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Web-based decision support system for boarding house selection according to preferences in Kefamenanu (BTN) area using Tsukamoto Fuzzy Logic Method

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Abstract

The problem in searching for boarding houses in the Kefamenanu (BTN) area is the many choices with different variations in price, facilities, distance, and comfort levels, making it difficult for prospective residents to determine a boarding house that suits their personal preferences. This study aims to build a web-based decision-making system that can help users choose a boarding house according to their interests quickly and accurately. The method used is the Tsukamoto Fuzzy Logic method, which is able to accommodate uncertainty and subjectivity in the assessment process of boarding house selection criteria. The system is designed with several fuzzy variables such as price, distance, facilities, and comfort, which are processed through fuzzy rules in the form of IF-THEN to produce the best boarding house recommendations. The novelty of this study lies in the application of the Tsukamoto method in the context of selecting boarding houses in Kefamenanu, which has not previously been widely developed using a fuzzy logic approach. The contribution of this study is to produce a web-based platform that is able to accelerate the process of searching for boarding houses that suit user needs, while increasing accuracy and satisfaction in decision making. The results of the study showed that the system was able to recommend boarding house options with a level of user preference matching reaching 90%, based on the results of trials on 30 respondents in the BTN Kefamenanu area.

Keywords: *Web-Based Application, Fuzzy Logic, Tsukamoto Method, Boarding House Selection, Decision Support System.*

1 INTRODUCTION

The speed and accuracy of information that used to take a very long time can now be accessed much more quickly, including in searching for information such as a boarding house information system [1]. A place to live is a very important necessity in life; generally, a residence or dwelling takes the form of a house, a shelter, or another type of space intended to be inhabited by humans [2].

There are many considerations when choosing a boarding house, such as strategic location—close to a campus, food stalls, boarding facilities, or entertainment venues [3]. A Decision Support System (DSS) is a computer-based system that assists individuals or organizations in making better decisions, especially for complex or difficult problems [4]. Various methods can be used to build a DSS, including Fuzzy Tsukamoto, Simple Additive Weighting (SAW), Weighted Product (WP), Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), ELECTRE, and PROMETHEE [5].

The Tsukamoto method, an extension of monotonic reasoning, is characterized by each IF-THEN rule consequent being represented as a fuzzy set with a monotonic membership function. The Fuzzy Tsukamoto method can provide recommendations in cluster determination. The inference output from each rule is given in a crisp form based on the α-predicate [6]. This method is chosen because of its ability to handle complex and uncertain data [7]. The function of a decision support system is to assist in making well-organized decisions more efficiently through the use of accessible data and analytical models [8]. This led the researcher to develop a program that would facilitate users in choosing temporary housing [9]. Therefore, a Decision Support System is needed to help users select the most suitable boarding house according to their preferences [10].

2 LITERATURE REVIEW

Boarding houses (*kost*) are one of the most popular housing options and are widely sought after by university students, workers, and the general public [11]. Newcomers, particularly those pursuing further studies such as university students, certainly require a place to live—such as a boarding house [12]. The method applied in this study is the Fuzzy Tsukamoto method [13].

a. Increasing Linear Representation

An increasing linear representation is one form of membership function in fuzzy logic. In this representation, the degree of membership (μ(x)) increases linearly from 0 to 1 as the value of *x* increases. It is typically used to describe conditions such as "the greater the better" or "the higher the more preferable."

In general, the membership function is defined as follows:

1. Increasing Linear Representation

In this linear representation, the mapping of input to its degree of membership is illustrated as, Equation (1) increasing linear representation:

$$\mu(x) = \begin{cases} 0, & x \le a \\ \frac{b-a}{x-a} & a < x < b \\ 1, & x \le b \end{cases} \quad (1)$$

