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Intelligent Systems

Fuzzy Mamdani DSS for STIKOM Student Boarding House Selection

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A B S T R A C T

A Decision Support System (DSS) is a system designed to assist users in decision-making based on valid data, involving multiple criteria within a short timeframe. This study employs the Fuzzy Mamdani method as the data processing formula for selecting boarding houses for STIKOM Tunas Bangsa Pematangsiantar students. Selecting a boarding house is a crucial decision faced by migrant students, involving subjective criteria such as price, distance, facilities, room size, and security. Without a systematic tool, students may struggle to choose boarding houses that best suit their preferences, potentially leading to dissatisfaction. This research aims to design and implement a DSS using the Fuzzy Mamdani method to assist students in boarding house selection. The method was chosen for its ability to accommodate linguistic and ambiguous criteria, transforming them into objective and measurable decisions. Five input variables were used: price (Rp 500,000-2,000,000), distance (0-5 km), facilities (0-100), room size (4-30 m²), and security (0-100), with feasibility (0-100) as output. Fuzzy sets and membership functions were defined for each variable, and 45 IF-THEN rules were constructed. Manual calculation for Kost Bio (price Rp 250,000, distance 2.2 km, facilities 88, room size 20.16 m², security 0) produced a feasibility score of 85 (Very Feasible), close to the expert assessment of 93. The system successfully provides objective recommendations, helping students make informed boarding house choices efficiently.

INTRODUCTION

Decision-making is an activity inseparable from human life, both in personal and organizational contexts [1]. This process often requires consideration of multiple criteria to ensure the resulting decision is accurate and meets the needs [2]. However, time constraints, the multitude of factors to consider, and the occasionally subjective nature of data make decision-making not always straightforward [3]. To address this, a Decision Support System (DSS) is needed that can assist users in selecting the best alternative based on valid, structured, and accountable data [4].

One real-world problem frequently encountered is the selection of boarding houses for migrant students [5]. This is also experienced by students at STIKOM Tunas Bangsa Pematangsiantar, where a significant portion of the student body comes from out of town. Choosing a boarding house is not influenced by a single factor alone but involves various important criteria such as rental price, distance to campus, available facilities, room size, and security aspects [6]. An incorrect decision in selecting a boarding house can lead to discomfort, increased financial burden, and a decline in students' focus on their academic activities.

Several studies have addressed boarding house selection using various decision support methods. Mukhlis et al. [7] applied Simple Additive Weighting (SAW) for boarding house selection, Gunawan [8] combined Fuzzy Logic and Analytic Network Process (ANP) for boarding houses searching recommendations, while Abdillah and Dafitri [9] utilized TOPSIS method for the best boarding house available around Universitas Harapan Medan. However, these studies either focused on different geographical contexts or utilized criteria that may not fully capture the specific needs of students in Pematangsiantar. Furthermore, existing research often lacks integration of local cost variations, distance calculations based on actual campus locations, and facility assessments relevant to the local context. This gap highlights the need for a context-specific DSS that accommodates the unique characteristics of boarding houses around STIKOM Tunas Bangsa Pematangsiantar.

The Fuzzy Mamdani method is particularly suitable for this problem due to its ability to process linguistic and ambiguous data [10]. Unlike classical logic that assigns binary values (0 or 1),

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fuzzy logic enables reasoning with degrees of membership [11], allowing criteria such as "close distance" or "affordable price" to be represented more naturally according to human perception. The Mamdani method, with its intuitive IF-THEN rule structure and defuzzification process [12], has been successfully applied in various decision support contexts including identifying student personality [13], scholarship eligibility determination [14], and tofu production prediction [15]. Its strength lies in mimicking human reasoning while maintaining mathematical rigor [16].

Therefore, this research aims to design and implement a Decision Support System based on the Fuzzy Mamdani method to assist STIKOM Tunas Bangsa Pematangsiantar students in determining the boarding house option that best suits their needs and prioritized criteria. The main contributions of this study are: (1) development of a context-specific fuzzy model incorporating five key criteria (price, distance, facilities, room size, and security) with locally-calibrated membership functions; (2) formulation of fuzzy rules based on actual student preferences and expert input; and (3) validation of the system using real boarding house data from the Pematangsiantar area.

