WEBGIS APPLICATION FOR SEARCHING NU MOSQUE IN EAST JAVA USING THE HAVERSINE METHOD

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ABSTRACT

Indonesia is the country with the largest number of mosques in the world. In East Java, there are many Islamic organizations, one of which is Nahdhotul Ulama (NU). Nahdhotul Ulama (NU) is one of the socio-religious organizations in Indonesia which was founded on 16 Rajab 1344 or to coincide with January 31, 1926 in Surabaya on the initiative of two leading traditional scholars at that time, K.H Hasyim Asy'ari and K.H Abdul Wahab Hasbullah.
Geographic Information System is a computer system that is used to collect, check, integrate, and analyze information related to the earth's surface. Basically, the term geographic information system is a combination of three main elements, namely system, information, and geography. Thus, an understanding of these three main elements will be very helpful in understanding GIS. The haversine is an important equation in navigation, giving the great circle the distance between any two points on the sphere of longitude and latitude. It is a special case of the more common formula in spherical trigonometry, the law of haversines, relating the sides and angles of a spherical triangle (Spherical Trigonometry).
From the calculation results of the haversine algorithm the first trial formula is at the user's location at 1. Jl. Raya Surabaya - Malang, Sawahan, Buduran, Buduran District, Sidoarjo Regency, East Java 61252 found the closest mosque based on the heversine formula is Darussalam Mosque, jl. Kedemang Singomenggolo no 98 Buduran with a distance of 1,396 Km. From the calculation results of the haversine algorithm, the first trial formula at the user's location on Jl. Raya Suko No.55, RT.01/RW.01, Ngemplak, Cemeng Kalang, Sidoarjo District, Sidoarjo Regency, East Java 61224 found the closest mosque based on the heversine formula is Miftahul Jannah Mosque, jl. Banjar poh village Banjar Bendo with a distance of 1,878 Km

Keywords: *Mosque, Geographic, Algorithm, Haversine.*

1. INTRODUCTION

In Indonesia, there are various religions, one of which is Islam. The place of worship for Muslims is the mosque. The mosque means a place of prostration, and a small mosque is also called a musholla, langgar or surau. Apart from being a place of worship, the mosque is also the center of the life of the Muslim community. Activities for celebrating holidays, discussions, religious studies, lectures and studying the Qur'an are often held at mosques. Indonesia is home to more than 250,000 mosques, which makes Indonesia the country with the largest number of mosques in the world. In East Java there are many One of the Islamic organizations is Nahdhotul Ulama (NU). Nahdhotul Ulama (NU) is a socio-religious organization in Indonesia which was founded on 16 Rajab 1344 or to coincide with January 31 1926 in Surabaya at the initiative of two leading traditional scholars at that time, K.H Hasyim Asy'ari and K.H Abdul Wahab Hasbullah.

There are so many mosques associated with the NU organization. For the NU community, knowing the location of the mosque (NU) in East Java is very important. The development of technology is currently very fast, and it should be able to help the NU community find out the location of mosques (NU) which are spread across East Java.

Geographic information system (GIS) is a tool that can be used to collect, store, retrieve, transform and display data for a specific purpose. The data can be in the form of spatial data or attribute data (Arronoff, 1989 in Danoedoro, 1996). Webgis is a combination of the internet, information and geography (especially mapping) and has developed into a separate scientific discipline (Fu, 2011).

To overcome the above problems, we need a geographic information system that can tell the location of mosques (NU) in East Java by implementing an algorithm that can help determine the location of the nearest mosque (NU). The method used is the Haversine method. The Haversine formula is the right formula for calculating the distance between two points, with the input latitude and longitude as the starting and ending points, the distance between the points that are nearby will be calculated. This geographic information system was created in order to find out the distribution of mosques (NU) and find out the closest location of mosques (NU) in the East Java region.

