ISSN: 2581-1274

Application to Determine Toddler Nutritional Status Using a Web-Based Fuzzy Mamdani Method

Khoirunnisya [a,1,*], Nurhasanah [a,2], Kevin Novebrianto [a,3]

[a] *University of Pamulang, Jl. Raya Puspitek, South Tangerang 15310, Indonesia*
[1]*dosen02386@unpam.ac.id*;* [2] *dosen01123@unpam.ac.id;* [3] *kevinnovebrianto212@gmail.com*
** corresponding author*

ARTICLE INFO

Article history:
Published
June 9, 2025

Keywords:
Expert System
Nutritional Status
Toddlers
Application
Fuzzy Mamdani Method

ABSTRACT

The nutritional status of toddlers is vital for assessing their health and growth, but it involves many interrelated variables, making it complex to determine. The Fuzzy Mamdani method, developed by Prof. H.J. Zimmermann in the 1970s, uses fuzzy logic to handle concepts like "a little," "enough," or "a lot," which are more intuitive than binary values. This method can be effectively implemented in a web-based application to accurately determine toddlers' nutritional status. Such an application supports medical personnel by providing efficient and accurate assessments, facilitating appropriate care and interventions.

I. Introduction

The nutritional status of toddlers is crucial for assessing their health and growth, yet it is complex due to numerous interconnected variables. The Fuzzy Mamdani method, developed by Prof. H.J. Zimmermann in the 1970s, uses fuzzy logic with terms like "a little," "enough," or "a lot," enhancing human understanding beyond binary values (0 or 1).

Implementing the Fuzzy Mamdani Method in a web-based application for toddlers' nutritional status offers several benefits. It allows for quick and accurate evaluations using input data such as weight, height, and age. The web interface ensures accessibility from any internet-connected device. This study will deploy an application that processes input data on toddlers' characteristics using fuzzy logic rules from nutrition experts, presenting results through a user-friendly interface.

The application aims to assist medical personnel and parents in obtaining timely and accessible information on toddlers' nutritional status. Its web-based approach ensures convenient access anytime, anywhere.

II. The Proposed Method/Algorithm

The Fuzzy Mamdani method is a data processing technique rooted in the principles of fairness in Islam. It addresses uncertainty and ambiguity in data by considering diverse information and assigning appropriate weights to each criterion or variable. The method determines the membership value of a variable in a specific fuzzy set using a membership function.

$$\mu_{\text{Low}}[Height] \begin{cases} \frac{500-x}{500-250}, & for\ 250 < x < 500 \\ 1, & for\ 10 \le x \le 250 \end{cases}$$

$$\mu_{\text{Medium}}[Height] \begin{cases} 0, & for\ x \le 250 \\ \frac{x-250}{500-250}, & for\ 250 \le x \le 500 \\ \frac{750-x}{750-500}, & for\ 500 \le x \le 750 \\ 0, & for\ x \ge 750 \end{cases}$$

$$\mu_{\text{High}}[Height] \begin{cases} 0, & for\ x \le 500 \\ \frac{x-500}{750-500}, & for\ 500 \le x \le 750 \end{cases}$$

Fig. 1. Fuzzy Mamdani Formula

The Fuzzy Mamdani method offers several advantages, including its adherence to fairness principles for equitable decisions and its ability to handle uncertain data through fuzzy relationships. Its flexibility supports complex decision-making across diverse fields, enhancing accuracy. However, drawbacks include subjective variable and rule determination, complexity in implementation, and potentially time-consuming computation due to parameter sensitivity, requiring rigorous testing and evaluation.

III. Method

A. System Analysis

This application aims to assist in determining the nutritional status of toddlers using the Fuzzy Mamdani method. Users will input data such as age, weight, height, and gender of the toddler. The application will then calculate the nutritional index of the toddler using the Fuzzy Mamdani method and provide the nutritional status. The Fuzzy Mamdani method offers advantages in handling uncertainty in toddler nutrition data by utilizing fuzzy sets and fuzzy logic rules.

