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Medan City Tourism Geographical Information System Using Dijkstra Algorithm Method

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Article Information	Abstract
Submitted :26 Jun 2022 Reviewed: 26 Jul 2022 Accepted : 8 Aug 2022	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
Keywords	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
Geographic Information System, Open Street Map, Waterfall, Tourism, Dijkstra Algorithm	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. 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].

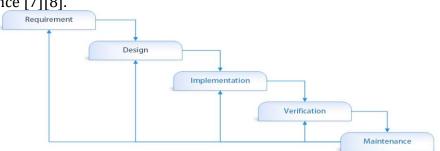


Figure 1. Waterfall Method

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.

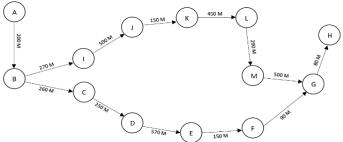


Figure 2. Dijkstra Algorithm Case Graph

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

Та	ıble 1.	List Of	f Rou	te Locatio	ns					
	Node Location Point									
	А	Tugu	Nol	Kilometer						

	Medan
В	Bukit Barisan
С	St.Ka
D	Pulau Pinang
Е	Mesjid
F	Palang Merah
G	Ahmad Yani
Н	Tjong A Fie Mansion
Ι	Kereta Api
J	Letdjen M.T.Haryono
К	Cirebon
L	Pandu
М	Pemuda

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

	Table 2. 1st Iteration Results											
В	С	D	Е	F	G	Н	Ι	J	Κ	L	Μ	
200	8	8	8	8	8	8	8	8	8	8	8	
Α												

 $A \to 0, B \to 200$ 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. 2 nd Iteration Results											
В	С	D	Е	F	G	Η	Ι	J	Κ	L	М	
200	460	8	8	8	8	8	470	8	8	8	8	
Α	В						В					

 $B \rightarrow 200 \text{ m}, C \rightarrow 260 \text{ m}, I \rightarrow 270 \text{ m}$. 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										М			
200	460	710	8	8	8	8	470	8	8	8	8		
Α	В	С					В						

Point C to point D \rightarrow 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. 4 th Iteration Results										
В	С	D	Е	F	G	Н	Ι	J	К	L	М
200	460	710	1.28	8	8	8	470	8	8	8	8
Α	В	С	D				В				

Point D to point E \rightarrow 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. 5 th Iteration Results											
В	С	D	Е	F	G	Н	Ι	J	Κ	L	М	
200	460	710	1.28	1.43	8	8	470	8	8	8	8	
Α	В	С	D	Е			В					

Point E to point $F \rightarrow 150$ 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

В	С	D	Е	F	G	Н	Ι	J	Κ	L	М
200	460	710	1.28	1.43	1.52	8	470	8	8	8	8
А	В	С	D	Е	F		В				

Point F to point G \rightarrow 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.

	Tab	le 8. 7	7 th Ite	ratioi	n Re	sults	
C	р	Е	Е	C	II	T	T

В	С	D	Е	F	G	Н	Ι	J	Κ	L	Μ
200	460	710	1.28	1.43	1.52	1.6	470	8	8	8	∞
Α	В	С	D	Е	F	G	В				
-		~ ~ ~	、 .	-				-	-	-	

Point G to point H \rightarrow 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:

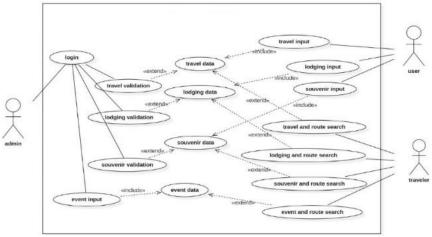


Figure 3. Use Case Diagram GIS Tourism Medan City

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:

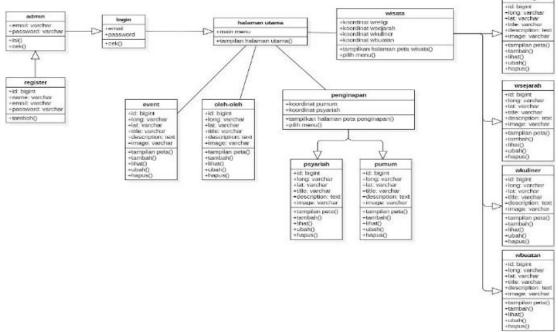


Figure 4. Class Diagram GIS Tourism Medan City

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:

					COLUMN REAL ACTIVE
Beranda Witsata Penginap	oan Oleh-oleh Event About		Ŀ	əgin	
Wisata Reigi Wisata Sejarah V	Wisata Kuliner Wisata Buatan		List	Form	
Sekip	Chip			Latitude	Longtitude
+ Kesawan G	Gang Buntu Pilih Titik Awal	 Plih Titk Akhir 	~ kesana		
- unst	Jalan Petra I	Pahlawan		Title	
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# RS Advent Hodan	Paceau	Contena			
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Ruman Saket Umam	MESJIO	Non RN Consta			
Rekomendasi Tempat	MESSIO		Jalan Den	Choose file	Browse
MEDAN TOURISM VIDEO CONTEST - evi 2.63 km		Sukaramai II			
Lapangan Merdeka Walk Medan - event	Mati	Tegal S	aril Juan		and the second second
Bolu Meranti SM Raja - oleh-oleh	Teladan Timur	Jalan Hatat		S	ubmit Location
a os ion. Suita Dama		Toks Bush Balch	Laster		
		nominht (?) M Fardianeah P			

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.