2. LITERATURE

A. The Haversine Method

Research conducted using the Haversine method to determine the distance between points. The input variable in the haversine method uses latitude (longitude) and longitude (lattitude) assuming the shape of the earth is perfectly round with. The Haversine formula gives the great circle distance between two points on the surface of the ball (earth) based on longitude and latitude assuming the radius R is 6.367.45 km, and the locations of the 2 points in spherical coordinates (latitude and longitude) are lon1, lat1, and respectively lon2, lat2. The Haversine formula can be written with the following equation:

```
x = (lon2-lon1) * cos ((lat1+lat2)/2);
y= (lat2-lat1);
d= sqrt(x*x+y*y)*R
```

Information:
x : Longitude
y : Lattitude
d : Range
R : Earth radius = 6371 km
1 degree = 0.0174532925 radians

B. Webgis

Webgis is a GIS application or digital mapping that utilizes the internet network as a communication medium that functions to distribute, publish, integrate, communicate and provide information in the form of text, digital maps and carry out analysis and query functions related to GIS through the internet network. (Prahasta 2007).

C. MySQL

MySQL is a relational database management system (RDBMS Relational Database Management System) that is able to work fast, robust and easy to use. Other RDBMS examples are Oracle, Sybase. The database allows you to efficiently store, browse, sort and retrieve data. The MySQL server will help perform this functionality. The language used by MySQL is of course SQL - the standard relational database language worldwide today.

3. RESEARCH METHODOLOGY

3.1. Problem Analysis

Create a mosque search (NU) webgis application using the haversine method which can be used to manage and present information about NU mosques. The Haversine method is used to calculate distances between points on the earth's surface using latitude (longitude) and longitude (lattitude) as input variables. The Haversine formula is an important equation in navigation, giving the great circle distance between any two points on the surface of the sphere (Earth) based on longitude and latitude. Assuming that the earth is perfectly spherical with a radius R 6367.45 km.

3.2. System Design Planning

The main objective of the system design is to provide an overview of the system design to be built or developed, in order to understand the flow of information and processes within the system. The following are the stages that will be carried out in the system design.

3.2.1. System Flowchart

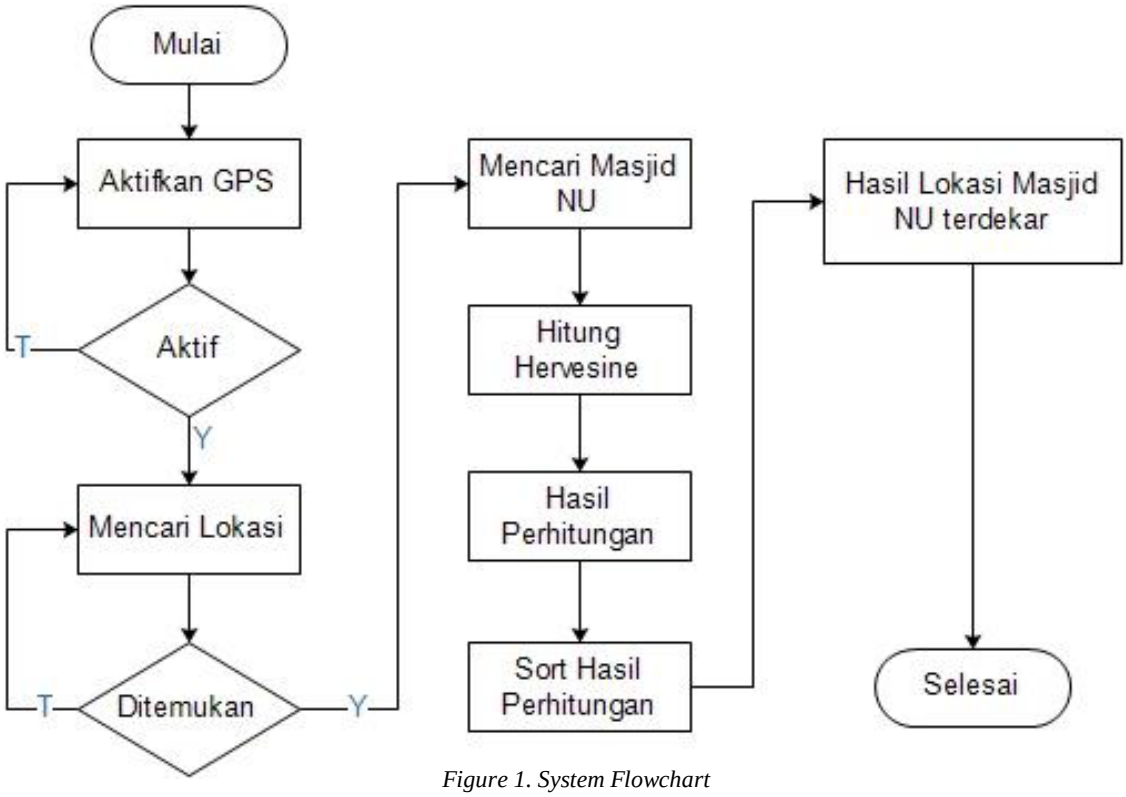

Figure 1. System Flowchart

The flowchart above explains that before using the webgis to search for mosques (NU) in East Java using the Haversine method the user must activate the GPS first then wait to open the location of the user's coordinates after finding the coordinates of the system user will calculate using the haversine method after obtaining the distance calculation then sorted by according to the lowest distance.

