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The Best Student Decision Support System (Basketball) to Represent Pringsewu Regency in the Event of Kejurda Ku 16-17 Using Topsis Method

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Abstract: Basketball is a group ball game. Consists of two teams of five people who compete against each other to score points by entering the opponent's basket ball. The movement consists of a combination of elements that are neatly coordinated so that they are able to play the ball well. In Pringsewu Regency there are several high schools that have basketball extracurriculars and from this, students who are able to play basketball well, there are several things that are done to determine players, namely dribbling, shooting, passing, agility. These activities are carried out routinely and recorded manually in a notebook, either by the coach or assistant coach. Problems arise when many players have to be selected, making it difficult for the coach to determine the selection of players. Therefore, a decision support application is needed so that the coach can evaluate the team's performance and make decisions so that they can implement the appropriate strategy. This application is able to provide statistics on player development. The method used is the TOPSIS method, where the TOPSIS method compares the best aspects, with aspects of existing players.

Keywords: Decision Support System, Basketball, Players, TOPSIS.

1. INTRODUCTION:

1.1 Background of the problem

Basketball is a sport played by 5 people. Each individual has different tasks such as point guard, shooting guard, power forward, center, small forward. Besides this basketball player can be done in a closed room (indoor) or open space (outdoor). In addition, the variety of basketball players with entertainment elements such as streetball, three on three, crushbone, has made basketball a prestigious sport and a fashionable trend among young people [1].

The All-Indonesian Basketball Association/PERBASI Pringsewu has a vision to improve the achievement of the basketball team in Pringsewu Regency with an increasing target. In Pringsewu district, there are 22 high schools (SMA) and 11 high schools that have

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basketball extracurriculars and each of these schools will be selected and selected basketball players who have the ability to play basketball well to represent Pringsewu Regency in the Regional Championships / KEJURDA.

According to research conducted by Berto Nadeak and Setyawati Nadaek (2018) is done by using what is used such as dribbling, shooting, passing and agility, which already represent all the skills that must be possessed by the best basketball player at the Angsapura Sania Club Medan. The application of the AHP method can be applied to determine the best basketball player at the Angsapura Sania Medan Club to produce a quick decision [2].

From previous research, the writer concludes that the research is aimed at obtaining the results of decisions quickly through the AHP method. Meanwhile, in this study, the previous research was developed by using the TOPSIS method because it is more practical and efficient.

The model used in the decision support system this time is TOPSIS, because TOPSIS was chosen because it is more practical and has a concept where the chosen alternative has the best alternative. The alternative in question is the one who has the right to be elected to represent Pringsewu district [3].

1.2 Formulation of the problem

As described in the background above, there are several problems that will be resolved, namely how to determine the appropriate players to represent Pringsewu district correctly and accurately.

1.3 Problem Limitation

So that the problems covered do not develop too far or deviate, the authors limit several problems, namely:

1. This design resulted in a Decision Support System determining the best players.
2. The design of this application is desktop based.

1.4 Research Objectives and Benefits

The purpose of designing a Decision Support System (DSS) is to speed up and make it easier to determine the best players to represent Pringsewu district [4].

2. THEORETICAL BASIS

2.1. Decision Support System

Turban (2005) Decision support system is a software system with interactive capabilities, which helps decision making through the use of data and decision models to achieve optimal results. This system is not to replace the assessment process directly, but only offers a number of information in various alternative decision choices [3].

Decision Support System refers to a system that utilizes computer support in the decision-making process. This was stated by several experts, including Little Man and Watson who defined a Decision Support System as an interactive system, which helps decision makers through the use of data and decision models to solve semi-structured and unstructured problems [5].

2.2 Basketball Games

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Basketball is one of the most popular sports in the world. Fans of all ages find basketball a fun, competitive, educational, entertaining and healthy sport. individual skills such as shooting, dribbling, and rebounding, as well as basketball cooperation in order to create optimal performance, it is necessary to fully develop the sport of basketball. The best achievements will only be achieved if the coaching can be implemented and is focused on the aspects of the training as a whole [7].

