

SMART MOBILE APPLICATION FOR DECISION SUPPORT SYSTEMS ON DETERMINATION OF RESIDENT IN DORMITORY

^aAchmad Jauhari, ^bFifin Ayu Mufarroha, ^cMuhammad Amfahtori Wijarnoko, ^dMoh. Yusril Ihza Maulana, ^eAhmad Try Bayu Al Haq, ^fLinawati

^{a,b,c,d,e,f} Departement of Informatic Engineering, University of Trunojoyo Madura, Bangkalan –
Madura, Indonesia

E-mail: ^ajauhari@trunojoyo.ac.id, ^bfifin.mufarroha@trunojoyo.ac.id

Abstract

The dormitory is one of the facilities provided with the aim of helping students to get a place to live because some of them come from distant places. The Trunojoyo Madura University dormitory has regulations that serve as a place for the process of character education, spiritual deepening, moral improvement. With these regulations, plus the boarding house is a conducive, economical, and strategic place to stay making many students interested in being able to live there. The problem is that each semester change is carried out by the selection of dorm residents and so far it is still done manually by way of discussion of each individual. Therefore, the purpose of this research is to help the board by building a decision support system in determining residents who are still eligible to live in a dormitory and provide opportunities for other students to live in a dormitory. We develop systems based on mobile applications. TOPSIS method (Technique for Order of Preference by Similarity to Ideal Solution) is implemented as a multi criteria decision making method with four main criteria including routine absence, non-routine absence, violation and notes. The final results of this decision support system are ranks and colors that indicate the status of boarding residents. Ranking starts from the top (1) to the bottom (216) accompanied by a status of green to red. The color status is divided into 3 namely green (safe), yellow (vulnerable), and red (issued). From 216 boarders we took 10 samples of dormitory data for testing. The results of trials with 10 data samples by applying the TOPSIS method obtained an accuracy of 90%.

Key words: mobile application , decision support system, dormitory, TOPSIS method.

INTRODUCTION

Dormitory is a building located in an agency that serves as a residence for members or groups, generally school students. Dorms usually consist of rooms that can be occupied by several people at once. The period of stay in the dormitory is longer or longer than in hotels and inns. One of the reasons students choose to live in a dormitory is that it is still an area with a place to study and the costs are relatively cheap when compared to other lodging such as apartments.

Some universities have student dormitories in accordance with Presidential Decree No. 40 of 1981, as well as the University of Trunojoyo Madura. The Trunojoyo Madura University student dormitory has a dual function which is as a conducive, economical, and strategic residence because it is within the campus area, as well as a place for the process of character education, spiritual deepening, moral improvement, intellectual development and strengthening the interests of talents as well as students' social care as successors a trustworthy, religious, caring and creative nation. Every semester change, the dormitory selects the residence residents. Residents of the dormitory are designations for students who live in the dormitory. The selection that has been done so far is manual, that is, it only conducts discussions among the residents of the dormitory one by one. With the selection support system for residents living in a dormitory, it is very helpful for the dormitory to do the selection. The selection is done to see whether the dormitory residents are still eligible to live in a dormitory and provide opportunities for other students who want to live in a dormitory.

Decision Support System (DSS) is a system that can help in making decisions in an organization or company [1]. In addition, decision support systems can solve problems in complex environments both in terms of hardware and software [2]. In education the Decision Support System can be seen as an important asset to support the smoothness and accuracy in achieving a goal. One of them is to determine or select, by using a decision support system. The selection process for boarding residents will be more objective and targeted by implementing the solution. Many methods are used in decision support systems such as TOPSIS (Technique for Order

Preference by Similarity to Ideal Solution) [3-6], SAW (Simple Additive Weighting) [7, 8], AHP (Analytical Hierarchy Process) [9-11] and several studies using the combination [12]. The SAW method reveals the criteria value based on its weight. This method uses the usual multiplication and addition operations and the values of these methods must be numeric so they can be compared [13]. While the AHP method uses pairwise comparisons obtained from interconnected criteria. This comparison process aims to find the interconnected criteria weight [14]. One other method that is widely used is TOPSIS. TOPSIS is one of the multi-criteria decision making methods by applying weighting values to each criterion, this method uses the principle that the chosen alternative must have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution [4]. The application of the TOPSIS method helps in the process of determining the selection method to be applied. The proposed method has correctly resolved problems in decision making with various criteria and groups [6]. This means that the choices will be sorted by the resulting value so that the alternative that has the shortest distance with a positive ideal solution is the best alternative. The purpose of this study is to help board administrators make the selection process in determining who are eligible to live in a dormitory..

