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UTILIZATION OF WEBSITE-BASED TECHNOLOGY FOR ANALYSIS AND PREVENTION OF STUNTING USING THE FUZZY TSUKAMOTO METHODS

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ABSTRACT

Stunting is a chronic malnutrition condition that has significant impact on inhibiting the growth of a child both physically and intellectually. The study aims toto analyze stunts using a web-based technology system using Tsukamoto's Fuzzy method. This method was chosen for its ability to deal with the uncertainty and variability medical data. The system integrates various variables that affect stunts, such as nutritional intake and physical growth, to produce a more accurate diagnosis. The research was carried out by collecting data from various health sources and applying the fuzzy Tsukamoto method to process the data. The trial subjects in this developmental study were 30 children aged 1–60 months, or 0–5 years. Subjects were selected by random sampling, consisting of 6 children from 1–5 years of age each. Based on the results of the analysis, it appears that the fuzzy Tsukamoto-based system development trial can provide a better prediction of the risk of stunting in children compared to conventional methods. Using this approach, it is expected to help health workers take more accurate steps in the treatment and prevention of stunts.

Keywords: *Stunting, Fuzzy Tsukamoto Method, Nutritional Analyisis, Technology Systems, Child Health*.

INTRODUCTION

Stunting is a public health problem that remains a serious concern, especially in developing countries such as Indonesia. Stunting is a condition that inhibits the growth and development of children due to poor nutrition and poor quality of care during their growth [1]. In addition to having physical growth disorders, children suffering from stunting will be more likely to get diseases and to have barriers in brain development that will result in intellectual decline, which in the long term will affect their productivity as adults [2]. However, there are a number of other factors that contribute to the occurrence of stunting, such as the lack of nutrients received by children during pregnancy and adolescence, restricted access to health services that provide special care for pregnant mothers, and a lack of knowledge among mothers about the nutritional needs of children during their growth.

According to the Indonesian Nutrition Survey report of the Ministry of Health, in 2019, the percentage of restraints in the country reached 27.7%, which is a figure well above the standard that the World Health Organization (WHO) determines regarding the prevalence of stunting, which should be less than 20%. Although there has been a fairly significant decline to 21.6% by 2022, the results of the report on the survey carried out describe a situation where the rate of distribution or prevalence of stunting in Indonesia is still quite wide. [6][7]. The government itself has taken many initiatives to prevent stunting, including enforcing national strategies to accelerate stunting prevention, coordinating between centers, districts, and villages, ensuring the availability of food and nutrition, and supplementing foods containing animal proteins to monitor and evaluate programs directly. Preventing the spread of this stunting is a shared responsibility that requires the collaboration of many parties in its work. However, there are some challenges in efforts to prevent it, such as how access to information is delivered to the areas, disturbances in communication routes, and the diverse characteristics of communities or populations in each region affecting the implementation of the program [8] [9] [10].

Nowadays, advances in information and communication technology have opened up new opportunities in efforts to overcome stunting. Previous research designed a website-based stunting early detection system [11, 12]. Based on the study, the researchers aim to develop a system for recording the child's health processes so that it is easier for mothers to identify food shortages that need to be filled for their children. One interesting approach is the use of technology based on fuzzy inference systems. This technology enables measurable analysis based on circumstances affecting stunts as well as giving more accurate recommendations for prevention and deterrence, and it can be used as a material for stunting education.

LITERATURE REVIEW

Stunting is a condition in which a child experiences an impediment in growth and development due to malnutrition, frequent exposure to infections, and a lack of adequate stimulation. Stunting not only affects physical growth but also affects the cognitive development and long-term health of the child [13].

In general, a system is a set of objects, elements, or parts that have different meanings but are interrelated, cooperating, and influencing each other. All of these elements are bound to the same plan or purpose for a specific goal in a complex environment.

A website is a collection of pages that provide information in digital form. This information can be text, picture, audio, video, animation, or a combination of all. Generally, websites can be accessed by anyone around the world as long as they have an internet connection. A website consists of three main components that complement each other, namely words, images, and code [15].

Analysis is a way to investigate and solve complex problems by dividing them into more comprehensible sections. By conducting analysis, we can reveal patterns, correlations, and the meaning of the data or information being reviewed [16].

The Fuzzy Tsukamoto method is one of the approaches in the fuzzy logic system used to deal with problems with uncertainty. Introduced by Masami Tsukamoto, this method is known because every fuzzy rule is represented in the form of IF-THEN implications with monotonous membership functions. The final result is a crisp value obtained through numerically fuzzy reasoning. The Tsukamoto method is applied in a variety of applications, such as automated control systems, decision-making, and decision-support systems, especially in situations involving data uncertainty and variability [17].