2. Decreasing Linear Representation

The decreasing linear representation is a type of membership function in fuzzy logic, where the degree of membership decreases linearly (μ(x)\mu(x)μ(x)) Decreases linearly from 1 to 0 as the value of x increases. It is usually used to describe conditions such as "the smaller" or "the lower". Equation (2), Decreasing linear representation membership function:

$$\mu[x] = \begin{cases} \frac{b-x}{b-a} & a \le x \le b \\ 0 & x \ge b \end{cases} \quad (2)$$

b. Triangular Curve Representation

It is a combination of increasing linear and decreasing linear representations. Membership function, Equation (3), Triangular Curve Representation:

$$\mu[x] = \begin{cases} 0 & x \le a \text{ atau } x \ge c \\ \frac{x-a}{b-a} & a \le x \le b \\ \frac{c-x}{c-b} & b \ge c \end{cases} \quad (3)$$

c. Trapezoidal Curve Representation

The trapezoidal curve has a wider domain than the triangular curve representation. Membership function, as shown in Equation (4):

$$\mu[x] = \begin{cases} 0 & x \le a \text{ atau } x \ge d \\ \frac{x-a}{b-a} & a \le x \le b \\ 1 & b \le x \le c \\ \frac{d-x}{d-c} & c \le x \le d \end{cases} \quad (4)$$

3 RESEARCH METHODOLOGY

The Fuzzy Tsukamoto method is based on the concept of monotonic reasoning, where the crisp value in the consequent region can be directly obtained and the fuzzy sets in the consequent are monotonic in nature [14]. Therefore, to address this issue, a decision support system was developed with the aim of helping the public in selecting a boarding house using the Fuzzy Logic method.

Fuzzy Logic is considered capable of mapping an input into an output without ignoring field-related factors. It is also highly flexible and tolerant of existing data. This method produces a system model that is able to make decisions based on the available variables [15]. The framework of this research is as follows.

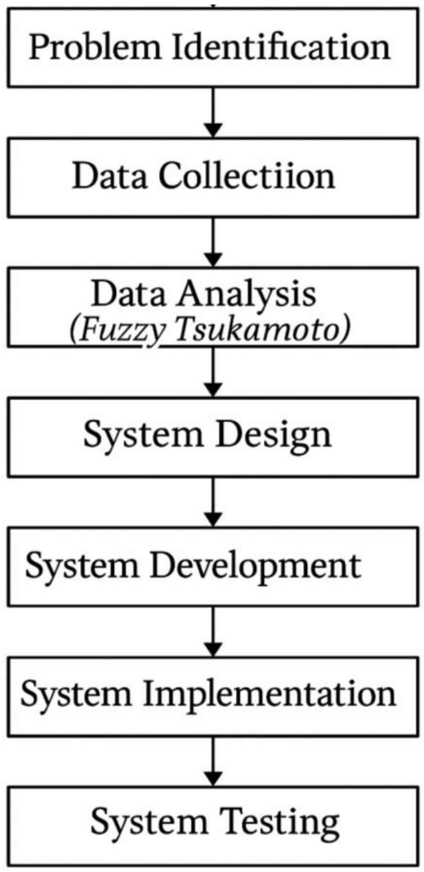

Figure 1. Research Stages

Figure 1, represents the Research Framework. The stages in this framework are as follows:

1. Problem Identification

Gathering information related to the problems in the process of selecting boarding houses (kost) in the Kefamenanu (BTN) area, including factors considered such as price, distance, facilities, security, and comfort.

2. Data Collection

Data is collected through:

a). Observation of boarding house locations in the BTN area.

b). Interviews with prospective tenants and boarding house owners.

c). Literature studies related to decision support systems and the Fuzzy Tsukamoto method.

3. Data Analysis

Determining the functional and non-functional requirements of the system, such as user interface needs, data processing, and output in the form of boarding house recommendations.

4. System Design

a). Fuzzy model design: Defining input variables (e.g., price, distance, facilities) and output (boarding house feasibility recommendation), as well as developing fuzzy sets and rule base.

b). Database design: Structuring the database to store boarding house data.

c). Web interface design: Creating mockups of the web-based application interface.

5. System Development

In this stage, the researcher has carried out system development or the coding process to build the system. The system is developed using PHP programming language with native PHP framework and MySQL as the database.

6. System Implementation

The system is developed using web programming languages (PHP/HTML/CSS/JavaScript) with a MySQL database. Fuzzy inference is carried out using the Tsukamoto method.

