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Locating Identification the Nearest Social Security Organizing Agency for Health Recipient Hospital Using the Haversine Formula and Black Box Method

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ABSTRACT

Currently, many people have difficulty finding the nearest hospital that can accept the health insurance of the Health Social Security Organizing Agency (BPJS) and the ignorance of the community whether a hospital can accept BPJS Health or not. This can cause critical problems, especially if the patient's condition requires immediate health action. This problem can be solved with an application that can find the closest distance to BPJS recipient hospitals. One method to find the closest distance that currently has the highest level of accuracy is the Haversine Formula method. Applications made using the Haversine Formula method and based on Location Based Service can find the location of the nearest hospital based on the coordinates of the user's location. In this study, the application built using the Haversine Formula method and Location Based Service was able to find the closest distance from 38 hospitals in the Bekasi Regency area using Google Firebase as a database and Mapbox as a Maps API application. Tests were carried out by comparing the distance of 15 hospitals in 3 different locations, showing that the distance between the application and Google Maps was no more than 0.5 km, in location 1 the distance equation was 99%, location 2 was 97% and location 3 was 96% with an average success rate of 97%.

Key Words: Haversine Formula, Location Based Service, Nearest Location Search, BPJS Hospital.

1. INTRODUCTION

Public service is an important service and a top priority for the government to meet the basic needs of society. The Social Security Administering Body (BPJS) for Health is a legal entity formed by law to administer social security programs, especially in the health sector. One of the first-level health facilities for health BPJS participants can be obtained at the Hospital. Hospital services are very beneficial and help the community, including BPJS patients. Currently, the community is still having difficulty finding the nearest BPJS recipient hospital, so an application is needed to find the location of the nearest BPJS recipient hospital, especially in Bekasi Regency.

There are many architectures that can be used to perform location based services, one of which is MapBox. Mapbox is a Maps API Services that has almost the same features as the Google Maps API, Mapbox is an open source mapping platform for custom design maps, which has been available since 2010 [1]. The Mapbox API was chosen as the location provider application because the API tends to be easier, and the information it produces is quite complete, starting from distances, coordinates, street names, to waypoints. This application also allows the User to display the mapping that has been entered into the geographic information system website and add the desired locations.

In running Maps on the Android Platform, a method is needed that can find the shortest distance, one of which is the Haversine Formula Method which currently has the most significant results compared to other closest location search methods, the Haversine Formula is an important equation in a navigation system, the Haversine Formula will produce distances shortest distance between two points, for example on a ball taken from longitude and latitude. The Haversine formula is an equation used in navigation, which gives the great circle distance between two points on the surface of the ball (earth) based on longitude and latitude [2]. The Haversine formula is a method for determining the distance between two points by taking into account that the earth is not a flat

plane but a plane that has degrees of curvature. The expected end result is that basic techniques can be implemented more easily and quickly. The angle in the formula uses radians to use trigonometry functions.

The harvesine formula is used in this study to calculate the shortest distance between the position of the application user and the nearest BPJS hospital, so that it can help relieve the community in solving problems of effectiveness and efficiency in the health sector, especially in finding BPJS referral hospitals. As well as this application can make it easier for people who use BPJS (Social Security Administering Body) for Health to find the location of the nearest hospital in Bekasi district.

2. METHOD

2.1 The Haversine Formula

The Haversine Formula method can be used to calculate the distance between two points, based on the position of latitude and longitude as input variables. The Haversine method is a method used to calculate distances between points on the earth's surface by using latitude (longitude) and longitude (latitude) as input variables [3], the Haversine formula is an important equation in navigation that can provide distances a great circle between any two points on the earth's surface or a spherical object based on longitude and latitude. The Haversine Formula method has now undergone development, namely by using a simple spherical law of cosine formula, where computer calculations can provide a very accurate level of precision between two points [4]. First, the starting point and heading point are determined, the starting point is latitude1(lat1) and longitude1(long1), and the heading point is latitude2(lat2) and longitude2(long2). The starting point and heading point are in the form of decimal degrees which are then converted into radian angle values, then do the calculations using the Haversine Formula, namely:

$$\Delta lat = lat2 - lat1 \quad (1)$$

$$\Delta long = long2 - long1 \quad (2)$$

$$a = \sin2\,(\Delta lat/2) + \cos(lat1).\cos(lat2).\sin2(\Delta long/2) \quad (3)$$

$$c = 2.\text{atan2}(\sqrt{a}, \sqrt{(1-a)}) \quad (4)$$

$$d = R.c \quad (5)$$

R : the radius of the earth is 6371(km)
Δlat : the magnitude of the change in latitude
Δlong : the change in longitude
c : axis intersection calculation
d : distance (km)

The steps in the haversine formula algorithm can be seen in Figure 1.