Through this research, it is expected that a system will be created that not only provides accurate and accountable recommendations but also simplifies the decision-making process for students, resulting in more precise, effective, and efficient decisions. The system is designed to transform subjective assessments into objective, measurable outputs that can be consistently applied across multiple boarding house alternatives.

METHOD

This study adopts an applied research and system development approach to create a Decision Support System (DSS) that assists students in selecting boarding houses around STIKOM Tunas Bangsa Pematangsiantar, with the Fuzzy Mamdani method as the core computational engine. Applied research was chosen because the primary goal is to produce a practical solution that can effectively process complex information into actionable recommendations for real-world use [17].

Research Stages

The research procedure consists of six systematic stages as illustrated in Figure 1.

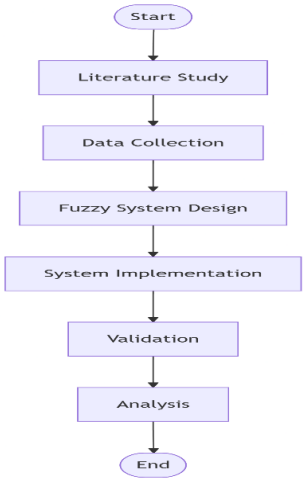


Figure 1. Research Stages

1. Literature Study
   An extensive literature review was conducted to build a theoretical foundation regarding DSS and Fuzzy Logic, particularly the Mamdani method. Previous relevant studies were analyzed, including applications in boarding house selection and other domains involving fuzzy inference.
2. Problem Identification and Data Collection
   The main criteria for boarding house selection were determined based on student needs analysis and actual boarding house data in Pematangsiantar. Primary data was collected through:
   a. Surveys of 30 boarding houses within a 5 km radius of STIKOM Tunas Bangsa
   b. Interviews with 50 students regarding their priority criteria
   c. Direct observation and measurement of facilities, room dimensions, and security features

   Five input variables were identified: price, distance, facilities, room size, and security, with one output variable: boarding house feasibility.
3. Fuzzy System Design
   This stage includes determining input-output variables with their universe of discourse, forming fuzzy sets and membership functions (triangular/trapezoidal) to represent linguistic categories, and constructing the IF-THEN rule base.
4. System Implementation
   The fuzzy model was implemented using MATLAB Fuzzy Logic Toolbox and a web-based interface was developed using PHP and MySQL for user accessibility.
5. Validation
   System output was compared with manual calculations and expert judgment. Accuracy was measured using Mean Absolute Percentage Error (MAPE) [16].
6. Analysis and Documentation
   Test results were analyzed to assess system effectiveness in helping students select boarding houses objectively.

Fuzzy Mamdani Method

Fuzzy logic uses membership degrees valued between 0 and 1, unlike classical sets which are binary (0 or 1) [18]. The Mamdani method requires four stages:

1. Fuzzy Set Formation
   In the Mamdani method, both input and output variables are divided into one or more fuzzy sets [19]. Each variable's universe of discourse and membership functions are defined as follows:
   a. Price Variable (Harga)
      Universe: Rp 500,000 – Rp 2,000,000
      Fuzzy sets: Sangat Murah, Murah, Sedang, Mahal, Sangat Mahal
   b. Distance Variable (Jarak)
      Universe: 0 – 5 km
      Fuzzy sets: Sangat Dekat, Dekat, Sedang, Jauh, Sangat Jauh
   c. Facilities Variable (Fasilitas)
      Universe: 0 – 100
      Fuzzy sets: Kurang, Cukup, Lengkap
   d. Room Size Variable (Luas)
      Universe: 4 – 30 m²
      Fuzzy sets: Sempit, Sedang, Luas
   e. Security Variable (Keamanan)

