Smart Zoning Application to Measured School Distance Using Haversine Method

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Abstract— The new student admission system is developing according to government regulations in the form of a zoning system that regulates regional zones for prospective students. In principle, the zoning is used to bring student's domicile closer to school where zoning is determined at every level by the Regional Government in accordance with its authority. The zone calculation is done by looking at the distance from student's domicile to school location, the closer the distance to school, the more likely it is to be accepted at the school. The problem that occurs is how to determine and calculate the distance from student's domicile to the school by calculating a straight line and getting the nearest distance according to the school zone. The Haversine method is used to calculate the distance between two points on the Earth based on the length of a straight line between two points without ignoring Earth's curvature. This study uses 13 State Senior High Schools in the Depok area as reference data. This Smart Zoning application can be used to determine straight-line distance of student's domicile with the school by using latitude and longitude coordinates, making it easier for users to obtain information on the distance of student's domicile to the school.

Keywords— Application, Haversine, Method, Smart, Zoning.

I. INTRODUCTION

Fast information is needed in various fields. The need for fast and accurate information is also needed in the field of education, for example in the new student admission system that provides services about registration and information about schools. Various technologies were developed for easier access, providing time efficiency, and procedures clarity for carrying out activities for users. The government through the Ministry of Education and Culture has issued Regulation of the Minister of Education and Culture No. 14 of 2019 about New Student Admission. The zoning system regulates regional zones for prospective students where the Zoning System is included in the four "Merdeka Belajar" education programs [1]. The principle is to bring student's domicile closer to the school where zoning is determined at every level by the Regional Government in accordance with its authority. In the application of zoning, it is important to pay attention on the amount of available capacity according to the availability of the number of school-age children at each level in the area. A written agreement between Regional Governments is carried out in determining zoning at each school level located in the border areas of the province or district/city.

Depok has 13 Public Senior High Schools spread over 11 sub-districts and able to accommodate 3,858 Junior High School graduates. This results a very tight competition for students who want to continue their education from junior high school to senior high school level because of an imbalance between the number of outputs or junior high school graduates which is more than the available capacity of senior high school [2]. Depok Education Authorities has begun to implement zoning system for the Admission of New Students in the 2017/2018 academic year. Based on the mayor's regulation No.20 of 2020, about the instructions for Admission of New Students in Depok City, it is stated that the zoning is carried out for students who live in the nearest zone from school based on the latest address on the Family Registration Card by Depok City Government no later than one year before New Students Admission [3]. In this zoning system, it emphasizes the distance or radius between student's domicile with the school where students with closer domicile to school are more entitled to these educational services.

The application of technology to utilize the function of location using GPS (Global Positioning System) or commonly called Location Based Services (LBS) is one of the solutions used in determining the distance between students' domicile with the schools. Location Based Services is a general term that is often used to describe the technology used to locate the user device. This service uses Global Positioning Service (GPS) technology and cell-based location from Google. The LBS consists of several components including mobile devices, communication network, position component, service, and content provider. Position component in question is that the user's position must be determined, this can define the coordinates of student and school location. This position is obtained by telecommunication network or by GPS, while service and content provider is a service provider that provides different services for users such as route finding, position calculation, and others [4].

The need to search for schools targeted by students makes students need to determine schools that meet the right criteria, one of which is a school that has the nearest distance from the student's domicile. It takes a system that can calculate the distance from student's domicile, where a straight-line distance calculation is needed between student's domicile and the school. The Haversine method is an equation that gives a large circle distance (radius) between two points on Earth's surface based on longitude and latitude. The Haversine method is a method that can be used to calculate the distance between two points by using latitude coordinates as the starting point and longitude coordinates as the ending point [5]. The distance between nearby points is calculated, then the value is obtained in kilo meters (Km). Smart zoning applications can be used to determine the latitude and longitude coordinates of the prospective student location based on the addresses entered in the system. Mapping of 13 schools in Depok was also carried

out in this study so that a map of the distribution of Public High Schools in Depok was produced. Based on the use of LBS technology and calculations using the Haversine method, which is implemented in this smart zoning application, it is hoped that it will make it easier for users to obtain information on the distance between students' domicile and school. Through this information, students can determine the choice of the right school based on the distance according to their regional zone.