MATERIAL AND METHOD

In system development, we build a mobile based system. The reason for choosing mobile-based is that many users are more comfortable using it and users can access it anywhere and anytime [15]. Smartphone is a modern communication tool that has been widely used by the public. The data used in this system is The student data feature contains a list of students who are residents in the dormitory. The data we get, the number of citizens currently living as many as 216 residents. the stages in system development can be seen in Figure 1. The process begins with collecting data on students who are residents of the dormitory. The processed data is the raw data in excel format obtained from the management of the dormitory. the next process, we designed the system by applying the TOPSIS method into the system. the application of the

TOPSIS method is implemented as a method in the process of determining dormitory residents. After obtaining the design method, the next step is to build the system. We have used one of the software in android development, namely android studio and implemented firebase in database storage. in testing, we perform validation testing. Validation testing is done to determine the results of the manual calculation of TOPSIS and the results of the prediction system.

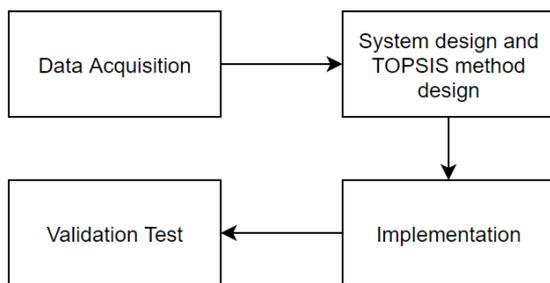


Fig 1. System development

Decision Support System

One area of scientific discipline in information systems is decision support systems. This system is focused on supporting and improving managerial decision making [16]. In the decision making process utilizing data and selecting certain models for the search for solutions that involve human intuition in making decisions. In various decision making situations, we need to differentiate computerized support for automated support systems and decision support systems. Automatic decision systems are intended to automate and make decisions in routine and well-structured situations while decision support systems are additional systems intended to help decision makers in various semi-structured and repetitive decision-making situations [17]. From the explanation above, we can conclude that the decision support system can be divided into several decision situations. The situation can be structured and unstructured.

TOPSIS Method

TOPSIS is a multi-criteria decision making method used to determine the best alternative in the solution concept. Euclidean distance is applied in finding the shortest distance in

finding the best alternative solution or expressed as a positive ideal solution. The farthest distance from the solution will be expressed as a negative solution [5]. The positive ideal solution is defined as the sum of all the best values that can be achieved for each attribute, while the negative ideal solution consists of all the worst values achieved for each attribute. The following steps must be prepared before starting the TOPSIS calculation process.

1. Alternative data

Alternative data as a representation of a person / object to be assessed. Alternative data usually consists of alternative code and names, some attribute additions are tailored to the case being studied.

2. Criteria data

Criteria data are used as a basis for evaluating alternatives. Criteria can be in the form of costs or benefits. the greater the value of the benefits will mean good. and vice versa for the smaller the value the better.

3. Alternative Values

Assigning values to alternatives in each criterion data is referred to as alternative values. For ease of understanding is represented in the form of a table (matrix) with the alternative as the title line and criteria as the column headings. It should be noted that each alternative must have a value on all criteria even though it is zero.

4. Normalization

Calculate the normalized matrix with equation 1:

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

r_{ij} = normalized value decision value matrix

x_{ij} = initial value decision matrix

5. Weighted Normalization

$$y_{ij} = \begin{bmatrix} W_{11}r_{11} & \dots & W_{1n}r_{1n} \\ \vdots & \ddots & \vdots \\ W_{m1}r_{m1} & \dots & W_{mn}r_{nm} \end{bmatrix} \tag{2}$$

y_{ij} = weighted normalized decision matrix

w_i = criteria weights i

6. The Ideal Solution Matrix

Determine the ideal solution A^+ and negative ideal solutions A^- [18].

positive (3)

$$A^+ = y_1^+, y_2^+, \dots, y_n^+$$

Negative

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

$y_1^+ = \max y_{ij}$, if j is an attribute of excess (benefit)

$y_1^- = \min y_{ij}$, jika j is an attribute of costs

7. Distance Positive Ideal / Negative Solution

Distance alternatives with positive solutions positively formulated [12]:

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_{ij} - y_j^+)^2}$$
 (4)

Alternative distances with the ideal Negative solution are formulated:

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_j^-)^2}$$
 (5)

y_j^+ = positive ideal solution for - j attribute

y_j^- = negative ideal solution for - j attribute

y_{ij} = elements of a normalized decision matrix weighted y

8. Value Preference

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}$$
 (6)

Defining Problems and Determining Solutions

- a. Problem: Decision Determination of Eligible Living in a Dormitory
- b. Criteria and Weight:

In this study we determined 4 criteria that we wrote down with C1 to C4. Explanation of

the four criteria can be seen in table 1. We write the weights and criteria specified in table 1 on the system that we have created (Figure 2).

