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Motorcycle workshop selection recommendation system in gading serpong using the topsis method

Septaria Dwi Natapura[1], Fenina Adline Twince[2], Adhi Kusnadi[3], Rena Nainggolan[4]
[1,2,3] Department of Informatics, Universitas Multimedia Nusantara, Indonesia
[4] Department of Computerized Accounting, Universitas Methodist Indonesia, Indonesia

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ABSTRACT

In Indonesia, motorbike repair shops have become a necessity for motorbike riders. The large number of motorcycle repair shops makes it difficult for users to determine the right repair shop according to their needs. Thus, the role of the recommendation system is needed. In order to meet the need for various criteria, a recommendation system for selecting a motorbike repair shop was built using a case study in Gading Serpong. The criteria used are distance, service, speed, price, and comfort of the waiting area. The TOPSIS method (Technique for Order Preference by Similarity to Ideal Solution) is a multi-criteria method that is computationally efficient and is able to measure the relative performance of various decision alternatives in simple mathematical form. Therefore, this research system was built using the TOPSIS method. The test results in this research show that the TOPSIS method has been implemented correctly. Apart from that, a success test of the recommendation system has been carried out by distributing questionnaires, with a success percentage of 82.24%. The questionnaire results obtained have also been tested using Cronbach Alpha, with a result of 0.81, which means that the questionnaire results obtained can be trusted.

Corresponding Author:

Fenina Adline Twince Tobing
Department of Informatics,
Faculty of Engineering and Informatics,
Universitas Multimedia Nusantara
Jl. Scientia Boulevard Gading, Curug Sangereng, Serpong, Kabupaten Tangerang, Banten, Indonesia
Email: fenina.tobing@umn.ac.id

1. INTRODUCTION

A motorbike repair shop is a business established with the aim of providing maintenance and repair services for two-wheeled vehicles, generally called motorbikes (Effendi, 2009). The growth of workshops in Indonesia is very rapid, based on data from the Indonesian Automotive Workshop Association (PBOIN), which records that there are at least more than 400,000 motorbike repair businesses with various specializations in Indonesia. In Gading Serpong itself, based on statistical data from the department of trade and industry, there are around 120 motorbike repair shops with various specializations, both official and general motorbike repair shops. Thus, it can cause confusion for consumers in terms of choosing the right motorbike repair shop to repair their motorbike. So it is necessary to create a system that can provide recommendations to consumers for choosing the appropriate repair shop.

There are many benefits from the recommendation system for selecting a motorbike repair shop, namely that it is more efficient, can find a motorbike repair shop with the closest distance, and can shorten the time in choosing the right motorbike repair shop to handle motorbike damage. A recommendation system is a type of application based on research results on user conditions and desires. There are several previous studies related to recommendation systems, including: Development of a Recommendation System for Selection of Spare Parts at the Langgeng Jaya

Motor Workshop Using the Weighted Product Method (WARDHANA, n.d.), Recommendation System for Spare Parts Based on Item-Based Filtering (Wibisono et al., 2021), Recommendation System for Purchasing Motorcycle Spare Parts (Syahrul Setyawan et al., 2023), Application of the Weighted Product Method in a Recommendation System for Selection of Motorcycle Tires (Waworuntu & Hermawan, 2023), and Recommendation System for Purchasing Motorcycle Spare Parts (Daniati, 2023). Unfortunately, in this research, there is no motorbike repair shop recommendation system in Gading Serpong.

Therefore, this research aims to create a recommendation system for selecting a motorcycle repair shop in Gading Serpong. The importance of research related to the recommendation system for choosing a motorbike repair shop is carried out because there is a need for an application that can make it easier for consumers to choose a motorbike repair shop according to their needs (Kristianto et al., 2021). With a recommendation system, the costs used to search for and select the desired items can be reduced (Ciaputra & Hansun, 2020).

