APPLICATION GUIDELINES FOR PARKING TRANSPORTATION DEPARTMENT REPORT ILLEGAL PARKING BANDUNG USING GPS AND COMPASS SENSOR ON ANDROID SMARTPHONE

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ABSTRACT

Increasing the number of two-wheelers and four wheelers in Bandung annually increasing, this results in an increased need for parking space. According to data from the Department of Transportation Bandung in Bandung number of vehicles reached 1.2 million vehicles were divided 400 thousand cars and 800 thousand motorcycles and this number does not include vehicles from outside Bandung, which came on vacation or sightseeing in Bandung , With the number of vehicles it the much needed parking space which is the official parking lot of the Department of Transportation Bandung itself, in order to avoid illegal parking causes traffic congestion, crime, and its parking rates which do not correspond to the official parking rates.

Based on this, it can be concluded the need to build software that can help the user's problem vehicles that were outlined earlier. The software is built to be run on a media that is easy to access and carry anywhere as a smartphone. Docpark is a software for parking guidance and report illegal parking that runs on mobile devices. Docpark software built using two modeling, namely modeling sub-system structured for web and object-based modeling sub-system for mobile. Platforms used for mobile sub-system is android, considering that Android currently has the most users in the world. In addition to supporting software performance better, the software docpark utilize third-party technologies such as GPS technology and Compass Sensor for the availability of user location data.

Based on test results using black box testing methods and beta can be concluded that the software enables users docpark vehicles or people to look for a parking space and guides parking official in the city of Bandung, and can report illegal parking in realtime.

Keywords: *Docpark, parking, GPS, Compass Sensor, Android*

1. INTRODUCTION

Increasing the number of two-wheelers and four wheelers in Bandung annually increasing, this results in an increased need for parking space. According to data from the Department of Transportation Bandung in Bandung number of vehicles reached 1.2 million vehicles were divided 400 thousand cars and 800 thousand motorcycles and this number does not include vehicles from outside Bandung, which came on vacation or sightseeing in Bandung , With the number of vehicles it needed a parking lot which is the official parking lot of the Department of Transportation Bandung.

Based on data from the Department of Transportation Bandung about the location and position of vehicles parked at the curb public parking and a special place in the city of Bandung there are 238 points the location and position of parking available in the city of Bandung. But this can not lessen awareness of the riders of two-wheel or four wheel in terms of determining the location and position of parking has been provided by the Department of Transportation Bandung, resulting in frequent traffic jams and parking rates are not in accordance with the tariff official parking caused by parking wild.

Illegal parking in the Field of Traffic and Parking Department of Transportation Bandung are vehicles parked in any place that is not an official parking lot or parking prohibited berambu / stop. The rise of illegal parking that occurs is very disturbing in the community, based on questionnaire data were obtained from 86 correspondent stated that 89% of citizens and motorists do not know the official parking lot and the position of the vehicle parked at the curb public spread in the city of Bandung.

Based on the problems described, it can be concluded the need to build an application that can become parking solution in Bandung with the theme "Application Development DocPark To Free Parking And Reports On Illegal Parking Department of Transportation Bandung Utilizing GPS and Compass Sensor On Android Smartphone". Geofencing technology is a combination of GPS and

GCM (Google Cloud Messaging) is a mobile service by sending a message to the smartphone user who enters a predetermined area [1]. While geotagging technology is a combination of camera features that can perform direct synergy with the GPS feature to provide realtime information about where and how the condition of an object [2]. And a compass sensor, a compass is used to determine the direction of the wind [3]. With the development of this application is expected to be a proper parking solutions in places that have been provided and reporting illegal parking in the city of Bandung in realtime Transportation Agency.

1.1 Purpose and Objectives

The purpose of this research is to build applications for parking guidance and report illegal parking at the Department of Transportation Bandung utilizing GPS and Compass Sensor on android smartphone.

The objectives to be achieved in this study are as follows:

1. Utilize geofencing technology for information on official parking places in Bandung.
2. Utilizing compass sensor technologies for vehicle parking guidance information by the public roads in Bandung.
3. Utilize technology for easy geotagging Department of Transportation Bandung get realtime reporting illegal parking.

2. CONTENTS RESEARCH

2.1 GPS (Global Positioning System)

Global Positioning System is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the US Department of Defense were first introduced beginning in 1978. GPS services previously only used for military purposes, but began to open to the public.

