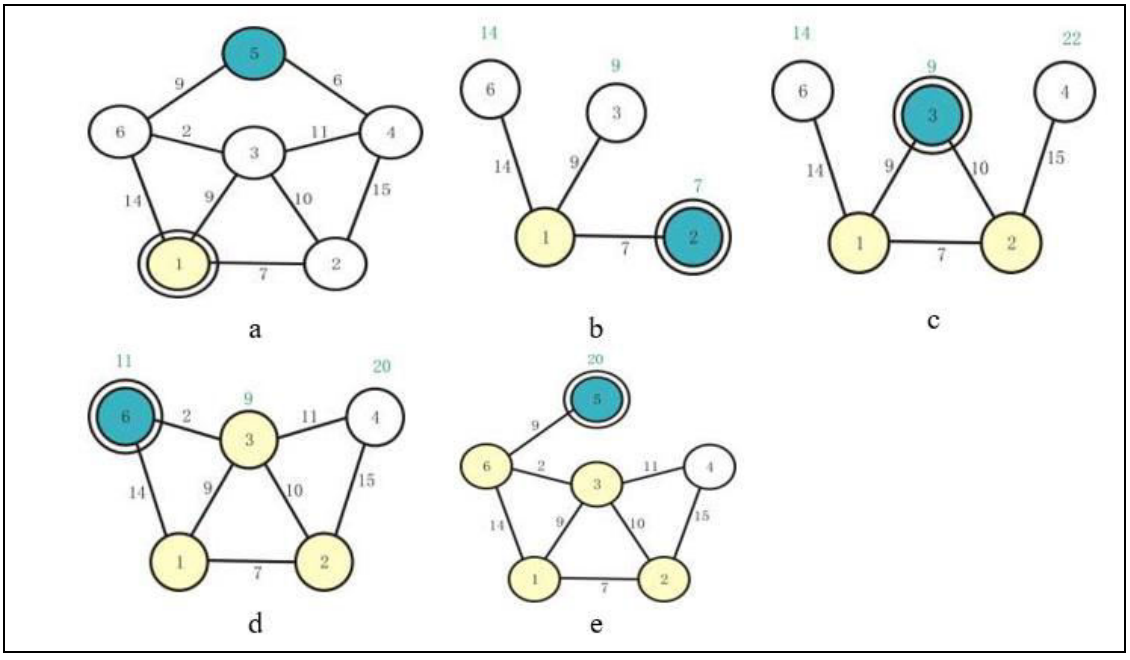

Fig. 1. Illustration of searching for the shortest path

Node 2 is set to be the departure node and is marked as touched node (c). Calculations are also carried out on neighboring nodes that are directly connected to the nodes that have been touched. Node 3 is the next departure node because of the smallest weight of the last calculation result, value 9 (0 + 9). The next node which is marked as touchable node (d) is node 6 because of the smallest weight value, with

a value of 11 (9 + 2). Node 6 becomes touchable node, the next calculation finds that node 5 (destination node) has been reached through node 6. The shortest path is 1-3-6-5, and the value of weight obtained is 20 (11 + 9). When the destination node has been reached, the calculation is declared complete (e).

Applications developed using a web service to display the nearest location of a tour. The role of the web service is as an intermediary to check data into the database and format it in JSON form before the data is sent to the user. The application will display tourist locations that will become tourist destinations. While the Admin has the duty to update tourism data both to improve information and input new tourist coordinates. The following Fig. 2. shows the communication scheme between the client (user) and the admin.

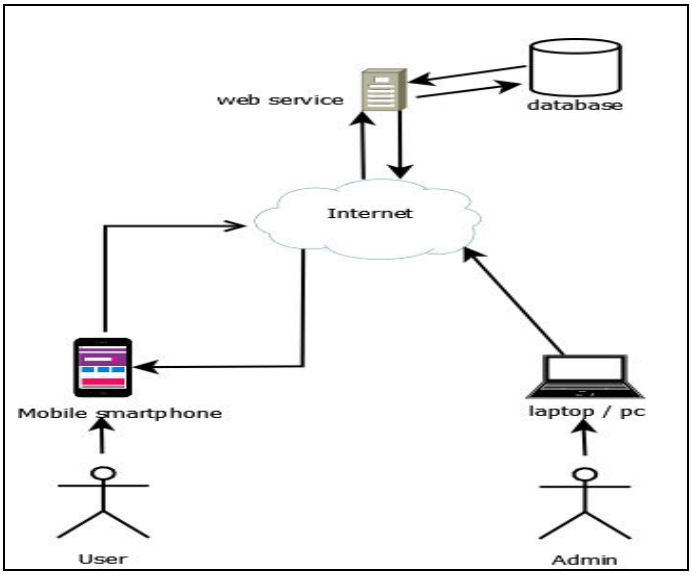

Fig.2. Communication scheme between client and admin

The input needs to implement the Dijkstra algorithm in finding the closest route for this tourist location are tourism coordinate data. While the output of this application is a list of tourist attractions, detailed information about each tourist attraction, a map of the overall tourist location, and the closest route to a tourist location.