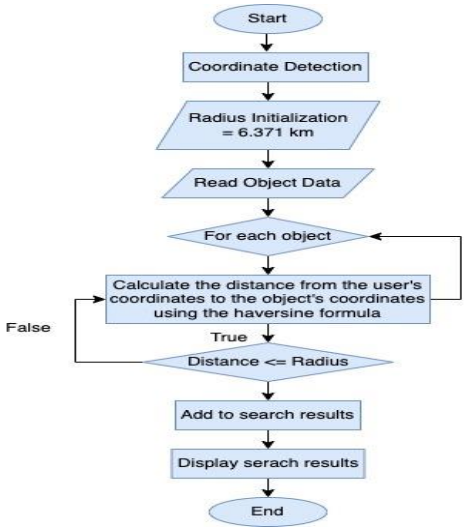

Figure 1. Haversine Formula Flowchart

2.2 MapBox

Mapbox is one of the largest providers of custom online maps on top sites like Foursquare, Pinterest, Evernote, Financial Times and Uber Technologies. Since 2010, Mapbox expanded its selection of custom maps to fill the limitations of map providers such as Google Maps. The Mapbox API was chosen as an alternative to the Google Maps API, which has now started implementing a

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(paid) billing system for its use [5]. Even though it's free, the Mapbox API tends to be easier to use, and the information it produces is quite complete, such as distances, coordinates, street names to waypoints. Mapbox is the creator or contributor of a number of well-known free map libraries and applications, for example the MBTiles specification, the Cartography TileMill IDE, the library Leaflet JavaScript, the CartoCSS map parser and style language, and the Mapbox.js JavaScript library. Mapbox is a Maps API Services that has almost the same features as the Google Maps API, Mapbox is an open source mapping platform for custom design maps, which has been available since 2010 [1], Mapbox API was chosen as a location provider application because These APIs tend to be easier, and the information produced is quite complete, starting from distances, coordinates, street names, to waypoints.

2.3 Location Based Service (LBS)

LBS is a location-based service, which is an internet-based service that functions to search using Global Positioning Service (GPS) technology and Google's cell-based location. Map and location-based services use latitude and longitude to determine geographic locations [6]. Android provides a geocoder that supports forward and reverse geocoding. Using a geocoder, it can convert latitude longitude values to real world addresses or vice versa. Location-based service or location-based service is a general term used to describe the technology used to find the location of the device used [7].

Key Elements of LBS:

a. Location Manager (Maps API): Provides tools for source or source for LBS, Application Programming Interface (API) Maps provides facilities for displaying or manipulating maps.
b. Location Providers (Location API): Provides the location search technology used by the device. The Location API deals with GPS (Global Positioning System) data and real-time location data.

The Location API is in the Android package, namely in the "Android location" package. Location, movement, and proximity to certain locations can be determined through the Location Manager.

2.4 Black Box Testing

Testing on the system uses the Black Box method, the aim is to find out that the parts in the application system correctly display error messages if an error occurs in data input [8]. Black Box Testing itself is a test that is carried out only by observing the results of execution through test data and checking the functionality of the software [9].

2.5 Research Stages

In order for this research to be directed and in accordance with the expected goals, the research methodology uses a research framework. The research flowchart can be seen in Figure 2:

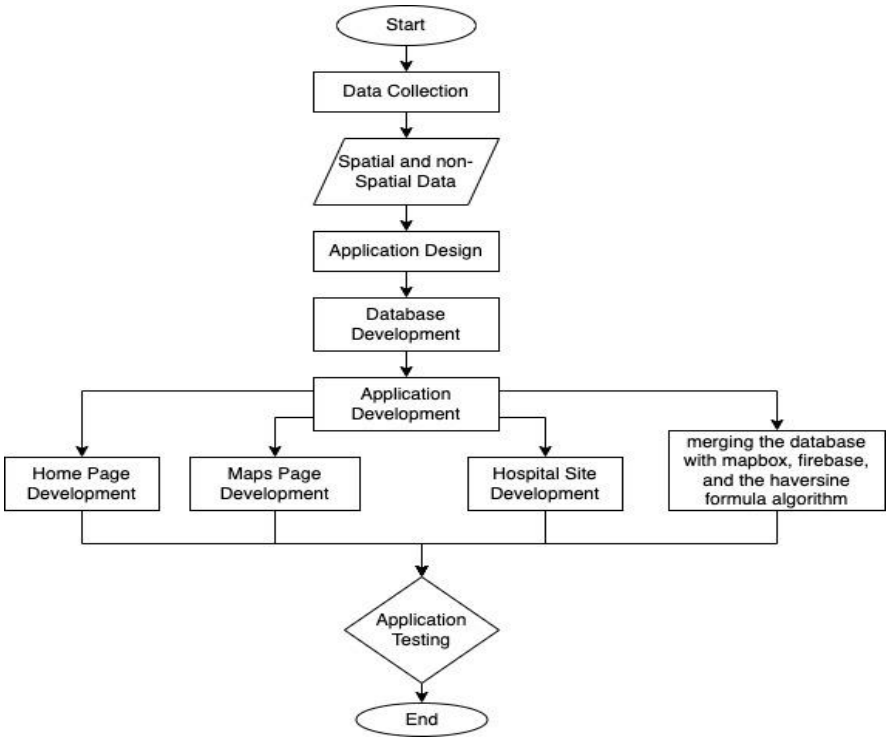

Figure 2. Research Flowchart

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2.6 Research Data

Observations made by researchers in this study were non-participant observations. In non-participant observation, the researcher is not involved and only acts as an independent observer. In practice, the researchers observed online or through the BPJS Health website and other supporting websites on the application of the Haversine Formula method in finding the closest distance to the BPJS BPJS hospital in Bekasi Regency. The thing that became the focus during the observation was the description of the hospital that received BPJS Health in Bekasi Regency which was obtained through the official BPJS website, namely (https://faskes.bpjskesehatan.go.id/aplicares/#/app/pnama/bylocation) [10]. The research object used is focused on BPJS referral hospitals in Bekasi Regency, totaling 38 hospitals. In Table 1, the hospital data can be seen:

Table 1. Research Data

NO.	HOSPITAL	ADDRESS	TELEPHONE
1	RS ANNISA	Jl. Raya Lemahabang No.31, Simpangan, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia	021-8904165
2	RS BHAKTI HUSADA (JST)	Jl. Keramik No.3RT01/RW 02, Karangbaru, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia	021-8900530
3	RS HOSANA MEDICA LIPPO (JST)	Jl. Moh. H. Tamrin Blok D No.5, Cibatu, Cikarang Sel., Bekasi, Jawa Barat 17530, Indonesia	021-8972472
4	RS KARYA MEDIKA I	Jl. Raya Imam Bonjol No.1, Kalijaya, Kec. Cikarang Bar., Bekasi, Jawa Barat 17530, Indonesia	021-89000190
5	RS ASRI MEDIKA	Jl. Citanduy Raya No.1, Simpangan, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia	021-89142968
6	RS KARTIKA HUSADA TAMBUN	Jl. Raya Sumber Jaya No.5, Mangunjaya, Kec. Tambun Sel., Bekasi, Jawa Barat 17510, Indonesia	021-883277281
7	RS AMANDA CIKARANG SELATAN	Jl. Raya Cikarang - Cibarusah No.83, Serang, Cikarang Sel., Bekasi, Jawa Barat 17530, Indonesia	021-8971643
8	RS CIKARANG MEDIKA	RS. Cikarang Medika, Karangasih, Kec. Cikarang Utara, Bekasi, Jawa Barat, Indonesia	021-8902210
9	RS CIBITUNG MEDIKA	Jl. Bosih Raya No.123, Wanasari, Kec. Cibitung, Bekasi, Jawa Barat 17520, Indonesia	021-88323444
10	RS TIARA	Rumah Sakit Tiara Bekasi, Kebalen, Kec. Babelan, Bekasi, Jawa Barat, Indonesia	021-89131111
11	RS HARAPAN MULIA	Jl. Raya Cibarusah No.5, Cibarusahjaya, Kec. Cibarusah, Bekasi, Jawa Barat 17340, Indonesia	021-89952340
12	RS MEDIROSSA 2 CIBARUSAH	Rumah Sakit Medirossa 2 Bekasi, Sindangmulya, Kec. Cibarusah, Bekasi, Jawa Barat 17340, Indonesia	021-8955555
13	RS HERMINA GRAND WISATA	Jl. Serma Achim No.88, RT.2/RW.2, Lambangsari, Kec. Tambun Sel., Bekasi, Jawa Barat 17510, Indonesia	021-82651212
14	SILOAM HOSPITAL LIPPO CIKARANG	Siloam Lippo Cikarang, RS, JL. M. H. Thamrin Kav. 105, Cibatu, Cikarang Sel., Bekasi, Jawa Barat 17530, Indonesia	021-29636900
15	RS KARTIKA HUSADA SETU	M25Q+VJF, Burangkeng, Kec. Setu, Bekasi, Jawa Barat 17320, Indonesia	021-82610003
16	RS MITRA MEDIKA NAROM	M38P+RCX, Cikedokan, Kec. Cikarang Bar., Bekasi, Jawa Barat, Indonesia	021-89983741
17	RS HARAPAN KELUARGA JABABEKA	Jalan Kasuari Raya Kav. 1A& 1B, Mekarmukti, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530	021-89840745
18	RS RIDHOKA SALMA	Jl. Raya Imam Bonjol No.7, Kalijaya, Kec. Cikarang Bar., Bekasi, Jawa Barat 17530, Indonesia	021-89116527
19	RS OMNI CIKARANG	Jl. Raya Cikarang - Cibarusah No. Selatan, Sukaresmi, Cikarang Sel., Bekasi, Jawa Barat 17530, Indonesia	021-29779999
20	RS BUNDA MULIA	Jl. Perjuangan No.14, Sukadanau, Kec. Cikarang Bar., Bekasi, Jawa Barat 17530, Indonesia	021-8900579
21	RS AMANDA	Jl. Raya Industri No.35, Cikarang Kota, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia	021-8900277
22	RS METRO HOSPITALS	17, Jl. Anggrek I No.B1, RT.29/RW.11, Mekarmukti, Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia.	021-89835223
23	RS KARYA MEDIKA II	Jl. Sultan Hasanudin No.96, Tambun, Kec. Tambun Sel., Bekasi, Jawa Barat 17510, Indonesia	021-88324366
24	RS TARUMAJAYA	No., Jl. Tarumajaya Raya No.1, Pantai Makmur, Kec. Tarumajaya, Bekasi, Jawa Barat 17211	021-88992337
25	RS PERMATA KELUARGA LIPPO	Lippo Cikarang, Jl. MH. Thamrin No.Kav.129, Cibatu, Cikarang Sel., Bekasi, Jawa Barat 17550	021-89905588
26	RS PUSPA HUSADA	Jalan Pondok Timur Indah No.Km.1 No.27, Jatimulya, Kec. Tambun Sel., Bekasi, Jawa Barat 17157	021-82618978
27	RS PERMATA KELUARGA JABABEKA	Jl. Dr. Cipto Mangunkusumo No.1A, Simpangan, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530	021-29083399

