

# DECISION SUPPORT SYSTEM FOR SELECTING TOURISM OBJECT IN SURABAYA CITY USING SIMPLE ADDITIVE WEIGHTING BASED ON ANDROID

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## ABSTRACT

*In this final project will discuss the implementation of the Decision Support System Attractions in Surabaya using Simple Additive weighting. Issues to be taken is to obtain the best results of 50 attractions in Surabaya based on the location of the user to take advantage of the Android-based operating system, to make it more easier for users to access these applications. To obtain the value of the distance criterion, the application is using the formula Haversine. The results of the election decision support system application attractions in Surabaya using Simple Additive weighting method is the obtainment of the highest values of attractions based on user location with weights to each criterion especially distance criterion which has a weight of 0.3.*

**Keywords :** Google Maps, attractions, Android, distance, Simple Additive weighting, Haversine

## 1. INTRODUCTION

Surabaya is the second largest city in Indonesia after Jakarta, making this city as business center, commerce, industry, and education in East Java. In terms of tourism, Surabaya has a variety of tourist attraction, including the historical sights are always searching for by tourists who come.

Some of the tourist attraction become the leading tourist attraction of Surabaya. However, some people are confused in choosing the tourist attraction liking especially near the location of tourist attraction, especially people who come from out of city who want to visit Surabaya would have trouble when first came. With the current development of technology, it is actually very easy to access information via smartphone. Whether it is written information or information in the form of images. Some people can take advantage of location based services technology to find the location they want to go to easily.

Location-based service is one of the information services by utilizing technology to know the position of something. Location-based services that use positioning system technology, allowing users to obtain location information according to their needs. LBS included in the category of the same technology as Geographic Information System (GIS). Location based services can help in the decision making process faced with various criteria as the selection of a tourist attraction. The method used in this decision-making system is the Simple Additive weighting method (SAW). The basic concept of the SAW method is looking for a weighted summation of the rating performance of each alternative on all attributes.

Based on the description above, this research is trying to create an application with the title "Decision Support System For Selecting Tourism Object in Surabaya City Using Simple Additive Weighting Based On Android."

## 2. DECISION SUPPORT SYSTEM

Decision Support System (DSS) or Decision Support System (DSS) is a system that can provide problem-solving ability and the ability of communicating to a problem with the condition of semi-structured and unstructured. This system is used to assist decision-making in situations of semi-structured and unstructured situations, where no one knows for sure how the decision should be made (Turban, 2001). [1]

## 3. FLOWCHART

*Flowchart* in the figure below describes the flow of the system is doing by the admin and user in this application.

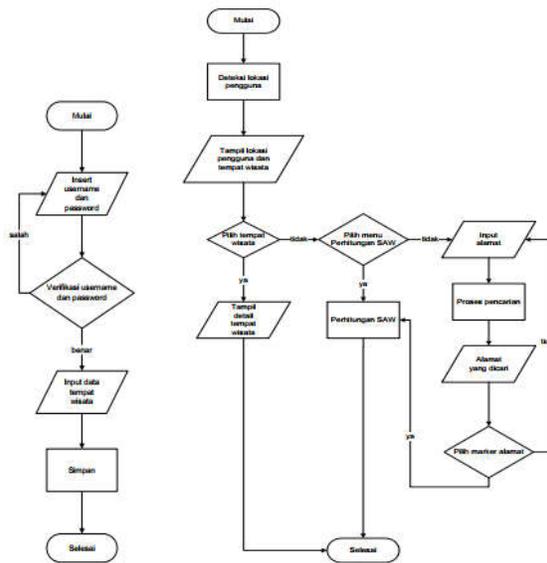


Figure 1. Flowchart admin and user

#### 4. SAW METHOD CALCULATION

According Kusumadewi (2007), the SAW method is also often known as the weighted summing method. [2]

##### 4.1 The structure of the weighting data assessment for each criteria, include:

a. Operational hour (benefit)

Weighting for Operating Hour criteria.

Operating hours (h)	Weight
6-15 hours	1
X > 15 hours	2

Table 1. Table weighting of the operating hour criteria

b. Ticket price (cost)

Weighting for Ticket Price criteria.

Ticket Price	Weight
X < 60000	3
60000-100000	2
X > 100000	1

Table 2. Table weighting of ticket price criteria

c. Facility (benefit)

Weighting for Facility criteria.

Facility	Weight
X ≤ 5	1
6-10	2
X > 10	3

Table 3. Table weighting of facility criteria

d. Address (cost)

Weighting for Address criteria.

