APPLICATION DEVELOPMENT OF WORKSHOP SEARCH BASED ON THE RECOMMENDATION OF DRIVING BEHAVIOR AND MECHANIC QUALITY ON ANDROID

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ABSTRACT

Motorcycles are a means of transportation that most people use to travel and activities outside the home, because the motorcycle can shorten the time or mileage traveled for sanpai to the destination.
This application aims to facilitate the user to perform maintenance / servicing the vehicle. By providing location information workshop that had been recommended by the method Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) based on the criteria of amenities, comfort and quality of the workshop. Workshops that have been sorted by the distance terekomendasi closest to the user by using Google Places API.Users can make a reservation online service by mechanics who have cooperated. By reservation online service, the user can perform vehicle service without the need to queue like in the workshop. Because the user can perform service by calling the mechanic closest to the location of the user. So that the user can perform vehicle service without having to come to the workshop. The mechanic is a mechanic who has registered in the application and recommended with Simple Additive weighting method (SAW) through kreiteria which include experience, education, and ratings by other users.

Keywords: android, TOPSIS, API google place, SAW, GPS.

1. INTRODUCTION

1.1 Background

The number of vehicles in Indonesia in 2015 reached 121.39 million units. Central Statistics Agency data shows, from these figures that most of the motorcycle with the amount of 98.88 million units (81.5 percent). Passenger car followed by the number of 13.48 million units (11.11 percent), and 6.6 million freight cars (5.45 percent), as well as bus car with the number of 2.4 million units (1.99 percent) of the total vehicle [1]. From the above data it can be concluded that the motorcycle is a vehicle that is most widely used as transportation by the public.

Based on data taken from questionnaires to the riders, in the can that 71.4% of respondents experienced a queue at the time of going to servicing their vehicles. So that the respondents should menunngu and time consuming. In addition 57.1% of respondents did not know when his vehicle spare parts must be replaced as a result every time the respondent will serve the vehicle, the respondent must prepare more money just in - in case if the spare parts to be replaced during a servis.Responden who do not know the mechanical quality, namely 57.1 %.

So we need an application that can allow the rider to perform a service vehicle. Smarthphone android is one of the most widely used platform mobileyang today, according to data from analytics strategy, at the end of the third quarter of 2016, there were 328.6 million Android devices shipped into the market. It grew as much as 10.3%, when compared to the same period in 2015. With the delivery of the device that much, Android now has a market share of 87.5%, growth of attainment in the third quarter in 2015 which only amounted to 84.1 % .With mobileyang properties owned smatphone android allows users to get information anywhere. So that motorists can easily access information about the location of the nearest service station [2].

Based on the above explanation smarthphone needed an android-based application to assist motorists in finding the location of the garage for servicing kendarraanya. Then lifted the title " *APPLICATION DEVELOPMENT OF WORKSHOP SEARCH BASED ON THE RECOMMENDATION OF DRIVING BEHAVIOR AND MECHANIC QUALITY ON ANDROID*".

1.2.Problems Identification

Based on the background that has been presented, the identification of problems in research are as follows:

1. The rider suffered a queue that takes time to be servicing the vehicle.
2. Motorists trouble knowing mechanical quality.
3. Motorists do not know the damage to the motor vehicle.

1.3 Purpose and Objectives

Based on the problems studied, the purpose of this thesis is to build an application workshop and booking online service based on driving behavior and mechanical quality using GPS on a smartphone.

While the objectives to be achieved in the research include:

1. Allows the rider to perform vehicle service.
2. Provide mechanical quality information.
3. Providing information on the workshop.

2. CONTENTS OF RESEARCH

2.1.Android

Android is an operating system for mobile phones based on Linux. Android provides an open platform for developers to create their own applications and are used by a wide variety of mobile devices. Initially, Google Inc. bought Android Inc., newcomers who make software for mobile phones. Then to develop Android, formed the Open Handset Alliance, a consortium of 34 companies hardware, software, and telecommunications, including Google, HTC, Intel, Motorola, Qualcomm, T-Mobile, and Nvidia. At the inaugural release of Android, 5 November 2007, along with the Open Handset Alliance Android states support the development of open standards on mobile devices. On the other hand, Google released the Android code under the Apache license.

