Jurnal mandiri IT
Vol. 10 No. 1, July (2021), pp. 23-28

ISSN 2301-8984 (Print), 2809-1884 (Online)
Published by Institute of Computer Science

Motorcycle Selection Decision Support System Using the Electre III Method

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ARTICLEINFO

Article history:

Received Jun 9, 2021
Revised Jun 20, 2021
Accepted Jul 08, 2021

Keywords:

Electre method;
Databases;
Motorcycle.

ABSTRACT

In making a decision on the selection of a motorcycle, someone will consider various criteria to get the best decision. To simplify the process, an application program for motorcycle selection decision making is made in this thesis. The application program was built by applying the Electre III method which is able to solve problems with many criteria. The criteria used are divided into 2 parts, namely technical factors such as dimensions, front brakes, rear brakes, engine type, front suspension, rear suspension and cylinder volume; and subjective factors such as availability of spare parts, available service areas, credit process, motorcycle body, motorcycle color, after-sales price, spare part price, purchase price, fuel consumption, speed and durability. The system will search for motorcycles from the database whose subjective and technical factors are the same as those entered by the user. Furthermore, the system will compare the value of the criteria between the selected motorcycle alternatives.

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1. INTRODUCTION

Life has become easier with computers. Computers can help humans in many ways, both in business, accounting, medical and other fields, which increasingly shows computers as universal tools. Humans try to computerize everything in the hope of making work easier with the automation obtained and obtaining more accountable accuracy.

One form of the computer as a tool is a computerized system to select a motorcycle. At first glance it looks so easy, but if there are enough considerations, the selection process will be complicated. There are several general criteria that are considered in choosing a motorcycle, namely funds, security, comfort, etc. It is hoped that the more parameters that are taken as reference material, the results obtained will truly represent the consumer's choice of motorcycles.

Decision is the activity of selecting an action from a set of alternatives to solve a problem (Daihani, 2001). Decision making is a management activity in the form of selecting actions from a set of alternatives that have been previously formulated to solve problems or conflicts in management (Daihani, 2001). Decision support system is a computer-based information system that is interactive, flexible, adaptable, and specifically developed to improve decision making in solving semi-structured or unstructured problems.

According to Simon (1980), decisions based on the level of regularity are subdivided into structured decisions, namely decisions related to previously known issues, with the decision-

making process based on certain techniques and standards have been made, and unstructured decisions, namely decisions that related to new problems.

2. METHOD

The general design of the system is the stage to define functional requirements in preparation for the implementation design. The general flow chart of the design of this system can be seen in Figure 3.1

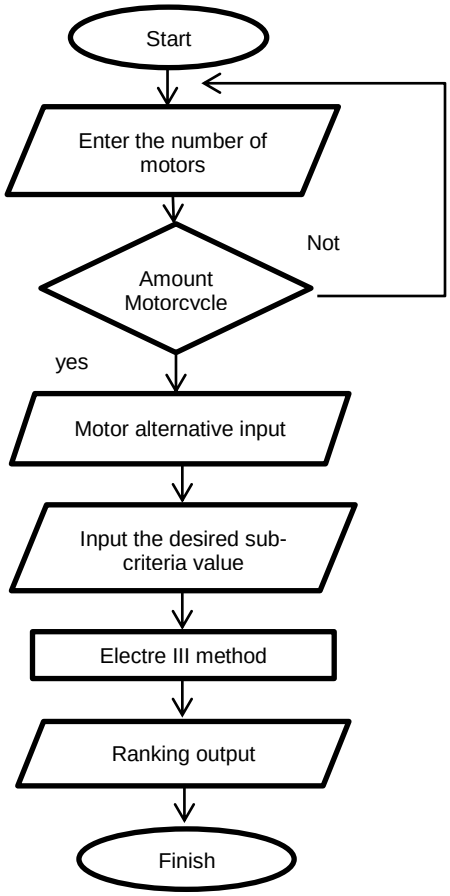

Figure 1 System Flowchart

a. Doing research with a questionnaire about some of the data that can be used as criteria in the selection of motorcycles.
b. Study of literature
   1. studied the Electre III method, which is one of the methods to support decision making.
   2. learn programming techniques suitable for the design and implementation of the Electre III method.
c. Designing SPPK with the Electre III method
   1. Analyzing System Requirements
   2. System General Design
   3. Database Design
   4. Interface Design
   5. Process Design
d. Implementing the Electre III Method Design

3. RESULTS AND DISCUSSIONS

1. Example of a Motorcycle Selection Case using the Electre III method
   A user wants to compare the Charisma_X125D and Jupiter_MX. Then the user will input the number of motorcycles, the name and brand of the motorcycle. After that, the user will enter the conditional value of the user. This value is the user's choice of sub-criteria. Suppose the input from the user is as shown in table 1.