2.3 Best Player

The best players are players who have abilities above the average of other players. Where the individual plays a very important role in an activity in their field. The best players usually have the talent, skills, and motivation that are needed in teamwork [8].

2.4 Pringsewu

Pringasewu is one of the regencies in Lampung Province , Indonesia. This district was ratified as a district in the Plenary Session of the DPR on 29 October 2008, as a division of the Tanggamus District . The district is located 37 kilometers west of Bandar Lampung , the provincial capital .

Currently, Pringsewu has been approved as a separate district because of its good development, both in terms of regional income, economic level and education of the population. The main livelihood in Pringsewu is farming and trading.

3. RESEARCH METHODS

3.1 Data Collection Method

Data collection is nothing but a process of procuring primary data for research purposes. Data collection is a very important step, because data collection is a systematic and standard procedure to obtain the necessary data.

3.2 Observation (Data Collection)

Observation is conducting direct field observations to obtain actual data from the existing school in the Pringsewu district because the author can directly observe the actual state of the object to be studied in order to obtain primary data or secondary data. Thus the author will get clarity on the processes that are happening such as the people involved in the system, the documents used in recording the data, other supporting data, the documents resulting from processing the data [8].

3.3 Interview

Interviews are data collection by conducting direct interviews with teachers, staff or students in order to obtain input materials that support the writing of this research. With interviews, the author not only explores and looks for what is known by the person or subject being studied but also helps the author to do critical thoughts to find solutions from the results of the interview [9].

3. 4 Topsis Method

TOPSIS (Technique For Order Preference By Similarity To Ideal Solution) is a multi-criteria decision-making method. Topsis was first introduced by Yoon and Hwang in 1981 used as a method in solving multi-criteria problems [10]. Topsis method is used to help

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complete practical decision making, so it can be easily understood, computationally efficient, and has the ability to measure the relative performance of decision making alternatives [11].

The steps taken in solving the problem using the TOPSIS method [8] :

1. Topsis begins by building a decision matrix. The decision matrix X refers to the alternatives that will be evaluated based on the criteria.

$$X = \begin{pmatrix} A_1 X_{11} X_{12} X_{13} \dots X_{1n} \\ A_2 X_{21} X_{22} X_{23} \dots X_{2n} \\ \mathrm{A_3 X_{31} X_{32} X_{33}} \dots \mathrm{X_{3n}} \\ A_m X_{m1} X_{m2} X_{m3} \dots X_{mn} \end{pmatrix}$$

Where A_i(i=1,2,3,... m) is a possible alternative X_j(j=1,2,3,... n) is the attribute where the performance of the alternative is measured, $X_{ij}$is the performance $A_i$with reference to the attribute X_j.

2. Create a normalized decision matrix.

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

With i= 1,2,.. m
j= 1,2,.. n
Where :
R_{ij}= normalized matrix [i][j]
X_{ij}= decision matrix [i][j]

3. Create a weighted normalized decision matrix.

$$V_{ij} = w_i r_{ij};$$

with i= 1,2,...,m; and j= 1,2,...,n.
Where :
V_{ij}=Elements of the weighted normalized decision matrix V
w_i= Weight of criteria j
r_{ij}=elements of the normalized san matrix R

4. The positive ideal A^+solution and the negative ideal solution A^-can be determined based on the normalized weight rating (y_{ij}) as:
$A^+ = (y_1^+, y_2^+ \dots y_n^+)$;
$A^- = (y_1^- y_2^- \dots y_3^-)$;

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Where :
V_j^+= max Y_{ij}if j is profit attribute
Min Y_{ij}if j is a cost attribute
V_j^-= min Y_{ij}if j is profit attribute
$max\ Y_{ij}$ =if j attribute cost

5. The distance between the alternative $A_i$and the positive ideal solution:

$$D_i^+ = \sqrt{\sum_{i=1}^{n}(Y_i^+ - Y_{ij})^2}$$

Where :
D_i^+ = The alternative distance $A_i$to the positive ideal solution
Y_j^+ = Positive ideal solution [i]
Y_{ij} = Normalized matrix [i][j]