Fig. 3. is an activity diagram that shows the user's activities when using the application, and the system response to input from user. After selecting the main menu and the system displaying it, the user selects a list of existing tourist attractions. Users can choose a tourist attraction, and the system will display detailed information about the attraction. Next, the system will ask the user whether to choose the route (the shortest route) or not. Eventually the system will generate and display the shortest route from the user's position to the desired sites by users.

This application was developed using the Java programming language. Java is a programming language that can be run on various computers including mobile phones. Java is a general / non-specific (general-purpose) programming language, and is specifically designed to make use of implementation dependencies to a minimum. Because of its functionality that allows Java applications to be able to run on several different operating system platforms. Java programming languages tend to have smaller methods than traditional procedure-oriented programs and tend to have more frequent interactions between objects (Anjali V., Swapna T.R., & Bharat Jayaraman., 2015).

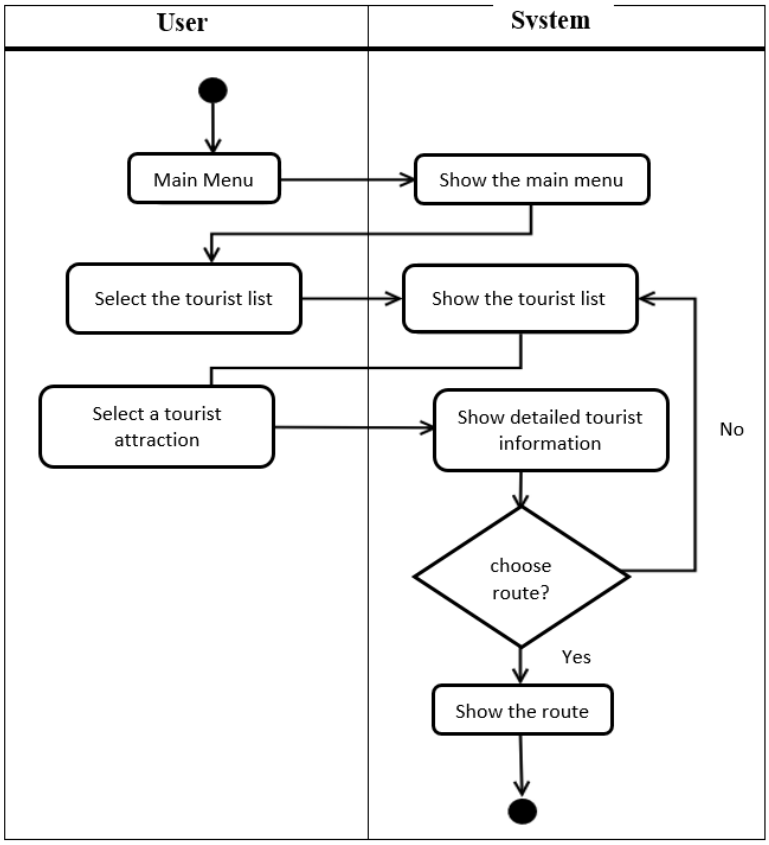

Fig. 3. Activity Diagram

RESULT AND DISCUSSION

The implementation of GIS is done to determine the closest distance to be carried out through several stages. The first stage is making a path with a set of user locations and tourist destination locations then retrieving data nodes from the database to be able to make a path. At this stage initialization of the user location and destination tourist location is carried out by storing latitude and longitude coordinates. All existing road angles are also initialized by retrieving the street corner node data from the database in the graph table. The street corner node data must be translated from the JSON form (JavaScript Object Notation) to a variable. After the decoding process is complete then the system will initialize all paths and be stored in a parameter and converted back into a JSON form to return the JSON representation of a value.

The second stage is making graphics using several functions in the data structure of the Java programming language. Function `addedge` used to add nodes to the graph according to neighboring relationships between nodes (beginning, end / destination, and weight). Function `paths_form` is used to store all points from the starting point by making a path until the last point is connected, and the path is drawn between points. Then do a repeated check of the points that have been saved to determine whether there is a next point that continues, so that all lines will be connected to the starting point.`

Function `path_to` is used to determine the path stop point where the point is the last point that will be made by using 2 parameters, namely parameter `$node_dsts` as a result of `paths_from`, the second parameter is `$tonode` which is the stop / destination point as the last node connected. There are

two repetitions on this function `paths_to`, namely looping with syntax `if (isset ($node_dsts [$current])) { array_push ($path, $tonode);.` This loop is executed if the end point is the starting point, then it is added to the push once. The second loop uses the syntax `while(isset ($node_dsts[$current ]))` which is used if the number of points is more than one with the current command as index, then the loop will only be done until index to `$current` as the index of the last point.