II. LITERATURE REVIEW

A. Geographic Information System (GIS)

Geographic Information System (GIS) is a computer-based system or technology that was built with the aim of collecting, storing, processing, and analyzing, as well as presenting data and information from an object or phenomenon related to its location or existence on Earth's surface [6]. GIS can carry out processing. Starting from data entry, storage, displaying information back to users, and the ability to analyze the data. Basically, the geographic information system term is a combination of three main elements which is system, information, and geography [7]. The geographical term is part of the spatial, containing the understanding of a problem regarding the Earth, namely a two- or three-dimensional surface. The term "Geographical Information" contains the meaning of information about places located on Earth's surface, knowledge of where an object is located on Earth's surface, and information about attributes contained on Earth's surface whose position is given or known.

GIS has several interrelated components; GIS components can be grouped as follows:

- Hardware: on the hardware there are several components that are often used for GIS applications including Personal Computer (PC), mouse, monitor, digitized, plotter, GPS receiver and scanner.
- Software: software in GIS consists of the operating system, compiler, and application programs. Operating System (OS) such as: Windows, Linux, UNIX, Sun Solaris. While the compilers that are commonly used are C, C +, Delphi, Visual Basic, and GIS builder application programs include MapInfo, ArcView, Arc info, ArcGIS, and Quantum GIS.
- Geographical Information and Data: data obtained by importing from existing geographic information system software or directly creating or digitizing spatial data from maps and attributes from tables and reports using keyboard or data points obtained using GPS (Global Positioning System).

B. Google Maps API

Google Maps is a free service provided by Google and is very popular. Google Maps is a world map that can be used to view an area. In other words, Google Maps is a map that can be viewed using a browser. Users can add Google Maps features on the web that has been created or on a blog with paid or free facilities. Google Maps API is a library in the form of JavaScript, so it is commonly called as Google Maps API [8]. API can be interpreted as program code which is an interface between applications or web by utilizing functions or features provided by Google. Google Maps is an application that is similar to Google Earth, but what makes it different is that Google Maps features are not as complete as Google Earth. This time Google Maps has a reliable engine that functions to provide supporting facilities to facilitate users in finding locations so that currently Google Maps is like Google Earth.

In Google Maps API there are 4 types of map model options that have been provided by Google, namely:

- ROADMAP is a form of model that is used to display a regular two-dimensional map.
- SATELLITE is the model used to display satellite photos.
- TERRAIN is a form of map that shows physical relief of Earth's surface and shows how high a location is, for example used to show mountains and rivers.
- HYBRID is a map form that shows satellite photos on which there are images that appear on the ROADMAP, which is street names and city names.

C. Haversine Method

The Haversine method is an important form of equation in navigation field, used to find the arc distance between two points on a sphere from longitude and latitude. The arc distance is a special form of spherical trigonometry, and the Law of Haversine performs a search for the relationship between the sides and angles of a triangle in a spherical plane.

The Haversine method was first discovered by James Andrew in 1805 and was first used by Josef de Mendoza y Rios in 1801. Prof. James Inman named the term Haversine in 1835. The first study using Haversine was done by Josef de Mendoza y Rios on "The Main Problems of Nautical Astronomy", Proc. Royal Soc, Dec 22. 1796. Haversine is used to find the distances between stars. Solving the spherical triangle with the Haversine formula as shown in Figure 1.
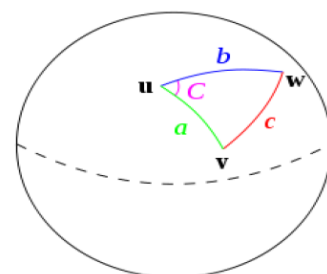

Fig. 1. The Spherical Triangle is Solved by the Haversine Formula [9]

The Haversine method describes all the equations used based on the spherical earth by eliminating the factor that the earth is slightly elliptical. One special case that uses the Haversine method in spherical trigonometry is dealing with the sides and angles of a spherical triangle. In a sphere, the shape of the "triangle" on the surface of the sphere is defined as the large circles connecting three points x, y, z on the sphere. If the lengths of the three sides are a (from point u to v), b (from point u to w), and c (from point v to w), the angles opposite c are C, we get the following Haversine formula:

$$Haversine\ (c) = haversine\ (a-b) + \sin\ (a) \cdot \sin\ (b)\ haversine\ (C) \quad (1)$$