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28	RS PINNA	Jl. Raya Karang Satria No.4-5, Karangsatria, Kec. Tambun Utara, Kota Bks, Jawa Barat 17510	021-8827554
29	RS AS SHOFWAN	Jl. Raya Rengas-Lemahabang, Bojongsari, Kec. Kedungwaringin, Bekasi, Jawa Barat 17540	021-89141890
30	RS GRHA MM2100	Kawasan Industri MM2100 Jalan Kalimantan Blok CB-1, Gandasari, Kec. Cikarang Bar., Bekasi, Jawa Barat 17530	021-50570999
31	RS KASIH INSANI SUKATANI	Jl. Raya Sukatani No.9, Sukadarma, Kec. Sukatani, Bekasi, Jawa Barat 17530	021-89161099
32	RS CENKA	Q5G6+38H, Sukaraya, Kec. Karangbahagia, Bekasi, Jawa Barat 17530	021-89121188
33	RS ANANDA BABELAN	Jl. Raya Babelan No.KM. 9.6, Kebalen, Kec. Babelan, Kota Bks, Jawa Barat 17610	021-89234000
34	RS UNIMEDIKA SETU BEKASI	Jl. Raya Setu No.99, Lungbuaya, Kec. Setu, Bekasi, Jawa Barat 17320	021-82592888
35	RS HERMINA METLAND CIBITUNG	Perumahan Metland Cibitung Telagapure Village, Kec, Telagamurni, Kec. Cikarang Bar., Bekasi, Jawa Barat 17530	021-88362626
36	RS SENTRA MEDIKA CIKARANG	P5C2+7V9, Pasirgombong, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia	021-8904160
37	RSUD KAB BEKASI	Jl. Raya Teuku Umar No.202, Wanasari, Kec. Cibitung, Bekasi, Jawa Barat 17520, Indonesia	021-88370449
38	RS MEDIROSSA CIKARANG	Jl. Raya Industri No.9, Pasirsari, Cikarang Sel., Bekasi, Jawa Barat 17530, Indonesia	021-89833216

3. RESULTS

In this study, produces an application that can determine the shortest distance by using one of the shortest distance search methods, namely the Haversine Formula method. In making this application, data is needed in the form of images, addresses, Latitude, Longitude, and Description of Hospitals in Bekasi Regency which will be input into the Database, using the Google Firebase Database in real-time and using Maps from the Mapbox application. In this study, there were 38 BPJS referral hospitals in the Bekasi Regency area. The steps taken in this study consist of data collection, database creation, splash screen application, home display, maps implementation, shortest distance, and data testing using the black box method.

3.1 Observation Results

In conducting research, researchers also use observation guidelines that are designed/arranged to make it easier for researchers to conduct research. Observation guidelines in research Find the shortest distance to the Bekasi Regency BPJS Hospital. Table 2 is the result of the researcher's observation of the Bekasi Regency BPJS Hospital. The following are observation guidelines used by researchers in conducting research: Geographical Location of the Hospital, Hospital description and Distance to the hospital.

Table 2. Observation Results

No.	Observed	Yes	No	Evidence/ Indicators
1	Geographical location			
a	The location of the hospital is no more than the scope of Bekasi Regency	✓		A total of 38 hospitals within the scope of Bekasi Regency
b	Road access to the hospital is available on Mapbox	✓		Mapbox provides Maps for Hospital destinations
c	There are hospital reviews on the Google Maps site	✓		In the Google maps application, reviews of 38 hospitals are available in Bekasi Regency
2	Hospital Description	✓		
a	Hospital has complete description of the profile	✓		Profiles of 38 hospitals are available
b	The hospital accepts BPJS patients	✓		38 Bekasi District Hospitals accept BPJS patients
c	The hospital is listed on the BPJS Website	✓		38 Bekasi Regency Hospitals are included in the BPJS website
d	The hospital has a call center and complete address	✓		38 Bekasi District Hospitals have call centers and complete addresses
3	Hospital Distance	✓		
a	The distance from location 1 is the location of the researcher to the nearest hospital	✓		Location calculation 1 entry in distance hospital
b	The distance from location 2, namely Pasar Setu, to the nearest hospital	✓		Calculation of location 2 entered within the distance of the hospital
c	The distance from location 3, namely SGC to	✓		Calculation of location 3 entered in the distance

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No.	Observed	Yes	No	Evidence/ Indicators
	the nearest hospital			hospital
d	Comparison distance of less than 1 Km	✓		Comparison of the distance between the application and google maps is less than 1 Km

3.2 Spatial and Non-Spatial Data Results

Based on the results of observations, there are 38 BPJS Referral Hospitals in Bekasi Regency based on the BPJS Site. Table 3 shows 3 samples of hospital data from a total of 38 hospitals data in this study.