Table 1.
User Input Table

Criteria	Sub-criteria	Mark
Safety and comfort	Availability of Spare Parts	Lots
Safety and comfort	Place of Service	Lots
Safety and comfort	Credit Process	Fast
Model	Motorcycle body	Small
Model	Motorcycle color	light
Financial	Purchase price	Currently
Financial	After Sales Price	Expensive
Financial	Spare Parts Price	Inexpensive
Reliability	Speed	Tall
Reliability	Fuel Consumption	Do not know
Reliability	Durability/life of use	Do not know
Specification	Dimension	Currently
Specification	Front Brake	Disc
Specification	Rear Brake	Tromol

After getting input from the user, the input value will be compared with the value in the database. The user also does not need to fill in all the sub-criteria values provided by the system. The system will look for which motorbike the criteria are as desired by the user. And then the system will display which motors are eligible and which are not eligible from the user. The data contained in the database for the two motors are as follows:

Table 2.
Calculation Table

Criteria	Sub-criteria	Charisma_X125D	Jupiter_MX
Safety and comfort	Availability of Spare Parts	Lots	Currently
Safety and comfort	Place of Service	Lots	Lots
Safety and comfort	Credit Process	Fast	Fast
Model	Motorcycle body	Small	Small
Model	Motorcycle color	light	Dark
Financial	Purchase price	Currently	Currently
Financial	Price of spare parts	inexpensive	Expensive
Financial	After Sales Price	Expensive	Inexpensive
Reliability	Fuel Consumption	economical	Currently
Reliability	Speed	Tall	Currently
Reliability	Durability/life of use	Durable	Durable
Specification	Dimension	Currently	Currently
Specification	Front Brake	Disc	Disc
Specification	Rear Brake	Tromol	Tromol

From the data in the database, it can be seen that the motorcycle that meets the requirements is Karisma _X125D. However, because the user chooses that the motor that does not meet the requirements is included in the calculation, both motors will be included in the calculation. The assessment for each sub-criteria is carried out by the admin and the Value Table for each sub-criteria can be seen in table 3.

Table 3.
Sub-criteria Value Table

Sub-criteria	Mark	Description
Availability of spare parts	90	Many
Availability of spare parts	75	Currently
Availability of spare parts	50	a little
Availability of spare parts	0	Do not know

Sub-criteria	Mark	Description
Available service points	85	Many
Available service points	70	currently
Available service points	45	a little
Available service points	0	Do not know
Credit Process	80	Fast
Credit process	50	currently
Credit Process	35	difficult
Motorcycle body	45	Big
Motorcycle body	75	Small
Motorcycle body	0	Do not know
Motorcycle Color	60	Light
Motorcycle Color	70	Dark
Motorcycle color	0	Do not know
Purchase price	60	expensive
Purchase price	80	currently
Purchase price	20	inexpensive
Purchase price	0	Do not know
After Sales Price	80	Expensive/high
After Sales Price	70	currently
After Sales Price	60	inexpensive
After Sales Price	0	Do not know
Price of spare parts	20	Expensive
Spare Parts Price	40	Currently
Spare Parts Price	60	Inexpensive
Spare Parts Price	0	Do not know
Fuel consumption	45	wasteful
Fuel consumption	65	Currently
Fuel consumption	85	economical

Previously, the admin had determined the threshold value for each criterion. Giving this value depends on the admin's assessment. The threshold table consists of the preference threshold, indifferent threshold, veto threshold and weight. The threshold value for each criterion can be seen in table 4

Table 4.
Criteria Threshold Value Table

	Safety and comfort	Model	Financial	Reliability	Specification
Preferences threshold	50	50	50	50	50
Indifferent threshold	25	25	25	25	25
Veto threshold	100	100	100	100	100
Weight	1	1	1	1	1

2. Calculating Performance Matrix
After the input is obtained, the data is processed into a performance matrix. The performance matrix is obtained by adding up the value of each sub-criteria and then taking the average. The result of the sum is the value of each criterion and is used to form a performance matrix. Table 3.4 is the result of the performance matrix.