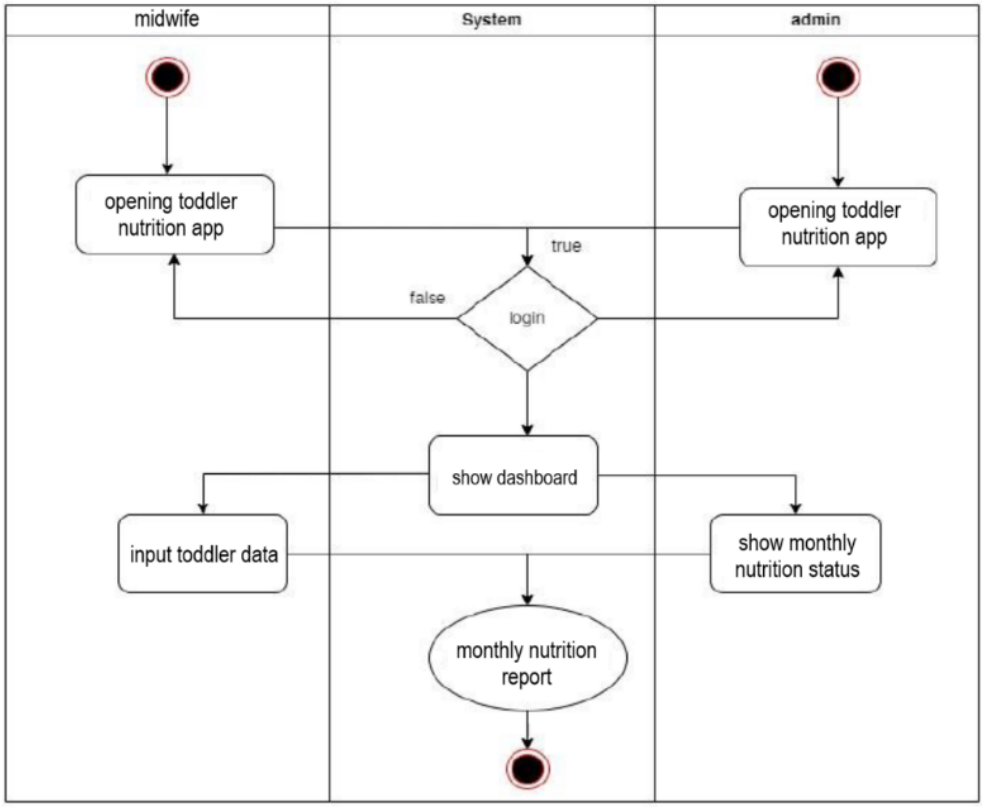

Fig. 2. Analysis of The Proposed Method

B. Unified Modelling Language (UML)

Unified Modeling Language (UML) is a graphical modeling language used to document, design, and communicate software designs.

a) Use Case Diagram

The Use Case Diagram depicts the flow of actions for users and administrators in performing their respective roles, such as accessing and determining the nutritional status of toddlers using the Fuzzy Mamdani method.

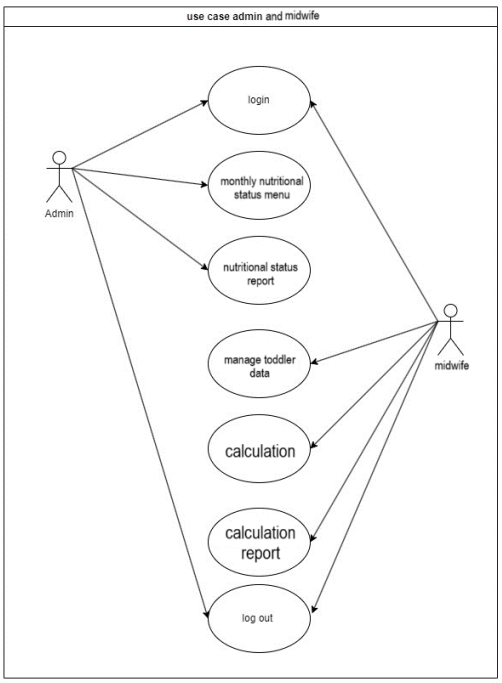

Fig. 3. Use Case Diagram “Admin” And “Midwife”

Description: This section involves admin users and Midwife who have different access levels to each menu in the application.

b) Sequence Diagram

A Sequence Diagram in UML depicts object interactions sequentially within a system. It shows how messages or method calls flow between objects during scenario execution.