In this world there are two types of distributors operating system Android. The first fully supported by Google or Google Mail Services (GMS) and the second is completely free distribution without direct support Google's otherwise known as the Open Handset Distribution (OHD) [3].

2.2.GPS (Global Positioning System)

GPS is a navigation system that uses satellites designed to provide instant position, velocity and time information in virtually any place on Earth, at any time and in any weather conditions.

While the means for receiving satellite signals that can be used by general users or the so-called GPS Tracker GPS Tracking, using this tool it is possible the user can track the position of the vehicle, fleet or the car in Real-Time[4].

2.3.Simple Additive Weighting (SAW)

SAW method is often also known summation method terbobot.Konsep term basis SAW method is a weighted sum of ratingkinerja looking at every alternative on all attributes. SAW method membutuhkanproses normalizing the decision matrix (X) to a scale that dapatdiperbandingkan with all the ratings of existing alternatives. Broadly speaking, SAW is used to perform the weighting of the data where culinary and so the end result mempunyasi sights and kulinerdi recommendations Bandung [5].

2.4.TOPSIS Method

TOPSIS is one of multiple criteria decision-making methods yangpertama introduced by Yoon and Hwang 1981. TOPSIS didasarkanpada concept whereby the selected alternative or mempunyaijarak best not only the closest (shortest) of the positive ideal solution, but it also has jarakterjauh (longest) from the negative ideal solution from a geometrical point USING Euclidean distance to determine the relative proximity of suatualternatif with the optimal solution. Positive ideal solution is defined as the entire value jumlahdari best that can be achieved for each attribute, while solusinegatif-ideal consisting of all the worst value achieved for each attribute [6].

TOPSIS into account both the distance of the positive ideal solution danjarak against the negative ideal solution by taking the relative closeness terhadapsolusi positive ideal. Based on the comparison of the relative distance, alternative susunanprioritas can be achieved. This method is widely used in some modelMADM to solve problems in a practical decision. Halini caused the concept is simple and easy to understand, efficient computation, and has the ability to measure the relative performance of the alternative-alternatifkeputusan in simple mathematical form [6].

2.5.Google Maps

Google Maps is an online map application service provided by Google for free. Google Maps map service can be accessed via the website resminyes that is http://maps.Google.com,Services created interactively by Google Maps offers maps and satellite images for the whole world which included a map can be shifted according to the wishes penggunam, change the zoom level, and change the look of the map type. Other facilities provided by Google Maps include location search by entering keywords such as names, places, towns or roads, and other facilities such as route calculation traveling from one place to another.

Google Maps are created using a combination of image maps, databases, and interactive objects created with the programming language HTML, Javascript, and AJAX, as well as several other programming languages. The picture that appears on the map is the result of communication with the database on Google's web server to display a combination of pieces of images that are requested. Wherein, the overall image that is integrated into the Google server database that can be invoked as needed [7].

2.6.Google Maps Distance Matrix API

Google Maps Distance Matrix API is a service that provides a travel distance for the origin and destination matrix. Google Maps Distance Matrix API retrieves information based on the suggested route between the starting and end points, as calculated by the Google Maps API, and consists of rows containing duration and distance values for each pair. Google Maps Distance Matrix API does not return detailed route information. Route information can be obtained in detail by forwarding the place of origin and the desired destination into Google Maps Directions API.

Request Google Maps Distance Matrix API takes the form as follows [8]:

https://maps.googleapis.com/maps/api/distancematrix/outputFormat?parameters

in this case, the output format can be from one of the values JSON or XML. Necessary parameters are as follows [8]:

a. *Origins*, is the starting point for calculating the distance and time of travel.
b. *Destination*, is one or more locations to be used as an end point to calculate distance and time.
c. *Key*, API key that identifies the application that the application made for the purposes of quota management.