The GPS satellites should always be on the right orbital position to maintain the accuracy of the data sent to the GPS receiver. To be able to know a person's position would require a tool called GPS receiver which serves for receiving the signals from GPS satellites. GPS receivers take this information and perform triangulation calculation to determine the user's location precisely. GPS receiver compares the time a signal is sent to the time the signal was received to determine the distance of the satellite. By knowing the distance, the GPS receiver can calculate and determine the user's position and display the electronic map. After determining the user's position, then the GPS can calculate other information, such as speed, the intended direction, path, destination, distance destination, sunrise and sunset, and many more.

The signals received by the receiver (receiver) on the surface, where the GPS receiver will collect information from GPS satellites [4], such as:

1. Time, GPS receiver receives timing information from the atomic clock that has a very high accuracy.
2. Location, GPS provides location information in three dimensions:
   a. Latitude
   b. Longitude
   c. Elevation
3. Speed, when on the move, GPS can indicate the switching speed information.
4. Directions trip, the GPS can show the direction of the goal.
5. Save locations, places that already have or want to visit can be stored by the GPS receiver.
6. Komulasi data, the GPS receiver can keep track of information, such as total travel that has been done, the average speed, highest speed, lowest speed, time / hours to the destination, and so on.

2.2 Latitude dan Longitude

Latitude and longitude is a coordinate on the Earth and is used to determine our position on the earth [5]. The following explanation of latitude and longitude:

1. Latitude
   Latitude is a line that ran from the north pole and a south pole. Point 0 is the angle of the equator, a + sign indicates an upward direction towards the north pole, while a minus sign in coordinates Latitude heading to the south pole. The point that is used from 0 to 90 degrees towards the north pole, and 0 to -90 degrees to the south pole.
2. Longitude
   Longitude is the latitude. Figures from the rounded corners of the earth horizontally. Starting point from 0 to 180 degrees, and - in the opposite direction. 0 starting point of the line of the British state. Leads to Indonesia will be a positive number. Longitude coordinate minus the reverse is the opposite direction.

2.3 Haversine

Haversine method used to calculate the distance between a point on the surface of the Earth using latitude (longitude) and longitude (lattitude) as input variables. Haversine formula is an equation important in navigation, giving great circle distance between two points on the surface of a sphere (Earth) by longitude and latitude.

Assuming that the earth is a perfect sphere with radius R 6367.45 km, and the location of the second point in koordinant ball (latitude and longitude), respectively lon1, lat1, and lon2, lat2, then the formula can be written with equations Haversine as follows [6]:

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

Figure 1 Haversine Formula

Information:
x = Longitude (Lat)
y = Latitude (Longitude)
d = Distance
r = radius of Earth = 6371 km
1 degree = 0.0174532925 radians

2.4 Problem Analysis

Department of Transportation Bandung in terms of curb parking places authorized and report complaints of illegal parking in the city of Bandung had several problems, these problems among them:

1. How motoring consumers and the public to know the official parking places in the city of Bandung.
2. How does the vehicle and guide the public to know the parking of vehicles on public roads on the edge of the city of Bandung.
3. How does the Department of Transportation Bandung get realtime reporting illegal parking.

2.5 Analysis Geofencing

Geofencing is a feature in the software program that uses the global positioning system (GPS) to determine the geographic boundaries. Programs that combine the geofencing allows to set triggers, so that when an object using a particular device entering or leaving the boundaries are set, it will display a notification (notification) to be sent to the user's application of the geofencing feature.

For the size of the area in geofence range from a few tens of meters to several kilometers. Geofence area in the form of irregular, shape can be a circle, geometric figures, such as square or rectangular, or more complex, such as complex polygons.

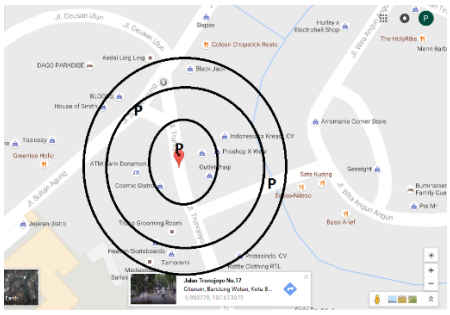


Figure 2 Geofencing Areas

Geofencing mechanism to determine the point to be in geofencingkan is to first determine the latitude and longitude that you want to give geofencing, after getting latitude and longitude, and then specify the radius that want to be included, defined radius permeter this term.