- Sequence Diagram “Admin Login.”

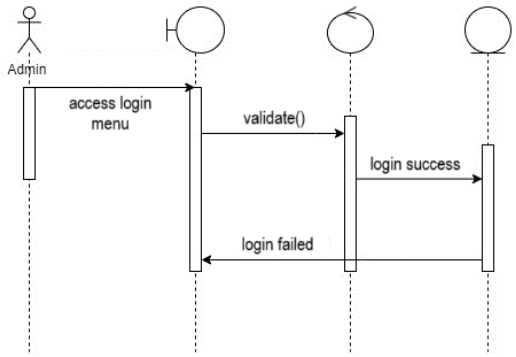

Fig. 4. Sequence Diagram "Admin Login"

Description: Admin logging into the expert system information system.

- Sequence Diagram “Midwife Login.”

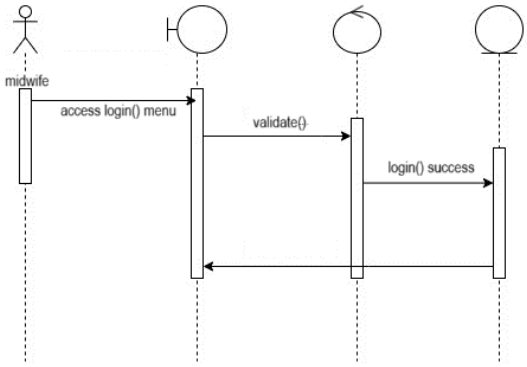

Fig. 5. Sequence Diagram "Midwife Login"

Description: Midwife logging into the expert system information system.

- Sequence Diagram “Admin Monthly Nutritional Status.”

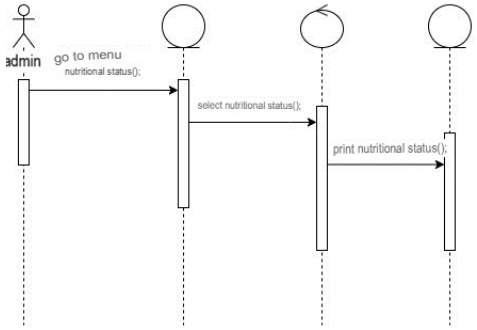

Fig. 6. Sequence Diagram "Monthly Nutritional Status"

Description: Admin inputting and printing monthly nutritional status of toddlers.

- Sequence Diagram “Midwife Monthly Nutritional Status”

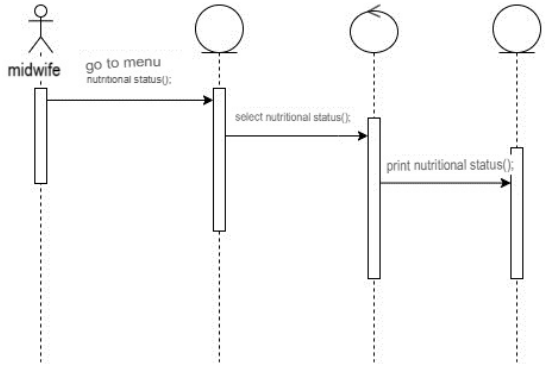

Fig. 7. Sequence Diagram " Midwife Monthly Nutritional Status"

Description: Midwife checking nutritional status of toddlers.

- Sequence Diagram “Midwife Manages Toddler Data.”

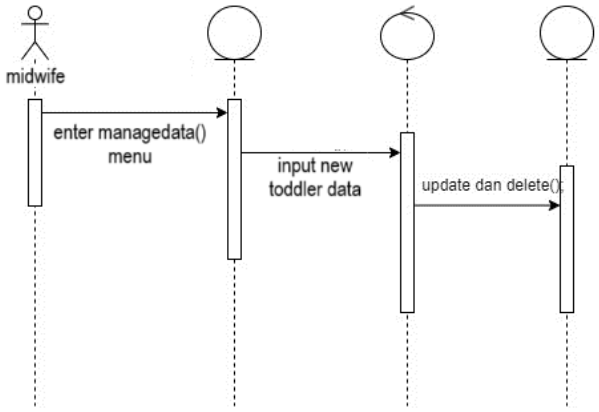

Fig. 8. Sequence Diagram " Midwife Manages Toddler Data "

Description: Midwife managing nutritional data of toddlers.