This recommendation system uses the Technique for Order Preference by Similarity to the Ideal Solution (TOPSIS) method. TOPSIS is a multi-criteria decision-making method or alternative choice, which is an alternative that has the smallest distance from a positive ideal solution and the largest distance from a negative ideal solution from a geometric point of view using Euclidean distance (Lado & Belutowe, 2020). This research uses five criteria based on consumer survey results in selecting a motorbike repair shop: service criteria, speed, comfort of the waiting area, price, and distance. Based on these criteria, the TOPSIS method was used because the concept is simple and easy to understand. This research compares the performance of 20 motorbike repair shops in Gading Serpong as a sample, then carries out a satisfaction test as feedback from consumers regarding the level of satisfaction, suitability, and recommended features of the system that has been built. Because consumer satisfaction can have a positive impact on motorbike repair shops, every repair shop needs to try to understand the values expected by consumers and try to fulfill these expectations as much as possible.

2. RESEARCH METHOD

The research stages carried out in this study are (Muliawan et al., 2022) : (a) Literature studies begin with searching and studying various sources, such as books, ebooks, journals, articles, and other online sources. (b) Problem identification is carried out by determining the problem raised in this research, namely the problem of selecting a motorbike repair shop in Gading Serpong. (c) Data collection was carried out at motorbike repair shops around Gading Serpong, taken via Google Maps and direct surveys. (d) System implementation is carried out by creating data flow diagrams (DFD), sitemaps, flowcharts, entity relationship diagrams (ERD), database schemas, and table structures, as well as designing system interfaces. System creation using PHP language and MySql database. (e)Thorough testing of the system that has been built to obtain data accuracy results and minimize existing errors. (f) Evaluation is carried out by distributing questionnaires to consumers to determine their level of satisfaction, suitability, and recommended features regarding the system that has been built. (g) Make a report in the form of documentation of each activity carried out in the research process.

In this research, there is a user sitemap that has five main pages : workshop information pages, workshop recommendations, help, about us, and application forms.

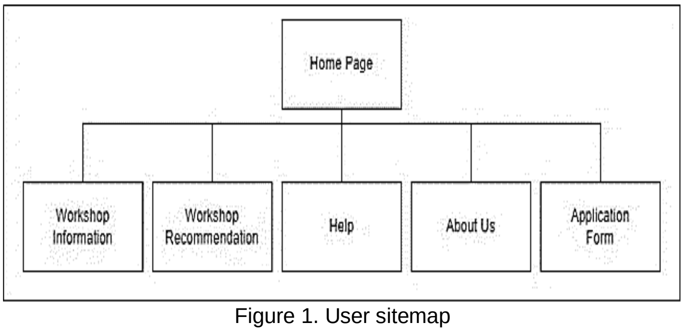

Figure 1. User sitemap

The workshop information page contains information about the workshop and the services and spare parts linked to the workshop. The workshop recommendation page contains a list of services and spare parts at workshops recommended by the system. The help page contains a guide on how to use the system. The about us page contains a brief description of the motorbike repair shop recommendation system in Gading Serpong, how the system was created, and all the researchers who created the system. The application form is a form that can be filled out by the user to apply to add a new workshop or add new services and spare parts from a workshop directly to the system.

Flowcharts, commonly called flow diagrams, are charts that have a flow that describes the steps and processes of a system (Kusnadi et al., 2016). Flowcharts are used to simplify and describe a series of processes in a system.