3.2.2. Context Diagram

Figure 2. Context Diagram

Context diagram is the highest part in DFD (Data Flow Diagram), meaning that before entering into making DFD, a context diagram is needed first.

The picture above explains that in the webgis application process the search for NU mosques using the heversine method has two entities, namely admin and user, the admin is tasked with adding and updating mosque data used in the webgis application while the user is tasked with finding the nearest mosque data using the heversine method.

3.2.3. Flow Diagram Data

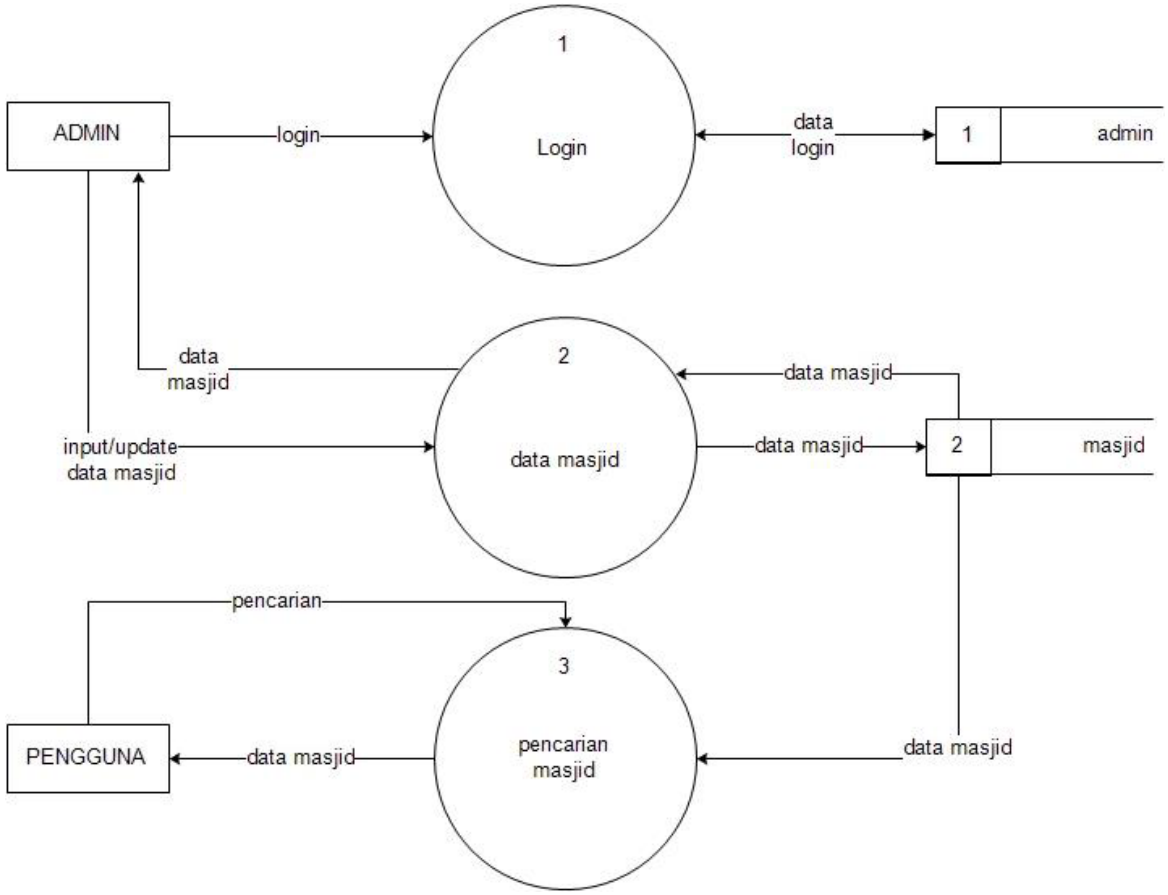

Figure 3. Flow Diagram Data Level 0

The picture above is the whole process in the webgis application for searching NU mosques using the heversine method, starting from admin login to searching for mosque locations by users. The following is a description of the process in Flow Diagram Data Level 0:

1. Login
   The login process is a process carried out by the admin by entering a username and password taken from the admin table.
2. Mosque Data
   The mosque data process is carried out by the admin to add mosque data and then it is stored in the mosque data table and processed, the admin can also edit mosque data taken from the mosque data table.
3. Mosque Search
   The mosque search process is a process carried out by the user by determining the user's initial location point and will be calculated using a heversine to get the closest distance to the mosque from the user's location.

3.2.4. Haversine Calculation Manual

Assuming that the earth is perfectly spherical with a radius R 6367.45 km, and the locations of the 2 points on the spherical coordinates (latitude and longitude) are lon1, lat1, and lon2, lat2, respectively, the Haversine formula can be written by the equation as follows:
The Haversine Formula

```
x = (lon2-lon1) * cos ((lat1+lat2)/2);
y= (lat2-lat1);
d= sqrt(x*x+y*y)*R
```

Information:
x : Longitude
y : Lattitude
d : Range
R : Earth radius = 6371 km
1 degree = 0.0174532925 radians

Haversine Formula Calculation Example:
Lokasi 1: lon1= 119.800801, lat1= -0.790175
Lokasi 2: lon2= 119.8428, lat2= -0.8989
lat1 = -0.790175 * 0.0174532925 radian = -0.013791155 radian
lon1 = 119.800801 * 0.0174532925 radian = 2.090918422 radian
lat2 = -0.8989 * 0.0174532925 radian = -0.01569 radian
lon2 = 119.8428 * 0.0174532925 radian= 2.091651 radian
x = (lon2-lon1) * cos ((lat1+lat2)/2)
= (2.091651-2.090918422) * cos ((-0.013791155 + -0.01569)/2)
= 0.0007329412
y = (lat2-lat1)
= (-0.01569- (-0.013791155))
= -0.001897609
d = sqrt (x*x + y*y) * R
= sqrt ((0.0007329412*0.0007329412) + (-0.001897609*- 0.001897609))*6371
= sqrt (0.0000041381) * 6371
= 12.96012927 km

4. RESULTS AND DISCUSSION

4.1. Result

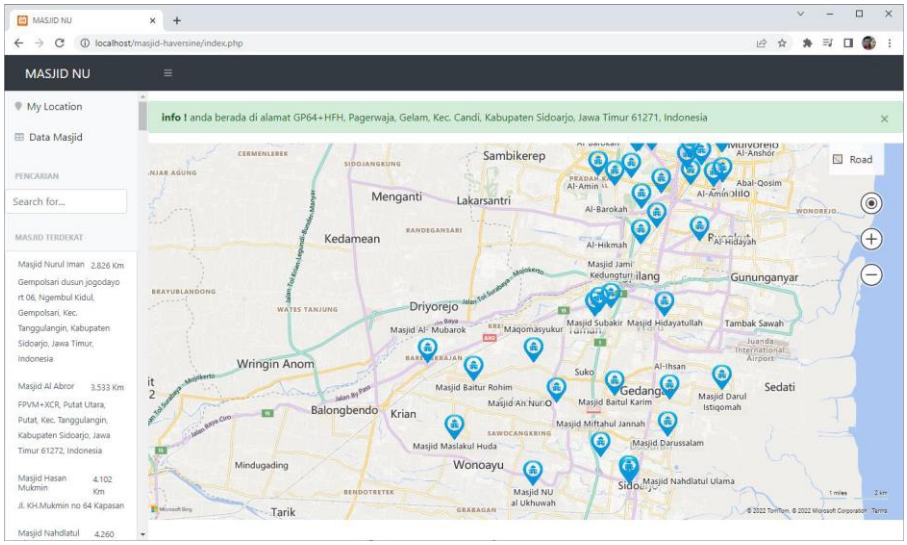

Figure 4. My Location Page

The my location page functions to display the user's location point with this feature allowing the user to find out where the location of the user is and the location of the NU mosque on this page also displays information on the distance of each mosque to the user using heversine calculations.