METHODS

Research methods are measures used to find solutions to a particular problem by collecting and analyzing data to achieve a goal. The research in this scientific work uses the Fuzzy Inference System-Tsukamoto method. This method is one of the approaches in intelligent control systems that uses fuzzy logic to make decisions based on rules. The research used in this study will be described in the course of the study.

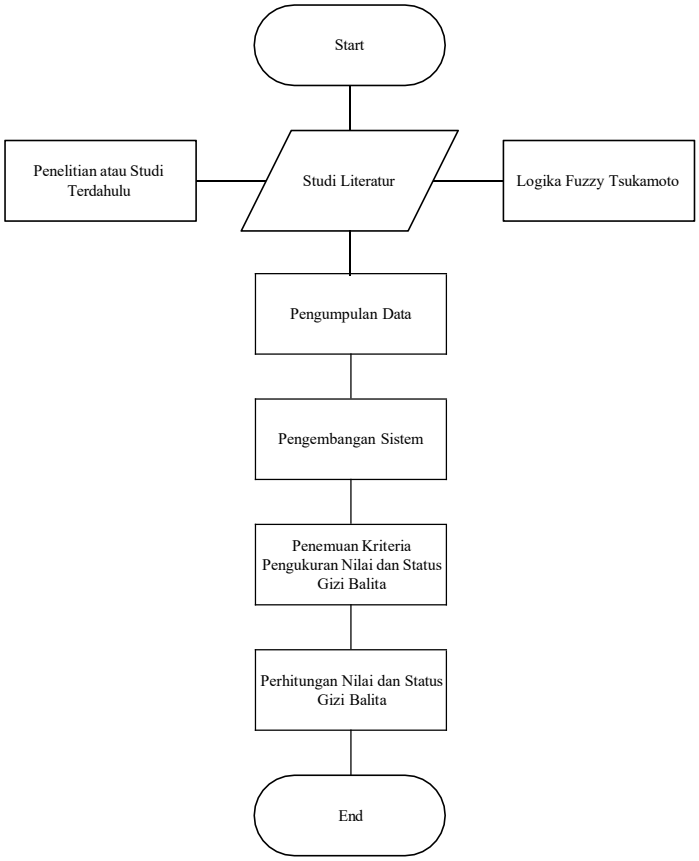


Figure 3 1. *Research Flow of the FIS-Tsukamoto Method*

a. Data Collection Methods

This step was carried out by researchers by conducting observations and direct interviews with health workers. Thus, the data obtained in this study will be more accurate and not only depend on literature studies. The data collected will then be used as information necessary to develop and create a system that is appropriate and suitable to the interests in system design, manufacturing, and testing.

b. System Development Methods

In this study, the method used to develop the system is to use a prototype approach to build a system that applies Tsukamoto's fuzzy concept. The system you want to develop can involve collaborating with other technology experts by using one or more experimental tools to build a prototype. The initial model for building this prototype is designed to present a concept, feature, or function before further implementation. Based on observations, investigations and interpretations carried out during the study, there are several criteria found to measure the results of the calculation of children's nutritional status,

including: *Age, Child Weight, Child Height and Child Upper Arm Circumference.* The design of the fuzzy structure is illustrated in figure 3.2.

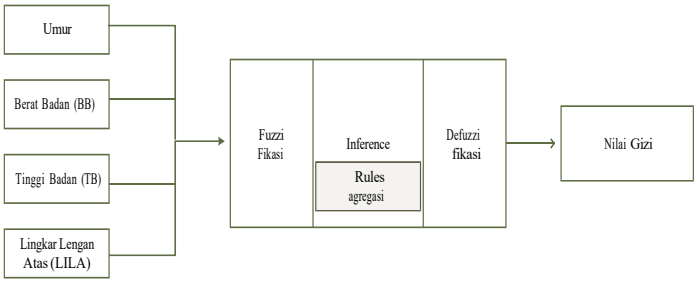


Figure 3 2. *Fuzzy Architecture*

c. Use Case Diagram

A Use Case Diagram is an illustration that illustrates how a user interacts with a computer program. The use of use case diagrams can help in planning website functionality and ensure that its development is in accordance with the needs of users and parties involved. An overview of the Use Case Diagram is illustrated through figure 3.3.