Address	Weight
Near highway	2
Settlements	1

Table 4. Table weighting of address criteria

Weighting of the criteria for selecting a tourist attraction spot to get the best tourist attraction is as follows:

- Operational hour = 0.15 (benefit)
- Ticket price = 0.25 (cost)
- Facility = 0.2 (benefit)
- Distance = 0.3 (cost)
- Address = 0.1 (cost)

**4.2 Calculation of Distance**

Before calculating method of SAW, calculated the distance calculation first between the user's GPS location with tourist attraction using the Haversine formula.

Suppose the user's GPS location is in Bhayangkara Surabaya University, then: User locations = Bhayangkara Surabaya University

Latitude : -7.3213517  
 Longitude : 112.7321167  
 Location sites = Surabaya Zoo  
 Latitude : -7.297014  
 Longitude : 112.738738

$$x = (\text{rad } Long_2 - \text{rad } Long_1) * \text{Cos} ((\text{rad } Lat_1 + \text{rad } Lat_2)/2)$$

$$y = (\text{rad } Lat_2 - \text{rad } Lat_1)$$
(3)

Distance =  $\sqrt{(x * x + y * y)}$  \* R  
 R = radius Earth= 6371 km 1° = 0.0174532925 radian

Latitude 1 = -7.3213517 \* 0.0174532925 = -0.1277817 radian  
 Longitude 1 = 112.7321167 \* 0.0174532925 = 1.96754661 radian  
 Latitude 2 = -7.297014 \* 0.0174532925 = -0.12735692 radian  
 Longitude 2 = 112.738738 \* 0.0174532925 = 1.96766217 radian

$$x = (1.96766217 - 1.96754661) * \text{Cos} ((-0.1277817 + -0.12735692)/2)$$

$$= (0.00011556) * (0.99187407)$$

$$= 0.000114621$$

$$y = (-0.12735692 - (-0.1277817))$$

$$= 0.00042478$$

$$\text{Distance} = \sqrt{(0.000114621^2 + 0.00042478^2)} * R$$

$$= \sqrt{1.93576E - 07} * 6371 \text{ km}$$

$$= 0.000439973 * 6371 \text{ km}$$

$$= 2.8030664 \text{ km}$$

**4.3 Match Rating**

Below is the table of match rating for each alternative on each criterion.

Table 5. Match Rating table

Tourist attraction	Operational hour	Ticket price	Amenities	Distance	Address
Zoo (zoo) Surabaya	1	3	1	2.80	2
Suroboyo Carnival	1	2	1	2.68	2
De EYES Trick Eye Museum	1	2	1	3:02	2
Parks Mayangkara	2	3	1	1.64	2

Parks Bungkul	2	3	2	3:43	2
Royal Plaza	1	3	3	1:39	2

**4.4 Normalization**

SAW method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all the ratings of existing alternatives.

$$r_{ij} = \frac{x_{ij}}{\text{Max}_i x_{ij}} \quad \text{if } j \text{ is an attribute of the advantages (benefits)}$$

$$r_{ij} \tag{4}$$

$$r_{ij} = \frac{\text{Min}_i x_{ij}}{\{x_{ij}\}}$$

Information

$r_{ij}$  = Normalized performance rating

$\text{Max}_i$  = The maximum value (largest) of each row  
 and column  $\text{Min}_i$  = The minimum value (the smallest) of each row and column

$X_{ij}$  = Rows and columns of the matrix with  $r_{ij}$  is the normalized performance rating of alternatives  $A_i$  on attribute  $C_j$ ;  $i = 1, 2,$

...,  $n$ .

**4.5 Value Preference For Any Alternatives**

The final result is obtained from the sum of the normalization matrix multiplication weights of criteria in order to obtain the greatest value is selected as the best alternative.

$$V_i = \sum_{j=1}^n w_j r_{ij}$$

Information

$V_i$  = The final value of the alternative

$w_j$  = Weights have been determined

$r_{ij}$  = normalization matrix

**5. RESULTS AND DISCUSSION**

Below is a table of test results application using SAW.