Table 3. Three Samples of Spatial and Non-Spatial Data

No.	HOSPITAL	ADDRESS	TELEPHONE
1	RS ANNISA	Jl. Raya Lemahabang No.31, Simpangan, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia **Picture:**  **Description:** Annisa Hospital is one of the health service institutions that was established based on the deed of Notary H. Irmik, SH with Number 19 dated 19 November 2002, and is under the auspices of PT. Annisa Mitra Husada. The forerunner to the establishment of the Annisa Hospital started with Maternity Hospital services and over time this hospital developed into the Annisa RSIA and finally became the Annisa Hospital until now. Supported by professional and experienced human resources, Annisa Hospital always provides good quality service to all of its customers, be it the general public, companies, or insurance. For the sake of helping the speed and accuracy of service, apart from being supported by human resources. Annisa Hospital has also been equipped with an integrated and online management information system for outpatient services, inpatient care, supporting examinations, pharmaceutical logistics, financial transactions, and medical record systems.	021-8904165 Coordinate : -6.273075, 107.174296 Latitude : -6.273075 Longitude: 107.174296
2	RS BHAKTI HUSADA (JST)	Jl. Keramik No.3 RT 01/RW 02, Karangbaru, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia **Picture:**  **Description:** Bhakti Husada Cikarang Hospital was founded on February 5, 1984, under the auspices of the Bhakti Husada Foundation. has a vision to become a hospital of choice and humane with a mission to provide professional, plenary and quality services.	021-8900530 Coordinate : -6.262644, 107.140347 Latitud:-6.262644 Longitude : 107.140347

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No.	HOSPITAL	ADDRESS	TELEPHONE
3	RS ASRI MEDIKA	Jl. Citanduy Raya No.1, Simpangan, Kec. Cikarang Utara, Bekasi, Jawa Barat 17530, Indonesia **Picture:**  **Description:** Asri Medika Hospital is a health service center equipped with medical support facilities as well as General Polyclinics and Specialist Polyclinics who are professional in their fields so that they can provide quality services for the community. In the midst of competition in the world of health at this time, Asri Medika Hospital is always improving itself in order to be able to answer all the needs of the community in the health sector.	021-89142968 Coordiate: -6.277194, 107.181130 Latitude: : -6.277194 Longitude: 107.181130

3.3 Database Development

In creating a real-time Firebase Database, all Google Firebase features can be accessed via the Firebase console page with the address https://console.firebase.google.com [11]. Firebase itself allows for use on iOS, Android, and Web platforms. Because this research uses an Android application, the implementation is carried out on an Android-based platform. In this study using the real-time Firebase Database is a cloud database. Data is stored in JSON format and synced in real time to every connected client. When building cross-platform hybrid apps, such as Android and iOS, all clients share a single Realtime Database instance and automatically receive updates with specific data (Figure 3).

Figure 3. Database inputs

3.4 Application Development

The database that has been created is then applied to a programming application, researchers use Android Studio and the Kotlin Programming Language in coding to find the shortest distance to the BPJS hospital. Application development is divided into 4 processes namely, Splash Screen application, Home Display, Mapbox maps implementation, and Shortest distance Haversine.

a. Splash Screen Application

The Splash Screen is the initial display of the application which contains images and text that appear when the application is first opened or run. To display the Splash screen. This Splash Screen is used to provide an initial display that contains information such as the application name, application logo. In this process, it is a complementary view that is intended to beautify the application that is made, the Splash screen is run for only a few moments which will then be directed to the main view of the application.

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b. Home Menu

On the application's main display menu, there will be lists of hospitals, a help icon that makes it easier for users to use the application, on the Home menu there is a list of BPJS regional hospitals in Bekasi Regency, as many as 38 hospitals that have been registered on the BPJS website, as well as hospitals has been sorted by Alphabet, and there are 4 help buttons to make it easier for users to understand and use the application, in the image and name of the Hospital address, the User can already determine which hospital he wants to go to.

c. Implementation of Maps Mapbox

Mapbox provides services for displaying maps on web pages and mobile applications. The Mapbox API was chosen as a web service because the API tends to be easier, and the information it produces is quite complete, starting from distances, coordinates, and street names, to waypoints.