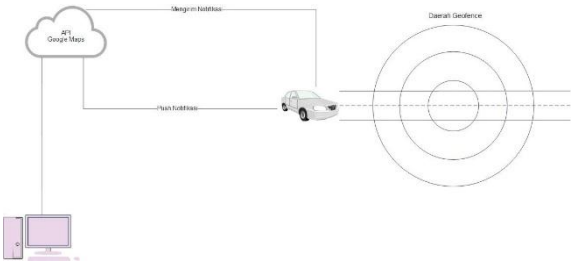


Figure 3 Receipt Mechanism Geofencing

In the image reception mechanism geofencing, users sign in to the area that has been in the geofence. Then, the detection occurs when smartphone users entering areas in geofence, planting in the application smartphone users give Push Notification via Google Maps, Google Maps which then sends back information official parking places are in geofence to mobile users.

The process of admission mechanism geofencing radius is one process where the user / user can specify a radius from where the user / user is located. Here are the admissions process geofencing radius of 50 meters from where the user / user are:

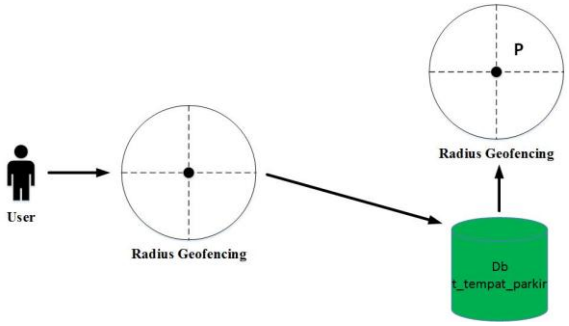


Figure 4 Geofencing Radius Admissions Process

1. Users select the geofencing radius distance of 50 meters from the location of the position of the user is located.
2. System taking or compare all of the data in the database park in table parking lot of the location the user is located.
3. The system displays the data from the parking lot 50 meter radius of the selected user.

Here are the admissions process geofencing radius of 100 meters from where the user / user are:

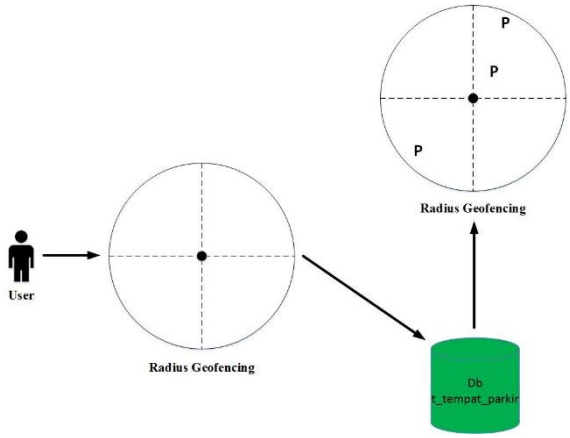


Figure 5 Geofencing Radius Admission Process

1. Users select a distance geofencing radius of 100 meters from the location of the position of the user is located.
2. System taking or compare all of the data in the database park in table parking lot of the location the user is located.
3. The system displays the data from the parking lot within 100 meters of the selected user.

Here are the admissions process geofencing radius of 150 meters from where the user / user are:

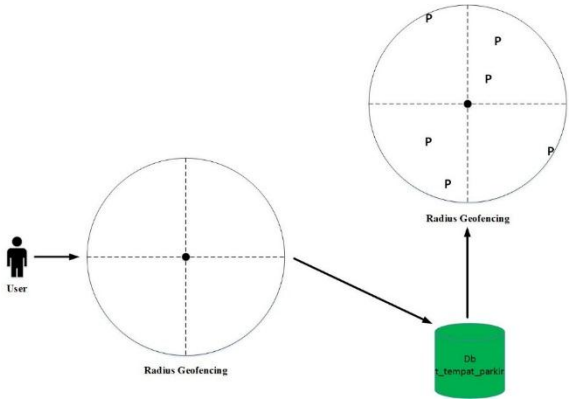


Figure 6 Geofencing Radius Admission Process

1. Users select the geofencing radius within 150 meters of the position of a user's location is.
2. System taking or compare all of the data in the database park in table parking lot of the location the user is located.
3. The system displays the data from the parking lot of 150 meter radius of the selected user.

