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Medan City Tourism Geographical Information System Using Dijkstra Algorithm Method

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Abstract

Medan City Tourism Office in providing tourism location information is currently still using the official website that only displays explanations about tourism and mapping of tourist location points only, the current system is less efficient and makes tourists or the public not know much about the location or route to be passed and search for tourist attractions in the city of Medan. Researchers try to solve the problem by implementing a geographic information system implemented with OSM (Open Street Map). In this study, data collection using qualitative methods and applications was developed using waterfall methods. The results of the analysis will be described using UML (Unified modelling language). The results of this study show that the geographical information system of tourism to find out the location point and the nearest route can provide benefits to tourists and local people to travel in the city of Medan.

A. Introduction

With the rapid development of technology today, GIS (Geographic Information System) has not only become a trend in cartography technology itself, but has also become one of the technical needs to solve government problems [1]. This is because GIS can be used as a reference to accurately display geographic data. Medan's tourism potential is diverse and has reached element 3A (attractions, amenities and accessibility). Tourist attractions in the city of Medan are divided into two categories, namely the attraction of tourist attractions and the attraction of tourist attractions (events). According to soekadijo experts, tourism is a complex phenomenon in the community, which includes hotels, attractions, souvenirs, tour guides, tourist transportation, travel agencies, restaurants, etc [2] [3].

Medan City Tourism Office is an agency engaged in tourism [4]. At this time the Tourism Office is still promoting its tours that are still not widespread enough among tourists and the public due to the spread of tourist information or events still using the old way such as through brochures, mass media and other social media. This method is not enough to promote tourism widely to tourists and the people of Medan because the picture of tourist areas cannot be obtained, such as visualization of the location, distance of tourist areas with roads to be traversed, and it is difficult for tourists and the public who do not know to determine the itinerary. Medan City Tourism Office is currently also still searching for tourist attractions through official sites that are only in the form of explanations of tourism and mapping of tourist location points only, and there are only a few tours that have mapping of tourist location points. This makes the tourists or the public do not know much about the location or route to be passed and the search for tourist attractions in the city of Medan.

Based on the above problems, the Medan City Tourism Office urgently needs a system to promote medan city tourism along with the shortest route. To overcome this, it is necessary to make careful planning in creating a Geographic Information System (GIS) using OSM (Open Street Map) through the LeafletJs Library in finding Medan city tourism places and using Dijkstra Algorithm in the search for the shortest route [5][6].

B. Research Method

The method used in this study is a qualitative method by conducting observations, interviews and literature studies. As for the development of the system used waterfall method. Waterfall methods approach systematically and sequence ranging from requirement, design, implementation, verification, and maintenance [7][8].

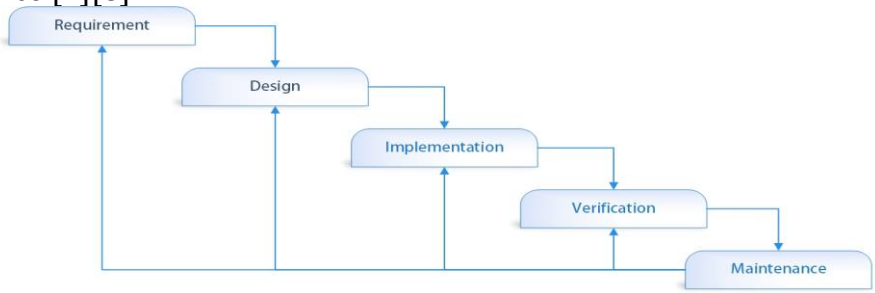

Figure 1. Waterfall Method

1. Requirement
   At this stage, data collection can be obtained by observation, interview, library study. This is to get the necessary data.
2. System Design
   At this stage, a relationship is made between tables, system design as well as the requirements and specifications of the hardware and software used.
3. Implementation
   At this stage, the system will be developed according to a predetermined design and use PHP, HTML, Laravel 8 and MySQL program code as a database.
4. Verification
   At this stage, revisions are made if on the system there is a malfunction or error in the system.
5. Maintenance
   In the last stage is maintenance. This stage of the system is in accordance with the necessary needs and can solve the problem. The software can be run and maintained. Improving system implementation and improving services is a new need.