7. System Testing

The testing phase is conducted to compare the output results of the designed application system with the manual calculations using the Tsukamoto fuzzy logic method.

4 RESULTS AND DISCUSSION

a. System Modeling

In the system modeling process for developing a web-based decision support system to select boarding houses (kost) based on user preferences in the Kefamenanu (BTN) area using the Tsukamoto fuzzy logic method, UML modeling is applied, namely the Use Case Diagram and Activity Diagram.

The system's Use Case Diagram can be seen in Figure 2.

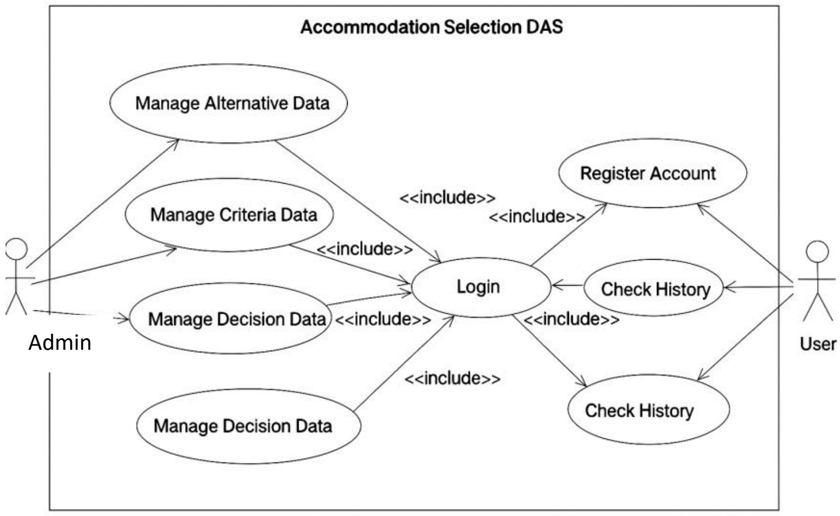

Figure 2. Use Case Diagram of the Boarding House Selection Decision Support System

b. Implementation of the Fuzzy Tsukamoto Method

The implementation of the Fuzzy Tsukamoto method in the decision support system for boarding house selection involves several main stages: fuzzification, rule formation, inference, and defuzzification. Several criteria used in the decision-making process are presented in table 1.

Table 1. Decision-making process criteria

Criteria	Sub-Criteria	Domain	Variable
Price	Cheap	Rp. 200,000 – Rp. 300,000	Input
	Expensive	Rp. 400,000 – Rp. 500,000	
Distance	Near	100 m – 200 m	
	Far	200 m – 500 m	
Facilities (6 facilities)	Incomplete	1 – 3 facilities	
	Complete	3 – 6 facilities	
Cleanliness	No	1 – 50 (%)	
	Yes	50 – 100 (%)	
Comfort	No	1 – 50 (%)	
	Yes	50 – 100 (%)	
Interest	Less Aligned	1 – 50 (%)	Output
	Matches Interest	50 – 100 (%)	

1). Price Criterion

In the price criterion, there are two membership functions: **cheap** (Rp 200,000 – Rp 300,000) and **expensive** (Rp 400,000 – Rp 500,000).

$$\text{Cheap (x)} = \begin{cases} 1 & \text{if } x < Rp\ 200{,}000 \\ \frac{300-x}{300-200} & \text{if Rp } 200{,}000 < x < Rp\ 300{,}000 \\ 0 & \text{if } x > Rp\ 300{,}000 \end{cases}$$

$$\text{Expensive (x)} = \begin{cases} 0 & \text{if x} < Rp\ 400{,}000 \\ \frac{x-400}{500-400} & \text{if Rp } 400{,}000 < x < Rp\ 500{,}000 \\ 1 & \text{jika } x > Rp\ 500{,}000 \end{cases}$$

2). Distance Criterion

$$\text{Near (x)} = \begin{cases} 1 & \text{if x} < 100\ m \\ \frac{100-x}{200-100} & \text{if 100 m} < x < 200\ m \\ 0 & \text{if } x > 200\ m \end{cases}$$

$$\text{Far (x)} = \begin{cases} 0 & \text{if x} < 200m \\ \frac{x-200}{500-200} & \text{if 200m} < x < 500m \\ 1 & \text{if } x > 500m \end{cases}$$