Here is the difference in the admissions process geofencing radius selected user:

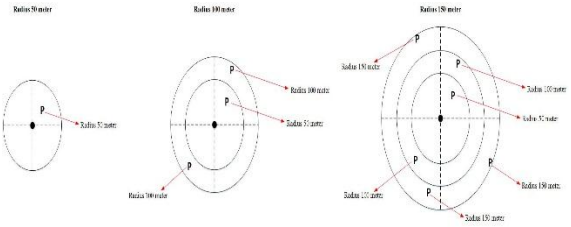
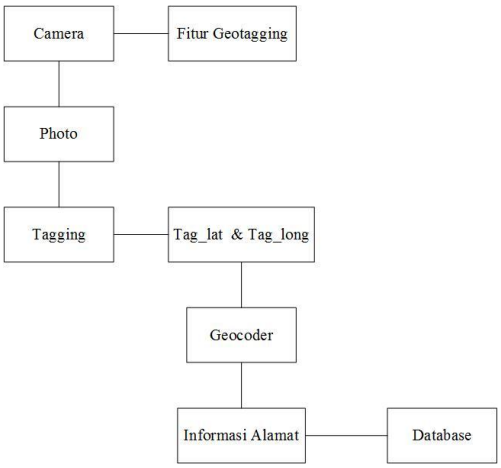


Figure 7 Radius difference Admission Process

2.6 Analysis Geotagging

These applications take advantage of geotagging technology that is embedded in the android smartphone camera, geotagging data is taken is tag_latitude and tag_longitude. These tags will be used as input data for the geocoder. Results of the geocoder is a form of address information in which the photograph. Below is a picture geotagging process of collecting data as input to the geocoder data storage to the database.



Figur 8 Making Mechanism Geotagging

In the picture the polling mechanism geotagging, users activate geotagging feature and activate the camera on android smartphone, then users take pictures and process tagging stored in Exif header to be taken Tag_latitude and Tag longitude to process data changes latitude and longitude into the address information through Geocoder to store Data latitude and longitude and the address information in the database.

The process of geotagging data retrieval mechanism is a process where the user / user retrieve data geotagging. Here is the geotagging data collection process:

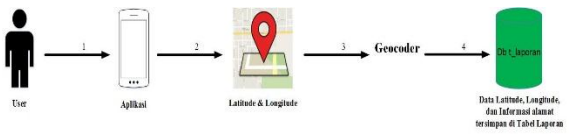


Figure 9 Making Process Data Geotagging

1. Users capture images of illegal parking in the application.
2. The systems acquire the latitude and longitude data is taken.
3. The system of data taking and change the latitude and longitude through geocoder process into the address information.
4. The system will store data latitude and longitude as well as address information into the database and the system will display information report illegal parking in the application.

2.7 Analysis System Architecture

The analysis aims to identify the system architecture architecture that will be built based on two subsystems web and mobile subsystems.

1. Sub-System Architecture Web
   Users sub-system software on the web is that administrator. Administrator in charge for data processing user content.

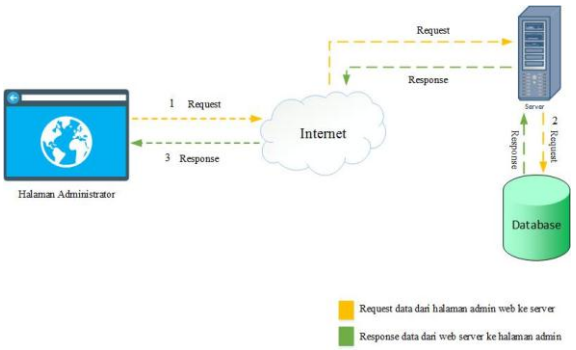


Figure 10 Sub System Architecture Web

Below is a description of the image 8 Architecture Software On Web Subsystem:

a. Sub web system admin to request a data request to the server through the Internet.
b. The server receives request data query and retrieve data on demand from the database.
c. The server sends the requested data to the computer via the Internet network admin.

2. Mobile Sub-System Architecture
   Users sub-system software on mobile that users and Transportation Agency officer, describing how the software interact on a mobile device.