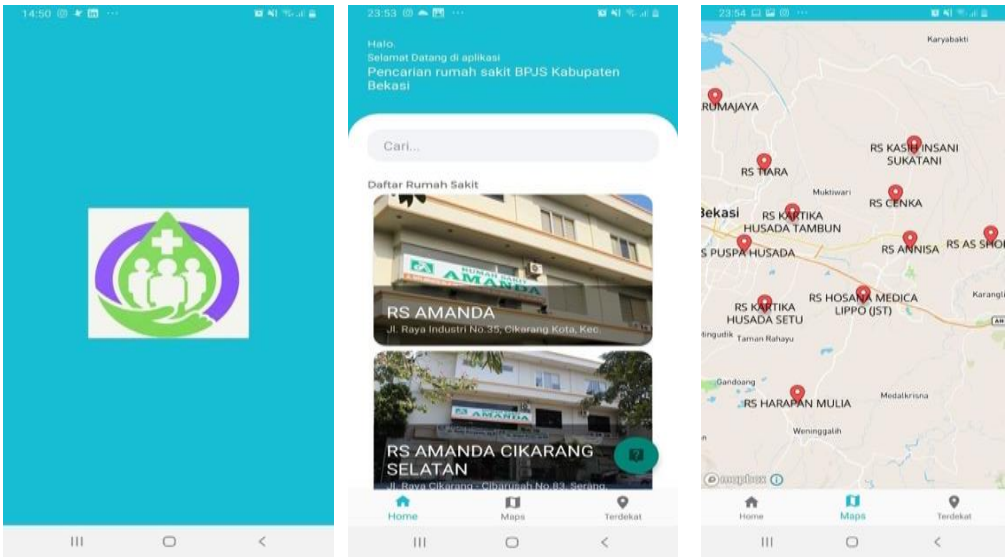

Figure 4. Splash Screen, Home Menu and Maps Menu

d. Haversine Nearest Distance

The Haversine theorem is used to calculate the distance between points on the earth's surface using latitude (longitude) and longitude (Latitude) as input latitude. The closest distance menu is intended to make it easier for users to find the nearest BPJS hospital, the distance is measured from where the user uses the application to the intended hospital, on the closest menu the user can directly find the hospital without having to enter another icon, in the nearest menu there is a picture of the house hospital, name, hospital address, and the distance in km from the User's location to the BPJS hospital location. An example of the closest hospital to the researcher is shown in Figure 5.

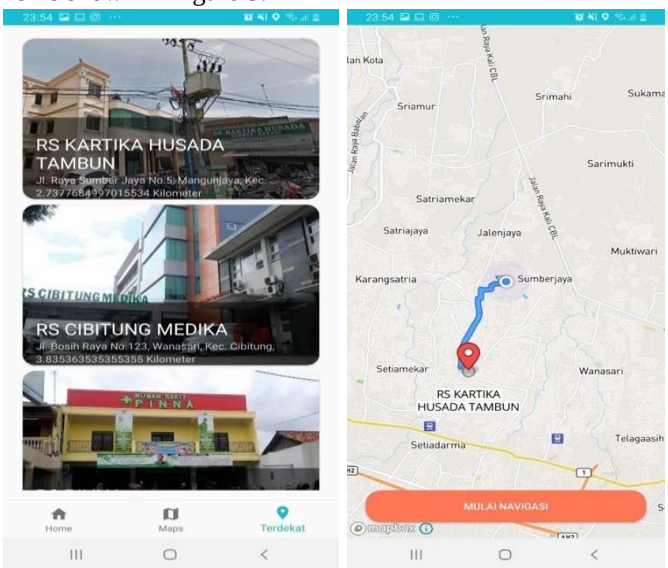

Figure 5. Nearest Hospital Menu

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3.5 Calculating the Shortest Distance

This calculation is to compare the Haversine value in the BPJS Hospital Search Android application with the Google maps application by using the distance measure that is already available on Google Maps, there are 38 BPJS hospitals which will calculate the distance from the user to the hospital location. Each uses a sample of 3 different locations divided by 15 hospitals. This calculation has been sorted from nearest to farthest depending on the User's location.

Table 4. Location 1: User Location (-6.221288, 107.072740) Villa Bekasi Indah 2

No	Hospital	Latitude	Longitude	Rad Latitude	Rad Longitude	Application Value (Km)	Google Maps Distance (Km)	Difference
1	RS Kartika Husada Tambun	-6.244.555	107.064.432	-6.221.288	107.072.740	2.745	2.745	0
2	RS Cibitung Medika	-6.253.214	107.086.314	-6.221.288	107.072.740	3.854	3.854	0
3	RS Pinna	-6.224.267	107.031.900	-6.221.288	107.072.740	4.531	4.526	0,005
4	RS Karya Medika 2	-6.264.130	107.067.568	-6.221.288	107.072.740	4.798	4.798	0
5	RS Tiara	-6.191.806	107.038.273	-6.221.288	107.072.740	5.029	5.026	0,003
6	RSUD Kab Bekasi	-6.267.013	107.082.846	-6.221.288	107.072.740	5.206	5.205	0,001
7	RS Ananda Babelan	-6.179.491	107.041.004	-6.221.288	107.072.740	5.825	5.823	0,002
8	RS Hermina Metland Cibitung	-6.253.746	107.115.243	-6.221.288	107.072.740	5.928	5.924	0,004
9	RS Hermina Grand Wisata	-6.276.530	107.047.581	-6.221.288	107.072.740	6.744	6,742	0,002
10	RS Bunda Mulia	-6.270.618	107.114.786	-6.221.288	107.072.740	7.192	7,198	-0,006
11	RS Ridhoka Salma	-6.269.309	107.121.030	-6.221.288	107.072.740	7.554	7,55	0,004
12	RS Karya Medika 1	-6.266.998	107.124.673	-6.221.288	107.072.740	7,671	7,667	0,004
13	RS Grha MM2100	-6.289.652	107.082.953	-6.221.288	107.072.740	7,685	7,685	0
14	RS Puspa Husada	-6.276.944	107.019.652	-6.221.288	107.072.740	8,532	8,528	0,004
15	RS Cikarang Medika	-6.252.094	107.145.026	-6.221.288	107.072.740	8,701	8,693	0,008
	Total Difference	**Distance Difference (%)**	**Distance Equation (%)**					
	0,031 Km	0%	100%					