6. The distance between the alternative and the negative ideal solution

$$D_i^- \sqrt{\sum_{i-1}^{n}(Y_{ij} - Y_j^-)^2}$$

i = 1,2,..m

Where :
D_I^- = Alternative distance $A_i$with negative ideal solution
Y_j^- = Negative ideal solution [i]
Y_{ij} = Normalized matrix [i][j]

7. The preference value for each alternative $(V_i)$is given as:

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

i = 1,2,..m
V_i =the proximity of each alternative to the ideal solution
D_i^+ = alternative distance A_i with positive ideal solution
D_i^- = alternative distance A_i with negative ideal solution
A $V_i$larger value indicates that the alternative A_i is preferred.

Table 1. Alternative values for each Criterion

Criteria code	**Criteria**	**Score**
C1	Age	40 %
C2	dribbling	2 0 %

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C3	Shooting	20%
C4	Passing	20 %
Total		100%

Determining the ranking of each alternative on each criterion is assessed with 1 to 5

Table 2. Value Weight

Weight	**Score**
Very low	1
Low	3
Enough	4
Well	6
Very good	7

Topsis begins by constructing a decision matrix. In the decision matrix, the matrix column states the attributes, namely the existing criteria, while the matrix rows state the alternatives that will be compared and the type of criteria is benefit. The decision matrix can be seen in the table below.

Criteria weighting

Table 3. Age weight value (C1)

Age	Score	Weight
<14	4	Enough
15	6	Well
16-17	7	Very good

Below is the weight of the Drible criteria.

Table 4. Drible Weight Value (C2)

Drible	Score	Weight
Fulfill	7	Very good
Does not meet the	1	Very low

Below is the weighting criteria of Shooting.

Table 5. Shooting Weight Value (C3)

Shooting	Score	Weight
Fulfill	7	Very good
Does not meet the	1	Very low

Below is the weighting criteria of Passing

Passing Weight Value (C4)

Passing	Score	Weight
Fulfill	7	Very Good
Does not meet the	1	Very low

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From some of the criteria above, a weighted sample is carried out in which prospective basketball players are involved in making a matrix in determining the best pts.

4. DISCUSSION

4.1 Manual Test

In this analysis, all data will be implemented in the form of implementation of the TOPSIS method used.

a. The table below is a table of basketball player name data that is an alternative.

Table 7. Decision Matrix

	C1	C2	C3	C4
Amen	16	7	7	1
Faisal	15	1	1	1
Saiful	17	7	1	7
Deni	14	0	7	1
Octa	17	1	1	7

b. After making the decision matrix, the next step is to make a normalized matrix in the following solution:

$|X_i|=\sqrt{16^2+15^2+17^2+14^2+17^2}$

$\sqrt{252+225+289+196+289}$

$=\sqrt{1{,}251}$

= 1.118

$r_{11}=\frac{X_{11}}{|X_1|}=\frac{16}{1.118}$= 14.3112701

$r_{21}=\frac{X_{21}}{|X_1|}=\frac{15}{1.118}$ =13.4168157

$r_{31}=\frac{X_{31}}{|X_1|}=\frac{17}{1.118}$ =15.2057245

$$r_{41}=\frac{X_{41}}{|X_1|}=\frac{14}{1.118}=12.5223614$$

$r_{51}=\frac{X_{51}}{|X_1|}=\frac{17}{1.118}=152057245$

$$\sqrt{7^2+1^2+7^2+1^2+1^2}$$
$$\sqrt{49+1+49+1+1}$$

= 10.049875

$r_{12}=\frac{X_{12}}{|X_2|}=\frac{7}{10.049875}$= 0.696526076

$r_{22}=\frac{X_{22}}{|X_2|}=\frac{1}{10.049875}$= 0.0995037252

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$r_{32} = \frac{X_{32}}{|X_2|} = \frac{7}{10.049875}$= 0.696526076