C. Result and Discussion

Results Of Dijkstra Algoritma Analysis

To generate the route of the Medan City Tourism Geographical Information System with Dijkstra algorithm is carried out with the following stages [9][10]:

1. Create a graph on a predetermined case.
2. Create a distance table.
   a. Created a table between interconnected points.
   b. With Dijkstra's algorithm looking for the point with the smallest route from the starting point to the end point [11].

A predefined case example of the graph shown in Figure 2 with a starting point = A, and a destination point = H with Dijkstra's algorithm to determine the shortest route.

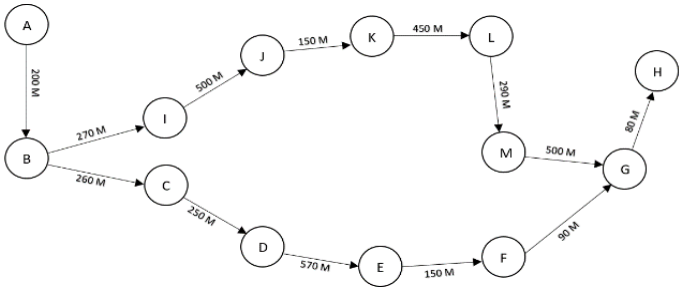

Figure 2. Dijkstra Algorithm Case Graph

The list of location points of the route passed from the starting point to the destination point, namely:

Table 1. List Of Route Locations

Node	Location Point
A	Tugu Nol Kilometer

	Medan
B	Bukit Barisan
C	St.Ka
D	Pulau Pinang
E	Mesjid
F	Palang Merah
G	Ahmad Yani
H	Tjong A Fie Mansion
I	Kereta Api
J	Letdjen M.T.Haryono
K	Cirebon
L	Pandu
M	Pemuda

1. Distance of Tugu Nol Kilometer Medan with Bukit Barisan.

Table 2. 1st Iteration Results

B	C	D	E	F	G	H	I	J	K	L	M
200	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
A											

A → 0, B → 200 m. the starting point starts from A with a distance of 0 and the point to go B with a distance of 200 m.

2. Distance Bukit Barisan with St.KA.

Table 3. 2nd Iteration Results

B	C	D	E	F	G	H	I	J	K	L	M
200	460	∞	∞	∞	∞	∞	470	∞	∞	∞	∞
A	B						B				

B → 200 m, C → 260 m, I → 270 m. The initial distance is A = 0, then point B with a distance of 200 m is fixed. Then the distance from point B to point C will be summed up by plus from points B and C = 200 + 260 = 460, but point B can pass point I because there is a path passed from point B and I = 200 + 270 = 470 m, then it can be the smallest path that is point C.

3. Distance St.KA with Pulau Pinang.

Table 4. 3rd Iteration Results

B	C	D	E	F	G	H	I	J	K	L	M
200	460	710	∞	∞	∞	∞	470	∞	∞	∞	∞
A	B	C					B				

Point C to point D → 250 m. from the previous A, B, and C points amounting to 460 m will be added to the purpose passed, namely point D with a distance of 250 m. Then the sum of the points C and D is 460 + 250 = 710 m.

4. Distance Pulai Pinang with Mesjid.

Table 5. 4th Iteration Results

B	C	D	E	F	G	H	I	J	K	L	M
200	460	710	1.28	∞	∞	∞	470	∞	∞	∞	∞
A	B	C	D				B				

Point D to point E → 570 m. From the previous A, B, C and D points totaling 710 m will be added to the goal passed, namely point E with a distance of 570 m. Then the sum of the points D and E is 710 + 570 = 1,280 km.

5. Distance Mesjid with Palang Merah.

Table 6. 5th Iteration Results

B	C	D	E	F	G	H	I	J	K	L	M
200	460	710	1.28	1.43	∞	∞	470	∞	∞	∞	∞
A	B	C	D	E			B				

Point E to point F → 150 m. From points A, B, C, D and E amounting to 1,280 km will be added with the point passed by which is F, from point E to point F is 1,280 + 150 = 1,430 km.