2.7 Similar Applications 2.7.Analisis

In the analysis of similar applications, will be observed against the application that has similarities with the application to be built.

2.7.1.Obeng (Online Bengkel)

Screwdriver (Online Shop) is an application-based search workshop android. The main menu view Screwdriver (Online Shop) can be seen in Figure 2.1.



Figure 2.1 Main menu Display Obeng

This application is intended to help users who are in need of treatment of motor vehicle in a way to show the location of the workshop kendaraanterdekat the user's location. Especially when the riders were to travel as far as when Lebaran or out of town. In addition to providing information about the location of the workshop, this application provides information mengenari quality of the workshop based on ratings from other users. So that you do not need to worry about servicing workshop you want to attend.

Display search and the quality of a garage workshop contained in the application screwdriver. In the image below:

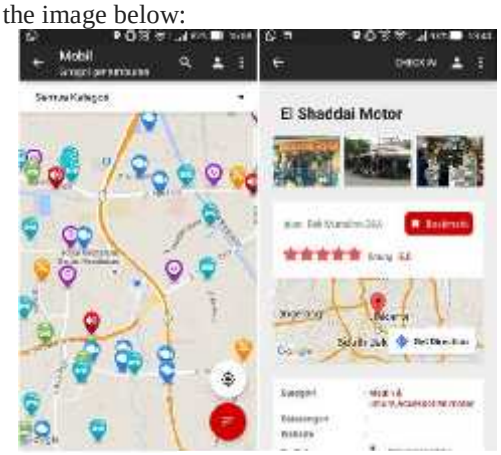


Figure 2.2 Display search workshops and workshop Information

2.7.2.Pitstop

Pitstop is a search application relating to vehicle location, both the motor vehicle and the car based on the location closest to the user application resides.



Figure 2.3 Main Display and Menu Pitstop

2.8.Google Maps API Analysis

This study uses the Google Maps API, this technology is used to get the distance between the user's location with the location of the workshop. As examples of the Google Maps API technology analysis used in this study is in figure 2.4

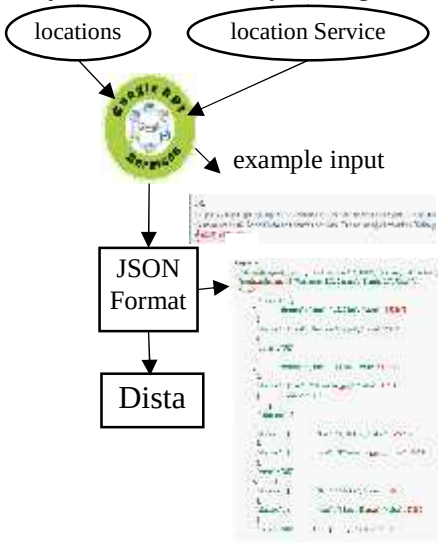


Figure 2.4 Analysis of the Google Maps API

2.9.Analysis Mechanic Quality and Workshop

2.9.1 Recommendation of Mechanics

The method used in this research that Simple Additive Weighting (SAW). This method is used to find the optimal alternative of a number of alternatives to certain criteria.
The criteria and their weights are determined as follows:

Table 2.1 Mechanics Education

Education	Weight
SMK (automotive)	1
SMA / SMK (non-automotive)	0.75
SMP	0.5
SD	0.25

Table 2.2 Mechanics Experience

Experience	Weight
More than 10 years	1
5 -10 years	0.75
15 years	0.5
Less than 1 year	0.25

Table 2.3 Rating of Mechanical

Rating	Weight
1 Star	0.2
2 Stars	0.4
3 Stars	0.6
4 Stars	0.8
5 Stars	1

Step Completion Method SAW

1. Specify the criteria that will be used as a reference in determining.
2. The rating determines the suitability of each alternative on each criteria already exist.
3. Creating a matrix based on criteria (Ci), then the matrix is normalized based on the equation that are tailored to the type attribute so obtained matrix normalized.
4. Looking for an alternative value obtained from the sum of the matrix multiplication which has been normalized by the weight vector so obtained alternative values (Ai).