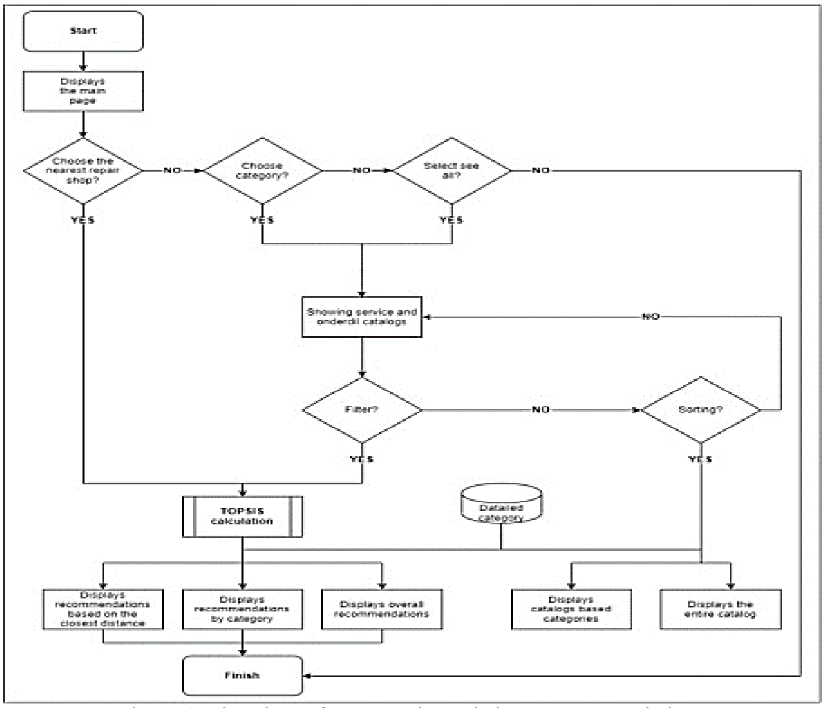

Figure 2. Flowchart of motorcycle workshop recommendations

Figure 2 explains the situation. If the user chooses a recommendation based on the nearest motorbike repair shop, a TOPSIS calculation will be carried out, and then the recommendation results based on the closest distance from the TOPSIS calculation will be displayed. If the user selects recommendations based on category, a service and spare part catalog will be displayed. Next, the user can carry out filtering and continue with the TOPSIS calculation, and then recommendations for filter results are displayed based on service categories and spare parts resulting from the TOPSIS calculation. Users can also sort by category or as a whole, then display the sorting results based on the service and spare part catalog by category or as a whole.

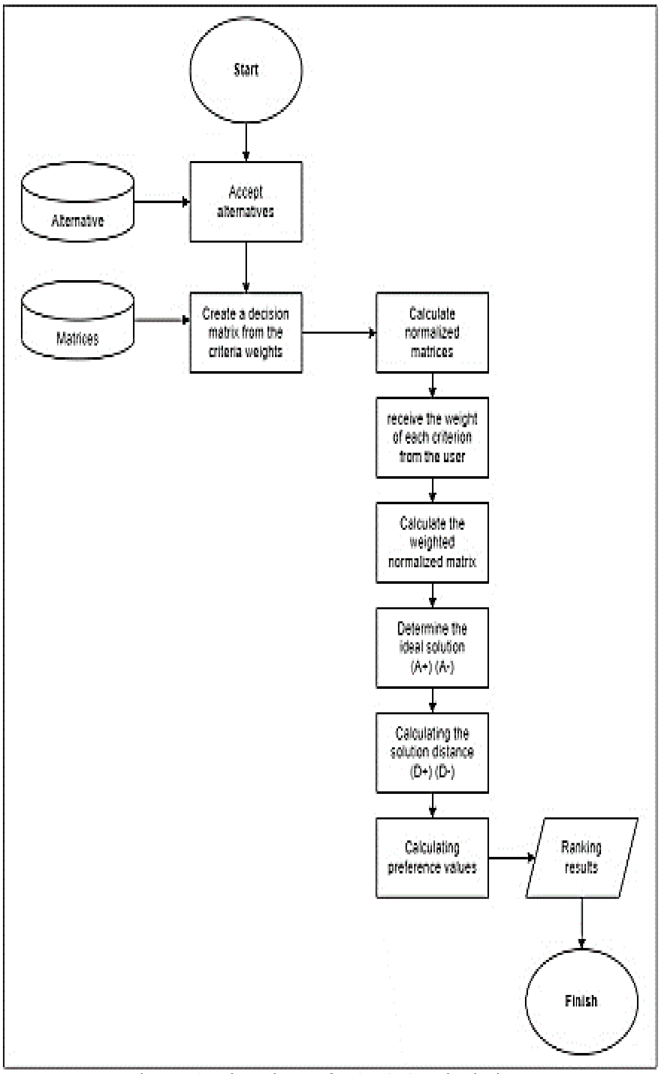

Figure 3. Flowchart of TOPSIS calculations

The TOPSIS method accepts alternatives from the database, receives the weight of each alternative from the matrix database, and creates a decision matrix (Falahin et al., 2019). Next, the normalized matrix calculation is carried out. The system receives the weight of each criterion input from the user, and the system calculates the weighted normalized matrix. Next, look for positive ideal solutions and negative ideal solutions for each existing criterion. Then the distance between the positive ideal solution and the negative ideal solution is calculated. The final step is to calculate the preference value to produce a ranking of each alternative.