6. Distance Palang Merah with Ahmad Yani.

Table 7. 6th Iteration Results

B	C	D	E	F	G	H	I	J	K	L	M
200	460	710	1.28	1.43	1.52	∞	470	∞	∞	∞	∞
A	B	C	D	E	F		B				

Point F to point G → 90 m. From point A, B, C, D, E and F previously amounted to 1,430 km will be added with the point passed by which is G, from point F to point G is 1,430 + 90 = 1,520 km.

7. Distance Ahmad Yani with Tjong A Fie Mansion.

Table 8. 7th Iteration Results

B	C	D	E	F	G	H	I	J	K	L	M
200	460	710	1.28	1.43	1.52	1.6	470	∞	∞	∞	∞
A	B	C	D	E	F	G	B				

Point G to point H → 80 m. From point A, B, C, D, E, F and G previously amounted to 1,520 km will be added with the point passed h, from point G to point H is 1,520 + 80 = 1.6 km.

So the result to determine the shortest distance from the starting point = A to the destination point = H has been obtained with the conclusion of each point, as follows:

1. The shortest line from A to B is A-B with a route of 200 m.
2. The shortest line from A to C is A-B-C with a route of 460 m.
3. The shortest line from A to D is A-B-C-D with a route of 710 m.
4. The shortest line from A to E is A-B-C-D-E with a route of 1.28 km.
5. The shortest line from A to F is A-B-C-D-E-F with a route of 1.43 km.
6. The shortest line from A to G is A-B-C-D-E-F-G with a route of 1.52 km.
7. The shortest line from A to H is A-B-C-D-E-G-H with a route of 1.6 km.

From the calculated and selected iteration table, it will produce the shortest path from point A to each point that exists to go to point H. To see which path is selected can be traced the result of point A to point H obtained is A-B-C-D-E-F-G-H.

Design Use Case Diagram GIS Tourism Medan City

Use Case diagram depicts the external view of the system that we will create the model. The use case model can be spelled out in a use case diagram, but keep in mind that the diagram is not identical to the model because the model is wider than the diagram. The use case must be able to describe the sequence of actors that produce measurable values [12][13] can be seen in the figure 3:

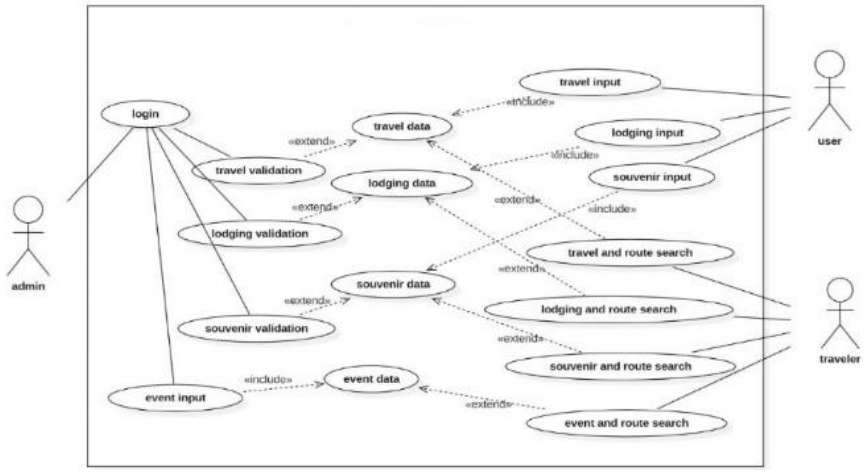

Figure 3. Use Case Diagram GIS Tourism Medan City

Use Case diagram GIS Tourism Kota Medan illustrates there are 3 actors involved in the system, namely the admin of the Medan City Tourism Office, users, tourists. Admin actors act to validate input by the user by logging in, then validate tours, lodging, souvenirs, and admins to input events. User actors get access to travel input, lodging, and souvenirs for the addition of location points to be validated by admin actors. Tourist actors get access to search locations and routes on tours, inns, souvenirs and events.