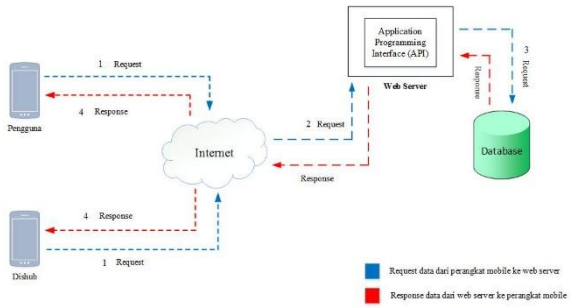


Figure 11 Sub System Architecture Mobile

Below is a description of the image 9 Software Architecture In Mobile Subsystem:

a. The mobile device user and the Transportation Agency to request data using the Internet network to the web server and database via API.
b. Web server receives request data from the user's mobile device and Transportation Agency via the API.
c. After the API receives request data from the user's mobile device and Transportation Agency, then the web server retrieves the data in the database on demand.
d. Once the web server receives the requested data, the data will be returned in the form of JSON via API's in response to the user's mobile device and Transportation Agency.

3. Overall System Architecture
   The overall system architecture describes the system architecture of an overall perspective.

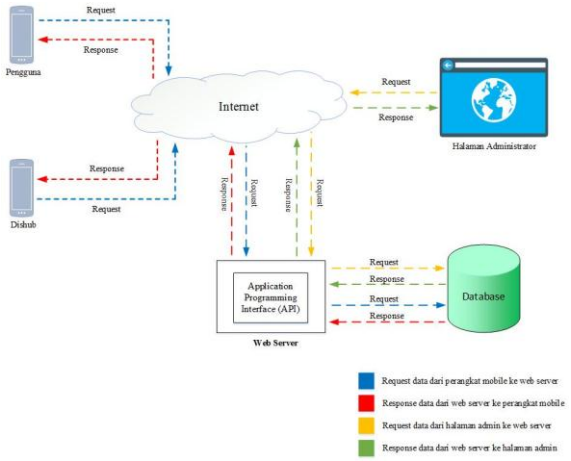


Figure 12 Overall System Architecture

2.8 Entity Relational Diagram (ERD)

Entity Relationship Diagram (ERD) is a set of means or tools to describe the data or objects created by and derived from the so-called real world entities (entities) and relationships (relationship) between these entities using some notation.

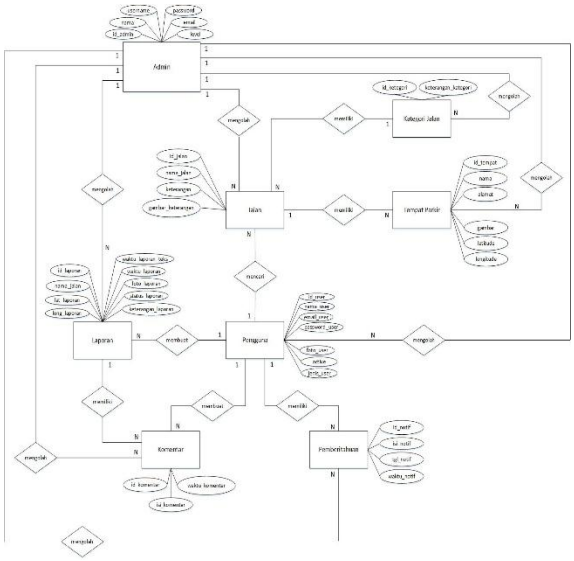


Figure 13 Entity Relational Diagram (ERD)

2.9 Functional Requirements Analysis Web

Analysis of functional requirements include the web context diagram and the DFD level 1 as a general overview of the functionality of the software built.

1. Diagram Context
   Diagram Context is a diagram illustrating generally being input, process and output that occurs in a system.

