Journal of Artificial Intelligence and Engineering Applications

Website: https://ioinformatic.org/

15th October 2023. Vol. 3. No. 1; e-ISSN : 2808-4519

Searching For The Nearest Route To The Location Of Health Facilities Using The Djikstra Method

Nurita Indriana [1*], A M H Pardede [2], Siswan Syahputra [3]

[1,2,3] *Informatics Engineering, STMIK Kaputama*
Jl. Veteran No. 4A-9A, Binjai, North Sumatra, Indonesia
Nuritaindriana561@gmail.com[1], akimmhp@live.com [2], siswansyahputra90@gmail.com[3]*

Abstract

A health facility or health service facility is a tool or place used to carry out health service efforts, both in terms of promotive, preventive, curative and rehabilitative carried out by the central government, regional government or the community. This research contains development applications that cover every hospital, health center, and practice clinic located in the Langkat Regency area with the aim of facilitating the community in finding the nearest hospital, health center, and practice clinic. The application built can display the location of the health facility in map form and can display information in the form of name, address, telephone number, photo of the health facility, services available there, working hours, and further information on the place. In this study, the search for health facilities is only subject to distance as a health facility criterion, so that it can be developed further. To find the closest route to a health facility, here the author uses the Dijkstra Algorithm method which has been widely researched to be applied to the shortest route search system. This algorithm was invented by Edsger Dijkstra, a computer scientist from the Netherlands. The way Dijkstra's algorithm works is with a greedy strategy, namely at each step it chooses the side with the smallest value that connects the selected and unselected nodes/nodes. This algorithm requires a point of origin and a destination with the final result being the shortest distance from the point of origin to the destination along with the route.

Keywords: *Health Facilities, Djikstra's Algorithm, Mobile Application*

1. Introduction

Technology is developing so rapidly nowadays, especially in mobile technology. Almost everyone uses a smartphone for their activities. The use of smartphones also varies, such as playing games, social media, searching for information and other needs that can be done using a smartphone [1]. There are many health facilities in almost every city or remote city, scattered everywhere, because everyone needs health facilities to get good health for citizens. Health facilities such as hospitals are institutions that serve individual health as a whole by providing inpatient, outpatient and emergency services [2], [3]. Indonesian people's awareness of the importance of maintaining a healthy body is still relatively low, so that health facilities have a very important role in assisting each individual in maintaining health, treating disease, and recovering health.

2. Previous Research

2.1 Health Facilities

A health facility or health service facility is a tool or place used to carry out health service efforts, both in terms of promotive, preventive, curative, and also rehabilitative carried out by the central government, regional government or the community [4], [5].

2.2 Shortest Route Search

The shortest route is the minimum route required to get from one point (location) to another point (location). The shortest path is one of the problems that can be solved by a graph in the form of a collection of points (vertices) in a two-dimensional plane connected by a group of lines (edges). This algorithm requires a point of origin and a destination with the final result the shortest distance from the point of origin to the destination along with the route[6], [7].

2.3 Dijkstra's Algorithm

Dijkstra's algorithm is one of the algorithms commonly used to determine the shortest path in a directed graph. The Dijkstra method is a method whose name matches the name of its inventor, Edger Dijkstra, where this method is used to solve the problem of finding the shortest route between locations connected by paths, where the distance between paths is not a negative value[8].Dijkstra's algorithm can find the shortest path in a few steps. This algorithm uses the greedy principle, which states that at each step the side with the least weight will be selected and recorded in the solution set. Dijkstra's algorithm is one of the most effective algorithms for providing the shortest route from one place to another. The principle of Dijkstra's algorithm is to find the location of a point by looking for the two shortest paths. For each iteration the distance from the known point (from the starting point) is updated if a new point is found that gives the shortest distance. The requirement for this algorithm is that the edge weights of the graph must have positive weights (≤ 0).

2.4 Mobile Applications

Mobile applications are software that runs on mobile devices such as smartphones or tablet PCs. Mobile applications are also known as applications that can be downloaded and have certain functions that add to the functionality of the mobile device itself. To get the desired mobile application, users can download it through certain sites according to the operating system they have. Google Play and iTunes are examples of sites that provide various applications for Android and iOS users to download the desired application [9].