The Haversine formula is used in calculating the distance between two coordinate points, namely the coordinates of user's position and the coordinates of the destination point. These coordinates are latitude and longitude values, so they can be used as the primary key in the comparison of distances in determining the nearest location, with the following formula:

$$Haversine\left(\frac{d}{R}\right) = haversine\left(\theta_1 - \theta_2\right) + Cos\left(\theta_1\right) \cdot Cos\left(\theta_2\right) \cdot haversine\left(\lambda_1 - \lambda_2\right) \quad (2)$$

$$Haversine(\theta) = \sin^2\left(\frac{\theta}{2}\right) = \frac{1 - \cos(\theta)}{2} \quad (3)$$

$\theta_1 = latitude\ point\ 1\ (\ user\ location\ )$

$\theta_2 = latitude\ point\ 2\ (\ destination\ location\ )$

$\lambda_1 = longitude\ point\ 1\ (\ user\ location\ )$

$\lambda_2 = longitude\ point\ 2\ (\ destination\ location\ )$

$d = Distance\ betwen\ 2\ point$

$R = Earth's\ Radius\ (\ 6371\ Km)$

III. RESEARCH METHODOLOGY

A. Research Framework

The research stages are divided into three parts. The first stage is collecting data and literature, formulating problems, and determining the aims of the research. The second stage is identifying system requirements followed by designing the system, then creating a system by implementing the Haversine method in a web-based programming language followed by testing and evaluating the system so that it is ready for use. The last stage, the third stage, is to analyze the results of the system and measure the accuracy of the results from the system so that improvements and developments can be made to the system. The research framework is shown in Figure 2.

B. System Development Stages

The system development methodology is a structured and systematic system development process that defines a series of automated activities, methods, and tools for developers in order to develop and maintain as a whole information system. The stages carried out in developing the system in this study were taken from the System Development Life Cycle (SDLC) model using the waterfall concept (waterfall approach), starting from the analysis stage to the test position and evaluation of the system and maintenance [10]. The advantage of using SDLC model is that it can determine system requirements precisely and in detail [11]. SDLC is one of the methods in the development of a popular information system and can be used when an information system is first developed as shown in Figure 3.

The explanation of each stage in system development is as follows:

1. Analysis, at this stage, the system will be analyzed how it will be run later. The results of the analysis are in the form of system advantages and disadvantages, system functions, and applicable updates. This section is included in the planning section. The form of analysis carried out is problem analysis, carried out to understand the conditions of the existing problems in order to carry out the right design process in order to achieve the right solution. Next

is system analysis, the stage where do an understanding of how the system is needed and will be designed based on the results of the problem analysis. In the analysis section, data collection was carried out, which is collecting primary data with survey methods and conducting direct observations in the field and interviews with respondents and conducting library studies in this case observing and collecting data on Public Senior High Schools in Depok. The data obtained is then processed and separated to obtain data and information in accordance with the discussion and scope of research.
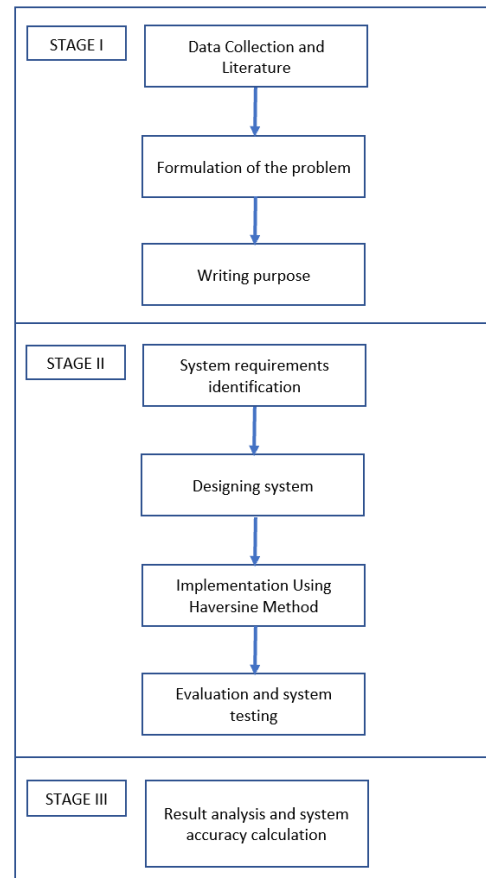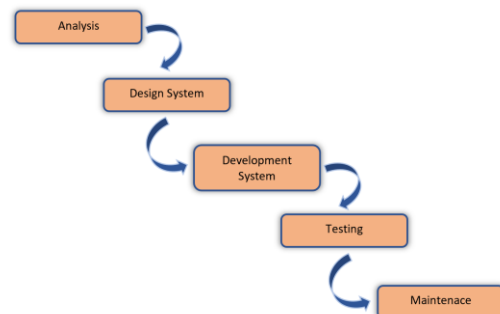