3. RESULTS AND DISCUSSIONS

Trial Scenario TOPSIS calculations are carried out by comparing the results of calculations carried out by the system with the results of manual calculations. In this calculation simulation, data from 20 motorbike repair shops in Gading Serpong is used.

Table 1. Alternative motorcycle workshop names

Workshop number	Workshop name
1	AeroSpeed Racing Gading Serpong
2	AHASS Gading Serpong
3	Ahong Motor
4	Bengkel Jaya Motor (Honda, Yamaha, Suzuki, Kawasaki, Bajaj)
5	Bengkel Motor Gading Serpong
6	Bengkel Motor 24Jam
7	Bes Motor Honda Bengkel dan Dealer

8	Depot Motor Gading Serpong
9	Dunia Motor
10	Gambot Motor
11	Keven Motor
12	Kusuma Motor
13	Lotus Motor
14	Miracle Sport Motor
15	Modificazone
16	Robin Motor
17	Serpong Indah Motor – Yamaha
18	TODA
19	Ultraspeed Racing Gading Serpong
20	Viar Motor – Multi Dimensi Baru

Before carrying out calculations using the TOPSIS method, a comparison matrix of alternatives and criteria is created first in a decision matrix. The criteria were obtained by distributing questionnaires to 35 respondents in each workshop. To get a value in the range of 1–5, calculations are needed to group the results of the questionnaire for the 35 respondents.

$$Persentase\ Skor = \frac{(15 \times 5) + (14 \times 4) + (6 \times 3) + (0 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 85\%$$

Information : Calculations are carried out using a Likert scale, with examples from workshop number 1 on service criteria. Based on the results of the questionnaire, 15 respondents answered strongly agree, 14 respondents answered agree, 6 respondents answered quite agree, 0 respondents answered disagree, and 0 respondents answered strongly disagree.

The final score percentage produces a value of 85%. After obtaining the alternatives and criteria, the next steps for calculating the TOPSIS method (Rinaldi et al., 2021) are as follows :

a. Create a decision matrix

The decision matrix was obtained from the results of Likert scale calculations based on the results of 35 consumers filling out questionnaires in each workshop.

Table 2. Decision matrix

Workshop number	P	K	KTT	H	J
1	5	4	5	5	5
2	2	3	5	2	4
3	3	5	3	4	3
4	5	4	3	4	3
5	4	4	3	3	3
6	5	5	4	5	1
7	4	4	4	3	4
8	5	5	5	5	4
9	4	5	3	4	3
10	5	4	4	4	4
11	4	4	4	4	5
12	5	5	4	4	3
13	3	3	4	4	3
14	5	5	4	4	5
15	5	5	5	5	5
16	4	4	3	4	3
17	4	4	4	4	4
18	5	5	5	4	4
19	5	5	5	4	5
20	4	5	4	4	4

Information : P = Service K = Speed H = Price
KTT = Comfortable Waiting Place J = Distance

b. Normalize the decision matrix.

The way to calculate the normalization matrix is to divide each value by the square root of the sum of the squared results for each criterion. The normalization matrix in the decision matrix is created using the formula (Rupang & Kusnadi, 2018) :

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}$$

Information : r_{ij} = normalized matrix x_{ij} = value/price of alternative i for j criteria

By producing a value of 0.288195209 for the distance calculation value at workshop number 1.

c. Build a weighted normalization decision matrix

Table 3. User input

Criteria	User Input	Weight Conversation Result (W)
P	Star 5	5
K	Star 5	5
KTT	Star 3	3
H	Star 4	4
J	>2km - <3km	3

with the formula calculation : $v_{ij} = w_{ij} \times r_{ij}$

Information : v_{ij} = criteria w_{ij} = weight conversion result r_{ij} = normalized matrix

The calculation of the weighted normalized decision matrix with the example from workshop number 1 is 0.864585627.

d. Determine the positive ideal solution and the negative ideal solution

The positive ideal solution and negative ideal solution are determined using the formula :

$$A^+ = \{(\max Vij \mid j \epsilon J), (\min Vij \mid j \epsilon J')\}$$
$$A^- = \{(\max Vij \mid j \epsilon J), (\min Vij \mid j \epsilon J')\}$$