Data of Mechanical:

Table 2.4 mechanical data

mechanics	Education	Experience	rating
mechanics 1	SD	6 years	5
mechanics 2	SMP	11 years old	4
mechanics 3	High School	3 years	3
mechanics 4	High School	1 year	3

To get a recommendation mechanics, then made a table based on the criteria for each mechanic as follows:

Table 2.5 Criteria based on the weight values

Alternative	Kritetia		
	C1	C2	C3
alternative 1	0.25	0.75	1
alternative 2	0.5	1	0.8

alternative 3	0.75	0.5	0.6
alternative 4	0.75	0.25	0.6

The matrix R = $\begin{bmatrix} 0,25 & 0,75 & 1 \\ 0,5 & 1 & 0,8 \\ 0,75 & 0,5 & 0,6 \\ 0,75 & 0,25 & 0,6 \end{bmatrix}$

The formula used to normalize the matrix above is as follows:

$$r_{ij} \begin{cases} \dfrac{x_{ij}}{Max_i \; x_{ij}} & jika\ j\ adalah\ atribut\ keuntungan\ (benefit) \\ \dfrac{Min_i\, x_{ij}}{x_{ij}} & jika\ j\ adalah\ atribut\ biaya\ (cost) \end{cases}$$

Information
rij = normalized performance rating of alternatives on attribute Ai Cj
A = alternative
C = criteria
i = data into 1,2, ..., m
j = Data to 1,2, ..., n
m = number of data
n = number of data

calculation of normalization

$R11 = \frac{0,25}{\max[0,25;0,5;0,75;0,75]} = \frac{0,25}{0,75} = 0,33$
$R21 = \frac{0,5}{\max[0,25;0,5;0,75;0,75]} = \frac{0,6}{0,75} = 0,66$
$R31 = \frac{0,75}{\max[0,25;0,5;0,75;0,75]} = \frac{0,75}{0,75} = 1$
$R41 = \frac{0,75}{\max[0,25;0,5;0,75;0,75]} = \frac{0,75}{0,75} = 1$

$R12 = \frac{0,75}{\max[0,75;1;0,5;0,25]} = \frac{0,75}{1} = 1$
$R22 = \frac{1}{\max[0,75;1;0,5;0,25]} = \frac{1}{1} = 1$
$R32 = \frac{0,5}{\max[0,75;1;0,5;0,25]} = \frac{0,5}{1} = 0,5$
$R42 = \frac{0,25}{\max[0,75;1;0,5;0,25]} = \frac{0,25}{1} = 0,25$

$R13 = \frac{1}{\max[1;0,8;0,6;0,6]} = \frac{1}{1} = 1$
$R23 = \frac{0,8}{\max[1;0,8;0,6;0,6]} = \frac{0,8}{1} = 0,8$
$R33 = \frac{0,6}{\max[1;0,8;0,6;0,6]} = \frac{0,6}{1} = 0,6$
$R43 = \frac{0,6}{\max[1;0,8;0,6;0,6]} = \frac{0,6}{1} = 0,6$

Normalization Matrix R = $\begin{bmatrix} 0,33 & 0,75 & 1 \\ 0,66 & 1 & 0,8 \\ 1 & 0,5 & 0,6 \\ 1 & 0,25 & 0,6 \end{bmatrix}$

weighting
The weights W = (3, 3, 4)