- Sequence Diagram “Midwife Calculates Monthly Nutritional Status”

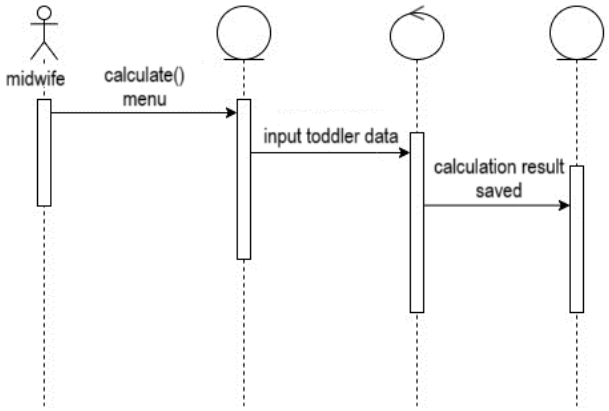

Fig. 9. Sequence Diagram " Midwife Calculates Monthly Nutritional Status"

Description: Midwife calculating monthly nutritional data of toddlers.

- Sequence Diagram “Admin Log Out”

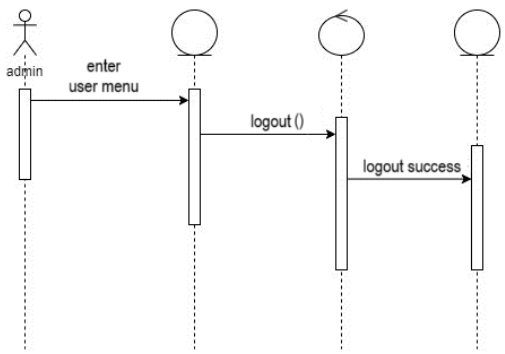

Fig. 10. Sequence Diagram "Admin Logs Out"

Description: Admin logging out of the toddler nutrition information system.

c) Class Diagram

A Class Diagram is a type of diagram that illustrates the flow of the activity diagram describing the process of determining the nutritional status of toddlers using the Fuzzy Mamdani method. Below is the proposed visual representation of the class diagram:

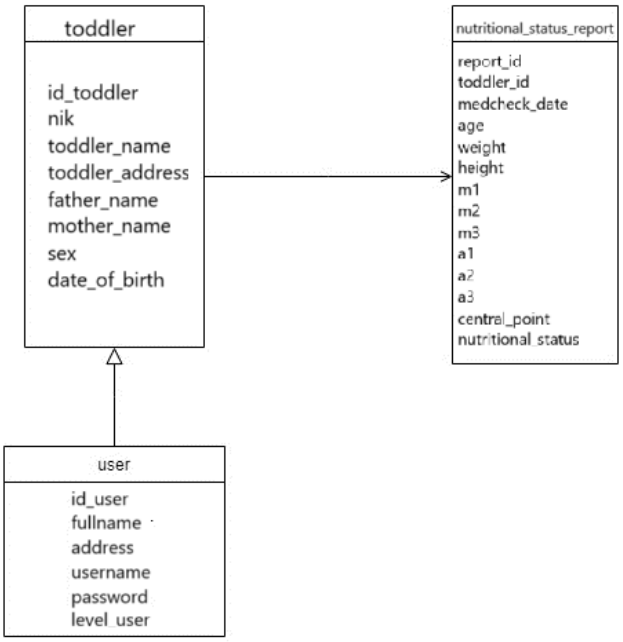

Fig. 11. Class Diagram

IV. Results and Discussion

A. Implementation

Implementation refers to the phase where the design specifications of a software system are translated into a working and operational software product. It involves writing code, configuring systems, integrating components, and performing necessary testing to ensure that the software behaves as intended. Implementation typically follows the design phase and precedes testing and deployment.