Design Class Diagram GIS Tourism Medan City

Class diagrams describe the types of objects in a system and the various static relationships that exist between them [14]. Class diagrams also show the properties and operations of a class and the limitations contained in the relationships of that object [15]. Here is the class diagram gis tourism city of Medan:

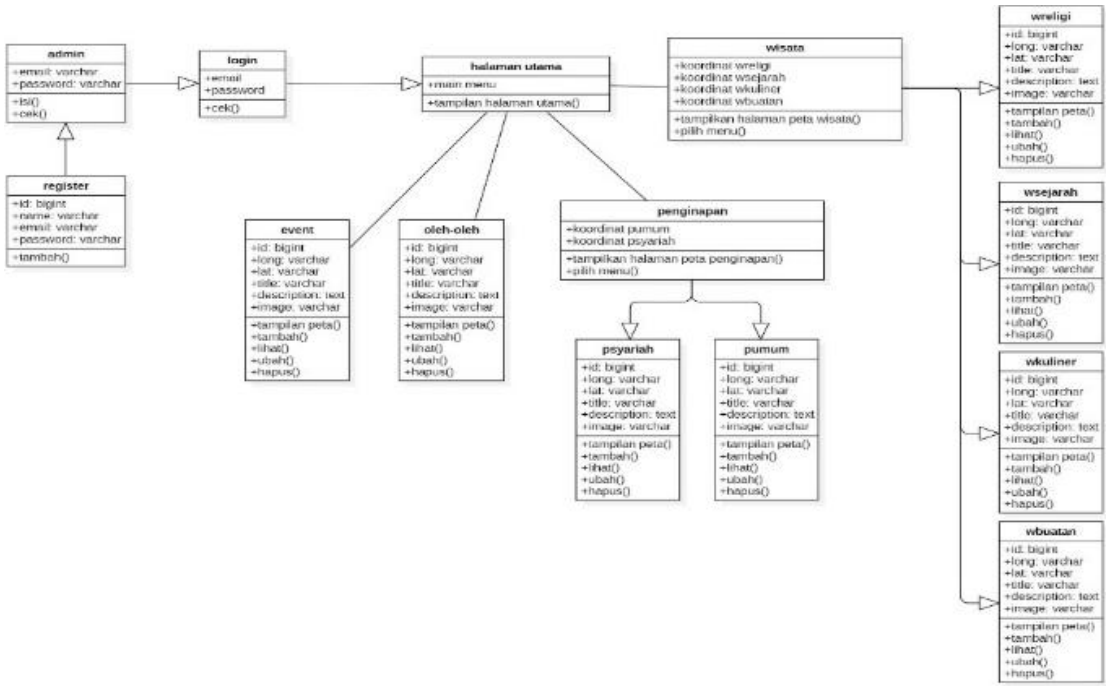

Figure 4. Class Diagram GIS Tourism Medan City

1. Home View

The home page or main page view is the view when the user open the website. Here's how you opened the website:

Figure 5. Home View

2. Travel Page View

There is a tourist page in which there are 4 categories of tourism such as religious tourism, historical tourism, culinary tourism, artificial tourism. And there is a user form for the input of tourist data, then there will be recommendations of places closest to the point the user is located. Here's how it looks:

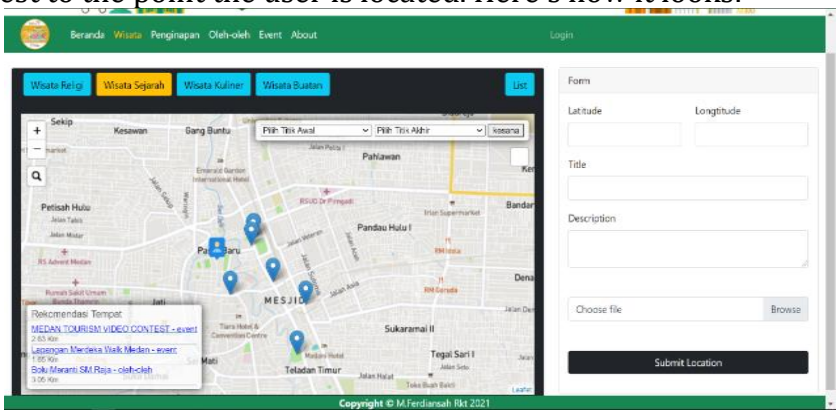

Figure 6. Travel Page View

3. Route Search View

There is a tourist page where the user searches the route from the starting point and the designated destination.