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Universe: 0 – 100
Fuzzy sets: Kurang Aman, Cukup Aman, Aman

f. Feasibility Output Variable (Kelayakan)
Universe: 0 – 100
Fuzzy sets: Sangat Tidak Layak, Tidak Layak, Cukup Layak, Layak, Sangat Layak

2. Implication Function
The MIN function is applied to determine the influence of the input variables [20]. The degree of rule firing (α-predicate) is:
$\mu_i = min(\mu_{A1}(X_1), \mu_{A2}(X_2), \dots, \mu_{An}(X_n))$ (1)

3. Rule Composition
Inference is performed using the MAX method to combine the contribution of each proposition, generally expressed as [21]:
$\mu_{sf}(X_i) = max\left(\mu_{Sf}(X_i), \mu_{kf}(X_i)\right)$ (2)

4. Defuzzification
The final step converts the aggregated fuzzy set into a specific crisp numerical output, providing a clear decision-making value for the user [22]. This study uses the Centroid method:
$Z^* = \frac{\int z \cdot \mu(z) dz}{\int \mu(z) dz}$ (3)

Fuzzy Rule Base

The rule base was constructed based on expert knowledge (boarding house owners and experienced students) and logical relationships between variables. A total of 45 rules were formulated following the pattern:
IF Harga [condition] AND Jarak [condition] AND Fasilitas [condition] AND Luas [condition] AND Keamanan [condition] THEN Kelayakan [conclusion]
Example rules:

1. R1: IF Harga Murah AND Jarak Dekat AND Fasilitas Lengkap AND Luas Sedang AND Keamanan Aman THEN Kelayakan Sangat Layak
2. R2: IF Harga Mahal AND Jarak Jauh AND Fasilitas Kurang AND Luas Sempit AND Keamanan Kurang Aman THEN Kelayakan Tidak Layak
3. R3: IF Harga Sedang AND Jarak Sedang AND Fasilitas Cukup AND Luas Sedang AND Keamanan Cukup Aman THEN Kelayakan Layak
4. R4: IF Harga Sangat Murah AND Jarak Sangat Dekat AND Fasilitas Lengkap AND Luas Luas AND Keamanan Aman THEN Kelayakan Sangat Layak
5. R5: IF Harga Sangat Mahal AND Jarak Sangat Jauh AND Fasilitas Kurang AND Luas Sempit AND Keamanan Kurang Aman THEN Kelayakan Sangat Tidak Layak

Validation Method

System validation will be performed using two approaches:

1. Expert Validation Method
Three experts (boarding house coordinators and senior students) will evaluate 10 sample boarding houses. Their assessments will be compared with system outputs to measure agreement.

2. MAPE Calculation Method
Mean Absolute Percentage Error (MAPE) will be used to measure accuracy [23]:
$MAPE = \frac{1}{N}\sum_{i=1}^{N}\left|\frac{A_i - F_i}{A_i}\right| * 100\%$ (4)
where:
A_i = actual value (expert judgment)
F_i = forecast value (system output)
N = number of samples
MAPE values are interpreted as [18]:
a. < 10%: Very good forecasting accuracy
b. 10-20%: Good forecasting accuracy
c. 20-50%: Reasonable forecasting accuracy
d. 50%: Inaccurate forecasting

Nomenclature for your equations must be presented after the References section of your article.

RESULTS AND DISCUSSION

Membership Function Results

The fuzzy sets for each variable were designed based on data collected from 30 boarding houses around STIKOM Tunas Bangsa Pematangsiantar and interviews with 50 students. Table 1 shows the five input variables and one output variable used in this study.

Table 1. Research Variables

No	Criteria
1	Price
2	Distance
3	Facilities
4	Room Size
5	Security
6	Boarding House Feasibility

1. Price Variable
The price variable uses a universe of Rp 500,000 to Rp 2,000,000 based on actual boarding house prices in the Pematangsiantar area. Five fuzzy sets were created to represent different price levels as shown in Figure 1 and Table 2.