Fig. 2. Research Framework

Fig. 3. Reasearch Gates

2. Design System, at this stage the design process will be carried out in order to facilitating the process of making applications. Information system modelling uses the Unified Modelling Language (UML) which is used to

define or describe a software system related to objects [12]. This design activity begins with making a use case diagram, navigation structure, storyboard, and database design of the created app.

3. Development System, the stage in this system development is to create and implement a design that has been made from the previous stages. Activities are carried out starting from creating a database according to the design scheme, making applications based on the design of the system that has been made and making improvements to the system (debugging) so that the system is free from errors.

4. Testing, at this stage the evaluation process of the system or its components is carried out with a view to finding out whether the system meets the specified requirements or not. The testing carried out is on process units that have been integrated tested with the interface that has been made so that this test is intended to test the software system.

5. Maintenance is a form of maintenance carried out on the system. Maintenance is carried out by an admin who is appointed to keep the system operating properly through the ability of the system to adapt itself according to needs.

C. Haversine Method to Calculate Distance

Based on the explanation of the Haversine formula in equations 1 to 3, the formula used to calculate the distance between two points in this study, is:

$$\Delta lat = \frac{\pi}{180} \times (lat2 - lat1) \qquad (4)$$

$$\Delta long = \frac{\pi}{180} \times (long2 - long1) \qquad (5)$$

$$a = \sin\left(\frac{\Delta lat}{2}\right)^2 \qquad (6)$$

$$c = \cos(lat1) \times \cos(lat2) \times \sin\left(\frac{\Delta long}{2}\right)^2 \qquad (7)$$

$$d = R \times 2 \times a\sin\left(\sqrt{a+c}\right) \qquad (8)$$

The distance calculation uses equations (4) to (8), where lat1 and long1 are the coordinates of student's domicile, while lat2 and long2 are the coordinates of the school. Variable d is the distance between two points and Variable R is the value of Earth radius with a value of 6371 Km. The distance calculation uses the Haversine method to determine the straight-line distance to 13 Public Senior High Schools in Depok. In this research, the Haversine method is implemented in the form of a query that is written in the PHP and MySQL programming languages.

IV. RESULT AND DISCUSSION

The Smart Zoning application is used to calculate the distance from student's domicile to the school. This application implements the Haversine method to calculate the straight-line distance between two coordinate points with the aim of getting the nearest distance between student's domicile to the school.

A. Analysis

The results of the analysis in this study are divided into the results of problem analysis, system analysis and data collection.

1. Problem Analysis

Most students and their parents do not know the position of the school they want to go to. Based on the New Student Admission of Depok in particular, knowing the location and especially knowing the straight-line distance between the location of residence and the location of the school is needed to get an accurate score. The zoning system implemented by Depok city government allows students and their parents to find out the distance of the nearest straight line to the location of residence as one of the admission requirements. The availability of a smart zoning application that maps Public Senior High School data in Depok in the form of a geographic information system and calculates the straight-line distance from the residence to all Public High Schools in Depok can help provide recommendations for the nearest school which is the student zone. The first step needed is to design the application.

2. System Analysis

System analysis of the problem is that it is necessary to make an application that can make it easier for students or parents to be able to find out the straight-line distance from the house to the intended school, it is also expected to help the school in providing Public Senior High School recommendations choices for students so that the possibility of getting Public Senior High School becomes more likely. Calculation of the straight-line distance from the residence to the nearest Public Senior High School using the Haversine method which is also considered with other devices.