Table 6. Calculation Results of Testing Applications with SAW

No.	name of travel	C1	C2	C3	C4	C5	result
1.	Ciputra Waterpark	1	1	1	11.64	1	0493
2.	Ciputra World	1	3	2	3:47	2	0354
3.	City Of Tomorrow	1	3	2	2.70	2	0362
4.	De Javasche Bank Museum	1	3	1	9.66	2	0277
5.	De EYES Trick Eye Museum	1	3	1	3:02	2	0291
6.	Delta Plaza	1	3	2	6:54	2	0345
7.	Food Junction Grand Pakuwon	1	3	2	11:03	1	0393
8.	Galaxy Mall	1	3	1	7:52	2	0344
9.	Grand City	1	3	2	6.92	2	0345
10.	House Of Sampoerna	1	3	1	10:03	1	0326
11.	Bamboo forest	2	3	1	8:32	1	0402
12.	ITC	1	3	2	9:07	2	0343
13.	Nurseries 2 Wonorejo	1	3	2	6:50	2	0345
14.	Surabaya Zoo	1	3	1	2.80	2	0294
15.	Lenmarc Mall	1	3	2	6.88	2	0345
16.	Mangrove	1	3	1	10:00	1	0326
17.	Museum Cancer	1	3	1	6:22	2	0279
18.	Submarine Museum	1	3	1	6:53	2	0278
19.	Health Museum	1	3	1	9:01	2	0277
20.	Museum NU	1	3	2	2:09	2	0375
21.	Museum of Struggle 10 November	1	3	1	8:46	2	0277
22.	Museum Surabaya	1	3	1	7:26	2	0278
23.	Museum of the Navy - Loka Jala Crana	1	3	1	10:57	1	0326
24.	Museum Yos Sudarso	1	3	1	10.97	1	0326
25.	Ria Beach Kenjeran	1	3	1	11:18	2	0276
26.	Pakuwon Trade Center	1	3	3	7:19	2	0411
27.	Royal Plaza	1	3	3	1:39	2	0484
28.	Suroboyo Carnival	1	2	1	2.68	2	0337
29.	Parks Apsari	2	3	1	6:53	2	0353
30.	Parks Bungkul	2	3	2	3:43	2	0429
31.	Parks Expression	1	3	1	7:24	2	0278
32.	Taman Flora	1	3	2	4:38	2	0349
33.	Taman Harmoni Keputih	1	3	1	8:30	2	0327
34.	Wildlife Inspiration	2	3	1	2:19	1	0430
35.	Parks Anchor	2	3	1	2:18	1	0431
36.	Parks Keputran	2	3	1	5:50	2	0355
37.	Parks Korea	2	3	1	4:25	2	0358
38.	Parks Elderly	2	3	1	5.93	2	0354
39.	Parks M Duryat	2	3	1	5.92	1	0404
40.	Parks Mayangkara	2	3	1	1.64	2	0404
41.	Monument Park Ronggolawe	2	3	1	2:41	2	0375
42.	Mundu Parks	2	3	1	8:14	2	0352
43.	Palliative Parks	2	3	1	7.70	1	0402

44.	Taman Pelangi	1	3	1	0.70	2	0575
45.	Parks Achievement	1	3	1	6.76	2	0278
46.	Taman Remaja Surabaya	1	3	1	8.0	2	0277
47.	Wildlife Sulawesi	2	3	1	5:19	2	0355
48.	Taman Teratai	2	3	1	7.81	1	0402
49.	Transmart	1	3	2	4:35	2	0349
50.	Tunjungan Plaza	1	3	3	6:55	2	0412

Based on the table above test results, it can be seen that the distance criteria is very influential on the final result of each alternative with weight for each of the criteria obtained from the test data in Table 7.

Table 7. Table of test data to determine the weighting of criteria

	C1	C2	C3	C4	C5	
A	2	3	1	3	1	
B	1	3	2	3	1	
C	1	2	3	3	1	
D	3	2	2	2	1	
E	1	2	2	4	1	
F	2	3	2	2	1	
G	2	2	2	3	1	
H	1	2	3	3	1	
I	1	3	2	3	1	
J	1	3	1	4	1	
Total	15	25	20	30	10	100

- Hours of Operation (C1) = 15/100 = 0:15
- Ticket (C2) = 25/100 = 0:25
- Facilities (C3) = 20/100 = 0.2
- Distance (C4) = 30/100 = 0.3
- Address (C5) = 10/100 = 0.1

Below is a calculations SAW page view on the application.



Figure 2 Calculation SAW Page

## 6. CONCLUSION

From the description in the previous chapters, it can be concluded as follows:

- 1) This application uses the Simple Additive weighting method to get the best tourist attraction with weighting on each criterion especially distance criterion which has a weight of 0.3, to obtained the highest value as the best alternative.
- 2) The application is able to provide a solution of the tourist attraction for the user in accordance with the location

of the user is located.

- 3) To know the distance criteria, this application uses Haversine formula by calculating the longitude and latitude location of the user and the tourist attraction, so that the distance of tourist attraction from the user's location can be known.

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