3. Results and Discusssion

3.1 Djikstra Calculation Analysis Graph

The stages of the Djisktra algorithm in graph theory are as follows:

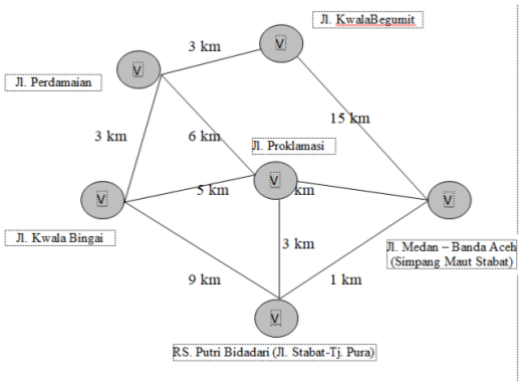

Fig. 1: Weighted Graph Calculation Analysis - 1

The table of distances between regions to destination health facilities is as follows:

Table 1: Distance Between Regions

Home Territory	Destination area	Skipped AddressSkipped Address	Distance
V1	V2	Jl. Perdamaian	3 km
V1	V5	Jl. Medan Banda Aceh	15 km
V2	V3	Jl. Kwala Bingai	3 km
V2	V4	Jl. Proklamasi	6 km
V3	V4	Jl. Proklamasi	5 km
V3	V6	Jl. Stabat – Tj. Pura	9 km
V4	V5	Jl. Medan Banda Aceh	2 km
V4	V6	Jl. Stabat – Tj. Pura	3 km
V5	V6	Jl. Stabat – Tj. Pura	2 km

Calculations using the Djikstra method to find the shortest route can be started from the starting point V1, namely $\bar{y}(V1) = 0$ for each point V on graph G. Then we write T as a set of points G that have not been permanently labeled, namely T = (V1, V2, V3, V4, V5).

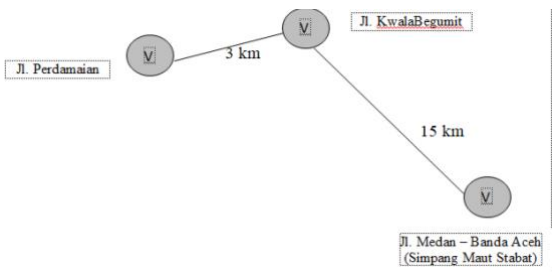

Fig. 2: Weighted Graph Calculation Analysis – 2

Table 2: Starting Point - 1

starting point Vi	V1	V2	V3	V4	V5	V6
Y (V)	0	∞	∞	∞	∞	∞
T	V1	V2	V3	V4	V5	V6

It is clear that the point T labeled minimum is V1 (Jl. Kwala Begumit).

y′ (V2 : Jl. Perdamian) = { ∞, 0 + 3 } = min {∞,3} = 3 km

y′ (V5 : Jl. Medan-Banda Aceh) = { ∞, 0 + 15 } = min {∞,15} = 15 km

Table 3: Starting Point - 2

starting point Vi	V1	V2	V3	V4	V5	V6
Y (V)	0	∞	∞	∞	15	∞
T	-	V2	V3	V4	V5	V6

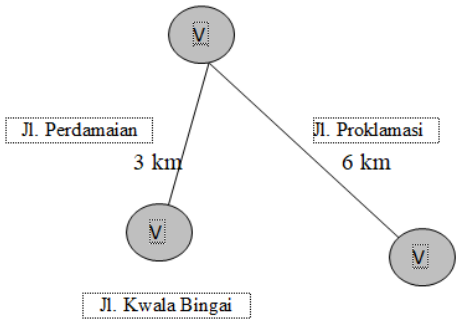

Fig. 3: Weighted Graph Calculation Analysis - 3

Our starting point starts from V2 Jl. Peace goes to the lane V3 and V4.

y′ (V3 : Jl. Kwala Bingai) = { ∞, 3 + 3 } = min {∞,6} = 6 km

y′ (V4 : Jl. Proklamasi) = { ∞, 3 + 6 } = min {∞,9} = 9 km

Table 4: Starting Point - 3

starting point Vi	V1	V2	V3	V4	V5	V6
Y (V)	0	3	6	9	15	∞
T	-	-	V3	V4	V5	V6

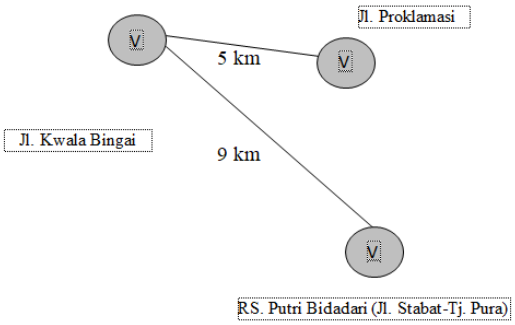

Fig. 4: Weighted Graph Calculation Analysis - 4

Our starting point starts from V3 Jl. Kwala Bingai headed for the lane V4 and V6.