Table 5. Location 2: User Location (-6.335926, 107.045065) Pasar Setu

No	Hospital	Latitude	Longitude	Rad Latitude	Rad Longitude	Application Value (Km)	Google Maps Distance (Km)	Difference
1	RS Unimedika Setu	-6.331.884	107.048.462	-6.335.926	107.045.065	0,40625	0,404166667	0,003
2	RS Kartika Husada Setu	-6.340.368	107.038.711	-6.335.926	107.045.065	0,859	0,855	0,004
3	RS Mitra Medika Narom	-6.326.182	107.085.873	-6.335.926	107.045.065	4.645	0,211111111	0,005
4	RS Hermina Grand Wisata	-6.276.530	107.047.581	-6.335.926	107.045.065	6.610	6,57	0,04
5	RS Grha MM2100	-6.289.652	107.082.953	-6.335.926	107.045.065	6.638	6,62	0,018
6	RS Puspa Husada	-6.276.944	107.019.652	-6.335.926	107.045.065	7,136	7,12	0,016
7	RS Karya Medika 2	-6.264.130	107.067.568	-6.335.926	107.045.065	8,362	8,33	0,032
8	RS Amanda Cikarang Selatan	-6.357.000	107.118.905	-6.335.926	107.045.065	8,503	8,5	0,003
9	RSUD Kabupaten Bekasi	-6.267.013	107.082.846	-6.335.926	107.045.065	8,729	8,62	0,109

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10	RS Omni Cikarang	-6.326.093	107.127.615	-6.335.926	107.045.065	9,203	9,17	0,033
11	RS Hosana Medica Lippo	-6.330.637	107.130.537	-6.335.926	107.045.065	9,479	9,45	0,029
12	RS Medirossa 2 Cibarusah	-6.407.617	107.093.978	-6.335.926	107.045.065	9,636	9,59	0,046
13	Siloam Hospital Lippo Cikarang	-6.331.511	107.134.833	-6.335.926	107.045.065	9,949	9,91	0,039
14	RS Cibitung Medika	-6.253.214	107.086.314	-6.335.926	107.045.065	10,268	10,26	0,008
15	RS Kartika Husada Tambun	-6.244.555	107.064.432	-6.335.926	107.045.065	10,383	10,35	0,033
	Total Difference	**Distance Difference (%)**	**Distance Equation (%)**					
	0,418 Km	3%	97%					

Table 6. Location 3: User Location (-6.259006, 107.145967) Sentra Grosir Cikarang

No	Hospital	Latitude	Longitude	Rad Latitude	Rad Longitude	Application Value (Km)	Google Maps Distance (Km)	Difference
1	RS Amanda	-6.357.000	107.118.905	-6.259.006	107.145.967	0,2375	0,233333333	0,006
2	RS Bhakti Husada	-6.262.644	107.140.347	-6.259.006	107.145.967	0,742	0,679	0,063
3	RS Cikarang Medika	-6.252.094	107.145.026	-6.259.006	107.145.967	0,775	0,758	0,017
4	RS Sentra Medika Cikarang	-6.279.019	107.152.699	-6.259.006	107.145.967	2,347	2,32	0,027
5	RS Karya Medika 1	-6.266.998	107.124.673	-6.259.006	107.145.967	2.521	2,52	0,001
6	RS Ridhoka Salma	-6.269.309	107.121.030	-6.259.006	107.145.967	2,991	2,97	0,021
7	RS Hermina Metland Cibitung	-6.253.746	107.115.243	-6.259.006	107.145.967	3,454	3,44	0,014
8	RS Annisa	-6.273.075	107.174.296	-6.259.006	107.145.967	3,508	3,45	0,058
9	RS Bunda Mulia	-6.270.618	107.114.786	-6.259.006	107.145.967	3,688	3,67	0,018
10	RS Cenka	-6.224.697	107.160.746	-6.259.006	107.145.967	4,151	4	0,151
11	RS Permata Keluarga Jababeka	-6.284.795	107.173.650	-6.259.006	107.145.967	4,199	4,17	0,029
12	RS Asri Medika	-6.277.194	107.181.130	-6.259.006	107.145.967	4,39	4,31	0,08
13	RS Medirossa Cikarang	-6.299.400	107.145.325	-6.259.006	107.145.967	4,492	4,48	0,012
14	RS Harapan Keluarga Jababeka	-6.299.570	107.159.573	-6.259.006	107.145.967	4,756	4,74	0,016
15	RS Metro Hospitals	-6.299.716	107.167.221	-6.259.006	107.145.967	5,103	5,06	0,043
	Total Difference	**Distance Difference (%)**	**Distance Equation (%)**					
	0,556 Km	4%	96%					