Information : A+ = positive ideal solution

A- = negative ideal solution Max/min Vij = weighted normalized matrix

Table 4. Positive and negative ideal solutions

Type	P	K	KTT	H	J
A^+	1.275775908	1.256297269	0.81468817	1.100963765	0.864585627
$A-$	0.510310363	0.753778361	0.488812902	0.440385506	0.172917125

The positive ideal solution value for service criteria (P) is the maximum value, namely 1.275775908 and the negative ideal solution value is the minimum value, namely 0.510310363.

e. Calculate alternative distances

Alternative distances from the ideal positive and negative solutions are calculated using the formula . (Kusnadi & Kurniawan, 2017) :

$$D_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^+)^2} \qquad D_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^-)^2}$$

Information :

$$D_i^+ = \sqrt{\begin{matrix} (1.275775908 - 1.275775908)^2 + & (1.005037815 - 1.256297269)^2 + \\ (0.81468817 - 0.81468817)^2 + & (1.100963765 - 1.100963765)^2 + \\ (0.864585627 - 0.864585627)^2 = & 0.251259454 \end{matrix}}$$

$$D_i^- = \sqrt{\begin{matrix} (1.275775908 - 0.510310363)^2 + & (1.005037815 - 0.753778361)^2 + \\ (0.81468817 - 0.488812902)^2 + & (1.100963765 - 0.440385506)^2 + \\ (0.864585627 - 0.172917125)^2 = & 1.292297356 \end{matrix}}$$

The result values can be seen in the following table :

Table 5. Alternative distances

Workshop number	D_i^+	D_i^-
1	0.251259454	1.292297356

2	1.142246349	0.612615442
3	0.731230151	0.794462172
4	0.580871914	0.981126667
5	0.740250561	0.701166284
6	0.710601146	1.14077827
7	0.615324206	0.817119631
8	0.172917125	1.284571551
9	0.582567622	0.909110907
10	0.409957518	1.067080067
11	0.450853636	1.011158426
12	0.441174399	1.085611417
13	0.841175825	0.636548162
14	0.273922473	1.239901663
15	0	1.36360786
16	0.63444176	0.798178365
17	0.482876105	0.901742223
18	0.279973536	1.186465266
19	0.220192753	1.271613995
20	0.412356666	1.001265687

f. Calculate preferences for ideal solutions

Preference for the ideal solution is calculated using the formula (Surahman & Nursadi, 2019) :

$$V_i^+ = \frac{D_i^-}{D_i^+ + D_i^-}, 0 \leq V_i^+ \leq 1$$

Information :

$$V_i^+ = \frac{1.292297356}{0.251259454 + 1.292297356} = 0.837220469$$

The value obtained is 0.837220469 with an example from workshop number 1.

g. Ranking alternatives

The results of the recommendations are then sorted based on the largest to the smallest preferences, which can be seen in the following table :

Table 6. Ranking of preferences in order

Workshop number	Alternative	Ranking
15	Modificazone	1
8	Depot Motor Gading Serpong	2
19	UltraspeedRacing Gading Serpong	3
1	AeroSpeed Racing Gading Serpong	4
14	Miracle Motor Sport	5
18	TODA	6
10	Gambot Motor	7
12	Kusuma Motor	8
20	Viar Motor – Multi Dimensi Baru	9
11	Keven Motor	10
17	Serpong Indah Motor - Yamaha	11
4	Bengkel Jaya Motor (Honda, Yamaha, Suzuki, Kawasaki, Bajaj)	12
6	Bengkel Motor 24jam	13
9	Dunia Motor	14
7	Bes Motor Honda Bengkel dan Dealer	15
16	ROBIN MOTOR	16
3	Ahong Motor	17
5	Bengkel Motor Gading Serpong	18
13	Lotus Motor	19
2	AHASS Gading Serpong	20

Table 6 shows that the motorbike repair shop recommended by the system is in accordance with the ranking order carried out in the manual TOPSIS method calculation. Thus, it can be concluded that the recommendations from the TOPSIS method have been implemented correctly.