3. Data Collection

At the data collection stage, the method used is to conduct surveys and direct observations as well as complete the detailed data taken using Key API Maps so that the mapping is in accordance with the detailed data and location of Public Senior High School. The data collected is spatial data and non-spatial data about information on Public Senior High School in Depok. There are 13 Public Senior High Schools located in Depok with data on SMAN, National School Principal Numbers (NPSN) and sub-districts as shown in table I.

TABLE I. List of SMAN in Depok Area [13]

No	SMAN	NPSN	Subdistrict
1	SMAN 1 Depok	20223819	Pancoran Mas
2	SMAN 2 Depok	20223818	Sukmajaya
3	SMAN 3 Depok	20223817	Sukmajaya
4	SMAN 4 Depok	20229166	Tapos
5	SMAN 5 Depok	20229167	Sawangan
6	SMAN 6 Depok	20229168	Limo
7	SMAN 7 Depok	20268524	Tapos
8	SMAN 8 Depok	20270492	Cilodong
9	SMAN 9 Depok	20276187	Cinere
10	SMAN 10 Depok	69851425	Bojongsari
11	SMAN 11 Depok	69857937	Sukmajaya
12	SMAN 12 Depok	69857938	Kec. Cipayung
13	SMAN 13 Depok	69857939	Kec. Cimanggis

4. Needs Analysis

The step that needs to be done before designing is knowing all about functional and non-functional requirements as a

basis for designing.
a. Functional Needs Analysis

Functional Needs are defined as requirements that contain processes that will be carried out by the system. Functional Needs have several scopes of software related to system design to be made, as follows:

1. Users can search for Public High Schools in Depok.
2. Users can find out the details and locations of Public Senior High Schools in Depok.
3. Users can see the map display along with Public Senior High Schools in Depok.
4. Users can find out the distance of the straight line from the residence (home) to Public High School in Depok.

b. Non-functional needs are everything that is needed and indispensable to support the process of making website applications. In making this website application requires some hardware and software, as follows:

1. The hardware requirements used include Intel(R) Celeron(R) CPU N2920 @1.86GHz, 2GB RAM Memory, 32-bit Windows 7 Ultimate operating system, and 1TB HDD hard disk.
2. Software requirements used include Start UML, Balsamiq Mockup, XAMPP, Sublime Text Editor, and Google Chrome as well as Key API Maps.

B. Design System Smart Zoning Application

The design of the smart zoning application begins with designing use case diagrams, designing storyboards and designing databases.

1. Use Case Diagram Design

This use case diagram design is a model diagram consisting of admin and user as well as processes that interact with each other and it contains information about the flow of actors. The use case diagrams admin and user can be seen in Figure 4. This use case diagram illustrates an outline of the application system.
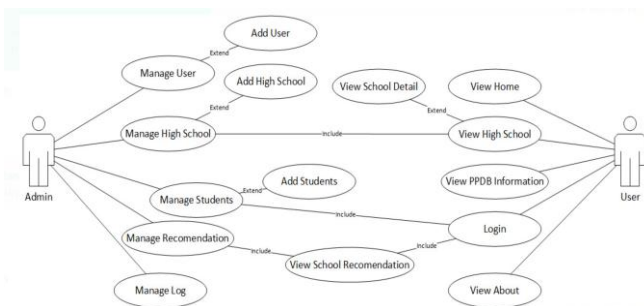
Fig.4. Use Case Diagram User and Admin [14]

2. Storyboard Design

Design of the storyboard will be very helpful when making the application. The storyboard for user is shown in Figure 5. In the user storyboard starting from the Home page, then the Public Senior High School list page in Depok which can also be seen in detail information from each Public Senior High School, the New Student Admission info page contains information about the latest New Student Admission conditions in Depok, About page and

Recommendation page can be accessed after logging in. The Recommendations page provides an estimate of the straight-line distance from the residential address to the nearest overall Public Senior High School address to all existing school. The users of this application consist of students, parents, parties with an interest in the application, and admin as the application manager.

