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Dijkstra-based Official Motorcycle Repair Shop Application for Determining the Shortest Route

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Abstract – Servicing on 2-wheeled vehicles is needed so that the condition remains prime and minimizes the symptoms of component damage. Motorcycle service activities have an impact on the automotive world, especially in the City of Kudus. There are also many motorized vehicle users who do not know the closest route to the nearest Authorized Motorcycle Workshop in the holy city and choose Engine Fuel (BBM) that is in accordance with the type of vehicle they have. shorter service life because the RON (Research Octane Number) or octane number for each motorized vehicle is different, the octane number represents the resistance of the fuel to engine compression. With the development of information science in the current era, an Android-based application was created to search for the closest route to an official motorcycle repair shop in the Kudus City using the Djikstra Algorithm and having a BBM recommendation feature that is suitable for motorbike users' vehicles in the Kudus City.

Keywords – The shortest route, application, android, djikstra, motorbike repair shop.

1. INTRODUCTION

The number of vehicles has increased dramatically from year to year. Transportation users, especially two-wheeled vehicles or motorbikes who travel, certainly need an accurate solution to get the closest path or route so that they can arrive on time at their destination. This is intended so that transportation users can save time, costs and energy spent. The current population of motorbike vehicles also requires routine maintenance or servicing in order to stay fit and minimize the symptoms of component damage to motorcycles [1]. Most motorized vehicle users also do not know which engine fuel (BBM) is suitable for the type of vehicle owned, if this habit continues, it is possible that the motorbike owned will have a shorter service life due to the RON (Research Octane Number) or the number Octane in each motorized vehicle is different, the octane number represents the fuel's resistance to engine compression. If the motor has a high compression engine, it must use high engine fuel, while for a motor that has low compression, it is the opposite.

Motor Workshop is a place that makes it easy to make repairs and solve various problems in the vehicles of its users. Activities at the Official Motorcycle Workshop itself are not only carried out by carrying out maintenance, maintenance and modifications, but also in the form of after-sales service activities as well as marketing of products to be sold by each company. Every day there are around 309,397 motorized vehicles crowding the roads in Kudus, so that the streets in Kudus City become crowded and congested, especially during peak hours such as going to or from work and during school hours. The rapid development of information technology in the current era can be used by transportation users to easily access traffic information. With the development of information technology, the problem of finding the shortest path or route can be solved by several algorithms, and one of them is by using the Djikstra Algorithm [2]–[6]. In searching for the shortest route, many still use conventional method calculations. The conventional method is a way to solve problems using ordinary mathematical calculations consisting of the Floyd-Warshall algorithm, the Bellman-Ford algorithm, and Djikstra's own algorithm which have been used in this study.

The Djikstra algorithm used in finding the shortest route will be implemented on the Android Operating System [7]–[10]. Android itself is currently widely used by the wider community. The Android operating system is an operating system introduced by the company giant Google which is the pioneer of search engines on the internet [11]. Android uses a system that is based on Linux which is basically used for devices that use touch screens on tablet computers and smartphones. Android provides an open source platform for software developers to create their own applications for and use by various devices. It is important for the people of Kudus City to know the shortest route, distance, and time to the Official Motorcycle Workshop and fuel recommendations for their vehicles, therefore the authors conducted research on Applications for Determining the Shortest Routes for Official Motorcycle Workshops Based on Android Using the Djikstra Algorithm.

2. RESEARCH METHOD

2.1 Djisktra

Dijkstra's algorithm is a form of greedy or greedy algorithm. This algorithm includes an algorithm that completes the search for the shortest path on a graph with one source on a weighted graph that has a negative side cost, and produces a shortest path tree [9], [12]–[14]. In the search for the shortest path, Djikstra's Algorithm can work by finding an efficient route and having a minimum length into a weighted graph, negative nodes cannot pass through weights that have positive numbers [11], [15], [16]. In Dijkstra's Algortima, nodes are used because they use directed graphs. The steps used to determine the shortest path in the Djikstra Algorithm are:

1. Give a weight or distance value for each node to another node, and give a value of 0 to the initial node and an infinite value for other nodes that have not been filled.
2. Gives all nodes that have not been given a value and the initial node is set as a departing node
3. On the number that departs, calculate the other nodes that are close and have not been given a value and calculate the distance to the departing node. If the calculated distance is smaller then delete the old data and save it with the new calculated data.
4. After calculating each distance to the nearest node earlier, mark the node that has been calculated as the calculated node. The count node will not be checked again and the distance stored is the last distance with minimum weight.
5. Set on a node that has not been calculated with a distance that has a small number from the departing node as the departing node.