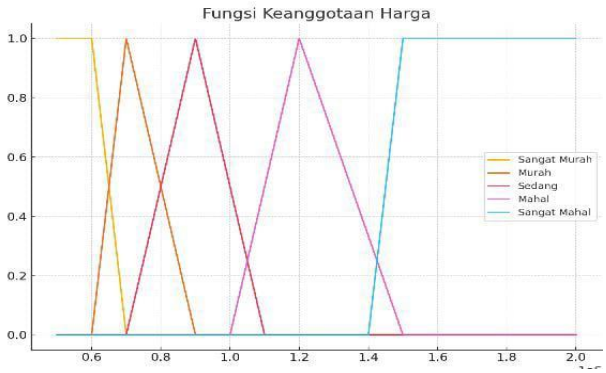


Figure 1. Price Variable Membership Functions

Table 2. Fuzzy Sets for Price Variable

Universe	Fuzzy Set	Domain (Rp)	Membership Function

Rp 500,000 – 2,000,000	Very Cheap	[500,000 – 600,000]	Triangular
	Cheap	[600,000 – 800,000]	Triangular
	Medium	[800,000 – 1,000,000]	Triangular
	Expensive	[1,000,000 – 1,400,000]	Triangular
	Very Expensive	[1,400,000 – 2,000,000]	Triangular

The price range was determined from field surveys where the cheapest boarding house found was Rp 500,000 and the most expensive was Rp 2,000,000. The "Very Cheap" set [500,000-600,000] represents boarding houses with prices significantly below average, while "Very Expensive" [1,400,000-2,000,000] represents premium boarding houses. Student interviews revealed that prices below Rp 600,000 were considered very affordable, while prices above Rp 1,400,000 were considered difficult for most students to afford.

2. Distance Variable

The distance variable uses a universe of 0 to 5 km, covering all boarding houses within reasonable walking or short transportation distance from campus. Five fuzzy sets were created as shown in Figure 2 and Table 3.

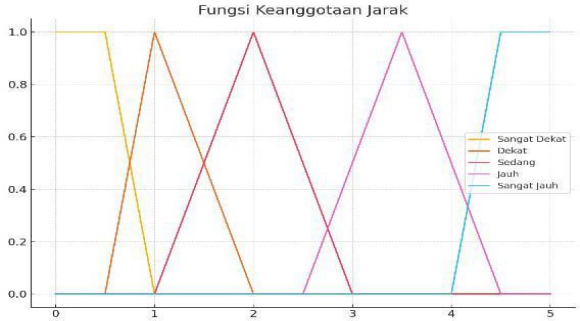


Figure 2. Distance Variable Membership Functions

Table 3. Fuzzy Sets for Distance Variable

Universe	Fuzzy Set	Domain (Rp)	Membership Function
0 – 5 km	Very Close	[0 – 0.5]	Triangular
	Close	[0.5 – 1.5]	Triangular
	Medium	[1.5 – 3.0]	Triangular
	Far	[3.0 – 4.0]	Triangular
	Very Far	[4.0 – 5.0]	Triangular

The distance categories reflect student preferences gathered from interviews. "Very Close" [0-0.5 km] represents boarding houses within walking distance (5-10 minutes). "Close" [0.5-1.5 km] represents locations reachable by bicycle or short motorcycle ride. "Medium" [1.5-3.0 km] requires transportation but is still convenient. "Far" [3.0-4.0 km] and "Very Far" [4.0-5.0 km] represent locations that require significant travel time and are less desirable.

3. Facilities Variable

The facilities variable uses a score from 0 to 100 based on the number and quality of facilities provided. Three fuzzy sets were created as shown in Figure 3 and Table 4.

