Development of Geographic Information System for Searching Shortest Trip Route on Online Tax

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DEVELOPMENT OF GEOGRAPHIC INFORMATION SYSTEM FOR SEARCHING SHORTEST TRIP ROUTE ON ONLINE TAXI

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ABSTRACT

Utilization of Geographic Information System (GIS) provides the ease to humans to dig information and take decisions from a set of geographic data with an effective and efficient manner. One application in the field of transportation is to extract information about the shortest route from a point to another point in order to save travel costs and shorten travel time. This article discusses the development of a GIS to help driver taxi online in Sidoarjo District, especially in the District of Taman, to obtain information on the shortest travel route. It is expected to help the driver to be able to go to the intended location in a short time, so the quality of service to consumers can increase. The route search technique used in this research is Dijkstra Algorithm combined with Node Combination algorithm with the aim to speed up computing time while saving memory consumption on computer. Geographic information in the form of two-dimensional maps obtained from Google Maps API that can be freely used.

Keywords: geographic information system, shortest route, online taxi, Dijkstra, node combination

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1. INTRODUCTION

Information technology developments have greatly altered habits and ways of human labor in completing its task. It certainly gives a positive influence especially in terms of ease and increased work efficiency when compared with conventional working systems that do not involve information technology in it. The application of information technology has successfully created a wide range of innovative applications that are appropriate for humans,

one of which is the Geographic Information System (GIS) that allows humans to store, analyze, and visualize geographic information accurately and in detail in the form of maps that can be used by users in decision-making efforts [1 - 2].

GIS allows people to obtain information accurately and quickly without having to do field exploration directly. To date, researchers have developed many GIS for various purposes, including spatial analysis to predict the impact of tsunami disaster [3 - 4], search for the fastest route for evacuation of disaster victims [5 -7], spatial analysis of disease distribution [8 - 9], logging and forest management [10-13], search for spatial analysis and service in the field of transport [14-18]. Even GIS is also used in the field of tourism and culture [19-21]. Currently, the GIS capability can be maximized by integrating it with the Big Data system so as to provide information and knowledge is more accurate and comprehensive for users. In the era of mobile computing is also more incentive at this time, GIS has also been applied to Android-based applications and other mobile operating systems. This of course makes GIS applications more easily accessible and used by the community.

In this article, GIS is implemented as a tool to guide taxi drivers to get information on the fastest route to reach the destination point by applying Dijkstra and Node Combination Algorithms to the system. The system allows a rider taxi destination points that will be addressed online. The system will automatically find and present the fastest route in real time to the rider from the starting point where the rider is located. It aims to provide optimal service to consumers, as well as from the economical side can save the fuel consumption of vehicles. The Google Maps API is embedded into the system to make it easier to serve and manage two-dimensional maps.

2. SYSTEM DESIGN

The developed application aims to provide convenience for taxi drivers to get information about the shortest travel route in real time. Therefore, this application is designed online-based in order to access the initial position of the rider and the destination point to be achieved. This application is applied to the Subdistrict of Taman, District of Sidoarjo, East Java, Indonesia. Two-dimensional map of the region can be seen in Figure 1.

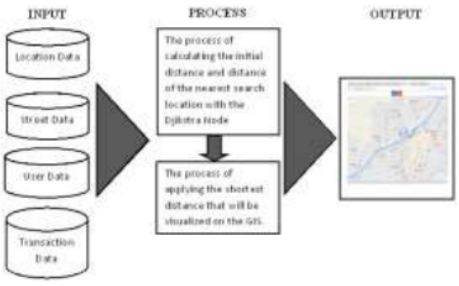

Figure 1 Map of Taman Subdistrict, District of Sidoarjo, East Java with 18 points location

2.1. GENERAL APPLICATION DESIGN

Figure 2 shows the general design of a built-in application consisting of three stages: input, process, and output. The system accepts inputs in the form of location data, road data, user data, and transaction data. Location data contains the latitude and longitude coordinates of all the important points / locations present in the map. These important points are generally in the form of public areas as well as other places that are well known, all of which amount to 18 points as shown in Figure 1. Road data contains all road-related data that exist in the area of

research focus. User data contains information in the form of user name and starting point of user existence. Transaction data contains data related to starting point and destination, user data and driver data. All these data are required for the process of calculating the distance and determining the shortest route

The shortest route search is done on the web server side by applying the Node Combination-Dijkstra algorithm, then the app will display the shortest route obtained to the taxi driver shown on the Google Maps API's two- dimensional map.