6. Repeat step number 3 until the uncounted nodes have a small number value

2.2. Graph Theory

Graph theory is a subject which is a collection of several objects that reflect computational objects and are interconnected with these related objects. With calculations, the graph is defined as follows: G is an inner set (V,E) which means that V is a non-empty set of vertices (vertex or vertices) or in writing notation = { v1 , v2 , ... , v } and for E is the set of edges that connects a pair of vertices and is written in notation = { e1 , e2 , ... , e } From this understanding it can be defined that V is a set that has a value of V. Whereas for E it can be empty . It can be concluded that a graph has vertices and at least one graph. Graph directed (Directed Graph). A graph that has the direction of element E on each side is given an arc. This directed graph consists of a set (V,E), so it has a pair of consecutive Vs. This graph itself has seven connected points or nodes, namely nodes A, B, C, D, E, F, G.

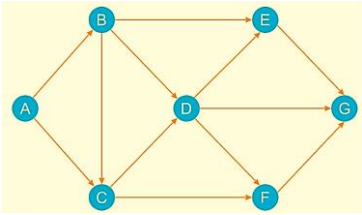

Figure 1. Sample Common Directed Graph

2.3. Tree

Tree (Tree) is a graph that is connected and does not form a pattern. Tree (Tree) is a structure of related data and is hierarchical or arranged from top to bottom sequentially from one element to another. This tree consists of 9 elements namely 1, 2, 3, 4, 5, 6, 7, 8, 9.

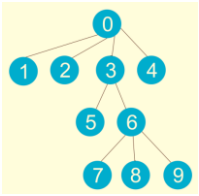

Figure 2. Sample of Tree

2.4. Extreme Programming (XP)

Extreme Programming (XP) is a planning approach that is widely used for rapid software development. In the method that will be used there are 4 stages of work, namely Planning, Designing, Coding, Testing, Product.

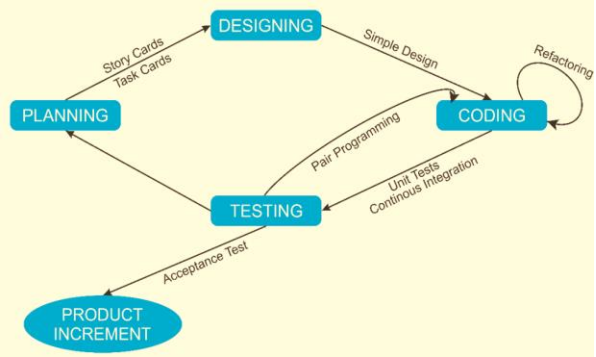

Figure 3. Extreme Programming Scheme

1. Planning

Do the planning needed by the developed application by describing the features and functions that support the making of the application. Applications developed by researchers have 2 main access rights, including:

a. The admin is in charge to monitoring and managing the location and adding features in the form of fuel recommendations for Yamaha, Honda, Suzuki and Kawasaki motorbikes as well as adding longitude and latitude points to official motorcycle repair shops that are not available on digital maps taken from the Google Maps API.
b. The user here only runs the application according to its function, namely finding the closest location to the Official Yamaha, Honda, Suzuki and Kawasi Motorcycle Workshops in the city of Kudus and knowing the right fuel recommendations for the motorbike when the application is running.