👼 Beranda Wosta Penginapan Oleh-oleh Event A	bout	Login	
Wisata Religi Wisata Sejarah Wisata Kuliner Wisata B	Gatan List	Form	
+ 1 Jacoban and Jun Tonyham and	Klometer Medar 🗸 Tjong A Fie Mansion 🛛 🖌 Kesana	Latitude	Longtitude
	Jalan Mesjić, Jalan Palang Merah 1.6 km Smin	Title	
Trans Astor DayHed	HS Ins. A Hood sest on Jalan Buks Bertean 200 m. P Turn right onto Stassun Karota Api 220 m.		
Rekomendasi Tempat Lapangan Merdeka Walk Medan - svant	Go straight 60 m F Turn light anto Pulsu Pinang 250 m Turn light anto Jalan Wegid 500 m	Description	
1 (5 Km AROMA PRIMA BAKERY & CAKE SHOP - dxth dish 4 35 Km	turn let 70m turn let 70m turn let onto Jalan Palang Varah turn let onto Jalan Palang Varah turn let onto Jalan Atmad Vara	· · · · · · · · · · · · · · · · · · ·	
NEDAN TOURISM VIDEO CONTEST - event 263 Km HOTEL, MADANI MEDAN - pengitapan 313 Km	B ng/t	Choose file	Browse
JAY MARRIOT HOTEL MEDAN - seng napan 1.77 Km Ma dani Pancake Durian - cieh-cieh	Aalan Stasiun Kerota Api, Jalan Crebon 2.4 km, 3 min 30 s	5. 	
3.02 Kn Oleh-oleh Khas Meter - cleh-oleh 3d5 Kn	A short set on Lase Bale Bales at the	Sul	omit Location
Contraction of the second seco	Conscient 0 M ExcEincols 94 2021	2	

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.

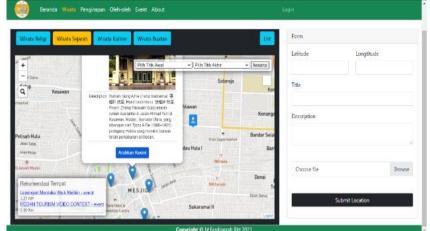


Figure 8. Pop Up View

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.

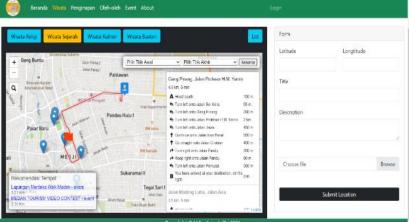


Figure 9. Realtime Route Search View

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.

Wisata Sej	arah Terbaru						Kembali
Show 10	← entries					Search:	
No *	Title 0		Description	0	Longtitude	Latitude	Foto 0
1	Tugu Nol Kilometer Medan	dari masa Kolonial samp	dan merupakan patung air pancur. Selain itu, ai saat ini terletak tepat di hadapan pintu ma ta dari Deli Data, pembangunan air mancur in 1915.	auk Kantor Pos	98.67739043340718	3.591472290508836	Lihat Foto
2	Tjong A Fie Mansion	Pinyin: Zhăng Yâoxua Kesawan, Medan, Sun	nzi tradisional: 張曜軒 故居; Hanzi sederhana: in Gùjù) adalah rumah dua lantai di Jalan Ahr satra Utara, yang dibangun oleh Tjong A Fie (yang memiliki banyak tanah perkebunan di 1	nad Yani di 1860–1921),	98.68030416346674	3.585421528910968	Lihat Foto
3	MENARA	Menara Air Tirtanadi (A	ksara Jawi : منارا ایر تیرتاند) merupakan salah s	atu ikon kota	98.68515932413514	3.5821939783357966	Libat

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.

pesona Contraction	Login	
	Email	
MARAD	Email	
*/Mealan	Password	
C RUMAH KITA	Password	
medan	Forgot Your Password?	Masuk

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.