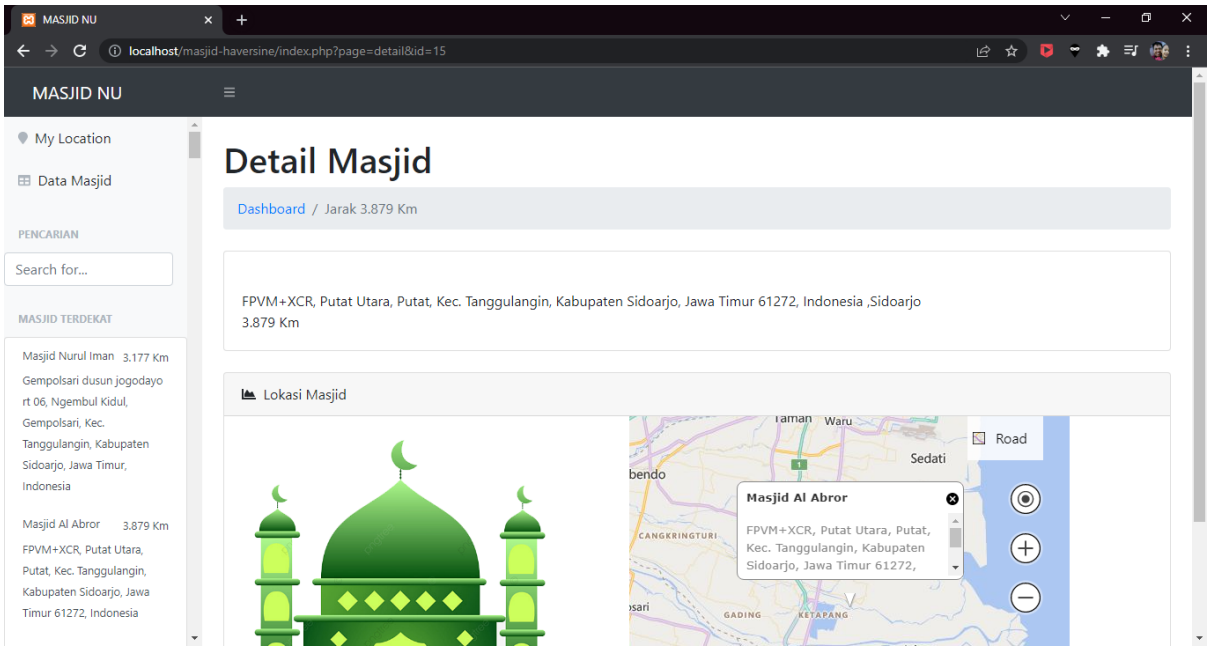

Figure 5. Mosque Details Page

The mosque details page functions to display mosque data in detail.