Mechanical calculations to determine recommendations
V1 = (0.33 * 3) + (0.75 * 3) + (1 * 4) = 0.99 + 2.25 + 4 = 7,24
V2 = (0.66 * 3) + (1 * 3) + (0.8 * 4) = 1.98 + 3 + 3.2 = 8.18
V3 = (1 * 3) + (0.5 * 3) + (0.6 * 4) = 3 + 1.5 + 2.4 = 6.9
V4 = (1 * 3) + (0.25 * 3) + (0.6 * 4) = 3 + 0.75 + 2.4 = 6.15

V2 is then obtained that the mechanics that will be recommended in the first place by the system

2.9.2.Rekomendasi Workshop

Workshop recommendations are recommendations made by the system to the user to get the garage. Adapaun steps to get the workshop recommendations are as follows:

1. Taking the initial location data and location specialist workshop
2. Finding the value of the distance between each workshop specialist with the initial locations, which is obtained from google maps.
3. 3 Taking the data specialist garage closest to the starting location.
4. Determine the best specialist workshop using TOPSIS method, the result will be the best value terekomendasi specialist workshop.

Table 2.6 Start location

locations	Latitude	Longitude
Starting location	-7.035903	107.713547

Furthermore, the location of a tire repair shop in the table below:

Table 2.7 Workshop locations tire specialist

specialist workshop	Latitude	Longitude
Tire repair shop 1	-7.0298697	107.7001152
Tire repair shop 2	-7.0301481	107.6902175
Tire repair shop 3	-7.0286032	107.6931265
Tire repair shop 4	-7.0487452	107.7401038
Tire repair shop 5	-7.0203898	107.6494898

Based on data from tire specialist workshop locations above, the distance of each workshop sought tire specialist workshop with the user obtained from google maps. Here is a chart from any location within the garage to the starting location,

Table 2.8 Distance Repair Specialist with the Start Location

NO	specialist workshop	Distance
1	Tire repair shop 1	1.7 km
2	Tire repair shop 2	3.5 km
3	Tire repair shop 3	2.6 km
4	Tire repair shop 4	3.3 km
5	Tire repair shop 5	8.2 km

From the above table it is known that a tire repair shop 1 garage nearest tire specialist from a starting location to a distance of 1.7 Km value. From the above data taken three nearest tire repair shop from the starting location to be recommended by using TOPSIS method. Ie tires Workshop 1, Workshop 3 tires and tire workshop 4. The criteria used to search for the workshop recommendations that comfort, quality workshops and facilities.

Table 2.9 Workshop Criteria Value tires

Joinery Specialists	Criteria		
	Comfort	Quality	Amenities
Tire repair shop 1	3	4	3
Tire repair shop 3	4	3	4
Tire repair shop 4	3	4	4

Information :
1 = Very Bad
2 = Fair Poor
3 = Enough
4 = Good
5 = Very Good

From the above table is made of a matrix as follows:

The matrix R = $\begin{bmatrix} 3 & 4 & 3 \\ 4 & 3 & 4 \\ 3 & 4 & 4 \end{bmatrix}$

Then normalization matrix above by using the following formula:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_i^m x_{ij}^2}}$$

Information :
x = value matrix
i = line matrix
j = column matrix
m = many alternatives

$$r_{11} = \frac{3}{\sqrt{3^2 + 4^2 + 3^2}} = \frac{3}{\sqrt{34}} = 0{,}5144$$
$$r_{21} = \frac{4}{\sqrt{3^2 + 4^2 + 3^2}} = \frac{4}{\sqrt{34}} = 0{,}6859$$
$$r_{31} = \frac{3}{\sqrt{3^2 + 4^2 + 3^2}} = \frac{3}{\sqrt{34}} = 0{,}5144$$

$$r_{12} = \frac{4}{\sqrt{4^2 + 3^2 + 4^2}} = \frac{4}{\sqrt{41}} = 0{,}6246$$
$$r_{22} = \frac{3}{\sqrt{4^2 + 3^2 + 4^2}} = \frac{3}{\sqrt{41}} = 0{,}4685$$
$$r_{32} = \frac{4}{\sqrt{4^2 + 3^2 + 4^2}} = \frac{4}{\sqrt{41}} = 0{,}6246$$