1) Database Implementation

a) Table "user"

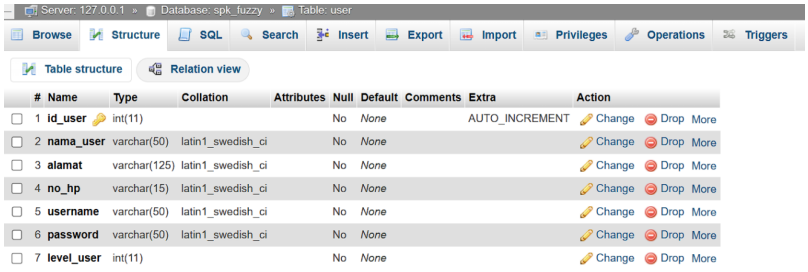

Fig. 12. Table "user"

Description: This is the display of the user table, which includes admin and Midwife.

b) Table "balita"

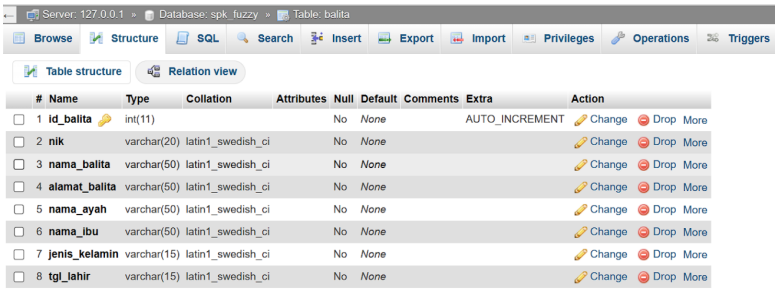

Fig. 13. Table "balita"

Description: This is the display of the toddler table.

c) Table "lap_status_gizi"

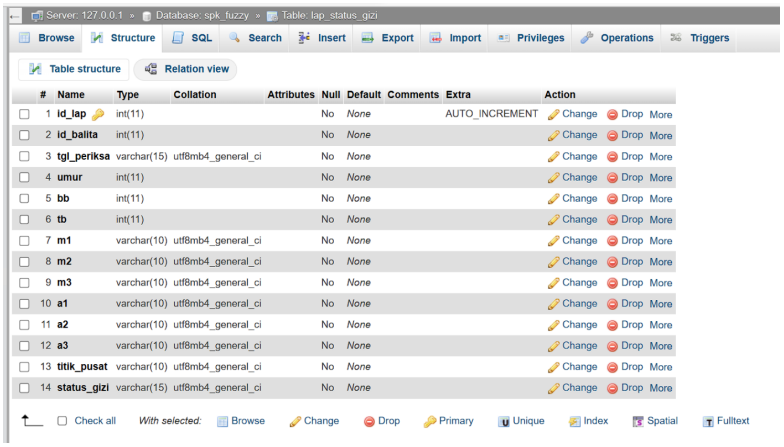

Fig. 14. Table "lap_status_gizi"

Description: This is the display of the toddler nutritional status report table.

2) User Interface Implementation

a) Login Page

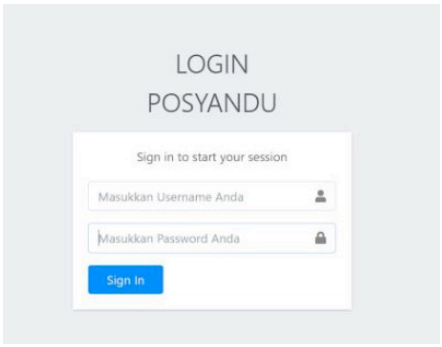

Fig. 15. Login Page

Description: Login display on the nutritional status expert system.

b) Midwife *Dashboard Page*

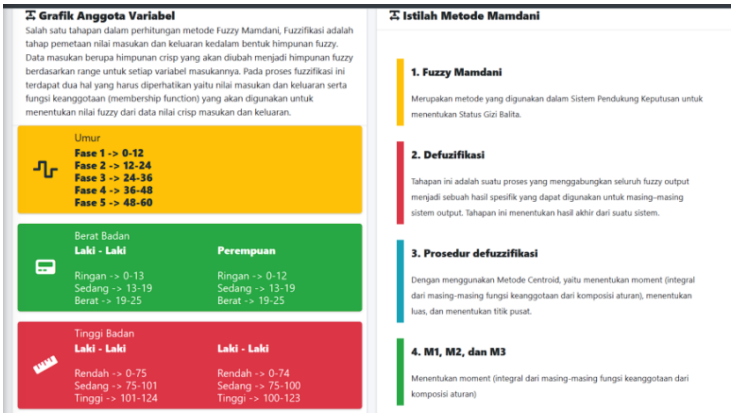

Fig. 16. Midwife Dashboard Statistic Page

Description: On the admin dashboard display, administrators can view data input by midwives during data collection.