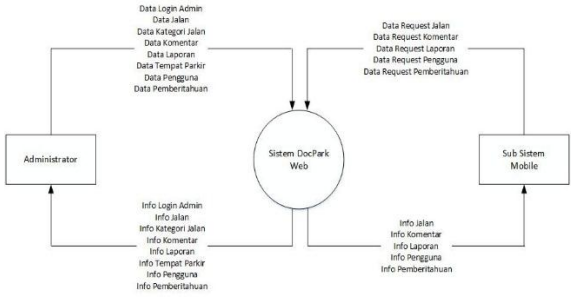


Figure 14 Diagram Context

2. DFD Level 1
   DFD level 1 is a diagram illustrating the general processing of data for user content.

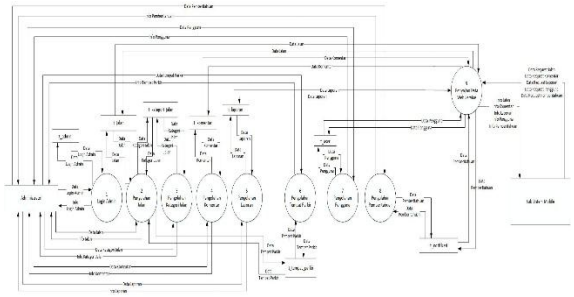


Figure 15 DFD Level 1

2.10 Functional Needs Analysis Mobile

Analysis of functional requirements of mobile includes use case diagrams to describe the existing functionality in the software built.

1. Use Case Diagram
   Use Case Diagram is a model to describe the behavior (behavior) software to be built.

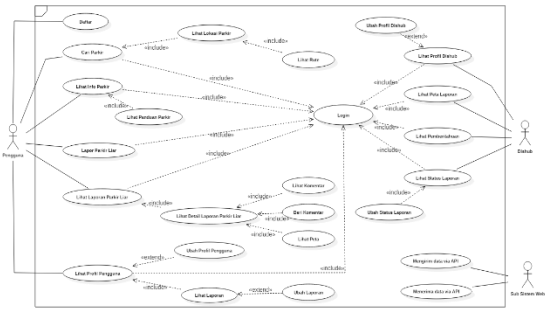


Figure 16 Use Case Diagram

2.11 Design Data

Here is the data from the design software built:

1. Relationship Diagram
   Here is a diagram Relation of software built.

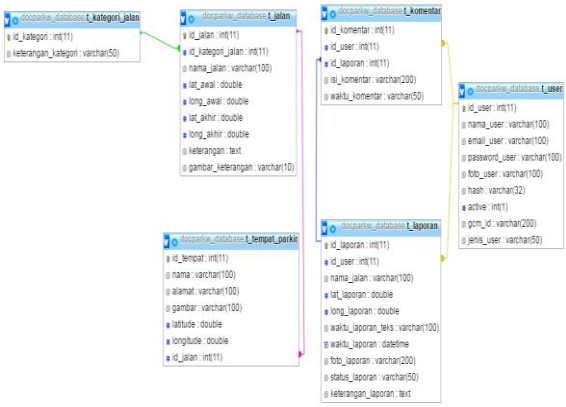


Figure 17 Relationship diagram

2.12 System Implementation

Implementation stage is the stage translation system design based on the results of the analysis into a particular programming language and application software that is built on a real environment. In this phase there is a need for the suggested system include:

1. Hardware Requirements
   Here are the hardware specifications that are used to using the system.

Table 1 Hardware Minimum Requirement

Sub Systems Web	Sub System Mobile
Processor core i3 @2.30 Ghz	Android 4.1 Jelly Bean
Harddisk 500 GB	TFT LCD
RAM DDR3 2GB	5 Megapixels Camera Resolution (Rear)
VGA 128 MB	Jaringan GSM / CDMA
The screen resolution 1366x768 Pixel	Data Connections HSDPA / EVDO
Internet connection	A-GPS Support

2. Software Requirements
   Here are the specifications of the software used to use the system.

Table 2 Minimum Software Requirement

Sub Systems Web	Sub System Mobile
Operating system Windows 7 32 bit	Operating System Android 4.1 Jelly Bean
Web browser Mozilla Firefox 20.0, Google Chrome 30.0.1750.154	

3. Requirement Server
   Here are the specifications of the server used to use the system.

Table 3 Requirement Specifications Server

Sub Systems Web
Web Space 500 MB
Bandwidth 50 GB Bulan
MySQL Database (5.1 & 5.5)
PHP (5.2 & 5.3)
Cpanel 11.x
Apache 2.x mod_deflate

2.13 Testing System

Phase Tests conducted for the software that is built consists of three parts:

1. Test Plan

System testing will be performed divided into two stages. The first phase of testing focused on the functionality of the software that is built using blackbox testing method. The second phase of testing will focus on the assessment of software that is built, the method of data collection is done is interview and questionnaire to be distributed to 20 respondents.