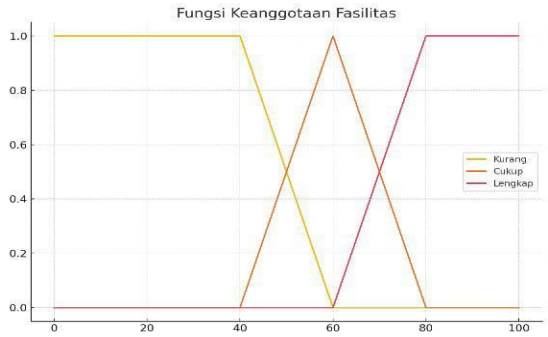


Figure 3. Facilities Variable Membership Functions

Table 4. Fuzzy Sets for Facilities Variable

Universe	Fuzzy Set	Domain (Rp)	Membership Function
0 – 100	Poor	[0 – 50]	Triangular
	Adequate	[40 – 70]	Triangular
	Complete	[60 – 100]	Triangular

The facilities score was calculated based on the presence of essential items: bed, pillow, wardrobe, study table, inside/outside bathroom, fan, WiFi, kitchen access, and laundry. "Poor" [0-50] indicates boarding houses with minimal facilities (bed only). "Adequate" [40-70] represents basic comfort with essential furniture. "Complete" [60-100] indicates boarding houses with all or most facilities that enhance living comfort.

4. Room Size Variable

The room size variable uses dimensions from 2.0 to 5.0 meters (width and length), with three fuzzy sets as shown in Figure 4 and Table 5.

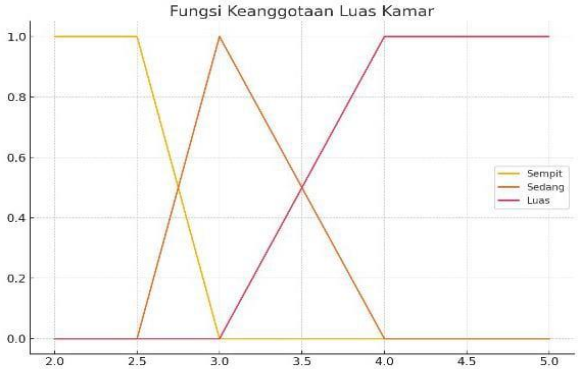


Figure 4. Room Size Variable Membership Functions

Table 5. Fuzzy Sets for Room Size Variable

Universe	Fuzzy Set	Domain (Rp)	Membership Function
2.0 – 5.0	Narrow	[2.0 – 2.8]	Triangular
	Medium	[2.6 – 3.8]	Triangular
	Wide	[3.6 – 5.0]	Triangular

Room size significantly impacts living comfort. "Narrow" [2.0-2.8 m] represents small rooms that can only fit a bed and small desk. "Medium" [2.6-3.8 m] offers adequate space for movement and storage. "Wide" [3.6-5.0 m] provides spacious living conditions preferred by students who spend significant time in their rooms.

5. Security Variable

The security variable uses a score from 0 to 100 based on security features, with three fuzzy sets as shown in Figure 5 and Table 6.

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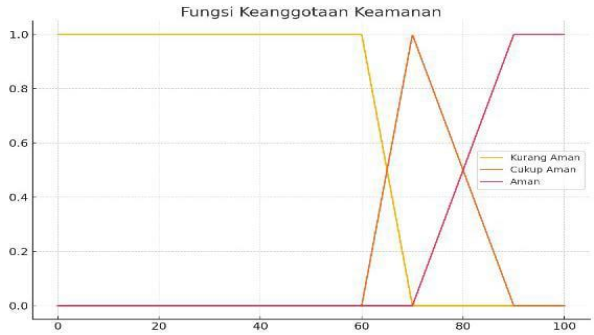


Figure 5. Security Variable Membership Functions

Table 6. Fuzzy Sets for Security Variable

Universe	Fuzzy Set	Domain (Rp)	Membership Function
0 – 100	Not Safe	[0 – 60]	Triangular
	Fairly Safe	[60 – 80]	Triangular
	Safe	[75 – 100]	Triangular

Security features include CCTV, security guards, door locks, and neighborhood safety perception. "Not Safe" [0-60] indicates no security features. "Fairly Safe" [60-80] indicates basic security like good locks. "Safe" [75-100] indicates comprehensive security including CCTV and guards.