From the results of research in 3 different locations, 15 hospitals were obtained as much as 45 data, at location 1, namely in Villa Bekasi Indah 2, the closest distance is Kartika Husada Hospital with a distance of 2.745 Km with a Google Maps distance comparison of 2.74 and a difference of 0.005 Km, the farthest location from location 1 is Cikarang Medika Hospital with a distance of 8.701 Km with a Google Maps distance comparison of 8.67 Km and a difference of 0.031 Km, and the most difference from location 1 is Hermina Metland Cibitung Hospital with a difference of 0.038 Km (Table 4). At Location 2, namely in Pasar Setu the closest distance is Unimedika Setu Hospital with a distance of 0.585 Km with a Google Maps distance comparison of 0.582 Km and a difference of 0.003 Km, the farthest location from Location 2 is Kartika Husada Tambun Hospital with a distance of 10.383 Km with a Google Maps distance comparison of 10.35 Km and a difference of 0.033 Km, and the biggest difference from Location 2 is the Bekasi District Hospital with a difference of 0.109 Km (Table 5). At Location 3, namely at the Sentra Grosir Cikarang (Table 6), the closest distance is Amanda Hospital with a distance of 0.342 Km with Google Maps distance comparison which is 0. 336 Km and a difference of 0.006 Km, The farthest location from Location 2 is Metro Hospitals Hospital with a distance of 5.103 Km with a Google Maps distance comparison of 5.06 Km and a difference of 0.043 Km, and the largest difference from Location 2 is Cenka Hospital with a difference of 0.151 Km, From the research above, the location closest to the hospital is the 3rd location of the Sentra Grosir Cikarang with a calculation of under 10 Km, the total difference between Location 1 is 0, 197 Km, The results of distance testing obtained 3 results and 1 total result of the equation and distance difference, Location 1 obtained a total result of 0.197 Km and a distance equation of 99% and a difference of 1%, location 2 obtained a total

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result of 0.418 Km and a distance equation of 97% and a difference of 3%, location 3 obtained a total result of 0.556 Km and a distance equation of 96% and a difference of 4%, From 3 different locations, the success rate of the Haversine Formula is 97%. Based on the distance measurement experiment that has been determined for 3 different locations (Villa Bekasi Indah 2, Pasar Setu , Sentra Grosir Cikarang) from the user's position with 15 hospitals in each location (Table 4, Table 5, Table 6), the results that are classified as closest and farthest are obtained in Table 7 below.

Table 7. Experiment Results

No.	User Location	Nearest Distance Measurement (Km)		Nearest hospital	Farthest Hospital	Distance Difference (%)	
		Application	Gmaps			Difference	Equality
1	Villa Bekasi Indah 2	2,745	2,74	RS Kartika Husada Tambun	RS Cikarang Medika	1%	99%
2	Pasar Setu	0,585	0,582	RS Unimedika Setu	RS Kartika Husada Tambun	3%	97%
3	Sentra Grosir Cikarang	0,342	0,336	RS Amanda	RS Metro Hospitals	4%	96%

3.6 Black Box Testing

Black Box Testing is testing that focuses on the functional specifications of the software, the tester can define a set of input conditions and perform tests on the program's functional specifications. Testing is divided into 2, namely testing the application interface, and testing the performance of the application Maps.

a. Application Interface Testing
   Interface testing aims to determine the functionality of the interface elements contained in the application, the interface elements tested are mainly Home, Maps, and Nearby elements.
b. Application Maps Performance Testing
   Interface testing aims to determine the application's ability to run Maps on Mapbox which is accessed by Users.

From all the tests that have been carried out, the application can run well on devices that have the specifications needed in the needs analysis, and make it easier for a system developer to develop errors that have been found in the test.

4. CONCLUSIONS

From the results of the research and discussion on the Implementation of the Haversine Formula Method for finding the location of the Nearest BPJS Hospital in Bekasi Regency, the following conclusions can be drawn:

a. The implementation of the Haversine Formula Method for finding the location of the nearest BPJS Hospital in Bekasi Regency is carried out using the Firebase Database on Google Firebase. Using the Kotlin Programming Language in Android Studio, as well as using Mapbox for the Application Maps API, from a collection of calculated data that has been sorted in ascending order within a scope that has been limited to a certain radius (in this sample is Bekasi Regency). Based on the distance trial, it can provide location recommendations based on the closest distance from the User's location to the destination location.
b. The total distance comparison in 3 different locations is less than 200 meters, the researchers were able to measure the closest distance to the BPJS hospital properly. Comparison results on testing data at 3 different locations with a total of 45 hospitals, the application runs well in testing 5 different mobile devices in order from closest to farthest.
c. The success rate of the Haversine Formula at location 1 is 99%, location 2 is 97% and location 3 is 96%. The average success rate at 3 different locations in this study was 97%.
d. Based on the results of application testing using the Black box method, it was considered successful in this research.

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