2.2. IDENTIFYING APPLICATION USERS

Users of the application are divided into three types, namely admin, driver, and client. Admin served as a system administrator who has full authority to manage driver and client data, such as changing passwords, add or remove clients and drivers. Driver is a taxi driver who is in charge to pick up and deliver the client to the destination. The driver has access to change their data. Client is a customer who becomes an online taxi service user who can place an order through online application. Figure 3 shows the use case diagram of the created system.

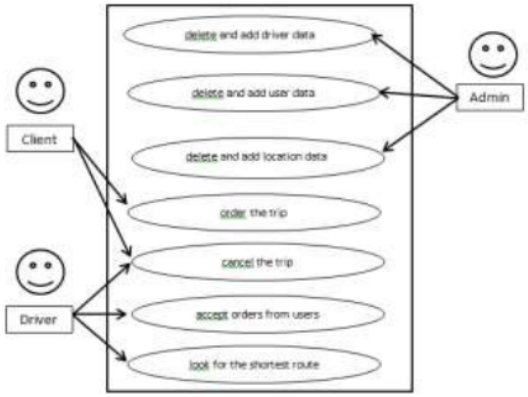

Figure 2 Use case diagram

3. RESULTS AND DISCUSSION

The discussion in this section will focus on some of the important menus present in the app, including location data management, taxi booking, order acceptance, and route search.

3.1. Location Data Management

Every important point or location within the map is stored in the system database. The coordinates of that point contain the coordinates of latitude and longitude whose value is derived from the Google Maps API. Within this app there are 18 points marked as important locations where the location points are connected to each other form a graph. The distance from one point to another point is calculated based on p gathering is the road that connects the two points. This menu is accessible only to users. The GUI in the menu of location data management is shown in Figure 4.

Figure 3 The location management menu interface

3.2. Taxi Booking

This taxi reservation menu is a key feature on client users. Through this feature, the client can make a taxi reservation by first determining the point of departure or pick-up and the end-point to be addressed. After client orders, then the application will display the information or resume booking as shown in Figure 5.

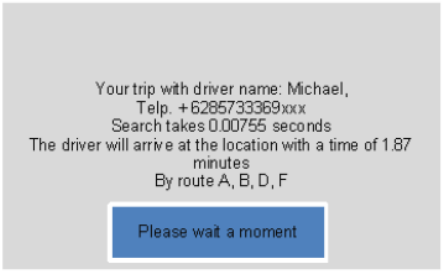

Figure 4 Notifications containing order information from the client

3.3. Order Reception

This navigation menu is used drivers to get information about the location of the client who booked the taxi. Basically, ordering information will be sent by the system to a number of drivers that are within a close radius of the client. One order can only be confirmed by one driver only, which means that drivers must be competing to receive taxi orders into the application. Drivers who first make a confirmation will be entitled to pick up and deliver client to the destination. The figure 6 presented interface from the order acceptance menu.

Figure 5 The interface of the order receiving menu on the driver user

3.4. Route Search

This menu is active when a driver has confirmed the taxi order from the client. In this menu, the system will perform the process of finding the shortest route that will direct the driver to pick up the client. Once the drivers arrive at the pick-up point, the system will search again to

determine the shortest route to the destination point of the client. The process of finding the shortest route in this application also consider the traffic density, so if there is a short distance route, but the traffic on the road is solid, then the system will not recommend the route, because the travel time to be passed longer. The route search of menu interface is shown in Figure 7.

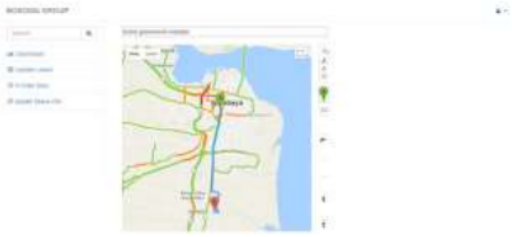

Figure 6 Route menu search interface

4. CONCLUSION

This article has presented GIS application development report that serves to guide the taxi drivers to find the shortest route in picking up and delivering passengers to the destination location. By utilizing the Node Combination-Dijkstra algorithm, this application successfully displays the fastest route the driver can pass. In addition, this app is also web-based and also uses the Google Maps API, so that the validity of the data on the map can be guaranteed. For future research, researchers can develop this application on mobile platforms, such as Android or iOS for the use of this application can be more widely distributed.

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