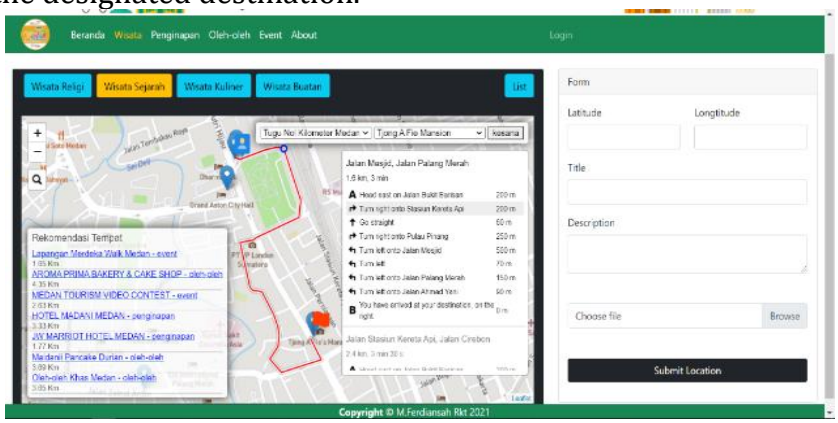

Figure 7. Route Search View

4. Pop Up View

When the user clicks on the location point as desired, then the location point will bring up a popup by displaying the title, description and image.

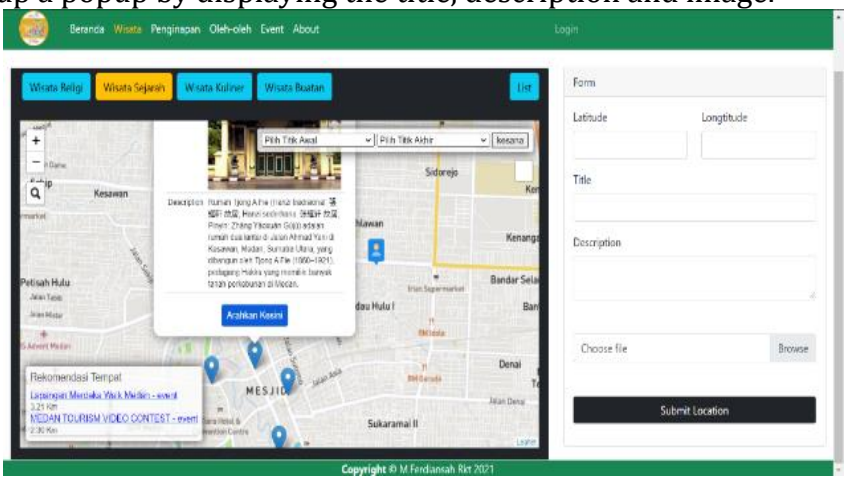

Figure 8. Pop Up View

5. Realtime Route Search View

On this page the user can perform a route search according to the point where the user is located without doing a designated point search.

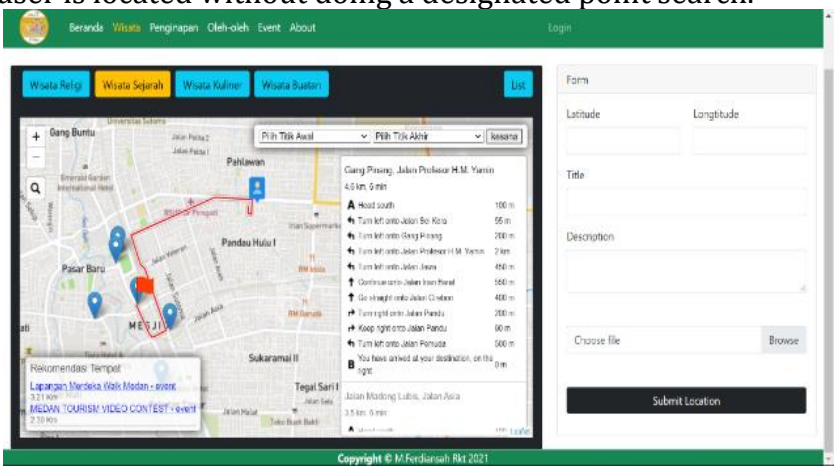

Figure 9. Realtime Route Search View

6. User Travel List View

The user's tourist list display contains tourist data in the form of title, description, langitude, latitude and users can see tourist photos.