Fig. 5. Storyboard User [14]

The admin storyboard starts from the login page, the activities that can be done are managing student data, managing school data, managing user data, managing activity logs, and managing school recommendation reports. The admin navigation structure is shown in Figure 6.
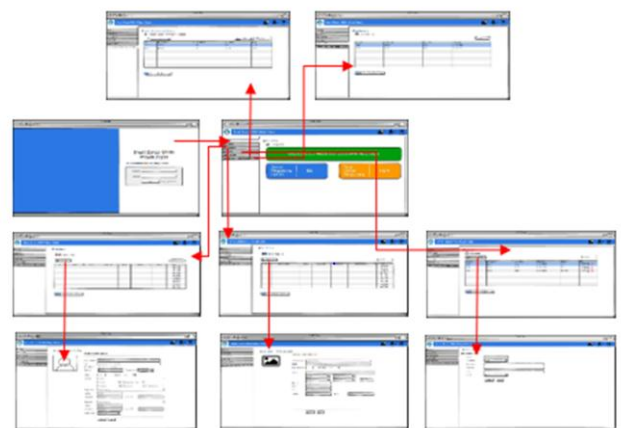

Fig. 6. Storyboard Admin [14]

3. Table Relation

Table relation is a relation between a table and another table. Tables no longer stand alone but can be connected to one another and become a single unit. The table in the making of the application based on the page design contained in the storyboard consists of 7 tables, namely the school table, the student and the user table, the content

table, the user role table, the users_student table, and the message table. The relation between tables is depicted through the class diagram shown in Figure 7.
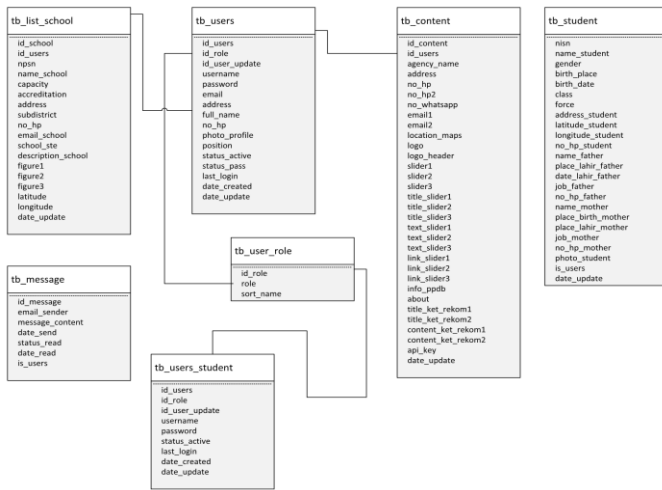

Fig. 7. Table Relation Smart Zoning Application

C. Development Smart Zoning Application

Development of the smart zoning application in this study was built on a web-based basis using PHP with the CodeIgniter framework version 3.1.11. The Haversine method is implemented using a query.

1. Implementation Code of the Haversine method
    The calculation of the straight-line distance in this smart zoning application is to calculate the distance from the coordinates of student's domicile to the school, the code can be seen in Figure 8, and the code for getting school recommendations is shown in Figure 9.

```
select npsn, nama_sekolah, kecamatan, alamat, latitude, longitude,

(select round((6371 * acos(cos(radians($latitude_siswa))

* cos(radians(latitude)) * cos(radians('$longitude_siswa') - radians(longitude))

 + sin(radians('$latitude_siswa')) * sin(radians(latitude)))),2)

 from tb_daftar_sekolah where npsn = tbs.npsn) AS jarak

from tb_daftar_sekolah order by jarak Asc
```

Fig. 8. Code for Implementation Haversine Method

Fig. 9. Code to Display School Recommendation

The map display in this study uses the Google Maps API with the source code link shown in Figure 10.

Fig. 10. Source Link Maps API

2. Interface Implementation of Smart Zoning Application
    The following are some of the results of implementing the smart zoning application interface that is used to calculate the distance between student's domicile and each school in Depok.
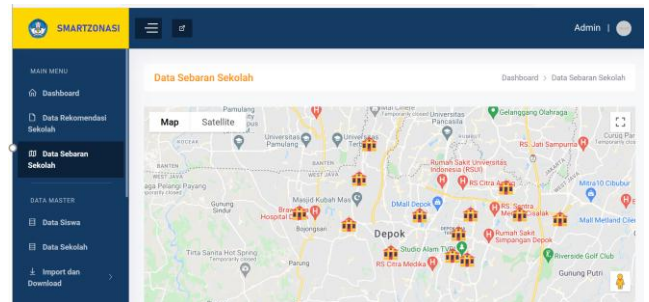   a. Map display of data distribution of 13 Public Senior High Schools in Depok.