$$r_{13} = \frac{3}{\sqrt{3^2 + 4^2 + 4^2}} = \frac{3}{\sqrt{41}} = 0{,}4685$$
$$r_{23} = \frac{4}{\sqrt{3^2 + 4^2 + 4^2}} = \frac{4}{\sqrt{41}} = 0{,}6246$$
$$r_{33} = \frac{4}{\sqrt{3^2 + 4^2 + 4^2}} = \frac{4}{\sqrt{41}} = 0{,}6246$$

normalization matrix

R = $\begin{bmatrix} 0{,}5144 & 0{,}6246 & 0{,}4685 \\ 0{,}6859 & 0{,}4685 & 0{,}6246 \\ 0{,}5144 & 0{,}6246 & 0{,}6246 \end{bmatrix}$

The second step is to create a weighted normalized decision matrix y with reference to the weight value with the following equation:

Information :
y = weight normalized
i = line matrix
j = column matrix

The weights W = (3,5,2)
y11 = 3 * 0.5144 = 1.5432
Y21 = 5 * 0.6859 = 3.4295
y31 = 2 * 0.5144 = 1.0288

Y12 = 3 * 0.6246 = 1.8738
Y22 = 5 * 0.4685 = 2.3425
Y32 = 2 * 0.6246 = 1.2492

y13 = 3 * 0.4685 = 1.4055
y23 = 5 * 0.6246 = 3.123
y33 = 2 * 0.6246 = 1.2492

y = $\begin{bmatrix} 1{,}5432 & 1{,}8738 & 1{,}4055 \\ 3{,}4295 & 2{,}3425 & 3{,}123 \\ 1{,}0288 & 1{,}2492 & 1{,}2492 \end{bmatrix}$

y1 + = max (1.5432; 3.4295; 1.0288) = 3.4295
y1- = min (1.5432; 3.4295; 1.0288) = 1.0288
y2 + = max (1.8738; 2.3425; 1.2492) = 2.3425

y21- = min (1.8738; 2.3425; 1.2492) = 1.2492
y3 + = max (1.4055; 3.123; 1.2492) = 3.123
y3- = min (1.4055; 3.123; 1.2492) = 1.2492

Table 3.10 Matrix of positive and negative ideal solution

name Criteria	y +	y-
Comfort	3.4295	1.0288
Quality	2.3425	1.2492
Amenities	3.123	1.2492

The fourth step is to determine the distance of the positive ideal solution with the following formula:

$$y = \begin{bmatrix} 1,5432 & 1,8738 & 1,4055 \\ 3,4295 & 2,3425 & 3,123 \\ 1,0288 & 1,2492 & 1,2492 \end{bmatrix}$$

$$D_i^+ = \sqrt{\sum_{j=1}^{n} (y_i^+ - y_j^i)^2}$$

Positive
D1 +
=
$\sqrt{(3,4295 - 1,5432)^2 + (2,3425 - 1,8738)^2 + (3,123 - 1,405$

= 2.5937
D2 +
=
$\sqrt{(3,4295 - 3,4295)^2 + (2,3425 - 2,3425)^2 + (3,123 - 3,12$

= 0
D3 +
=
$\sqrt{(3,4295 - 1,0288)^2 + (2,3425 - 1,2492)^2 + (3,123 - 1,249$

= 3.2357

negative
D1-
=
$\sqrt{1,5432 - 1,0288)^2 + (1,8738 - 1,2492)^2 + (1,4055 - 1,2492)^2}$

= 0.8241
D2-
=
$\sqrt{3,4295 - 1,0288)^2 + (2,3425 - 1,2492)^2 + (3,123 - 1,2492)^2}$

= 3.2357
D3-
=
$\sqrt{1,0288 - 1,0288)^2 + (1,2492 - 1,2492)^2 + (1,2492 - 1,2492)^2}$

= 0

$$V_i = \frac{D_i}{D_i^- + D_i^+}$$

V1 = 0.8241 / (0,8241+ 2.5937) = 0.2191
V2 = 3.2357 / (3.2357 + 0) = 1
V3 = 0 / (0 + 3.2357) = 0

From the above calculation can dikethaui that, V2 will be recommended by the system to the driver as the best workshops.