3). Facilities Criterion

$$\text{Incomplete (x)} = \begin{cases} 1 & \text{if x} < 1\ facility \\ \frac{3-x}{3-1} & \text{if 1 facility} < x < 3\ facility \\ 0 & \text{if } x > 3\ f\text{acility} \end{cases}$$

$$\text{Complete (x)} = \begin{cases} 0 & \text{if x} < 3\ facility \\ \frac{x-3}{6-3} & \text{if } 3\ facility < x < 6\ facility \\ 1 & if\ x > 7\ facility \end{cases}$$

4). Cleanliness Criterion

$$\text{Dirty (x)} = \begin{cases} 1 & \text{if x} < 1\ \% \\ \frac{1-x}{50-1} & \text{if } 1\ \% < x < 50\ \% \\ 0 & if\ x > 50\ \% \end{cases}$$

$$\text{Clean (x)} = \begin{cases} 0 & \text{if x} < 50\ \% \\ \frac{x-50}{100-50} & \text{if } 50\ \% < x < 100\ \% \\ 1 & if\ x > 100\ \% \end{cases}$$

5). Comfort Criterion

$$\text{Uncomfortable (x)} = \begin{cases} 1 & \text{if x} < 1\ \% \\ \frac{1-x}{50-1} & \text{if } 1\ \% < x < 50\ \% \\ 0 & if\ x > 50\ \% \end{cases}$$

$$\text{Comfortable (x)} = \begin{cases} 0 & \text{if x} < 50\ \% \\ \frac{x-50}{100-50} & \text{if } 50\ \% < x < 100\ \% \\ 1 & if\ x > 100\ \% \end{cases}$$

Case Example Rudi is looking for a boarding house that suits his needs. He finds *Kost Melati*, which costs Rp250,000 per month, includes 4 facilities, is located 260 meters from the campus, has a cleanliness level of 65%, and a comfort level of 60%. Based on these criteria, Rudi wants to evaluate how well *Kost Melati* meets his preferences.

The user's role in this system is as follows,

a). The main subject in the decision-making process
b). The provider of preference inputs that are converted into fuzzy values
c). The beneficiary of the decision based on fuzzy logic
d). The evaluator of the system's quality and accuracy, as shown in table 2 below.

Table 2. Nilai User

Nilai User	
Criteria	Score
Price	250
Distance	260
Facilities	4
Cleanliness	65
Comfort	70

c. Purpose of Fuzzification in This System

1. To translate the user's input values (numerical) into linguistic terms that can be processed by fuzzy rules.
2. To provide a foundation for the Tsukamoto fuzzy logic inference process.
3. To offer flexibility in evaluating uncertain or subjective values (e.g., “affordable price”), table 3.

Table 3. Fuzzification

Fuzzification		
Criteria	Sub-criteria	Fuzzification value
Price	Cheap	0.5
	Expensive	0
Distance	Near	0
	Far	0.2
Facilities	Complete	0.333333333
	Incomplete	0
Cleanliness	Clean	0.3
	Dirty (Not Clean)	0
Comfort	Uncomfortable	0
	Comfortable	0.4

6). Tsukamoto Inference Stages

1. Rule Formation (Rule Base)

The system constructs rules in the following format: *IF (A1 = x) AND (A2 = y) THEN (Z = z)*

Example in a boarding house system:

a). **IF** Price = Cheap **AND** Distance = Near **THEN** Feasibility = High

b). **IF** Price = Expensive **AND** Facilities = Complete **THEN** Feasibility = Medium

2. Calculation of Degree of Truth (α - alpha)

For each rule, the minimum membership value from the premises is calculated (*AND* operator → take the lowest value).

Example:

a). Membership degree of “Cheap” price = 0.7

b). Membership degree of “Near” distance = 0.5 → Therefore, α = min (0.7, 0.5) = **0.5**

3. Calculate Crisp Output from Each Rule (z)

Since the Tsukamoto method uses monotonic membership functions, each α value can be mapped to a crisp output using the inverse function of the output membership (e.g., a linear increasing or decreasing function).