Fig. . is one of the displays of the application prototype made. Fig. 4. displays the closest location route to a tourist location called "Kids Fun". On this page the system will display a map to the destination tourist location. The system will take the user's location as the starting point and destination tourist location as the end point using GPS on the user's mobile phone device.

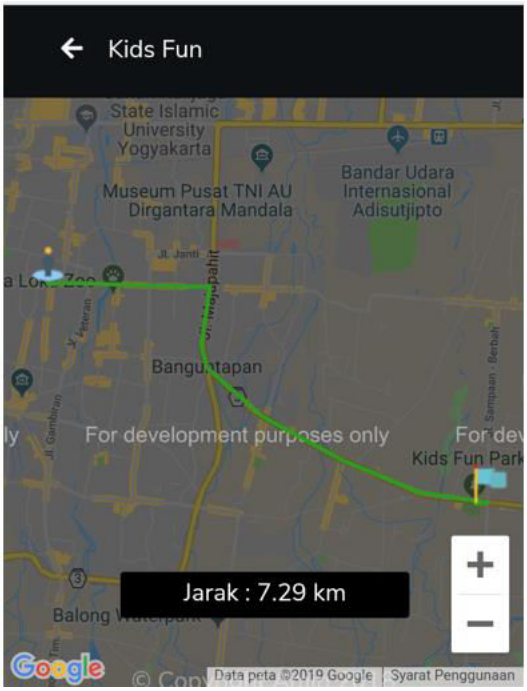

Fig. 4. Route to tourist location

The value of distance generated by the application has been compared with the results produced by Google Map. Fig. 5. is the distance comparison that will be taken by the Google Maps application with the mobile application created, where the start starts from the coordinates of the user located ie coordinates -7.792184, 110.408642 towards the tourist location of Balong Waterpark at coordinates -7.843224, 110.410345. From the picture above shows the difference in the length of the route produced between the Google Maps application and the mobile web application, because the routes chosen by the two applications are different. The Google Maps application uses the route Jl. Ahmad Yani with the distance produced is 7.4 km; while the mobile web application takes the route Jl. Wonosari and the resulting distance is 7.24 km. The route chosen by the application has a shorter distance than the route chosen by Google Maps.

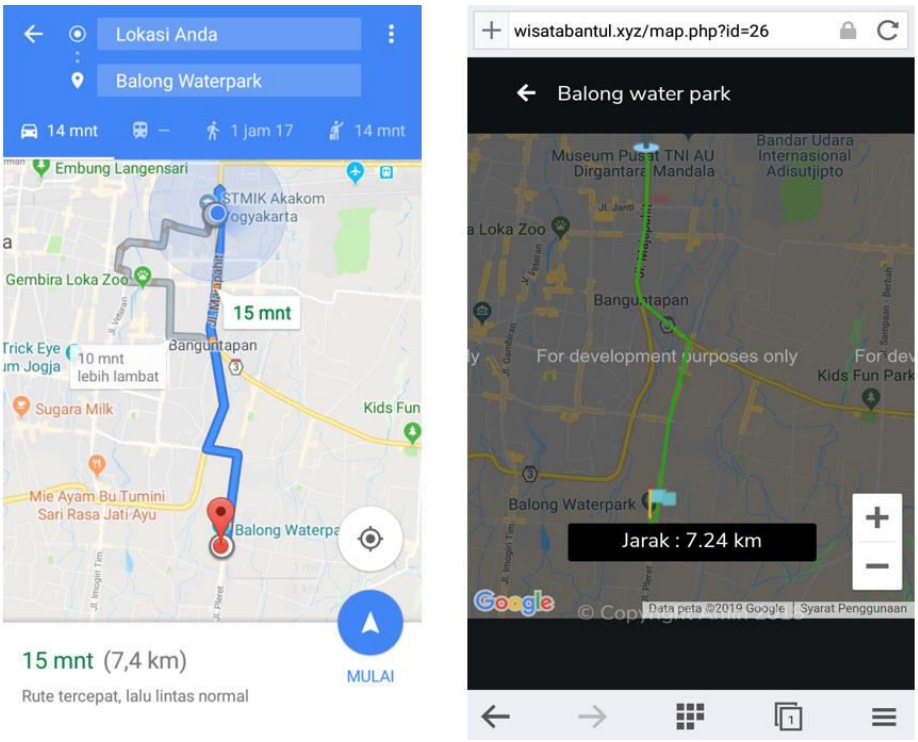

Fig. 5. Comparison with Google Maps

CONCLUSION

The application of the Dikjstra algorithm in the development of application prototypes has been carried out and has succeeded in determining the closest distance to the tourist attraction. Paths with the closest distance generated by the application are shorter than the route recommended by Google Maps. The results of this comparison can be due to other factors outside the closest distance taken by Google Maps. The thing that needs to be noted is that information technology continues to change, GIS applied in tourism management also needs to be improved in accordance with the development of information technology to adapt to the development of information technology.

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