Table 1. Criteria and weights

Criteria	Description	Weight
C1	Routine Absent	0.375
C2	Non Routine Absence	0.2
C3	Violation	0.275
C4	Note	0.15

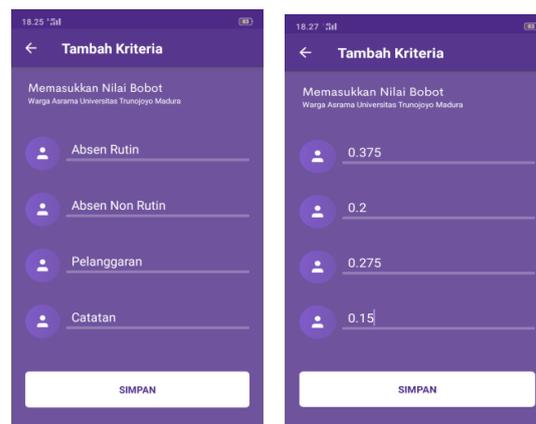


Fig 2. Write the weights on the criteria

In entering the score into the system, we provide a range of the four criteria to make it easier to calculate (Figure 1). So the user will enter a score for each resident based on the range of scores in the four criteria. In Table 2 for the range of routine absences if one of the residents of the dormitory does not do more than ten times the routine absence then will get a score of 1 with a red card statement. And if one of the residents is less than equal to seven times not doing routine absences then get a score of three with a green card statement..

Table 2. Range of Routine Absence values

Range of Value	Score	Description
>10	1	Red Card
>=8	2	Yellow card
<=7	3	Green Card

In table 2 describes the scoring for non-routine absence values. The range of values in this criterion is if one resident does more than two non-routine absences then the score is one. Conversely, if always perform routine absent zero absent or non-routine then get the value of the score is three. Table 3 explains the grading of violation value criteria and records.

In both of these criteria if one of the people do not infringe and does not have a record of it will get a green card with the maximum score is three. Meanwhile, if the residents do a lot of offense and have a record of it will get a red card with a score value is one.

Table 3. Range of Non Routine Absence values

Range of Value	Score	Description
>2	1	Red Card
>=1	2	Yellow card
0	3	Green Card

Table 4. Range of Abuse and Note values

Score	Description
1	Red Card
2	Yellow card
3	Green Card

RESULT AND DISCUSSION

Application Development

In the decision making process to make it easier for administrators to determine boarding residents who deserve to live, we built a decision support system on mobile applications. In this application we provide security by providing a login page that functions that the system can only be used for authorized users. Followed by a starting page with 4 main features (student data, criteria, calculation results, and dormitory regulations) and 1 additional feature (about the developer).

Figure 3-5 is a display of the mobile application that has been built by the author. Figure 2 shows the user must log in first by entering a username and password in order to access the application. users can add occupant data by filling in the existing fields and there are also hostel rules (Figure 3). while in figure 4, users are presented with a data display of students who are residents of the dormitory.

The criteria feature is a feature that provides input to the criteria weights used as calculations. The calculation results feature contains a calculation table obtained by applying the TOPSIS method. Whereas the dormitory regulations feature displays a list of the regulations that are in the dormitory.

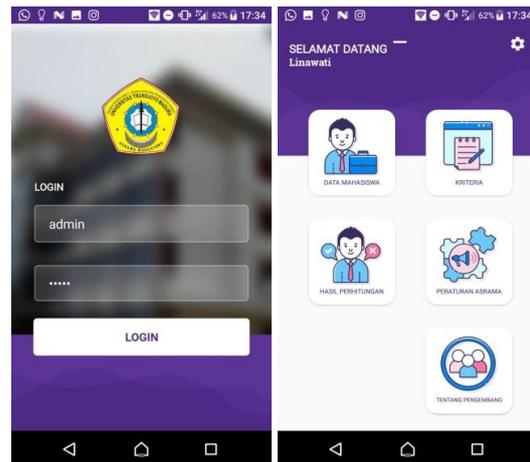


Fig 3. Log in and homepage

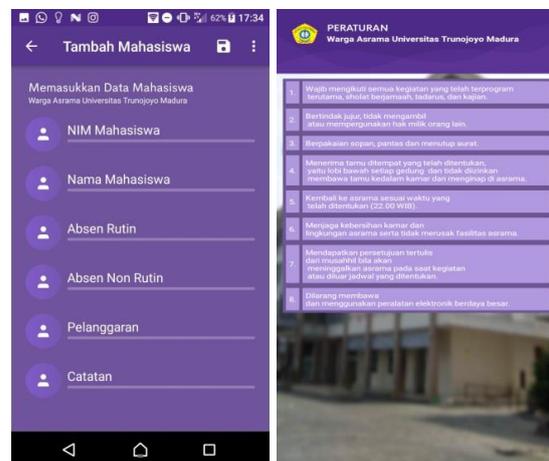


Fig 4. Add residents along with the scores of each dormitory's criteria and regulations