Example: If α = 0.5, and the membership function for “High” is a linear increase from 60 to 100, then: z = 60 + (0.5 × (100 - 60)) = 80

4. Aggregation (Final Calculation)

The final output is calculated using the weighted average method, Equation (5) :

$$Z = \frac{\sum(\alpha_i \text{ x } z_i)}{\sum \alpha_i} \qquad (5)$$

Example:

a). Rule 1: $\alpha_1 = 0.5$, $z_1 = 80$

b). Rule 2: $\alpha_2 = 0.4$, $z_2 = 60$

$$Z = \frac{(0.5 \text{ x } 80 \ + \ 0.4 \text{ x } 60\ )}{0.5 + 0.4} = \frac{40 + 24}{0.9} = 71.11$$

7). System Implementation

This section describes the implementation of the developed system, which is a decision support system for selecting boarding houses (kost) in the BTN area based on user preferences. The system implementation showcases the features or menus available in the developed application. These menus are as follows:

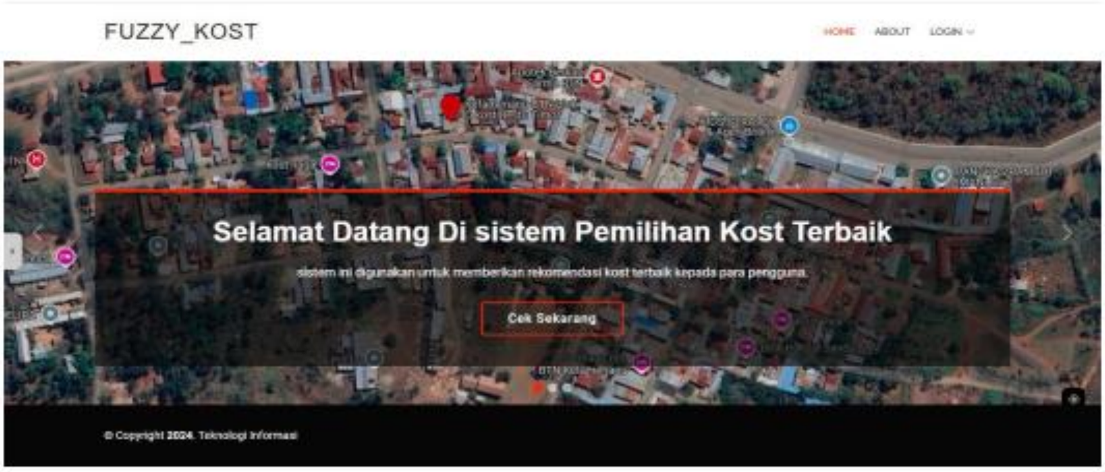

Figure 3. Main Page Display

a. Main Page

This is the first page displayed when users access the system. On this page, several menus are available for users to view or access, whether they are admin users or general users (students). The main page display is shown in Figure 3 above.

b. About Page

Figure 4. About Page

This page explains the system, including the purpose of the boarding house selection application, the important factors involved in selecting a boarding house, and the method used to assist in the decision-making process. The *About* page display is shown in Figure 4 above.

c. Login Page

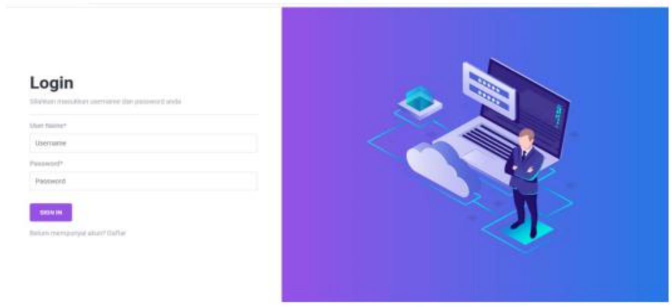

Figure 5. Login Page

This is the login page designed for use by different types of users, including students (users) and administrators (admins). The login page display is shown in Figure 5 above.