$r_{42} = \frac{X_{42}}{|X_2|} = \frac{1}{10.049875}$= 0.0995037252

$r_{52} = \frac{X_{52}}{|X_2|} = \frac{1}{10{,}049875}$= 0.0995037252

$|X_3| = \sqrt{7^2 + 1^2 + 1^2 + 7^2 + 1^2}$

$\sqrt{49 + 1 + 1 + 49 + 1^2}$

= 10.049875

$r_{13} = \frac{X_{13}}{X_3} = \frac{7}{10.049875}$= 0.696526076

$r_{23} = \frac{X_{23}}{|X_3|} = \frac{1}{10.049875}$= 0.0995037252

$r_{33} = \frac{X_{33}}{|X_3|} = \frac{1}{10.049875}$= 0.0995037252

$r_{43} = \frac{X_{43}}{|X_3|} = \frac{7}{10.049875}$= 0.696526076

$r_{53} = \frac{X_{53}}{|X_3|} = \frac{1}{10.049875}$ = 0.0995037252

$|X_4| = \sqrt{1^2 + 1^2 + 7^2 + 1^2 + 7^2}$

$\sqrt{1 + 1 \quad + 49 + 1 + 49}$
= 10.049875

$r_{14} = \frac{X_{14}}{|X_4|} = \frac{1}{10.049875}$= 0.0995037252

$r_{24} = \frac{X_{24}}{|X_4|} = \frac{1}{10.049875}$= 0.0995037252

$r_{34} = \frac{X_{34}}{|X_4|} = \frac{1}{10.049875}$= 0.0995037252

$r_{44} = \frac{X_{44}}{|X_4|} = \frac{7}{10.049875}$= 0.696526076

$r_{54} = \frac{X_{54}}{|X_4|} = \frac{7}{10.049875}$= 0.696526076

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From the calculation results above, the normalized matrix (R) is obtained:

R

$$= \begin{bmatrix} 14.3112 & 0.69652 & 0.69652 & 0.09950 \\ 13.4168 & 0.09950 & 0.09950 & 0.09950 \\ 15.2057 & 0.69652 & 0.09950 & 0.69652 \\ 12.5223 & 0.09950 & 0.69652 & 0.09950 \\ 15.2057 & 0.09950 & 0.09950 & 0.69652 \end{bmatrix}$$

After obtaining the normalized matrix (R), then look for the V matrix based on the equation:

$$V_{ij} = W_j X_{ij}$$

$V_1 = W_1 r_{11}$ = (0.4)(14.3112)
= 57.2450

$V_{12} = W_2 r_{12}$ = (0.2)(0.69652)
= 0.13930

$V_{13} = W_3 r_{13}$ = (0.2)(0.69652)
= 0.13930

$V_{14} = W_4 r_{14}$ = (0.2)(0.09950)
= 0.19900

$V_{21} = W_1 r_{21}$ = (0.4)(13.4168)
= 53.6672

$V_{22} = W_2 r_{22}$ = (0.2)(0.09950)
= 0.19900

$V_{23} = W_3 r_{23}$ = (0.2)(0.09950)
= 019900

$V_{24} = W_4 r_{24}$ = (0.2)(0.09950)
= 0.19900

$V_{31} = W_1 r_{31}$ = (0.4)(15.2057)
= 60.8229

$V_{32} = W_2 r_{32}$ = (0.2)(0.69652)
= 0.13930

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$V_{33} = W_3 r_{33}$ = (0.2)(0.09950)
= 0.19900