2. Functionality Testing Results

Results of testing the functionality divided into three test results web admin, mobile users, and mobile Transportation Agency of software that is built can be seen in the following table:

a. Functionality Testing Web Admin

Table 4 Functionality Testing Web Admin

Class Test	Test Item	Types of Tests
Login admin	Input data login	Black Box
	Verifikasi username	Black Box
	Verifikasi password	Black Box
	Displays form add road	Black Box
	Fill in the form add data	Black Box
Add Road	path	
	Save data path plus	Black Box
Edit Path	Displays form edit data path	Black Box
	Fill in the form edit data path	Black Box
	Save the modified data path	Black Box
Clear the Way	Select the data path	Black Box
	Clear the data path to be deleted	Black Box
Add Category Road	Displays form add category road	Black Box
	Fill in the form add data category road	Black Box
	Store data path plus category	Black Box
Edit Category Road	Displays form edit data categories road	Black Box
	Fill in the form edit data categories	Black Box
	save the modified data categories	Black Box
Remove Category Road	Choose a category data path	Black Box
	Clear Data category of road to be deleted	Black Box
Add a Comment	Display form details comment	Black Box
	Write comments to be added	Black Box
	Send comments to be added	Black Box
Edit Comments	Display form details comment	Black Box
	Edit comment to be changed	Black Box
	Send comments changed	Black Box
Delete Comment	Select comments to delete	Black Box
	Remove comments will be deleted	Black Box
Edit Status Report Illegal Parking	Displays form edit status report	Black Box
	Select the input status report	Black Box
	Save the changed status report	Black Box
Clear Reports Illegal Parking	Select the data report illegal parking	Black Box
	Remove report illegal parking will be removed	Black Box
Add Parking Spaces	Displays form add data park	Black Box
	Fill in the form of data plus park	Black Box
	Data store parking place plus	Black Box
Edit Points Parking	Displays form edit data park	Black Box
	Fill in the form edit data park	Black Box
	Data store parking place changed	Black Box
Remove Parking Spaces	Select the data park	Black Box
	Remove the parking lot of data to be deleted	Black Box
Add User	Displays form add user data	Black Box
	Fill in the form of user	Black Box

Class Test	Test Item	Types of Tests
	data plus	
	Keep user data plus	Black Box
Edit User	Displays form edit user data	Black Box
	Fill in the form edit user data	Black Box
	Keep user data is modified	Black Box
Remove User	Choose your user data	Black Box
	Delete user data will be deleted	Black Box
Add Affair Officer	Displays form add data clerk Transportation Agency	Black Box
	Fill in the form of data added Transportation Agency officers	Black Box
	Transportation Agency data store clerk plus	Black Box
Edit Officer Dishub	Displays form edit the data officers Transportation Agency	Black Box
	Fill in the data form edit Transportation Agency officers	Black Box
	Transportation Agency data store clerk who changed	Black Box
Clear Officers Dishub	Select the data officers Transportation Agency	Black Box
	Remove Transportation Agency officials to be removed	Black Box
Edit Notifications	Displays form edit notice	Black Box
	Fill in the form edit notice	Black Box
	Save the modified notification	Black Box
Remove Notifications	select notifications	Black Box
	Clear notification to be removed	Black Box

b. Functionality Testing Mobile Users

Table 5 Functionality Testing Mobile Users

Class Test	Test Item	Types of Tests
Register	Input data register	Black Box
	Validasi inputan data register	Black Box
	Verifikasi data register	Black Box
Login	Input data login	Black Box
	Verifikasi email	Black Box
	Verifikasi password	Black Box
Parking Info	Choose a distance radius	Black Box
	Press the parking info	Black Box
	Show info park official	Black Box
Find Parking	Showing page find parking	Black Box
	Fill textbox with the name of the street or park name is sought	Black Box
	Displaying data sought	Black Box
	Check the location of the parking lot	Black Box
	See the park	Black Box
Profile	Displays profile form	Black Box
Edit Profile	Displays form edit profile	Black Box
	Fill in the form edit profile	Black Box
	Save the profile data is modified	Black Box
Guide Parking	Showing the form guide to parking	Black Box
Lapor Parkir Liar	Displaying the form to report illegal parking	Black Box
	Take a photo report illegal parking	Black Box
	Fill in the information report illegal parking	Black Box
	Press the button and send the report	Black Box
Reports Illegal Parking	Display form report illegal parking	Black Box
	Choosing see detail report illegal parking	Black Box
	View comments	Black Box
	comment	Black Box
	See map	Black Box

c. Functionality Testing Mobile Transportation

Table 6 Functionality Test Mobile Transportation

Class Test	Test Item	Type of Tests
Login	Input data login	Black Box
	Verifikasi email	Black Box
	Verifikasi password	Black Box
See Status Reports	List the status report	Black Box
	Change status report	Black Box
Profile	Displays profile form	Black Box
Edit Profile	Displays form edit profile	Black Box
	Fill in the form edit profile	Black Box
	Save the profile data is modified	Black Box
Map Report Illegal Parking	Showing detail of illegal parking on a map google maps	Black Box
Notice	Displays a list of reports of illegal parking	Black Box