Fig. 11. Map of the Distribution of 13 High Schools in Depok Area

The data map for the distribution of Public Senior High School in Depok consists of 13 schools, namely SMAN 1 to SMAN 13. This map depicts the location of the school's position on a map where detailed school information will be obtained by clicking on the icon of the school on the map.

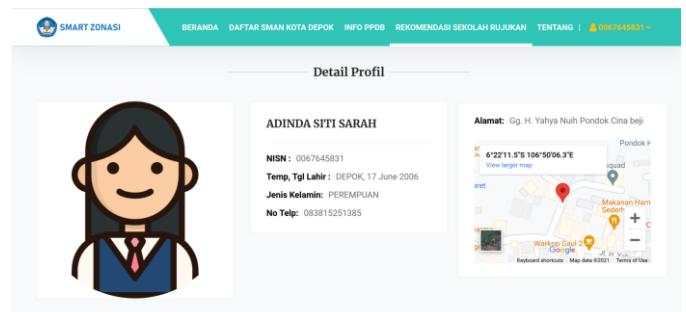b. Student Profile Data display in the application.

Fig. 12. In-app student profile

Figure 12 is the display of student profile details in the application after the student log in as a user, which contains information on name, NISN, date of birth, gender, and telephone number and contains information on the student's domicile address along with the location coordinates that have been converted to latitude and longitude.

c. Results of distance calculations using the Haversine method display.

Students as users in this smart zoning application can find out how far the domicile address to each school. In this application the coordinates of student's domicile which have been converted into latitude and longitude values are calculated using the Haversine formula and produce distances in kilo meters. In the application the calculation results can be displayed in the form of a sequence from the nearest distance to the farthest distance from school location to the domicile. From the calculation results that appear in this application, students can find out which school is the nearest school and in the regional zone. The calculation that appears in the study is student with the domicile address of Gg. H. Yahya Nuih Pondok Cina Beji with coordinates latitude -6.36972 and longitude 106.8351. The results of the distance calculation using the Haversine method from the system can be seen in Figure 13, SMAN 2 is the school that has the nearest distance from student's domicile, which is 3.16 Km.

Fig. 13. The results of distance calculations using the Haversine Method of the system
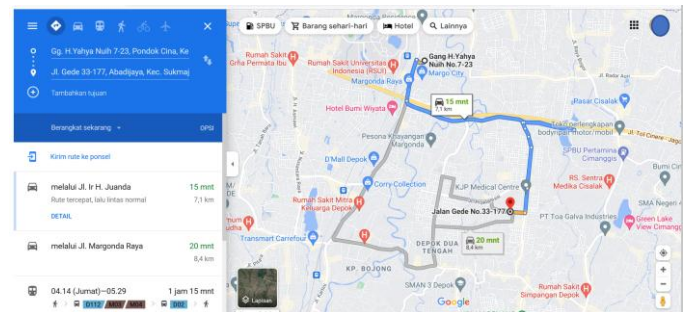
d. Location of the nearest school in a map visualization display.

Fig.14. Visualization of nearest school distance in map

Figure 14 describes the location of the nearest school, results of the distance calculation using the Haversine method in the form of map visualization, based on the results of the calculation the nearest school is SMAN 13.

e. Display route information to school.

In addition to providing distance information from student's domicile address to the school, the smart zoning application also provides information on alternative routes to the school, to make it easier for students to arrive at the location. The alternative route information is shown in Figure 15.

Fig. 15. Alternative route to school

D. Testing Smart Zoning Application

Based on the results of testing using the Blackbox method, it can be concluded that the data entry process can be carried out successfully, and functionally the system can produce the expected output. In terms of security, the system has been able to limit user access rights, so that only users who are registered in the system can use this system. The following are the details of the Blackbox test in Table II.