c) Toddler Data Management Page

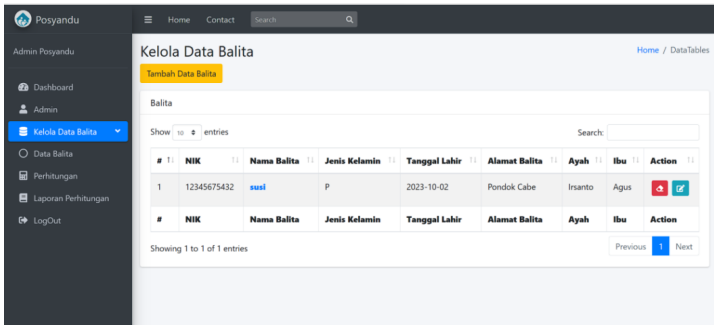

Fig. 17. Toddler Data Management Page

Description: This table will display nutritional status input by midwives.

d) Nutrition Calculation Page

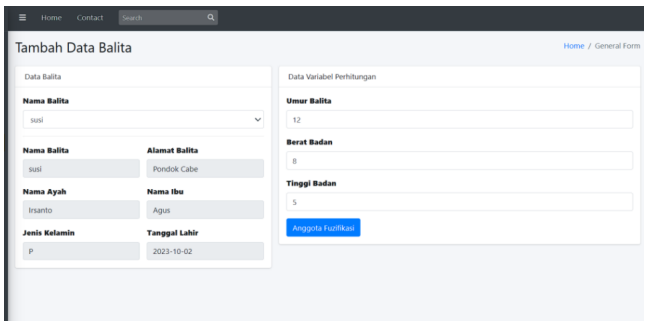

Fig. 18. Nutrition Calculation Page

Description: This table will input data on toddlers to be calculated by the system.

e) Nutrition Calculation Report

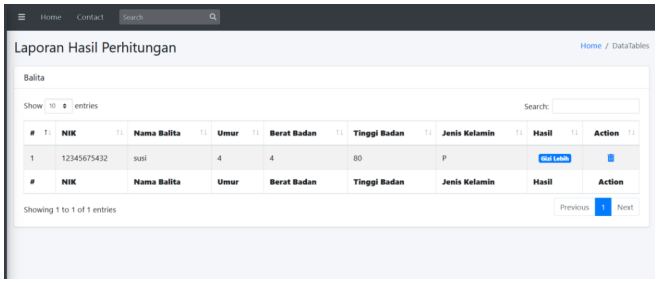

Fig. 19. Calculation Results Report Page

Description: This table will display the report of previously calculated data.

f) Monthly Nutritional Status Report Page

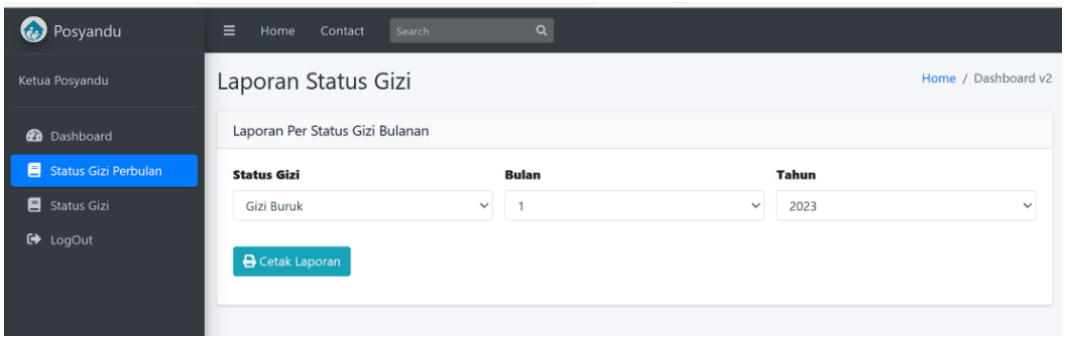

Fig. 20. Monthly Nutritional Status Report Page

Description: This table will display monthly nutritional status report.