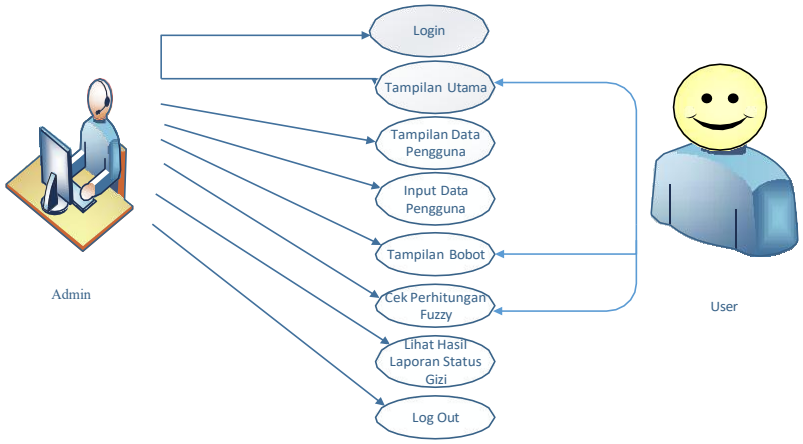


Figure 3 3. *Use Case Diagram*

d. Class Diagram

A class diagram is a visual way of describing how classes are constructed in a system whose roles are statically related to each other through the properties that each class has. Typically, these diagrams are used in object-based programming for documentation and designing class structures in a software system. An overview of the Class Diagram is illustrated through figure 3.4.

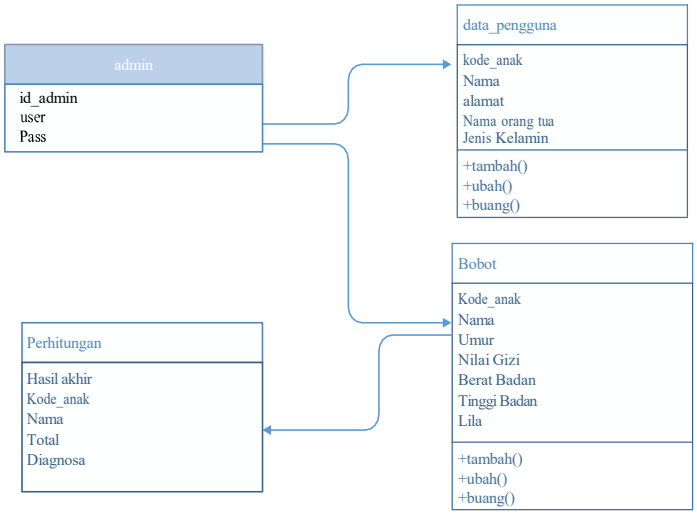


Figure 3 4. *Class Diagram*

e. Activity Diagram

Once the relationship or interaction between the user and the program or system has been successfully illustrated through a use case diagram, the next step is to create an activity diagram. Activity diagrams describe workflows or activities in a system and how users and systems interact to complete those tasks. In this study, the activity diagram consists of an activity diagram for the admin and user, which is illustrated through figure 3.5 and figure 3.6.