Table 5.
Performance Matrix Table

	Safety and comfort	Model	Financial	Reliability	Specification
Charisma_X125D	240	135	160	255	430
Jupiter_MX	145	70	150	115	400

3. Calculating Concordance Matrix
The results of the performance matrix are used to calculate the concordance matrix. The formula for the concordance matrix is as follows.

$$C(a,b) = \frac{1}{k}\sum_{j=1}^{r} k_j c_j(a,b), \quad where \quad k = \sum_{j=1}^{r} k_j \qquad (1)$$

Table 6.
Concordance Matrix Table

	Charisma_X125D	Jupiter_MX
Charisma_X125D	1.00	1.00
Jupiter_MX	0.36	1.00

Calculating Positive and Negative Separation Distance, after the results of weighted normalization are obtained, the maximum and minimum values for each criterion are searched.

$PIS = A^{+} = \{ V_1^{+}, V_2^{+} \ldots, V_n^{+} \}$, where: $V_j^{+} = \{(\text{maxi } (V_{ij}) \text{ if } j \in J); (\text{mini } V_{ij} \text{ if } j \in J') \}$

$NIS = A^{-} = \{ V_1^{-}, V_2^{-} \ldots, V_n^{-} \}$, where: $V_j^{-} = \{(\text{mini } (V_{ij}) \text{ if } j \in J); (\text{maxi } V_{ij} \text{ if } j \in J') \}$

The maximum and minimum values are to determine the positive ideal solution and the negative ideal solution. The following are the maximum and minimum results obtained from the weighted normalization table:

Table 7.
Table of Positive and Negative Ideal Solutions

	KK	SOUL	TANK	HAMLET
MAX	3.265224931	1.142107	1.7588	1
MIN	0.087273293	0.038361	0.19542	0.25

Calculate the separation size. This separation measure is a measurement of the distance from an alternative to a positive ideal solution and a negative ideal solution.
Get a positive ideal solution value:

4. Creating Rankings
After obtaining the T matrix, it remains only to add up the values in each row and column for each alternative. And the value for each alternative is the result of subtraction for each row minus the column . After obtaining the results, the rows and columns with the largest results are removed. This is called descending distillation. Done until all is done for all alternative pairs. It is also calculated for the smallest subtraction value between rows and columns or it is called Ascending distillation. This is done for all alternative pairs. The end result is to combine all the results obtained from the two

Table 8.
Table of Results Ranking from high to low

Motorcycle Name	Mark
Charisma_X125D	3
Jupiter_MX	2

Table 9.
Table of Results Ranking from low to high

Motorcycle Name	Mark
Charisma_X125D	0
Jupiter_MX	1

Table 10.
Table of Results Ranking from low to high

Motorcycle Name	Mark
Charisma_X125D	4
Jupiter_MX	2

From the combination table, it can be seen that the results obtained are that Karisma gets the first rank with a higher value than Jupiter_MX . Jupiter_MX is in second place. The result of implementing SPPK for Motorcycle Selection is that this system can support the motorcycle selection process and decision making. The results obtained for the admin are that the admin can update the data in the system database, which can delete, save, add motorcycle data, criteria and motorcycle brands. For users with this system can make decisions to choose a motorcycle. Users can also quickly find out the details of the selected motor data. In general, this system can simplify the process of selecting a motorcycle that works computerized to calculate and compare the criteria for the motorcycle that best fits the requirements of the user's choice.

4. CONCLUSION

From the Decision Support System Program for Motorcycle Selection with the Electre III Method, it can be concluded that the Electre III Method is able to overcome qualitative criteria, so as to be able to solve the problem of selecting motorcycles that have qualitative values. The application of the Electre III method in making this application program succeeded in obtaining an application program that could assist in the process of selecting a motorcycle with many criteria.

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