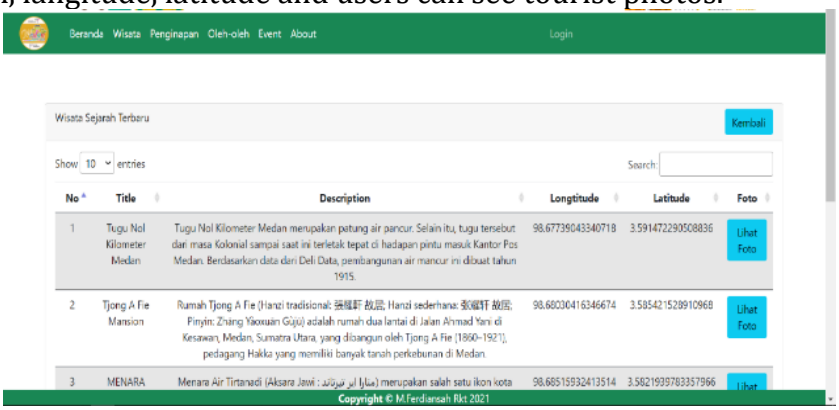

Figure 10. User Travel List View

7. Admin Login View

On the look of this page we must login by filling in the email and password and then click the login button.

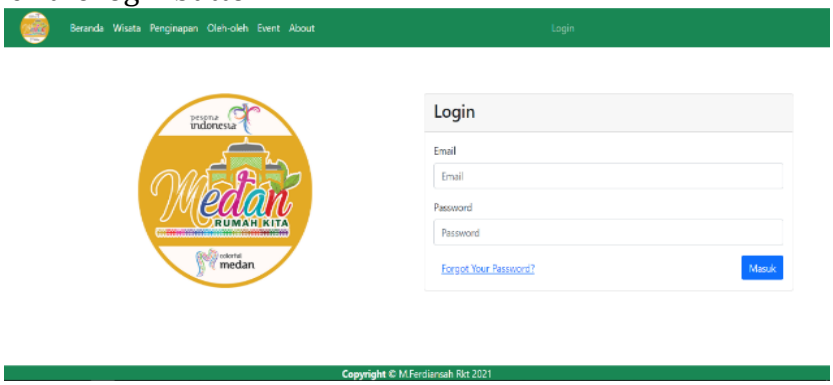

Figure 11. Admin Login View

8. Admin Menu View

On this page admin has 4 features, namely tour admin, lodging admin, souvenir admin, and event admin.

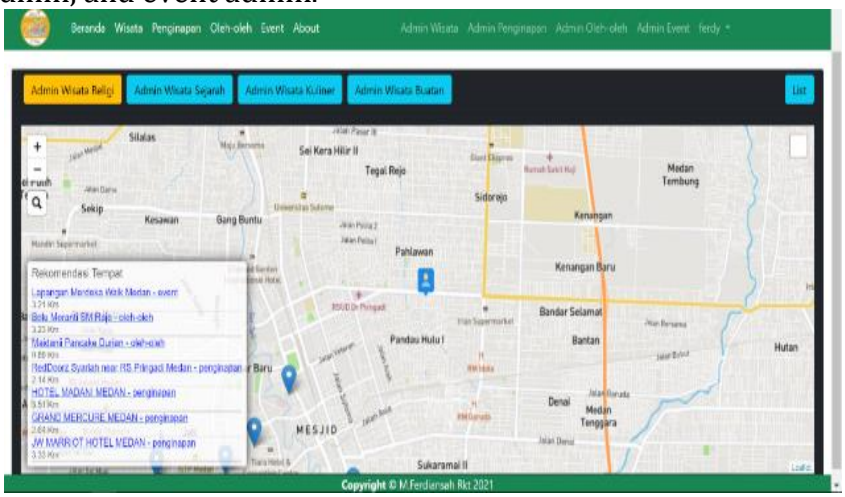

Figure 12. Admin Menu View

9. Location Data Validation List View

In this view, the admin gets access to verify the location point that the user inputs to enter the database permanently and will appear to maps, then the admin gets access to reject the location point and see the photo.