No	NIM	Nama
1	170441100001	Wardatul Muthiin
2	170441100002	Ismi Firusiyah
3	170441100003	Messy Dwi Saputri
4	170441100004	Clarisa Eriyanyo Putri
5	170441100005	Nur Dini Rifaiyah
6	170441100006	Sepia Rohma Umami
7	170441100007	Faridatul Hasanah
8	170441100008	Faizah Fairani
9	170441100009	Fadila Febriana Tanesha
10	170441100010	Maulidiyah Isnaini

Fig 5. Sample list of boarding residents

Analysis of the TOPSIS Method calculation

- a. Sampling data were taken from 10 residents of the total number of dormitory residents as many as 216 boarding residents who currently live.

Based on the ten data we assume with alternatives A1 through A10. When entering the list of citizens the scores of the four criteria have been written down which can also be seen in table 5. We assume alternatives (A1), routine absences (RA), non-routine absences (NR), violations (Vi), and notes (Nt) .

Table 5. Alternative score criteria values

AI	RA	NR	Vi	Nt
A1	3	2	2,5	2,5
A2	3	3	2,5	2,5
A3	3	2	3	3
A4	3	3	3	3
A5	3	3	2,5	2,5
A6	3	2	3	3
A7	1	3	3	3
A8	3	3	2,5	2,5
A9	3	3	3	3
A10	3	3	3	3

- b. After knowing the problems, criteria, weights and alternatives, the next step is to calculate normalization. To get the normalization value, first look for the X value. The X value can be seen in table 6 and Table 7 is the normalization value.

Table 6. X value

X Value	RA	42.6380112
	NR	43.89760814
	Vi	40.7553677
	Nt	40.755

Based on normalization values, weighting normalization calculation is done by applying equation 2. The results of weighting normalization can be seen in table 8 while positive ideal values and negative ideal values can be seen in table 9.

Tabel 7. Normalization

AI	RA	NR	Vi	Nt
A1	0,3312 94578	0,2309 40108	0,2812 71975	0,2812 7
A2	0,3312 94578	0,3464 10162	0,2812 71975	0,2812 7
A3	0,3312 94578	0,2309 40108	0,3375 2637	0,3375 3
A4	0,3312 94578	0,3464 10162	0,3375 2637	0,3375 3
A5	0,3312 94578	0,3464 10162	0,2812 71975	0,2812 7
A6	0,3312 94578	0,2309 40108	0,3375 2637	0,3375 3
A7	0,1104 31526	0,3464 10162	0,3375 2637	0,3375 3
A8	0,3312 94578	0,3464 10162	0,2812 71975	0,2812 7
A9	0,3312 94578	0,3464 10162	0,3375 2637	0,3375 3
A10	0,3312 94578	0,3464 10162	0,3375 2637	0,3375 3

Table 8. Weighting Normalization

AI	RA	NR	Vi	Nt
A1	0,1242 35467	0,0461 88022	0,0773 49793	0,0421 9
A2	0,1242 35467	0,0692 82032	0,0773 49793	0,0421 9
A3	0,1242 35467	0,0461 88022	0,0928 19752	0,0506 3
A4	0,1242 35467	0,0692 82032	0,0928 19752	0,0506 3
A5	0,1242 35467	0,0692 82032	0,0773 49793	0,0421 9
A6	0,1242 35467	0,0461 88022	0,0928 19752	0,0506 3
A7	0,0414 11822	0,0692 82032	0,0928 19752	0,0506 3
A8	0,1242 35467	0,0692 82032	0,0773 49793	0,0421 9
A9	0,1242 35467	0,0692 82032	0,0928 19752	0,0506 3
A10	0,1242 35467	0,0692 82032	0,0928 19752	0,0506 3

Table 9. Determine the positive and negative ideal values

ideal values	RA	NR	Vi	Nt
Positive	0,124235 467	0,0692 82032	0,0928 19752	0,05 063
Negative	0,041411 822	0,0461 88022	0,0773 49793	0,04 219

c. The next stage is looking for the distance between the weighted values of each alternative ideal values positive and negative. Calculation of the distance in the TOPSIS method by applying the calculation of the euclidean distance. The concept of calculating euclidean distances is to compare 2 values or points in euclidean space.