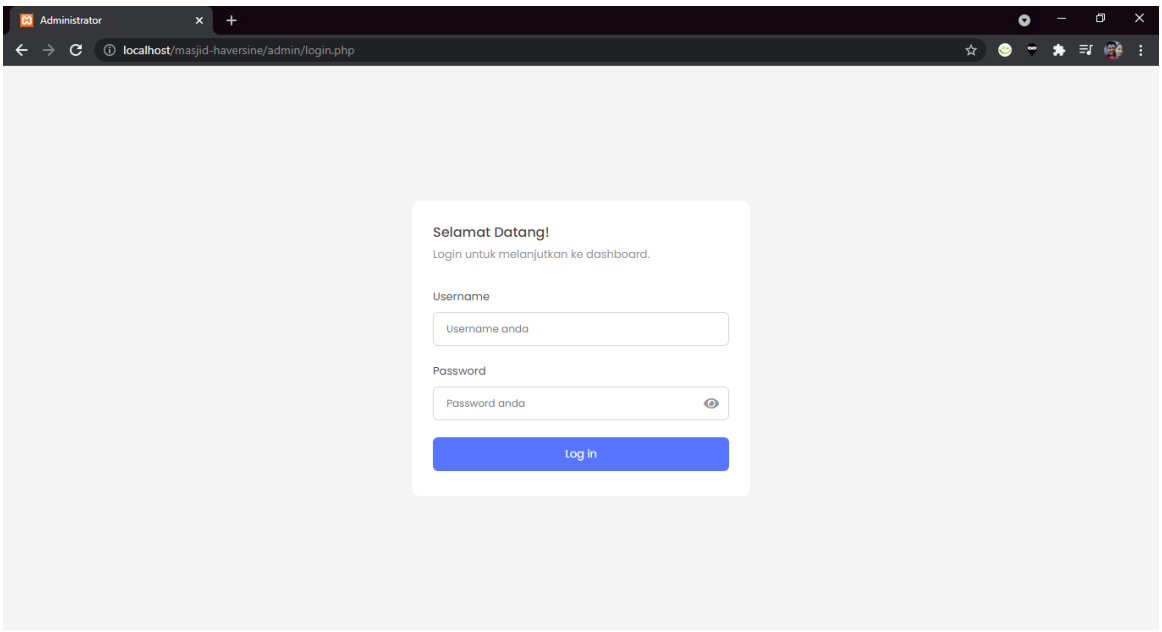

Figure 6. Admin Login Page

The admin login page functions to enter the dashboard page. To enter the admin dashboard page, you must enter a username and password and if successful, the admin can add mosque data and change mosque data

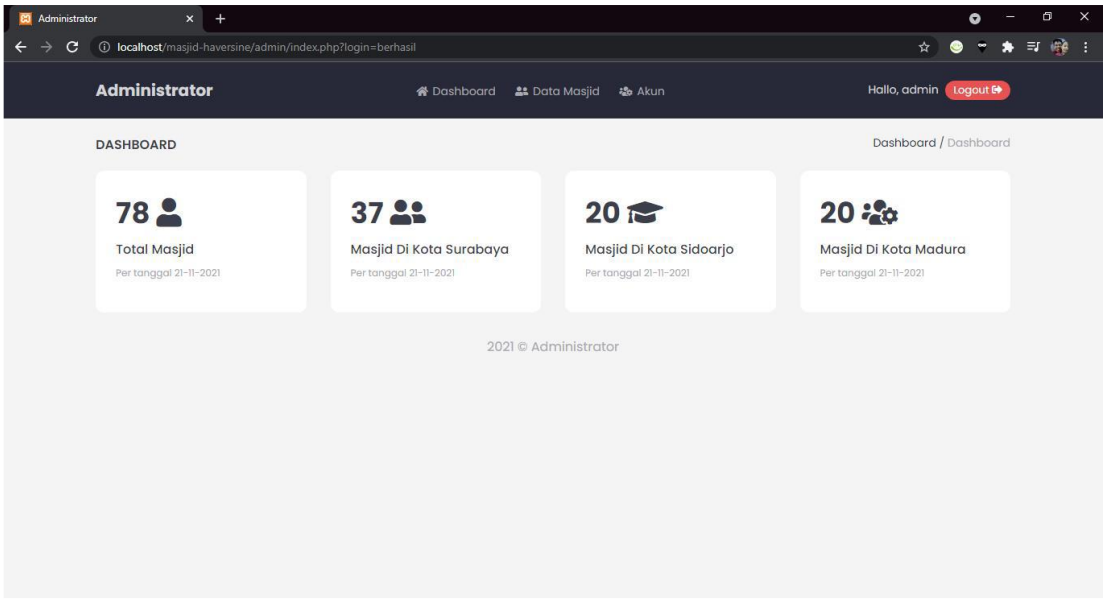

Figure 7. Admin dashboard page

The admin Dashboard page is the main view of the website administrator which functions to make various changes and additions to the user's website.