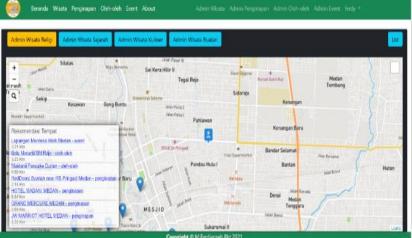


Figure 12. Admin Menu View

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.

rw 10 v	entries								Searc	'n	
No 🔺	Title 0	Description	0	Longtitude	0	Latitude	0	Foto	0	Action	0
1	ngetes	apa aja		98.69557479477903		3.598654043489379		Lihat Fo	oto	Setujui Tolak	
wing 1 to	1 of 1 entries									Previous 1	Next

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.

Berar	nda Wisata P	enginapan	Oleh-oleh	Event	About	Admin Wisa		Admin Penginapan	Ad	imin Oleh-oleh Adm	in Event	ferdy	•
Wisata R	eligi Terbaru												Kembali
Show 1	0 v entries									Searc	h		
No *	Title	0			Description		¢	Longtitude	0	Latitude	Fo	to 0	Action 0
1	VIHARA KLENTENG GUNUNG TIM	tana	ih seluas sek	itar 5.000 konon, v	meter persegi.	ioa (Taoisme) ini berdiri Diparkirakan sudah ad zakan yang terbesar yar tra.	8	98.668738397709	05	3.577720935922754	Lit Fo		Edit Delete
2	gereja Immanuel					sip lembaran Kenegara: an telah dibangun sekit		98.672912816727	56	3.5808171043521975	- Lit Fo		Edit Delete
3	MASJID AL- JIHAD		an yang terle	rtak di jal		u masjid terkenal di kot bis. Masjid ini sangat ra at bagus.		98.658726964506	84	3.577365213311769	Lit Fo		Edit Delete
					Cop	pyright © M.Ferdiansal	Rkt	: 2021					

Figure 14. Admin Tour List View

11. Edit Form View

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

Update Data Wisata Religi	
	Kembali
Latitude	Longtitude
3.577720935922754	98.66873839770905
Title	
VIHARA KLENTENG GUNUNG TIMUR	
Description	
Vihara yang merupakan Kelenteng Tionghoa (Taoisme) ini berdiri di tanah seluas merupakan yang terbesar yang ada di Pulau Sumatra.	sekitar 5.000 meter persegi. Diperkirakan sudah ada sejak tahun 1958, konon, vihara ini
Image	
Piih Fie Tidak ada file yang dipilih	
"kosongkan jika tidak ingin mengubah gambar	
	Update Location

Figure 15. Edit Form View

12. Admin Event View

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

lmin Event			Form	
bersajaan			Latitude	Longtitude
+	hlawan	Gang Pinang, Jalan Profesor H.M. Yamin 2.4 km 3 min 30 s		
Arahkan Keeni	Irian Super	A Haad south 100 m + Tam left onto Jalan Sei Kena 56 m + Tum left onto Gang Pinang 200 m	Title	
Rekomendas Tempat	Pandau Hulu I	An Turn left onto Jolan Profesor H.M. Yamin 2 km An Turn left 45 m B You have arrived at your destination, on the Orn left	# Description	
MASJID RAYA AL-MASHUN - wisata See Kri SoTO KESAWAN - wisata SAT Kris MES 210	II RM Garves	Jalan Mabar, Jalan Profesor H.M. Yarrin 23 km, 4 nin	-	
Tamar Ahmad Yani - wisata 4.29 Km	Sukaramai II	A shoul much 100 m		
PAGARUYUNG FOOD COURT - wisata 4.80 Km	Sukaramai li	No.	Choose file	Brows
LAPANGAN BENTENG - wisets Hotel	Tegal S Jolan Jolan Halut =			
156 Km JW MARR OT HOTEL MEDAN - penginapan	Toke Bush Bakt		s	ubmit Location

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.

Beran	da Wisata)	Penginapan Oleh-oleh Event About Admin Wisata Admin Peng			
Event Teri	1971				
create rett	ne u				Kemisali
Show 10	* entries			Search:	
No *	Title	Description 4 L	Longtitude	Latitude 🕴	Foto Action
1	Lapangan		7857941752357	3.59025209540291	Lihat Edit
	Merdeka Walk	hari itu Kota Medan genap berusia 428 tahun. Dan untuk menyambut dan menyemarakkan HUT Kota Medan, Dinas Panwisata Kota Medan akan			Foto
	Medan	menyelenggarakan berbagai kegiatan menarik sepanjang bulan Juli 2018.			
		Diawali dengan Pesona Colorful Medan Camival 2018, dari tanggal 30 Juni			
		2018 sampai dengan 01 Juli 2018. Malamnya, dilanjutkan dengan pagelaran			
		budaya dan penampilan artis Ibu Kota, Kali ini "SETIA BAND" didatangkan dari Jakarta untuk menghibur warga Kota Medan dan menyemarakkan suasana di			
		Lapangan Merdeka Kota Medan. Kemudian pada keesokkan harinya, Minggu,			

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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