d. Account Registration Page

Figure 6. Registration Page

This is the account registration page intended for users who do not yet have an account. The registration page display is shown in Figure 6 above.

e. User Page

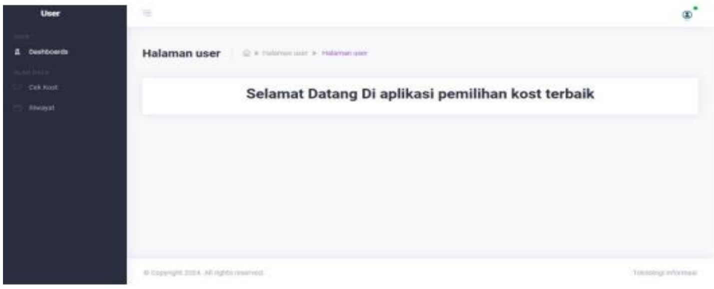

Figure 7. Dashboard Page

This is the first page displayed after the user successfully logs into the system. The dashboard page display is shown in Figure 7 above.

f. Boarding House Check Page

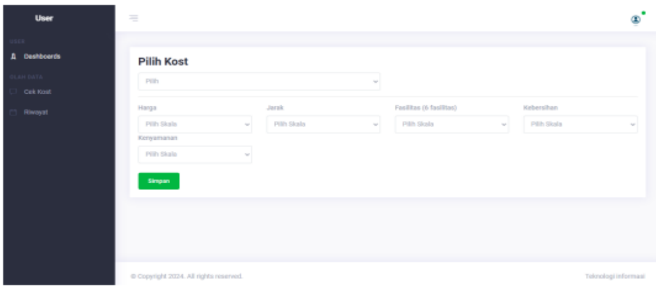

Figure 8. Boarding House Check Page

This page is part of the user section and functions to help users search for boarding houses that match their preferences or specified criteria. The *Boarding House Check* page display is shown in figure 8 above.

5 CONCLUSION

The conclusions of this study are as follows

1. **Decision Support System**: This research successfully developed a web-based decision support system for selecting boarding houses in the Kefamenanu area by utilizing information technology. The system is designed to assist users in finding boarding houses that match their interests and needs through an intuitive interface.
2. **Criteria-Based Approach**: The system adopts a criteria-based approach that includes factors such as price, location, facilities, and environmental conditions. These criteria are input by users and processed to generate suitable boarding house recommendations.
3. **Tsukamoto Fuzzy Logic Method**: The Tsukamoto fuzzy logic method is used to handle uncertainty in the evaluation of various criteria. The process begins with fuzzification,

followed by the application of fuzzy rules, and ends with defuzzification to produce the final recommendation score.

4. **Recommendation Results**: The system successfully provides boarding house recommendations based on the highest score that aligns with user preferences, demonstrating consistent results with the expected specifications.
5. **Suggestions for Future Research**: This study suggests the use of other methods for comparison in recommendation accuracy and the development of a more attractive and Android-based interface to enhance user accessibility.

Thus, this research makes a significant contribution to the development of information systems for selecting boarding houses that meet user needs.

REFERENCES

[1] D. Yusma, N. Merlina, and N. Nurajijah, "Web-Based Boarding House Search Information System," *INTI Nusa Mandiri*, vol. 15, no. 2, pp. 127–134, 2021, doi: 10.33480/inti.v15i2.1702. https://doi.org/10.33480/inti.v15i2.1702

[2] T. Adriantama and Y. Brianorman, "Decision Support System in Selection of Student Stays (Kost) With Simple Additive Weighting (Saw) Method," *J. Digit. Teknol. Inf.*, vol. 4, no. 1, pp. 1–7, 2021. https://doi.org/10.32502/digital.v4i1.2645

[3] K. K. Rekayasa *et al.*, "Web-Based Decision Support System for Predicting Boarding House Prices for IT Telkom Purwokerto Students Using the Fuzzy Tsukamoto Method," *Data Inst. Teknol. Telkom Purwokerto*, vol. 1, no. 2, pp. 77–81, 2021, [Online]. Available: http://journal.ittelkom-pwt.ac.id/index.php/dinda https://doi.org/10.20895/dinda.v1i2.202