2. Desain

The design that will be used by the system in this study is to illustrate the UML (Unified Model Language) model in the form of use case diagrams, class diagrams, and activity diagrams. This design is used to make it easier for developers and develop applications to be built.

a. Use Case Diagrams. Use case diagrams are the result of representations of some or all of the actors, use cases and interactions that introduce a system. Use Case Diagrams can also be called modeling which is used to describe a nature and behavior (behavior) in the system to be created. The Use Case Diagram does not explain how the workflow works in detail how the Use case is used, but is in the form of a brief description between the use case and the actor and also the system. The following are the elements in the Use Case Diagram: actor, use case, association, include, class diagram.
b. Class Diagrams. Class Diagram has the function of defining existing classes to build a system that describes the structure of the system itself. 3 Components in the Class Diagram are attributes, operations, and names.
c. Activity Diagrams. Activity Diagram is a diagram that represents all the activities that occur in the system that is created, from the beginning to the end of the work process of the system that we make.
d. Coding. Coding is the stage of implementation or design translation that must be known by the computer. These stages are steps that are shown clearly and clearly. With the meaning that the developer will work optimally for computer use. At this stage, the process of changing the software system is also carried out as needed and does not change the external code to improve the internal code structure. This is done to reduce the occurrence of bugs or design flaws so that they don't work as they should.

3. Testing

Testing is carried out when the quality of the system has been ensured (quality assurance), namely testing whether the system is suitable for use by the wider community. The purpose of testing is also to be able to analyze a system entity that is made to check whether there are differences in the desired conditions by evaluating the features embedded in the system.

2.5. Dataset

The data collected in this study by searching for data from the websites of each motorcycle manufacturer in the city of Kudus. From this literature study method, we obtained location data for latitude and longitude coordinates from Google Maps for 4 types of motorcycle manufacturers, namely Honda, Yamaha, Kawasaki, and Suzuki.

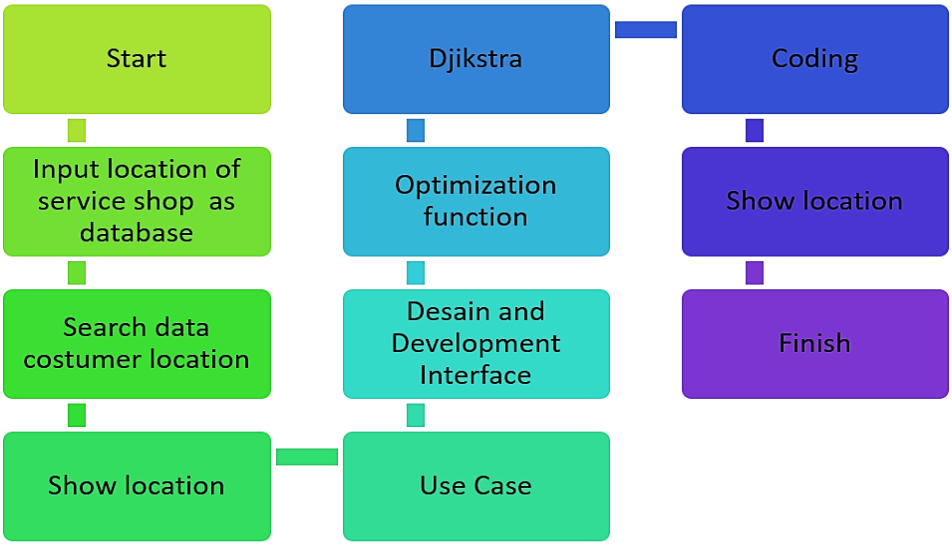

Figure 4. Proposed Method

3. RESULTS AND DISCUSSION

Based on the map in Figure 5, it is known that the coloring at the nodes indicates the official Motorcycle Workshop in the city of Kudus varies, dark blue indicates the official Yamaha Motorcycle Workshop, Red indicates the official Honda Motorcycle Workshop, Light Blue indicates the official Suzuki Motorcycle Workshop, and Green has been shown the official Kawasaki Motorcycle Workshop. After obtaining the latitude and longitude coordinates of the motor repair shop, the distance between points is calculated and a graph is created containing edges and nodes as shown in Figure 6.