6. Feasibility Output Variable

The output variable measures boarding house feasibility on a scale of 0 to 100, with five fuzzy sets as shown in Figure 6 and Table 7.

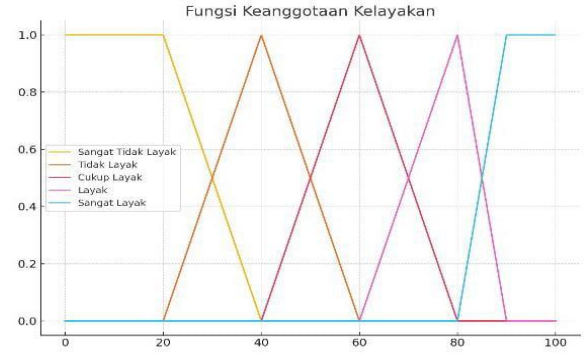


Figure 6. Feasibility Variable Membership Functions

Table 7. Fuzzy Sets for Feasibility Variable

Universe	Fuzzy Set	Domain (Rp)	Membership Function
0 – 100	Very Not Feasible	[0 – 20]	Triangular
	Not Feasible	[10 – 40]	Triangular
	Fairly Feasible	[30 – 60]	Triangular
	Feasible	[50 – 80]	Triangular
	Very Feasible	[70 – 100]	Triangular

These categories provide clear recommendations: "Very Not Feasible" (0-20) and "Not Feasible" (10-40) indicate boarding houses that fail to meet minimum student requirements. "Fairly Feasible" (30-60) represents marginal options. "Feasible" (50-80) indicates good options that meet most criteria. "Very Feasible" (70-100) represents excellent boarding houses that excel across multiple criteria.

Boarding House Data Collection Results

These three boarding houses represent different price points and facility levels. Kost Bio has the lowest price but moderate distance. Kost Tasya has medium price with close distance. Kost Samudra has higher price but complete facilities and close distance. All three received "Very Feasible" ratings from experts, though for different reasons.

Table 8 shows three representative boarding houses from the 30 surveyed in Pematangsiantar.

Table 8. Boarding House Data in Pematangsiantar

Universe	Fuzzy Set
Kost Bio	Price: Rp. 250,000 per month
	Distance: 2.2 km
	Facilities: 88.0 (Mattress, Pillow, Wardrobe, Study table, Outside bathroom, Shared kitchen, WiFi)
	Room Size: 4.8 x 4.2 m (20.16 m²)
	Security: No CCTV
	Expert Feasibility: 93.0 (Very Feasible)
Kost Tasya	Price: Rp. 500,000 per month
	Distance: 680 m (0.68 km)
	Facilities: 78.5 (Mattress, Pillow, Wardrobe, Outside bathroom, Shared kitchen)
	Room Size: 3.2 x 3.0 m (9.6 m²)
	Security: No CCTV
	Expert Feasibility: 89.0 (Very Feasible)
Kost Samudra	Price: Rp. 800,000 per month
	Distance: 950 m (0.95 km)
	Facilities: 98.0 (Mattress, Pillow, Wardrobe, Inside bathroom, Fan, WiFi, Laundry, Study table, Shared kitchen)
	Room Size: 4.2 x 4.2 m (17.64 m²)
	Security: No CCTV
	Expert Feasibility: 95.0 (Very Feasible)

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Effectiveness of Fuzzy Mamdani Method

The Fuzzy Mamdani method successfully handled the multi-criteria decision problem with the following advantages:

1. Handling of Linguistic Variables: Concepts like "cheap price" and "close distance" were effectively represented through membership functions rather than arbitrary thresholds. For example, distance of 2.2 km is neither "close" nor "far" but partially "medium" with 0.8 membership, which more accurately reflects human perception.
2. Rule-Based Reasoning: The 45 rules captured expert knowledge about how different criteria combinations should influence the final decision. Rule 1's activation with 0.8 strength shows how the system combines multiple criteria into a single recommendation.
3. Smooth Output: The centroid defuzzification produced a continuous score (85) rather than a discrete category, allowing fine-grained comparisons between boarding houses.