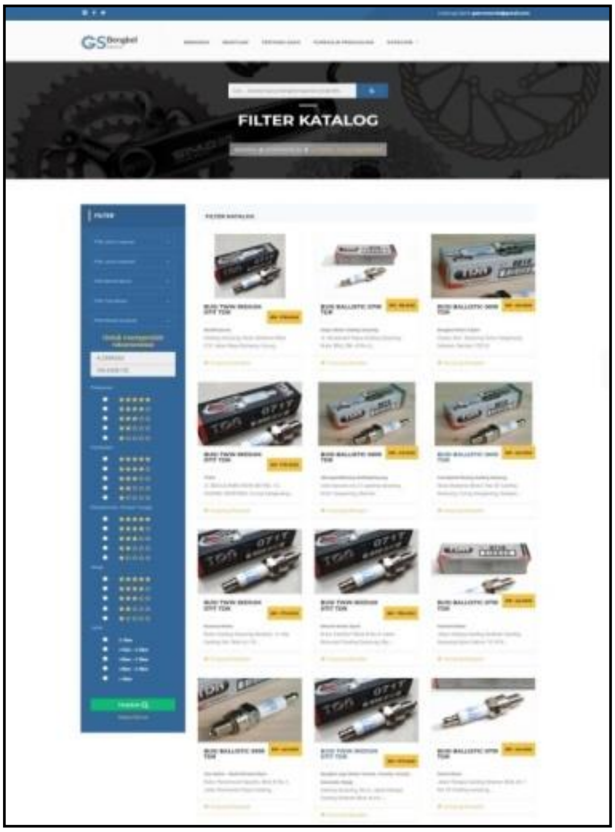

Figure 4. User input and recommendation results

You can see in the picture several ratings based on user input on the system that has been built, which can help consumers determine a motorcycle repair shop that suits their needs.

3.1 Test System Success

The success test was carried out by distributing questionnaires using Google Forms to 35 respondents. System success consists of six variables, namely, system quality, information quality, service quality, use, user statistics, and net benefits. The following is a list of questions from this research questionnaire (Abdurraffi & Tobing, 2023).

Table 7. List of success test questionnaires

A list of questions
System Quality
1. GSBM is easy to use and user-friendly.
2. GSBM meets the requirements needed for the motorbike repair shop recommendation system.
Information Quality
3. GSBM provides complete workshop information.
4. GSBM provides information that is easy to understand.
Service Quality
5. Help regarding how to use the system provided on GSBM is clear.
6. GSBM is able to solve problems well.
Use
7. GSBM helps save time when looking for a motorbike repair shop in Gading Serpong.
User Satisfaction
8. The results of the GSBM recommendations are satisfactory.
Net Benefits
9. GSBM helps in determining which motorbike repair shop in Gading Serpong to visit.

In questionnaires, there is a psychometric scale that is commonly applied, and surveys are the scale that is most widely applied in research in the form of determining the answer scale using numbers 1 to 5, where 1 is a very poor value and 5 is a very good value (Sukma et al., 2021). Next, the percentage score for the system quality variable is calculated. Information quality, service quality, use, user statistics, and net benefits using the formula :

$$Score\ percentage = \frac{(SS \times 5) + (S \times 4) + (N \times 3) + (TS \times 2) + (STS \times 1)}{5 \times number\ of\ respondents} \times 100\%$$

Information :

SS	= Strongly Agree	S	= agree	N	= neutral
TS	= disagree	STS	= Strongly Disagree		

3.2 Quality System

System quality is measured with two questions, as follows

a. The system is easy to use and user-friendly.

$$Score\ percentage = \frac{(14 \times 5) + (16 \times 4) + (3 \times 3) + (2 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 84\%$$

b. The system built meets the requirements needed for a motorbike repair shop recommendation system

$$Score\ percentage = \frac{(12 \times 5) + (18 \times 4) + (4 \times 3) + (0 \times 2) + (1 \times 1)}{5 \times 35} \times 100\% = 82.857\%$$

To get the final results, the average final score percentage of the system quality variable is calculated.

$$Score\ percentage = \frac{84\% + 82.857\%}{2} = 83.429\%$$

The final score percentage resulted in a value of 83.429%, which shows that respondents strongly agree that the system built meets the requirements of system quality.