[4] Y. P. K. Kelen *et al.*, "Decision support system for the selection of new prospective students using the simple additive weighted (SAW) method," *AIP Conf. Proc.*, vol. 2798, no. 1, 2023, doi: 10.1063/5.0154676. https://doi.org/10.1063/5.0154676

[5] A. Firdonsyah, B. Warsito, and A. Wibowo, "Comparative Analysis of SAW and TOPSIS on Best Employee Decision Support System," *SinkrOn*, vol. 7, no. 3, pp. 1067–1077, 2022, doi: 10.33395/sinkron.v7i3.11475. https://doi.org/10.33395/sinkron.v7i3.11475

[6] S. Fadli, M. Ashari, and S. Saikin, "Decision Support System for Determining Poor Families Using the Fuzzy Tsukamoto Method," *J. Inf. Syst. Res.*, vol. 4, no. 1, pp. 300–308, 2022, doi: 10.47065/josh.v4i1.2305. https://doi.org/10.47065/josh.v4i1.2305

[7] S. Agius, C. Magri, and V. Cassar, "A Cognitive Task Analysis for Developing a Clinical Decision Support System for Emergency Triage," J. Emerg. Nurs., 2025, doi: https://doi.org/10.1016/j.jen.2025.05.013

[8] I. A. Mitrofani, D. M. Emiris, and D. E. Koulouriotis, "An Industrial Maintenance Decision Support System based on Fuzzy Inference to Optimize Scope Definition," Procedia Manuf., vol. 51, pp. 1538-1543, 2020, doi: https://doi.org/10.1016/j.promfg.2020.10.214

[9] Suharjito, Diana, Yulyanto, and A. Nugroho, "Mobile Expert System Using Fuzzy Tsukamoto for Diagnosing Cattle Disease," Procedia Comput. Sci., vol. 116, pp. 27-36, 2017, doi:https://doi.org/10.1016/j.procs.2017.10.005

[10] P. Zandi, M. Ajalli, and N. S. Ekhtiyati, "An extended simple additive weighting decision support system with application in the food industry," Decis. Anal. J., vol. 14, p. 100553, 2025, doi: https://doi.org/10.1016/j.dajour.2025.100553

[11] O. U. Araz, E. Kemiklioglu, and B. Gurboga, "Modeling of the lyotropic cholesteric liquid crystal based toxic gas sensor using adaptive neuro-fuzzy inference systems," Expert Syst. Appl., vol. 240, p. 122326, 2024, doi: https://doi.org/10.1016/j.eswa.2023.122326

[12] M. K. Sharma, N. Dhiman, A. Sharma, and T. Kumar, "IoMT Tsukamoto Type-2 fuzzy expert system for tuberculosis and Alzheimer's disease," Clin. eHealth, vol. 7, pp. 77-91, 2024, doi: https://doi.org/10.1016/j.ceh.2024.05.002. https://doi.org/10.1016/j.ceh.2024.05.002

[13] A. Letsoin and A. S. Purnomo, "Development of a Decision Support System To Determine Used Motorcycle Prices Using the Web-Based Fuzzy Tsukamoto Method," *IJIS Indones.*

J. Inf. Syst., vol. 9, no. April 2024, pp. 60–72. https://doi.org/10.36549/ijis.v9i1.311
[14] J. Hutahaean and J. Hutagalung, "Decision Support System for Selecting the Best Technician Using the Fuzzy Tsukamoto Method," *JURIKOM (Jurnal Ris. Komputer)*, vol. 9, no. 4, p. 846, 2022, doi: 10.30865/jurikom.v9i4.4519. https://doi.org/10.30865/jurikom.v9i4.4519
[15] J. Khan et al., "Optimizing alpha-beta filter for enhanced predictions accuracy in industrial applications using Mamdani fuzzy inference system," Alexandria Eng. J., vol. 119, pp. 598-608, 2025, doi: https://doi.org/10.1016/j.aej.2025.01.116. https://doi.org/10.1016/j.aej.2025.01.116