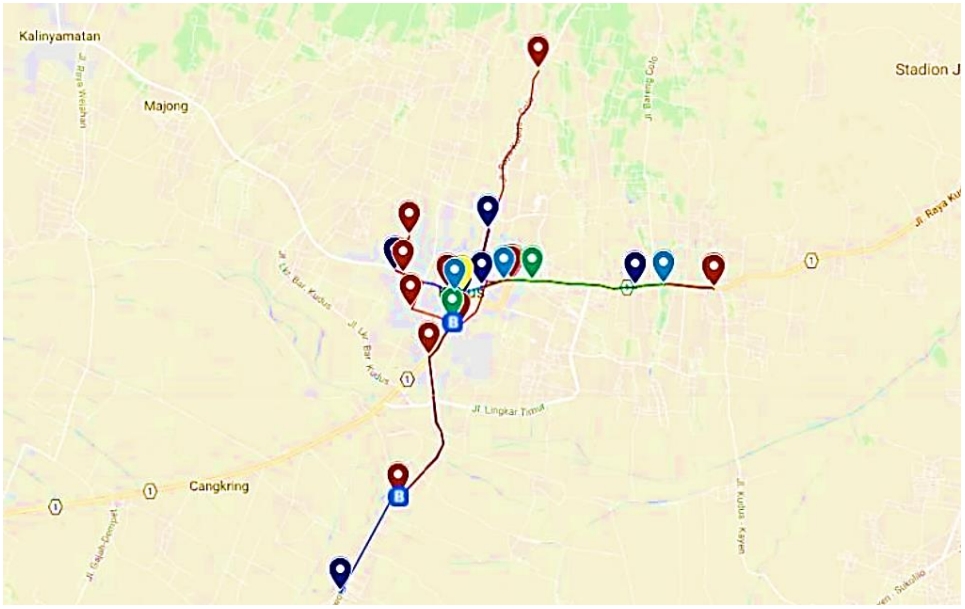

Figure 5. Maps location motorcycle service shop in Kudus City

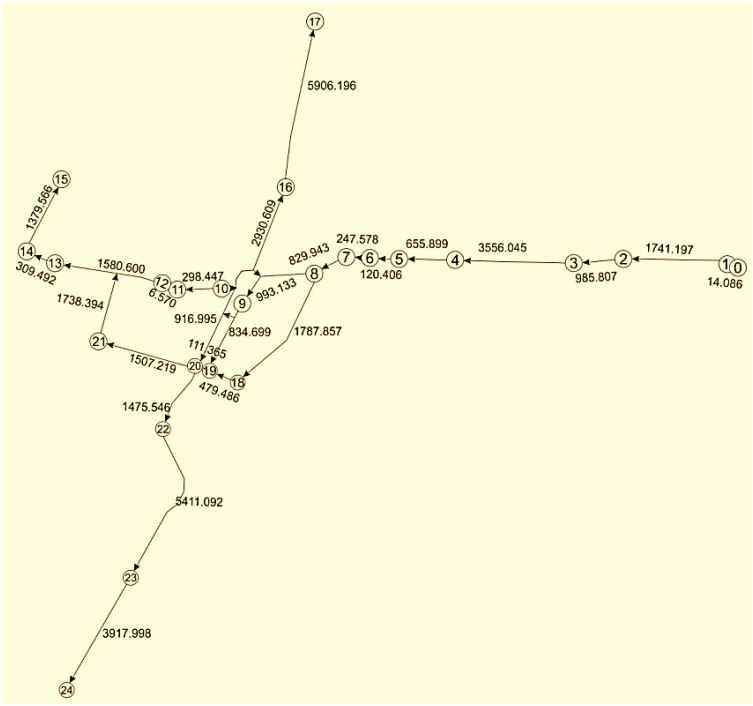

Figure 6. Graph directed to the official Motor Workshop of Kudus City

Table 1. Node Explanation

Node	Service Motorcycle Shop
0-1	Yamaha harpindo jaya bareng – AHASS 9261 muria motor
1-2	AHASS 9261 muria motor – Suzuki indosun bareng
2-3	Suzuki indosun bareng – Yamaha mataram sakti bareng
3-4	Yamaha mataram sakti bareng – Kawasaki sinar gemala sakti
4-5	Kawasaki sinar gemala sakti – Sentral yamaha kudus
5-6	Sentral yamaha kudus – Honda taruna adiprima motor
6-7	Honda taruna adiprima motor – Suzuki SMG kudus
7-8	Suzuki SMG kudus – Yamaha tunas kencana motor
8-9	Yamaha tunas kencana motor – Yamaha murah motor 1
9-10	Yamaha murah motor 1 – Suzuki wahid motor
10-11	Suzuki wahid motor – Yamaha mataram sakti
11-12	Yamaha mataram sakti – Honda jaya motor
12-13	Honda jaya motor – AHASS 01822 taruna adiprima motor
13-14	AHASS 01822 taruna adiprima motor – Yamaha hidup baru
14-15	Yamaha hidup baru – AHASS sukses motor
15-16	Suzuki wahid motor – Yamaha harpindo jaya panjang
16-17	Yamaha harpindo jaya panjang – Honda tugu sekawan motor
8-18	Yamaha tunas kencana motor – Honda mandala motor
18-19	Honda mandala motor – Honda astra motor
19-20	Honda astra motor – Kawasaki A.yani kudus
20-21	Kawasaki A.yani kudus – Honda wali motor pengkol
21-13	Honda wali motor pengkol – AHASS 01822 taruna adiprima motor
9-19	Yamaha murah motor 1 - Honda astra motor
19-22	Honda astra motor – Zirang honda
22-23	Zirang honda – Honda bina putra kudus
24-23	Honda bina putra kudus – Yamaha murah motor undaan

Based on the information in Table 1, an example of a case can be taken according to Figure 7. Based on the information above, an example of a case can be taken as shown in Table 2. The position of a Honda motorbike rider is marked in yellow and the position of a Honda Motor Workshop is marked in red, the motorbike rider which way will it go? The following is the path that can be taken according to Table 2. Namely from node 3 to node 2 and finally to node

1 which is a Yamaha Mataram Sakti motorcycle repair shop together, Suzuki Indosun together, and all the way to AHASS 9261 muria motor. So it can be concluded that from the proof table above, motorbike riders can travel a distance of 1.727 m to the nearest official Honda motorcycle repair shop.

Table 2. Node Study Case

From	Until	Distance
Node3	Node3	985,8 m
Node2	Node1	741,2 m
Total Distance		741,2 m

After the application system is launched, it is best to do a trial or test whether this application runs as it should or not. Testing this application is also to avoid bugs or other damage and can be launched en masse. In this study used black box and white box testing. Black box testing is carried out to test functionally without testing the application system design and testing coding. This test is carried out to find out whether the program runs from start to finish in the form of smooth input and output without problems and according to the specifications required according to Table 3. White Box testing is carried out to test whether the procedural design is in accordance with the Flow Graph flow or not in accordance with Figure 8.