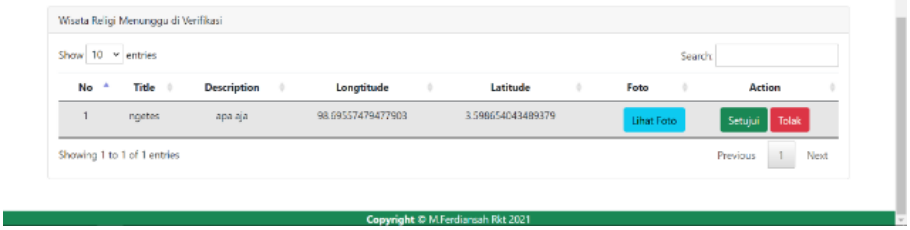

Figure 13. Location Data Validation List View

10. Admin Tour List View

The view of the admin tour list page contains tourist data. On this page, admins can edit, delete and view photos.

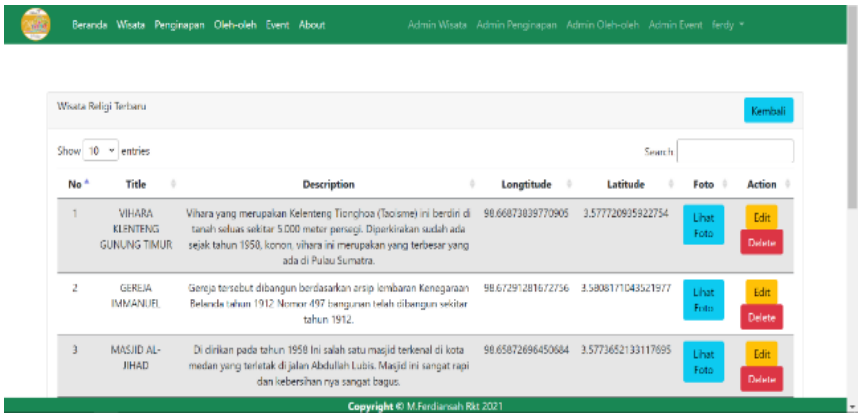

Figure 14. Admin Tour List View

11. Edit Form View

On this page the admin can change the data you want to change.

Figure 15. Edit Form View

12. Admin Event View

On this page admin can input the event location point without verification anymore.

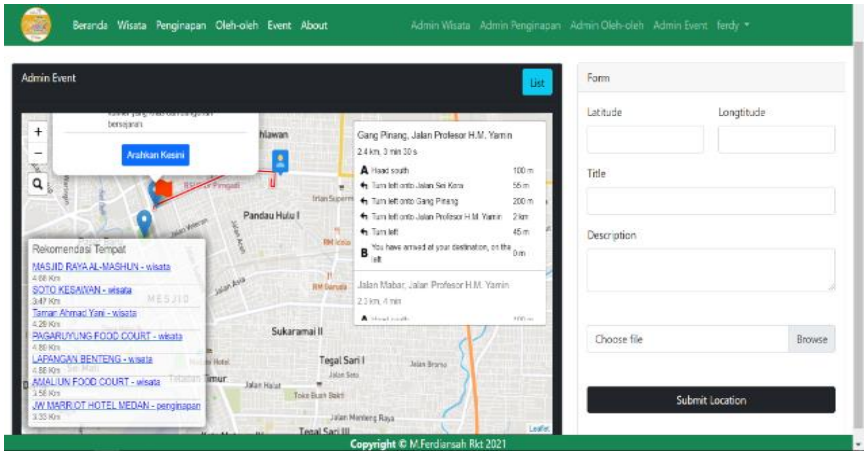

Figure 16. Admin Event View

13. Event Data List View

On the event data page that lists events in the city of Medan, and admins can delete event data and edit.

Figure 17. Event Data List View

D. Conclusion

Based on the research conducted, it can be obtained conclusions, namely:

1. The construction of this geographical information system produces a tourist location located in medan city, the location of lodging, as well as the location of souvenirs typical of Medan City and events held in Medan City.
2. With this geographical information system makes it easier for tourists or the people of Medan City to choose a location to go to the shortest route.

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