TABLE II. Testing using Blackbox Method

Class Test	Item Test	Observation Result	Conclusion
User Login	Login test case with correct user login data	Login data successfully used and directly entered the main page of the application	Succeed
Student Data Information	Profile student data display	Already displaying the appropriate information.	Succeed
Calculation Result Information	Distance calculation display to determine school recommendations base on shortest display	The distance calculation display data has appeared in kilo meters. The distance that appears is in accordance with the student's domicile and destination school address	Succeed
Map Visualization	Map visualization of distance calculation results	The visualization results have been successfully displayed and are in accordance with the calculation of the distance to the nearest school and the student's domicile	Succeed
Route Visualization	Map visualization of distance calculation results	The results of the alternative route display have succeeded in providing information on the appropriate address for the route to the school	Succeed

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E. Maintenance Smart Zoning Application

Things that are done in the maintenance process are making improvements if there may be problems with the application, collaborating with the team regarding the resolution of application performance issues and conducting regular monitoring of application content. The maintenance process also includes providing assistance and training to application users (in this case the junior high school) who intend to find the location of the nearest high school from the student's residence.

V. CALCULATION OF SYSTEM ACCURACY

Accuracy test calculations are carried out to see the accuracy of the results from distance calculations that have been carried out automatically using the application. In the following, a comparison will be made between the calculation results from the smart zoning application using the Haversine method and the distance calculation results based on Google Earth by drawing a straight line from each of the latitude and longitude coordinates of student's domicile to the school. Accuracy tests and comparisons of results were carried out to obtain effective results accuracy, as shown in table III.

TABLE III. Table of Results Calculating Accuracy of Haversine by System Smart Zonation with Result of Google Earth [15]

User Coordinates		Name of School	School Coordinates		Haversine by smart zonation System (km)	Google API Distance (km)	% Error
Latitude	Longitude		Latitude	Longitude			
-6.36972	106.8351	SMA Negeri 1	-6.395047	106.814458	3.61	3.64	0.82
		SMA Negeri 2	-6.3946006	106.8491576	3.16	3.15	0.32
		SMA Negeri 3	-6.4075209	106.8409172	4.24	4.3	1.40
		SMA Negeri 4	-6.394434	106.8882392	5.90	5.94	0.67
		SMA Negeri 5	-6.4011561	106.7666284	8.33	9.4	11.38
		SMA Negeri 6	-6.3706803	106.7733785	6.82	6.84	0.29
		SMA Negeri 7	-6.3975893	106.9100008	8.84	8.83	0.11
		SMA Negeri 8	-6.424844	106.8468016	6.25	6.21	0.64
		SMA Negeri 9	-6.3472217	106.7801344	6.57	6.75	2.67
		SMA Negeri 10	-6.3932982	106.7327226	11.61	11.66	0.43
		SMA Negeri 11	-6.3868742	106.8303999	5.80	5.75	0.87
		SMA Negeri 12	-6.4200047	106.794943	7.13	7.07	0.85
		SMA Negeri 13	-6.376502	106.873379	4.30	4.36	1.38
						Rata-Rata Error (%)	1.68
						Accuracy(100%- Rata-rata Error)	98.32

The accuracy value of the Haversine calculation automatically by smart zoning application with Google API (earth) got a value of 98.32%, explaining that the distance calculation value with the system using the Haversine formula has good accuracy, and the system can be used to help calculate distance automatically.

VI. CONCLUSION

Based on the results of the explanation in this study, it can be concluded that the Smart zoning Application can be used to calculate the straight-line distance between the coordinates of student's domicile and the school by implementing the Haversine method to solve the problem of calculating the distance with a straight line. This application can be used to generate information in determining the results of the calculation of the nearest distance in the zoning system. The calculation of the nearest distance is used to determine the recommendation of the school based on zoning. In this study, the implementation of the Haversine method uses a web-based system to complete the calculation of the nearest path between the coordinates of student's domicile and the coordinates of the school which is sorted in ascending order within a scope that has been limited to a certain radius, which is zoning in Depok area. Results of the calculations accuracy from the application when compared with distances on Google Earth get 98.32% results which explain that the system can be used to calculate the nearest distance using the Haversine method.

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