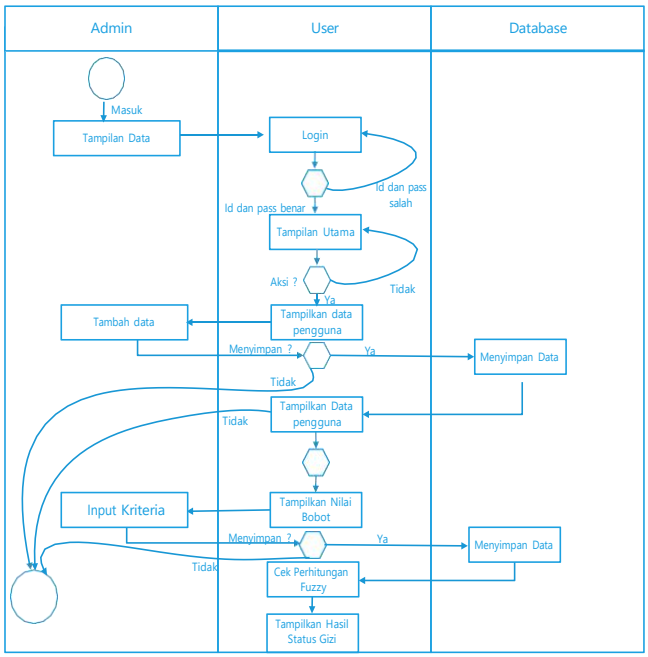


Figure 3 5. *Activity Diagram Admin*

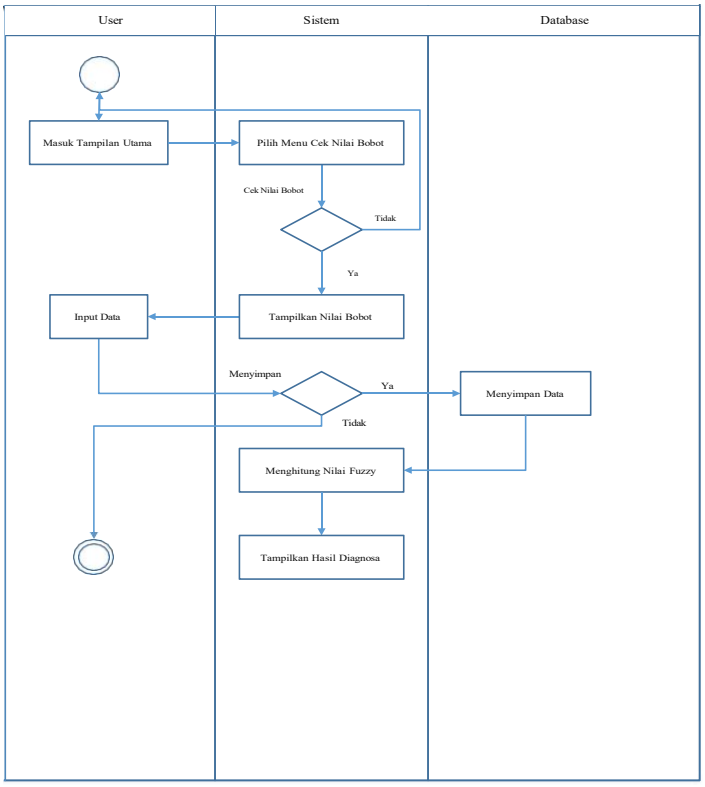


Figure 3 6. *Activity Diagram User*

RESULTS AND DISCUSSION

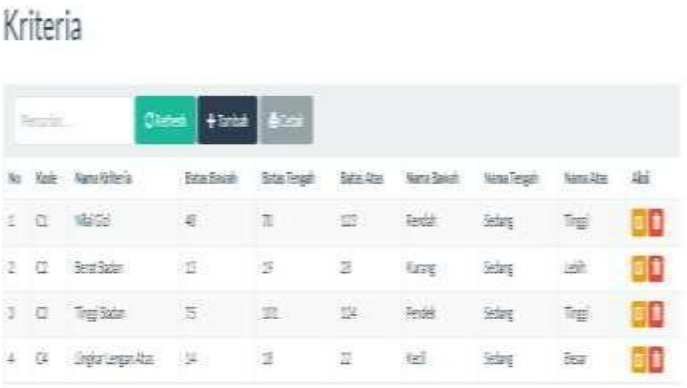
a. Alternative

The alternative menu on the system contains a display of user data that has been input by the administrator as shown in the image below.

(a) (b)

b. Criteria

The variables obtained from the data analysis process in the previous methods will be placed as criteria that function as criteria for measuring user or respondent data.

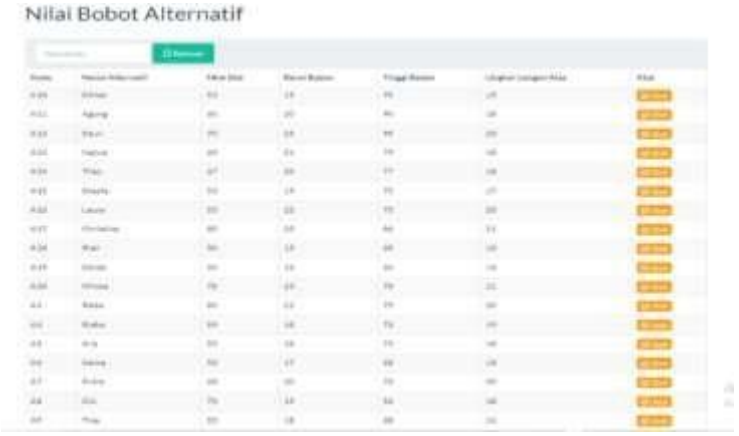


c. Rules

In the "rules" menu , various rules or rules will be created as a function to determine the conditions managed from the data and variables used to determine the nutritional status of toddlers. The display design that has been made can be seen in the image below..

d. Weight

The alternative weight value menu contains the measurement results obtained with rules or rules after inputting or collecting user data as well as variables or criteria that apply to the analysis of nutritional status with the Fuzzy Tsukamoto approach. The page to calculate the nutritional status that has been designed can be seen in the image below.



e. Calculation Results

In the calculation menu, there are diagnostic results regarding the nutritional status of children through fuzzy calculations carried out by the system. The report page of the calculated results that has been designed can be seen in the images below.

(a) (b)

CONCLUSION

This research has completed the design of a website-based system that aims to measure nutritional value as an analysis and prevention of stunting by using the Tsukamoto fuzzy method which as we know today The difficulty in preventing stunting is due to the lack of information and knowledge of mothers in knowing the criteria and nutritional values that are sufficient and are not in the category of Stunting diagnosis.

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