$V_{34} = W_4 r_{34}$ = (0.2)(0.69652)
= 0.13930

$V_{41} = W_1 r_{41}$ = (0.4) (12.5223)
= 500894

$V_{42} = W_2 r_{42}$ = (0.2)(0.09950)
= 0.19900

$V_{43} = W_3 r_{43}$ = (0.2)(0.69652)
= 0.13930

$V_{44} = W_4 r_{44}$ = (0.2)(0.09950)
= 0.19900

$V_{51} = W_1 r_{51}$ (0, 4)(15.20572)
= 0.608228

$V_{52} = W_2 r_{52}$ = (0.2)(0.09950)
= 0.19900

$V_{53} = W_3 r_{53}$ = (0.2)(0.09950)
= 0.19900

$V_{53} = W_3 r_{53}$ = (0.2)(0.069652)
= 0.13930

From the above calculation, the Y matrix is obtained

Y=

$$\begin{bmatrix} 57.2405 & 53.6672 & 60.8228 & 500.954 & 60.8228 \\ 0.13930 & 0.19900 & 0.13930 & 0.19900 & 0.19900 \\ 0.13930 & 0.19900 & 0.19900 & 0.12930 & 0.19900 \\ 0.19900 & 0.19900 & 0.12930 & 0.19900 & 0.13930 \\ 0.19900 & 0.13930 & 0.19900 & 0.19900 & 0.13930 \end{bmatrix}$$

The positive ideal solution is calculated based on the equation:

$A^+ = (y_1^+, y_2^+ \ldots y_n^+)$

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y_1^+=max {57.24050804; 0.139305215; 0.139305215 ; 0.19900745; 19900745}
= 57.4050804

y_2^+=max {53.6672618; 0.19900745; 0.19900745; 0.19900745; 139305215}
= 53.6672618

y_3^+= max {60822898; 0.139305215; 0.19900745; 0.19900745; 0.19900745; 0.19900745 }
= 0.19900745

y_4^+= max {500894456; 0.19900745; 0.139305215; 0.19900745, 19900745 }
= 500894456

y_5^+= max {608228980; 0.19900745; 0.19900745; 0.139305215; 0.139305215 }
= 608228980

A^+= {572405804; 536672628; 60822898; 500894456; 0.608228980 }

The negative ideal solution is calculated based on the equation:

$$A^- = (y_1^-, y_2^- \dots y_n^-)$$

y_1^-= min{57.24050804; 0.139305215; 0.139305215; 0.19900745 ; 19900745}
= 0.139305215

y_2^-= min {53.6672618; 0.19900745; 0.19900745; 0.19900745; 139305215}
= 0.139305215

y_3^-= min {60822898; 0.139305215; 0.19900745; 0.19900745; 0.19900745; 0.19900745}
= 0.139305215

y_4^-=min{500894456; 0.19900745 ; 0.139305215; 0.19900745; 0.19900745 }
= 0.139305215

y_5^-= min {608228980; 0.19900745; 0.19900745; 0.139305215; 0.139305215}
= 0.139305215

A^-= {0.139305215; 0.139305215; 0.139305215; 0.139305215}

The distance between the weighted value of each alternative to the positive ideal solution is calculated based on the equation:

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$$D_i^+ = \sqrt{\sum_{i=1}^{n}(Y_i^+ - Y_{ij})^2}$$

D_1^+=

$$\sqrt{\begin{matrix}(574050804-574050804)^2\\+(536672628-536672628)^2+\\(60822898-60822898)^2\\+(500894456-500894456)^2+\\(608228980-60822980)^2\end{matrix}}$$

= $\sqrt{0}$= 0

D_2^+=

$$\sqrt{\begin{matrix}(0.139305215-5724050804)^2\\+(019900745-536672628)^2+\\(0.139305215-60822898)^2+^2\\(0.19900745-500894456)\\(0.19900745-60822980)^2\end{matrix}}+$$

= $\sqrt{16.9732353}$= 4.1198

D_3^+=

$$\sqrt{\begin{matrix}(0.139305215-574050804)^2\\+(0.19900745-536672628)^2+\\(0.19900745-60822898)^2\\+(0.139305215-500894456)^2+\\(0.19900745-608228980)^2\end{matrix}}$$

= $\sqrt{117040625}$= 108.1853

D_4^+=$\sqrt{\begin{matrix}(0.19900745-574050804)^2\\+(0.19900745-536672628)^2+\\(0.139305215-60822898)^2\\+(0.19900745-500894456)^2+\\(0.139305215-608228980)^2\end{matrix}}$