y′ (V4 : Jl. Proklamasi) = { ∞, 6 + 5 } = min {∞,11} = 11 km

y' (V6 : Jl. Stabat-Tj.Pura) = { ∞, 6 + 9 } = min {∞,15} = 15 km

Table 5: Starting Point - 4

starting point Vi	V1	V2	V3	V4	V5	V6
Y (V)	0	3	6	11	15	15
T	-	-	-	V4	V5	V6

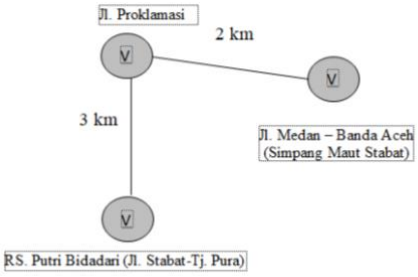

Fig. 5: Weighted Graph Calculation Analysis - 5

Our starting point starts from V4 Jl. Proclamation to the lane
V5 and V6.

y' (V5 : Jl. Medan-Banda Aceh) = { ∞, 9 + 2 } = min {∞,11} = 11 km

y' (V6 : Jl. Stabat-Tj.Pura) = { ∞, 9 + 3 } = min {∞,12} = 12 km

Table 6: Starting Point - 5

starting point Vi	V1	V2	V3	V4	V5	V6
Y (V)	0	3	6	9	11	12
T	-	-	-	-	V5	V6

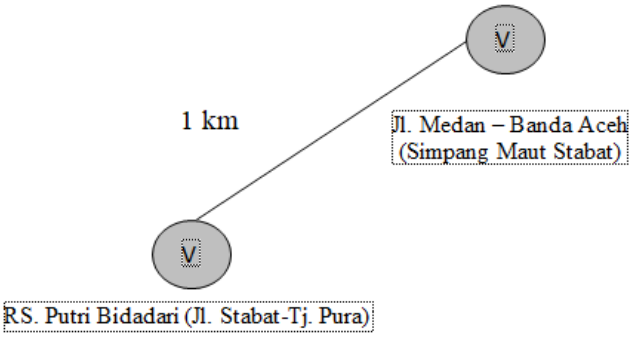

Fig. 6: Weighted Graph Calculation Analysis - 6

Our starting point starts from V5 Jl. Medan-Banda Aceh headed for line V6.

y' (V6 : Jl. Stabat-Tj.Pura) = { ∞, 11 + 1 } = min {∞,12} = 12 km

Table 7: Starting Point - 6

starting point Vi	V1	V2	V3	V4	V5	V6
Y (V)	0	3	6	9	11	12
T	-	-	-	-	-	V6

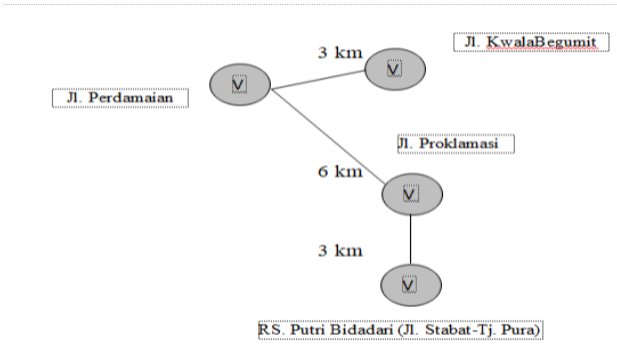

Fig. 7: Weighted Graph Calculation Analysis - 7

From the table above, the closest route to the health facility starting from point V1 to V6 is 12 km. That is, by calculating:

y˄ (V6 = Jl. Stabat – Tj. Pura) = 12 km y˄(V1,V6)

y˄ (V4 = Jl. Proklamasi) = 3 km y˄(V4,V6)

y˄ (V2 = Jl. Perdamaian) = 9 km y˄(V2,V6)

so obtained y˄(Jl. Stabat – Tj. Pura) (V1+V2+V4) = 12 km

Table 8: Starting Point - 7

starting point Vi	V1	V2	V3	V4	V5	V6
Y (V)	0	3	6	9	11	**12**
T	-	-	-	-	-	V6

3.2 Context Diagram

Context diagram (context diagram) is used to describe the input and output relationships between the system and external entities. A context diagram always has one process that represents the entire system. This system has two external entities, namely admin and public.