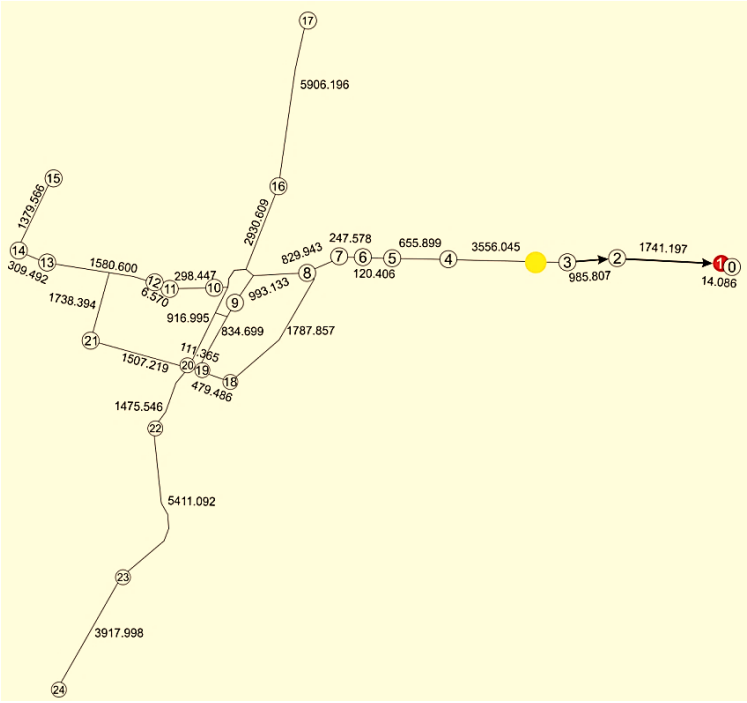

Figure 7. Study Case Based on Motorcycle Position

Table 3. Black Box Testing

Test Case	Target Result	Result	Conclusion
Set the coordinates of the workshop location and the name of the workshop	Adding and reducing location coordinate data and workshop name	Adding and reducing location coordinate data and workshop name	Succeed
Manage BBM recommendation data	Add and reduce the appropriate BBM RON recommendation data by motor type	Add and reduce the appropriate BBM RON recommendation data by motor type	Succeed

Menu Map	Displays location markers and displays the shortest route to official motorcycle repair shops in the city of Kudus	Displays location markers and displays the shortest route to official motorcycle repair shops in the city of Kudus	Succeed
BBM recommendation menu	Displays the results of fuel recommendations according to the type of motorbike	Displays the results of fuel recommendations according to the type of motorbike	Succeed
Splash Screen Page	Displays the Splash Screen the first time you open or run the application	Displays the Splash Screen the first time you open or run the application	Succeed

```
int start = 0;
dbHelper = new SQLHelper(this);
SQLiteDatabase db = dbHelper.getReadableDatabase();

for(int i = 0; i < exp.length-1; i++){

(3)     ArrayList<LatLng> lat_lng = new ArrayList<LatLng>();
(3)     cursor = db.rawQuery("SELECT jalur FROM graph where simpul_awal ="+exp[start]+" and simpul_tujuan ="+exp[(++start)], null);
(3)     cursor.moveToFirst();
(3)     String json = cursor.getString(0).toString();
(3)     JSONObject jObject = new JSONObject(json);
(3)     JSONArray jArrCoordinates = jObject.getJSONArray("coordinates");

(4)     for(int w = 0; w < jArrCoordinates.length(); w++){

(5)     JSONArray latlngs = jArrCoordinates.getJSONArray(w);
(5)     Double lats = latlngs.getDouble(0);
(5)     Double lngs = latlngs.getDouble(1);
(5)     lat_lng.add( new LatLng(lats, lngs) );

}
```

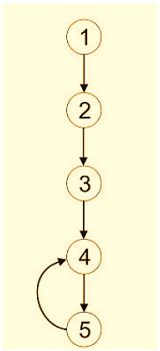

Figure 8. Flow Graph

Cyclomatic Complexity (V(G))
V(G) = E - N + 2
V(G) = 5 – 5 + 2 V(G) = 0 + 2
V(G) = 2
Description: E = The number of arcs on the flowgraph is 7
N = The number of nodes in the flowgraph is 7
The Cyclometic Complexity value in the coding above is 2 1.2 Path.
Path 1 : 1 - 2 - 3 - 4 - 5
Path 2 : 1 - 2 - 3 - 4 – 5 – 4

The system testing results using the Black Box and White Box test methods can be concluded that the application system for finding the shortest route for official motorbike repair shops in the city of Kudus has provided the results of each process functionally and non-functionally and as expected.

4. CONCLUSION

Designing results an Android-based application system had been concluded in the previous chapter using the Djikstra algorithm to find the shortest route for an official motorbike repair shop in Kudus. User had been saved time just to find an official motorcycle repair shop in the city of Kudus. In conducting research, there are no shortages. Therefore, there are several suggestions that researchers write to improve and develop better in future research:

1. The interface design is still simple, it is hoped that further research will be even more interesting.
2. There are still many methods or algorithms used other than Djikstra to be implemented in this application system, so it needs to be implemented in other algorithms or methods.
3. There needs to be an update of the official motorcycle repair shop route in the holy city in stages, because every year the official motorbike repair shops in the holy city are sure to increase and decrease.

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