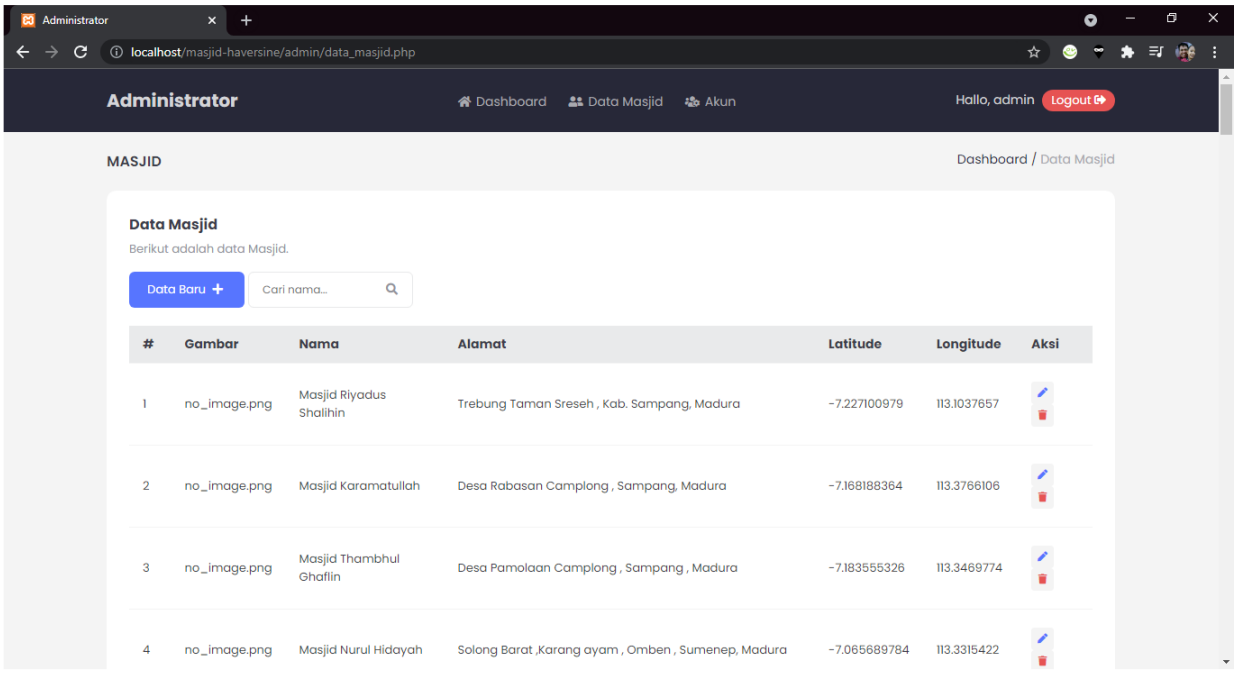

Figure 8. Mosque Data Page

The mosque data page functions to display mosque data information used in webgis.

4.2. Discussion

The stages of testing the mosque search (NU) webgis application using the haversine method are carried out by comparing the application search results with Google maps search results. The test was carried out at the address Jl. Dr. Ir. H. Soekarno No.18 - 19, Semolowaru, Sukolilo District. For more details, see the following table.

Table 1. Software Testing Results

No.	Application		Google Maps		Information
	Mosque	Range	Mosque Name	Range	
1.	Ar Royan Mosque Jl. Galaxi Bumi Permai Block N7 no. 20, Jl. The South Asri Klampis Galaxy II No. 20, Medokan Semampir, Sukolilo District, Surabaya.	0.467 km	Ar Royan Mosque Jl. Galaxi Bumi Permai Block N7 no. 20, Jl. The South Asri Klampis Galaxy II No. 20	0.46 km	Distance difference
2.	Sabilillah Jl. Semampir Selatan II A No. 144, Surabaya.	0.639 km	Sabilillah Mosque Jl. Semampir Selatan II A No. 144, Surabaya.	0.603 km	Distance difference
3.	Abdussalam Mosque Jl. Perumahan Semampir Praja, Medokan Semampir, Sukolilo District, Surabaya.	0.701 km	Abdussalam Mosque, Jl. Perumahan Semampir Praja	0.704 km	Distance difference
4.	Baitul Izzah Jl. Arief Rahman Hakim No. 100, Surabaya.	1.489 km	Luhur Al - Ikhlash Mosque, (LDII) Mosque, Jl. Semampir Selatan IIA No.110.	0.75 km	LDII Mosque
5.	Baitur Rohim, Wisma Kedung Asem Indah, Surabaya	1.787 km	Baitur Rohman Mosque, (LDII) Mosque, Gg. Anggrek No.9	0.697 km	LDII Mosque

The table above explains the comparison of test 2, each of which is taken from 5 nearest mosque data and the results are 3 the same mosque with the difference in the distance between the user's location to the mosque and 2 different mosques because the mosque does not belong to NU.

5. CONCLUSIONS

a. The system is capable of producing a map of the location of the Nahdatul Ulama mosque, accompanied by information about that location.
b. The Haversine formula can be used as a search for the shortest distance by looking for the result with the smallest value as the location with the shortest distance.

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