3. Beta Testing Results

Results of testing the beta of the software that is built as shown in Table 7 Beta Testing Results

Tabel 7 Beta Testing Results

Purpose	Question	value Scale	Value
Utilizing geofencing technology for information on official parking places in Bandung.	Is this application can help find information about the location of the official parking place in Bandung?	**4.2**	**4.1**
	Is this application can help show the location as well as the official parking lot on google maps exactly?	**4**	
Utilizing compass sensor technologies for vehicle parking guidance information by the public roads in Bandung.	Is this application can help provide guidance in accordance with the location of the parking official parking lot?	**4**	**4**
Utilizing technology for easy geotagging Department of Transportation	Is this application can help to report illegal parking to the authorities is appropriate?	**4.1**	**4.1**

Purpose	Question	value Scale	Value
Bandung get realtime reporting illegal parking.			
Build software that is easy to understand and interesting and interactive in appearance	Whether the application is easy to understand and use?	**4.2**	**4.3**
	Is it interesting and interactive applications in appearance?	**4.3**	

Table 7 Results of Beta Testing, the objectives are achieved from the development of applications docpark for parking guidance and report illegal parking at the Department of Transportation Bandung, is as follows:

1. From the research, the question number (1) is (84: 20) = 4.2, and the question number (2) is (79: 20) = 4. So (4.2 + 4 = 8.2) : 2 = 4.1 than expected 5. then 4.1 lies in the region between strongly agree agree with docpark application can help find information about the location of official parking place in the city of Bandung, and can show the route to the location of the official parking lot.
2. From the research, the question number (3) is (79: 20) = 4. So the question number (3) its results are expected 4 of 5. So 4 is located in the area agree docpark applications can help provide guidance park according to the location of the official parking lot.
3. From the research, the question number (4) is (81: 20) = 4.1. So the question number (4) its yield was 4.1 than expected 5. Then 4.1 lies in the region between strongly agree agree with docpark applications can help to report illegal parking to the authorities.
4. From the research, the question number (5) is (83: 20) = 4.2, and the question number (6) is (86: 20) = 4.3. Thus (4.2 + 4.3 = 8.5): 2 = 4.3 than expected 5. Then 4.3 lies in the region between strongly agree agree with docpark application is easy to understand and use, as well as interesting and interactive way to see

3. PENUTUP

Based on the results of testing on the application docpark for parking guidance and report illegal parking in Department of Transportation Bandung by utilizing GPS and compass sensors on android smartphone, it could be concluded as follows:

1. Application docpark for parking guidance and report illegal parking in Department of Transportation Bandung on android smartphone that is built has been successfully utilized geofencing technology to help facilitate transport users or society in finding parking places officially in Bandung.
2. Application docpark for parking guidance and report illegal parking in Department of Transportation Bandung on android smartphone built to help users to see public transport or parking guidelines.
3. Applications docpark for parking guidance and report illegal parking in Department of Transportation Bandung on android smartphone that is built has successfully utilize geotagging technology to facilitate the Department of Transportation Bandung in the field of traffic and parking in getting a report illegal parking in realtime.

Application docpark to guide park and report illegal parking At the Department of Transportation Bandung on android smartphone built an application that focuses on vehicle users or the public to be aware of parking places authorized and guide to parking in the city of Bandung, and can facilitate the relevant office in getting report illegal parking in realtime. Therefore, there are some suggestions that can be used as an alloy development, in order to support the growth of users and content on docpark application for parking guides and illegal parking this report. The advice - the advice is as follows:

1. Improving the use of sensor technology as parking guide for vehicle users.
2. Adding technology to determine the total quota of parking of vehicles in the car park official in Bandung and in the parking lot vehicle parking service provider.
3. Develop a platform that can be supported by the application docpark, since currently only supports the android platform.

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