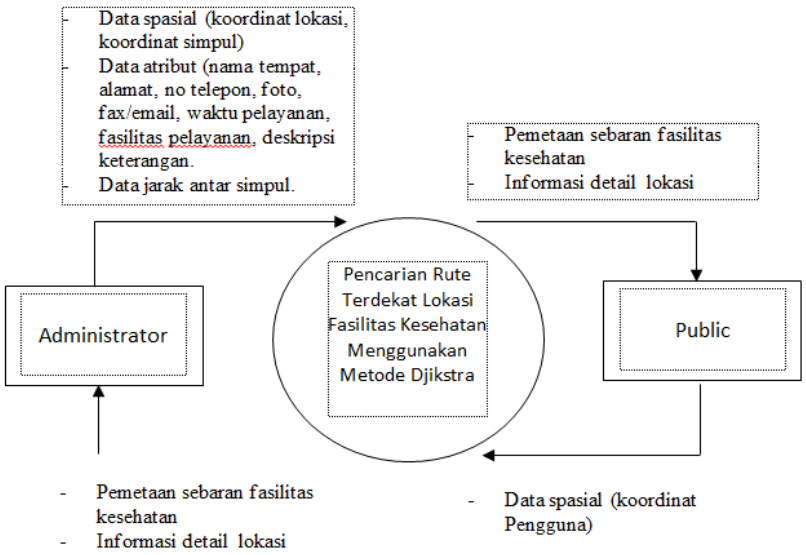

Fig. 8: Context Diagram

3.3 DFD Level 0

DFD Level 0 is a diagram that explains the process sequences that occur in the context diagram. Level 0 DFD design can be seen in Figure 9:

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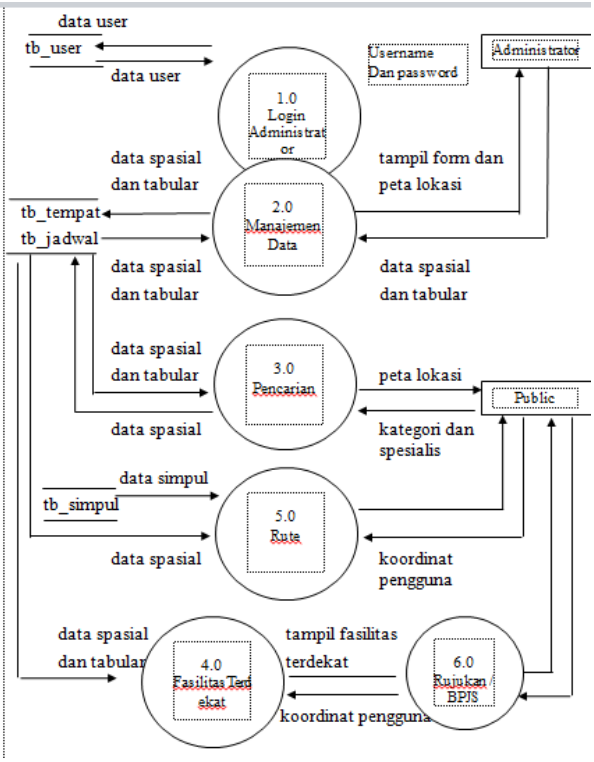

Fig. 9: DFD Level 0

3.4 Entity Relationship Diagram (ERD)

Entity Relationship Diagram is a graphical technique that describes the database schema. It is called an E-R-D diagram because it shows the various entities being modeled, as well as the relationships between these entities. An entity is anything about which the organization wishes to collect and store information.
Entity Relationship Diagram can be seen in Figure 10 as follows:

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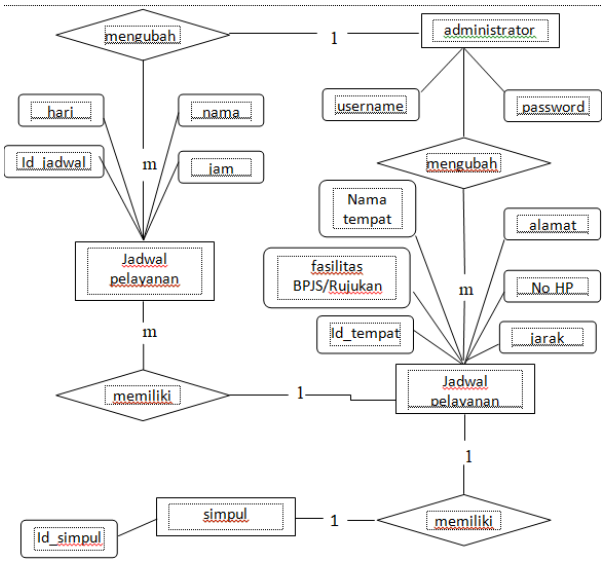