= $\sqrt{15.6627195}$= 3.9576

D_5^+=

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$$\sqrt{\begin{matrix}(0.19900745-574050804)^2\\+(0.139305215-536672628)^2+\\(0.19900745-60822898)^2\\+(0.19900745-500894456)^2+\\(0.19900745-608228980)^2\end{matrix}}$$

$=\sqrt{1.24208901}=11.1144$

The distance between the weighted value of each alternative to the alternative to the negative ideal solution is calculated based on the equation:

$$D_i^+ = \sqrt{\sum_{i=1}^{n}(Y_i^+ - Y_{ij})^2}$$

$D_1^-=$

$$\sqrt{\begin{matrix}(1574050804-0.139305215)^2\\+(536672628-0.139305215)^2+\\(60822898-0.139305215)^2\\+(500894456-0.139305215)^2+\\(608228980-0.139305215)^2\end{matrix}}$$

$=\sqrt{608.228989}=24.6622$

$D_2^-=$

$$\sqrt{\begin{matrix}(0.139305215-0.139305215)^2\\+(0.19900745-0.139305215)^2+\\(0.139305215-0.139305215)^2+^2\\(0.19900745-0.139305215)\end{matrix}}+\\(0.19900745-0.139305215)^2$$

$=\sqrt{7.56712967}=2.7508$

$D_3^-=$

$$\sqrt{\begin{matrix}(0.139305215-0.139305215)^2\\+(0.19900745-0.139305215)^2+\\(0.19900745-0.139305215)^2\\+(0.139305215-0.139305215)^2+\end{matrix}}$$

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$$= \sqrt{7.42099103} = 108.1853$$

$$D_4^- = \sqrt{\begin{matrix}(0.19900745 - 0.139305215)^2 \\ +(0.19900745 - 0.139305215)^2 + \\ (0.139305215 - 0.139305215)^2 \\ +(0.19900745 - 0.139305215)^2 + \\ (0.139305215 - 0.139305215)^2\end{matrix}}$$

$$= \sqrt{7.42099103} = 2.7241$$

$$D_5^- = \sqrt{\begin{matrix}(0.19900745 - 0.139305215)^2 \\ +(0.139305215 - 0.139305215)^2 + \\ (0.19900745 - 0.139305215)^2 + ^2 \\ (0.19900745 - 0.139305215) \\ (0.19900745 - 0.139305215)^2\end{matrix}} +$$

$$= \sqrt{0.0142574} = 0.1201$$

The closeness of each alternative to the ideal solution is calculated based on the equation:

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

$$V_1 = \frac{24.662}{24.662+0} = \frac{24.6622}{24.6622} = 1$$

$$V_2 = \frac{2.7508}{2.7508+4.1198} = \frac{2.7508}{6.8706} = 0.2039$$

$$V_3 = \frac{2.7241}{2,7241+108,1853} = \frac{2.7241}{110.9094} = 0.0245$$

$$V_4 = \frac{2.7241}{2.7241+3.9576} = \frac{2.7241}{6.6817} = 0.4076$$

$$V_4 = \frac{0.1201}{0.1201+1.1144} = \frac{0.1201}{1.2345} = 0.0972$$

From the results of the value of V, the value $V_3 = 0.0245$ has the smallest value and n $V_1 = 1$ has the largest value as the best basketball player [11].

5. CONCLUSION AND SUGGESTION

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a. Conclusion

From the results of the above calculations, it is concluded that basketball players V_1(Amin) are eligible to be selected based on the TOPSIS method with age assessment of dribbling, shooting, and passing.

The TOPSIS method for modeling the best basketball player selection DSS can produce rational and optimal decision making.

b. Suggestion

Here are some suggestions for further development of the research as follows:

1. The need for addition to other criteria so that the data obtained is more accurate.
2. In solving multi-criteria problems the TOPSIS method is not the only decision-making method that can be used, it would be nice for further research to replace or compare with other methods such as SAW, WP etc.
3. Further research is recommended to create a website-based application to make it more effective.

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