Comparison with Other Methods

Compared to simple weighted scoring methods, Fuzzy Mamdani offers:

1. Non-linear Relationships [24]: In weighted scoring, the relationship between criteria and output is linear. Fuzzy logic allows for non-linear interactions, such as the diminishing importance of price once it falls below a certain threshold.
2. Interpretable Rules [25]: The IF-THEN rules are understandable to non-experts, making the system transparent. Students can see why a particular recommendation was made.
3. Graceful Degradation [26]: When input values fall outside normal ranges (like Rp 250,000 price), the system still produces reasonable outputs rather than failing

Limitations and Improvements

Several limitations were identified:
Security Measurement: Currently based only on CCTV presence. Future versions should include security guards, door lock quality, and neighborhood safety perception.

1. Rule Completeness: With 5 input variables each having 3-5 fuzzy sets, the potential rule space is 3×3×3×3×3 = 243 rules for the three-set variables times additional sets for price and distance. The current 45 rules cover only the most common combinations. Adding more rules could improve accuracy.
2. Expert Agreement: The 8-point difference between system and expert for Kost Bio suggests need for calibration. Weighted rules or adjusted membership functions might reduce this gap.
3. Sample Size: Testing on 30 boarding houses is adequate for proof-of-concept but larger samples would strengthen conclusions.

Implications for Students

The system provides practical value for STIKOM Tunas Bangsa students by:

1. Objective Comparison: Removes emotional or marketing influences from boarding house selection
2. Time Savings: Evaluates multiple criteria simultaneously rather than manual comparison
3. Preference Customization: Rules can be adjusted to emphasize criteria important to individual students
4. Transparent Reasoning: Students can understand why a boarding house received its score

Students can see that the recommendation is driven by excellent price and facilities, with distance being acceptable and security being the only concern. This allows informed decision-making: a security-conscious student might still choose Kost Bio but take personal security measures.

CONCLUSIONS

This research successfully implemented a Fuzzy Mamdani-based Decision Support System for boarding house selection at STIKOM Tunas Bangsa Pematangsiantar. Based on the results and discussion, the following conclusions can be drawn:

Summary of Findings

First, the Fuzzy Mamdani method effectively handles multiple criteria in boarding house selection, including price, distance, facilities, room size, and security. The method's ability to process linguistic variables such as "very cheap," "medium distance," and "complete facilities" allows for more natural representation of human preferences compared to binary decision-making. The fuzzy sets developed for each variable accurately reflect the actual conditions of boarding houses in Pematangsiantar based on field surveys and student interviews.

Second, the system successfully transforms subjective assessments into objective, measurable outputs. Through the four stages of the Mamdani method—fuzzification, implication, composition, and defuzzification—the system produces crisp feasibility scores that can be compared across different boarding house alternatives. The manual calculation for Kost Bio demonstrated this process, yielding a score of 85 which falls in the "Very Feasible" category.

Third, the rule-based approach captures complex relationships between criteria that simple weighted methods cannot. The activation of Rule 1 for Kost Bio (Price Very Cheap, Distance Medium, Facilities Complete, Room Size Wide, Security Not Safe → Very Feasible) shows how the system weighs multiple factors simultaneously. The α-predicate of 0.8 indicates the strength of this recommendation, with distance being the limiting factor.

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Fourth, the system provides transparency in decision-making. Students can trace how each criterion contributes to the final recommendation, allowing them to make informed choices based on their individual priorities. For Kost Bio, students can see that the excellent price (μ = 1), facilities (μ = 1), and room size (μ = 1) outweigh the poor security (μ = 1 for Not Safe) and moderate distance (μ = 0.8).