3.3 Information Quality

Information quality is measured with two questions, as follows :

a. The system provides complete motorbike repair shop information.

$$Score\ percentage = \frac{(9 \times 5) + (19 \times 4) + (6 \times 3) + (1 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 80.57\%$$

b. The system provides information that is easy to understand

$$Score\ percentage = \frac{(11 \times 5) + (18 \times 4) + (6 \times 3) + (0 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 82.88\%$$

To get the final results, the average percentage of the final scores of the variables is calculated.

$$Score\ percentage = \frac{80.57\% + 82.88\%}{2} = 81.71\%$$

The final score percentage produces a value of 81.71%, which shows that the system built meets the information quality requirements.

3.4 Service Quality

Service quality is measured with two questions, as follows :

a. Assistance regarding how to use the system provided in the system that has been built is made clear.

$$Score\ percentage = \frac{(11 \times 5) + (16 \times 4) + (6 \times 3) + (1 \times 2) + (1 \times 1)}{5 \times 35} \times 100\% = 80\%$$

c. The system that has been built is able to solve problems well

$$Score\ percentage = \frac{(11 \times 5) + (16 \times 4) + (8 \times 3) + (0 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 81.714\%$$

To get the final results, the average final score percentage of the service quality variable is calculated.

$$Score\ percentage = \frac{80\% + 81.714\%}{2} = 80.857\%$$

The final score percentage produces a value of 80.857%, which shows that the system built meets the service quality requirements.

3.5 Use

Usability was measured by the question "The system helps save time in looking for a motorbike repair shop in Gading Serpong". Next, the percentage score is calculated using the formula :

$$Score\ percentage = \frac{(13 \times 5) + (18 \times 4) + (4 \times 3) + (0 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 85.143\%$$

The final score percentage resulted in a value of 85.143%. It can be concluded that the respondents strongly agree that the system built meets the requirements for use.

3.6 Use Statisfaction

User satisfaction is measured by the question "The recommendation results from the system being built are satisfactory". Next, the percentage score is calculated using the formula :

$$Score\ percentage = \frac{(9 \times 5) + (18 \times 4) + (7 \times 3) + (1 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 80\%$$

The final score percentage produces a value of 80%. It can be concluded that the respondents strongly agree that the system built meets the requirements for using statistics.

3.7 Net Benefits

Profits are measured by the question "The system helps in determining which motorbike repair shop in Gading Serpong you want to visit". Next, the percentage score is calculated using the formula :

$$Score\ percentage = \frac{(10 \times 5) + (19 \times 4) + (68 \times 3) + (0 \times 2) + (0 \times 1)}{5 \times 35} \times 100\% = 82.29\%$$

The final score percentage resulted in a value of 82.29%. It can be concluded that the respondents strongly agree that the system they built meets the requirements for net benefit.

After calculating the percentage of the final score from the nine variables, calculating the percentage of success of the system built was carried out by calculating the average value of each variable. The calculation of the percentage of system success is as follows

$$Success\ percentage = \frac{83.429\% + 81.71\% + 80.857\% + 80\% + 82.29\%}{6} = 82.24\%$$

The percentage of success of the system produces a value of 82.24%, so it can be concluded that respondents strongly agree that the system built has been successful in providing recommendations for motorbike repair shops in Gading Serpong.

4. CONCLUSION

The recommendation system for selecting a motorbike repair shop in Gading Serpong has been successfully designed using the TOPSIS method and has adjusted the results of various trials by comparing manual calculations and calculations from the system. Apart from that, a system success test was also carried out by distributing questionnaires to 35 respondents, and a success percentage of 82.24% was obtained. These values indicate that the questionnaire results obtained are reliable. Based on the research that has been carried out, the implications and contributions of this research are to make it easier for users to choose a motorbike repair shop in Gading Serpong. And so that further research can develop the system that has been designed, several criteria should be added, such as operating hours, authenticity of spare parts, guarantees, and other criteria needed to support the maximization of this recommendation system. Then combine the TOPSIS method with a method that can determine priority weights, namely calculating priorities against criteria such as the Analytical Hierarchy Process (AHP), thereby producing maximum output or decisions.

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