Table 10. Calculation of distances for positive ideal and negative ideal

Alternatif	Positif	Negatif
A1	0,029049191	0,082823645
A2	0,017621639	0,085983076
A3	0,023094011	0,084677496
A4	0	0,08777022
A5	0,017621639	0,085983076
A6	0,023094011	0,084677496
A7	0,082823645	0,029049191
A8	0,017621639	0,085983076
A9	0	0,08777022
A10	0	0,08777022

Based on table 10, it can be seen the value of the distance between two ideals (positive ideal and negative ideal). If the value is close to 0 or even 0, the value is at the ideal. Some alternatives have a value of 0 on a positive ideal, namely A4, A9 and A10, so the three alternatives can be said to have a positive ideal. For more details, we can see in table 11 and figure 6 which is the final value of the TOPSIS calculation.

Table 11. Value or the final value of the TOPSIS method calculation.

AI	Value	Rank	Color
A1	0,74033740 5	183	yellow
A2	0,82991470 3	120	green
A3	0,78571320 4	180	green
A4	1	1	green
A5	0,82991470 3	119	green
A6	0,78571320 4	178	green
A7	0,25966259 5	201	red
A8	0,82991470 3	119	green
A9	1	1	green
A10	1	1	green

Tabel Perankingan			
NAMA	VALUE	RANGKING	KLASIFIKASI
Clarisa Eriyanyo Putri	1.0	1	Diterima
Fadila Febrina Tanesha	1.0	2	Diterima
Maulidiah Isnaini	1.0	3	Diterima
Ismi Firaiziyah	0.8299147030816967	4	Diterima
Nur Dini Rilayah	0.8299147030816967	5	Diterima
Felzah Fairani	0.8299147030816967	6	Diterima
Mesy Dwi Saputri	0.7857132041605707	7	Diterima
Sepia Rohma Umami	0.7857132041605707	8	Diterima
Wardatul Muthin	0.7403374045538252	9	Kurang
Faridatul Hasanah	0.2596625954461747	10	Merah

Fig 6. Ranking Table with 10 sample data

Accuracy testing is used to determine the ability of the system to make decisions, whether the results are accurate or not. Here is a sample of 10 data from a total of 216 data can be seen in table 12.

The actual results were obtained by calculating the TOPIS method manually using the help of Microsoft Excel software, while the prediction result is the calculation result of the TOPSIS method which has been implemented into the system. Comparison of accuracy testing is used to determine the ability of the system to make decisions.

Tabel 12. Comparison of results

AI	Value	Rank	Prediction	Actual	Results
A1	0,74 0337	183	yellow	yellow	√
A2	0,82 9915	120	green	yellow	×
A3	0,78 5713	180	green	green	√
A4	1	1	green	green	√
A5	0,82 9915	119	green	green	√
A6	0,78 5713	178	green	green	√
A7	0,25 9663	201	red	red	√
A8	0,82 9915	119	green	green	√
A9	1	1	green	green	√
A10	1	1	green	green	√

In conducting test calculations using the confusion matrix method. In this method there are four terms namely true positive (TP), false negative (FN), true negative (TN), and false positive (FP) for 2 classes namely positive and negative [19]. If the positive and correct sample is decided as positive it is counted as TP; and if the sample is decided as negative then FN is considered. If the sample is negative and is decided negative then it is considered TN; if classified as positive, then it is calculated as FP. From Table 12, we get the results from the system predictions and actual results. Based on the table, the accuracy of the prediction is calculated by determining the class prediction (Table 13). Accuracy results of 90% (Table 14) are obtained by adding up

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the results of correct decisions and wrong decision results that are considered wrong divided by the overall results of the decision.

Table 13. Accumulation of class predictions

TP	FN	TN	FP
9	0	0	1

Table 14. Accuracy

ACCURACY	$(TP + TN) / (TP + FP + FN + TN)$
	0.9

CONCLUSION

Based on the results of the study by applying the TOPSIS method for the determination of boarders who are eligible to stay, it can be concluded that the making of this decision support system application is able to provide the best decision solution and provide accurate results with the criteria determined by the board administrator. The calculation is done using 10 data from 216 total boarding residents who currently live. The application will display the final calculation data sorted by ranking the level of eligibility of residence. The ranking makes it easy for administrators to see the data and also decides which residents will remain or must be removed from the dormitory. The green color indicates that the residents are in a safe position, the yellow color indicates that the residents are in a vulnerable condition and the red color indicates the residents are expelled

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