Fig. 10: Entity Relationship Diagram

3.6 Program Output Design

The design of the main menu page display contains choices of health facilities such as hospitals, health centers, clinics. To find information and information on health facilities, the distance and travel time you want to go to, see the main menu display design in Figure 11.

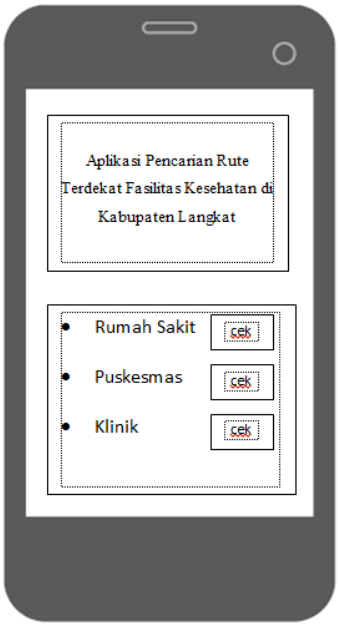

Fig. 11: Main Menu

Design the appearance of the menu searching for health facilities which is made to make it easier for users to go where they choose for treatment. The design of the health facility searching menu can be seen in Figure 12.

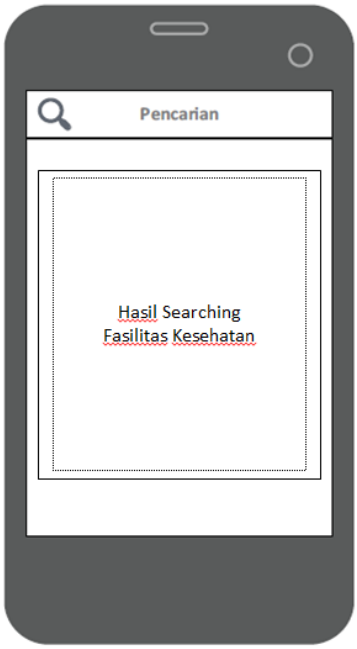

Fig. 12: Facility Search Menu

Design a health facility information detail menu page that contains all the health facility attributes selected by the user.

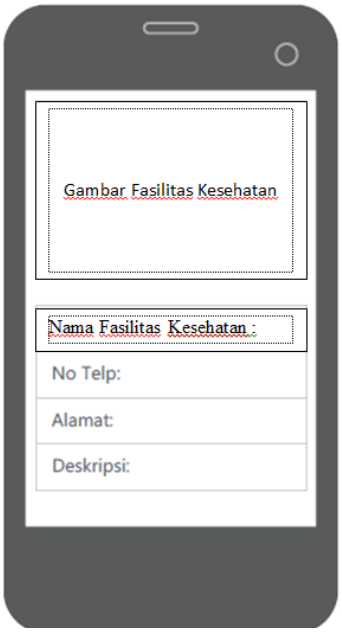

Fig. 13: Information Detail Menu Page

The design for the display of the Langkat Regency health facility map page contains users looking for the closest distance to health facilities in Langkat Regency and information on the distance and travel time of the health facility they want to go to. The design of the Langkat Regency health facility map display page can be seen in Figure 14.

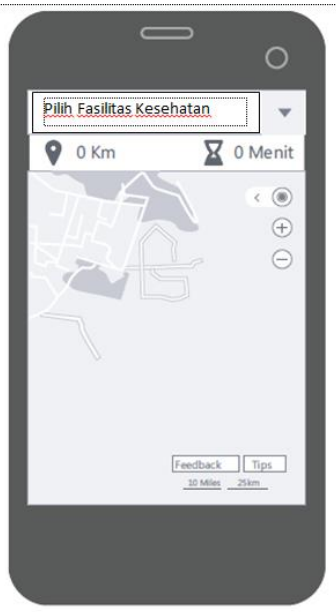

Fig. 14: Health Facility Map Menu Page

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