2.10.Implementasi System

Implementation of the system is the steps being taken for the system to function properly and operated in accordance with the purpose.

2.11.Interface Implementation

Adapaun interface implementation that is applied to this application as shown below:



Figure 3.1 Main Page

2.11.1. Implementation Recommendations of Workshop

On this page are applied search workshop recommendations as shown below:



Figure 3.2 Page Recommendations Workshop

2.11.2.Implementasi Recommendations of Mechanics

On this page of search applied mechanics recommendations as shown below:

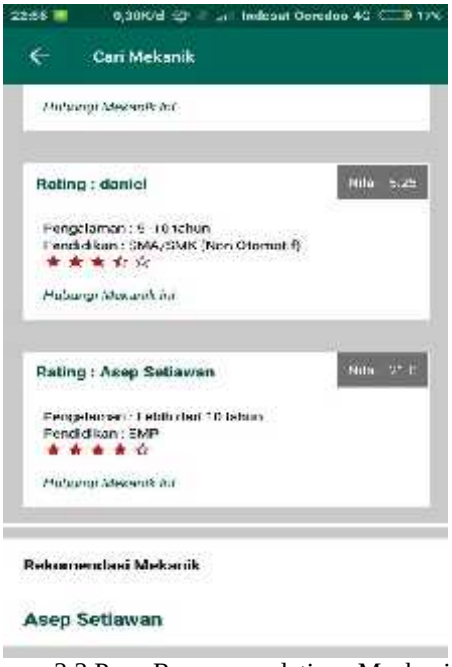


Figure 3.3 Page Recommendations Mechanics

CLOSING

3.1.Conclusion

Based on test results and discussion that has been created, it can be
concluded that:

1. Search Application Workshop and Online Services can facilitate the rider to get on the workshop.
2. Search Application Workshop and Online Services can facilitate the rider to get on mechanics.

3.2.Saran

Advice can be given to the development of this application are:

1. Adding features online registration for the workshop has been validated.
2. Adding a garage for four-wheeled vehicles.
3. Adding features to the online payment service booking online.

Reference

[1] BP Statistics, "the Central Bureau of Statistics ," 23 May 2017. [Online]. Available: https://www.bps.go.id/linkTableDinamis/view /id/1133. [Accessed January 17, 2018].

[2] Hasanuddin, "Teknorus," [Online]. Available: https://teknorus.com/jumlah-pengguna-android -2017/. [Accessed 15 September 2017].

[3] HN Application Programming Mobile smarth-phone and Android-based Tablet Pc, Bandung: Informatics, 2012.

[4] "STMIK Bidakara," [Online]. Available: http://bidakara.ac.id/pengertian-gps-cara-kerja-gps-dan-fungsi-gps/. [Accessed October 10, 2017].

[5] MAMA Wirawan and IKR Arthana, Decision Support System Development Site Selection Culinary ith MetodeAHP and SAW, vol. 5, no. ISSN 2252-9063, p. 2, 2016.

[6] FK Harahap, Applications TOPSIS method in determining the priority districts / cities in North Sumatra province, vol. 1, 2013.

[7] SD H, SR and LJ, "Geographic Information Systems to Feature Map and Travel These Case Studies in Malang," vol. 1, no. ISSN: 2355-1941, pp. 2-3, 2014.

[8] "Distance Matrix API," Google Inc., [Online]. Available: https://developers.google.com/maps/documen-tation/distance-matrix/start [Accessed October 2, 2017].