B. *Testing*

Black box testing focuses on the functional aspects of the system, ensuring it meets user requirements by evaluating integrated components. It assesses system correctness based solely on outputs from specified inputs, without examining internal processes. This testing verifies alignment with specified functions.

Table 1. Blackbox Testing

Case and Test Result			
Input	***Applied Actions***	***Observed Results***	***Conclusion***
Registered Email and password as user Email: admin Password: admin	System login to access admin dashboard page	Displaying dashboard page with Admin priveleges	Success
Click the user data edit button	Enter user name, address, phone number, username, password, and user level	All entered admin data is successful	Success
Click add toddler data	Enter NIK, child's name, gender, child's address, father's name, mother's name, and date of birth	All toddler data input successfully saved	Success
Click the user data edit button	Enter user name, address, phone number, username, password, and user level	All entered admin data is successful	Success

Case and Test Result			
Input	***Applied Actions***	***Observed Results***	***Conclusion***
Click the "cetak laporan" button		Data printed successfully	Success

Based on testing results, the toddler nutritional status information system performs successfully across all evaluated aspects. It operates efficiently, meeting requirements with reliable and accurate outputs.

V. Conclusion

Based on implementation and testing, the toddler nutritional status system simplifies recording at health posts (Posyandu) with user-friendly features. Implementing the Fuzzy Mamdani method enhances efficiency in recording and generating reports on toddler nutritional statuses for parents, Midwife, and health post leaders.

References

[1] R. Maulana, Z. Panjaitan, and A. Alhafis, "Penerapan metode naive bayes untuk mendiagnosa," Sistem Informasi TGD, 2022, pp. 425-438.

[2] H. Andrianof, "Sistem pakar stunting pada balita menggunakan metode," Sains Informatika Terapan (JSIT), 2022, pp. 115-119.

[3] D. Simanjuntak and A. Sindar, "Sistem pakar deteksi gizi buruk balita," Jurnal Inkofar, 2019, pp. 54-60.

[4] E. D. S. Mulyani and I. N. Restianie, "Aplikasi sistem pakar untuk mendiagnosa penyakit," STMIK AMIKOM Yogyakarta, 2016, pp. 43-48.

[5] Hanafi, Ramadhan, and Suharto, "Implementasi sistem pakar diagnosa penyakit anak menggunakan metode fuzzy mamdani berbasis web," Jurnal Informatika Dan Sistem Informasi, 2018, pp. 1-7.

[6] Hidayat, Setiawan, and Arifin, "Expert system for diagnosing child diseases using naive bayes method," Conference Series, 2020, pp. 45-55.

[7] Nurhasanah and Nurhadi, "Expert system for diagnosing children's diseases using fuzzy mamdani method," Conference Series, 2019, pp. 53-67.

[8] S. Alam and G. W. Nurcahyo, "Sistem pakar dalam mendiagnosis gizi buruk pada balita dengan," Sistim Informasi dan Teknologi, 2022, pp. 143-148.

[9] Utami and Rahmawati, "Sistem pakar diagnosa penyakit balita berbasis web menggunakan metode naive bayes," Jurnal Teknnik Informatika Dan Sistem Informasi, 2019, pp. 1-8.

[10] P. Utomo, "Perancangan sistem informasi akademik berbasis web di SMP PGRI 174 Cikupa," Jurnal SISFOTEK GLOBAL, vol. 8, no. 1, 2018, pp. 63-68.

[11] R. Firliana, "Aplikasi sistem informasi absensi mahasiswa dan dosen," DoubleClick: Journal of Computer and Information Technology, 2019.

[12] N. Septiarina, "Perancangan sistem informasi penerimaan siswa baru berbasis web pada SMK Bandara," PROSISKO: Jurnal Pengembangan Riset dan Observasi Sistem Komputer, vol. 8, no. 1, 2021, pp. 60-67.