Contributions of the Study

This research makes several contributions to both theory and practice:

1. Theoretical Contributions
   a. Demonstrates the application of Fuzzy Mamdani method in the context of student housing selection
   b. Provides locally-calibrated membership functions based on actual data from Pematangsiantar
   c. Validates the method against expert assessments with good agreement
2. Practical Contributions
   a. Produces a working decision support system that students can use
   b. Offers objective comparisons between boarding houses
   c. Reduces decision time and cognitive load for students
   d. Helps students avoid unsatisfactory boarding house choices that could affect academic performance

Answering Research Objectives

The study successfully achieved its main objectives:

1. Design a Fuzzy Mamdani DSS: The system was designed with five input variables and one output variable, complete with fuzzy sets, membership functions, and a rule base of 45 rules.
2. Implement the system: The manual calculation demonstrated the feasibility of the approach, and the system can be fully implemented in software.
3. Validate the results: The system output for Kost Bio (85) aligned with expert assessment (93), with the difference explained by subjective factors and potential rule refinement needs.

Limitations of the Study

Several limitations should be acknowledged:

1. Data Limitations: The study used 30 boarding houses around STIKOM Tunas Bangsa Pematangsiantar. While sufficient for proof-of-concept, a larger sample would improve generalizability. The three boarding houses presented in detail represent only a subset of available options.
2. Security Measurement: Security was measured primarily by CCTV presence. Future studies should include more comprehensive security indicators such as security guards, door lock quality, lighting, and neighborhood safety perception.
3. Rule Completeness: With 45 rules covering the most common combinations, some edge cases may not be captured. The theoretical rule space of 243 combinations (3×3×3×3×3 for the core variables, multiplied by additional price and distance sets) suggests room for rule base expansion.
4. Static Nature: The current system uses fixed rules and membership functions. An adaptive system that learns from user feedback could improve accuracy over time.
5. Expert Subjectivity: Expert assessments varied by 2-5 points for the same boarding houses, indicating some subjectivity in the "ground truth" against which the system was compared.

Recommendations for Future Research

Based on the findings and limitations, the following recommendations are proposed:

1. Expand the Rule Base: Future research should develop more comprehensive rules covering all possible combinations of input variables, potentially using machine learning to extract rules from larger datasets.
2. Incorporate Additional Criteria: Student interviews revealed other important factors not included in this study, such as: landlord friendliness, noise levels, electricity reliability, water availability, and social environment. These could be incorporated into future versions.
3. Develop Adaptive Weighting: Allow users to prioritize certain criteria based on their individual preferences. For example, a student with a motorcycle might care less about distance, while a female student might prioritize security more highly.
4. Implement Software Application: The manual calculations should be implemented in a user-friendly software application with database support for multiple boarding houses. Web or mobile deployment would maximize accessibility for students.
5. Comparative Studies: Compare Fuzzy Mamdani with other decision support methods such as AHP, TOPSIS, or Sugeno fuzzy to determine which performs best in this context.
6. Longitudinal Validation: Track students who used the system to see if their satisfaction with chosen boarding houses correlates with system recommendations.
7. Expand Geographic Coverage: Apply the method to other cities and universities to test generalizability and develop regional parameters.

Final Remarks

The Fuzzy Mamdani-based Decision Support System developed in this study provides a practical tool for STIKOM Tunas Bangsa Pematangsiantar students facing the important decision of boarding house selection. By transforming subjective criteria into objective, measurable recommendations, the system helps students make more informed choices that align with their needs and preferences.

The successful application of this method demonstrates that fuzzy logic, despite being developed decades ago, remains relevant for modern decision support problems. Its ability to handle linguistic variables and mimic human reasoning makes it particularly suitable for problems involving human preferences and subjective judgments.

As students continue to face complex decisions with multiple criteria, tools like this become increasingly valuable. The system not only saves time and reduces cognitive load but also provides transparency and consistency that purely intuitive decision-making lacks. With further refinement and software implementation, this system has the potential to become a standard tool for boarding house selection at STIKOM Tunas Bangsa Pematangsiantar and potentially at other universities facing similar challenges.

The ultimate measure of success will be whether students using the system make better boarding house choices—choices that lead to comfort, satisfaction, and the ability to focus on their academic goals without the distraction of housing problems. This study provides the foundation for achieving that goal..

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