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Development of a Web-Based Decision Support System for Child Growth Evaluation using the Simple Additive Weighting (SAW) Method at the Narwastu Child Development Center

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Abstrack

Monitoring child growth is an essential activity for assessing children's health and development from an early age. The Narwastu Child Development Center (CDC) routinely measures children's weight and height every month as the basis for growth evaluation. However, the current manual or semi-digital recording and evaluation process presents several challenges, including data processing errors, difficulties in managing historical measurement records, and inefficient evaluation procedures. This study aims to develop a web-based Decision Support System (DSS) to facilitate a more effective and structured child growth evaluation process using the Simple Additive Weighting (SAW) method. The SAW method is employed to evaluate children's growth based on weighted criteria of body weight and height, producing preference values and corresponding growth status classifications. The system development process consisted of requirements analysis, system design, implementation, and testing using the Black Box Testing method. The results indicate that the developed system is capable of managing child growth data, performing automatic SAW calculations, presenting growth evaluation results, and providing historical records as well as graphical visualizations of children's growth. Based on the testing results, all system functions operated as expected and met the specified requirements. Therefore, the developed system effectively improves the efficiency of child growth data management and supports decision-making in the child growth evaluation process at the Narwastu Child Development Center.

Keywords: *Decision Support System, Child Growth Evaluation, Simple Additive Weighting (SAW), Web-Based System, Child Development Center.*

1. Introduction

Child growth monitoring is one of the essential aspects of assessing children's health and development from an early age. Anthropometric indicators, such as body weight and height, are used to determine whether a child's growth is within the normal range or affected by growth disorders, such as undernutrition, stunting, or overweight [1]. Therefore, growth monitoring should be conducted regularly to enable the early detection of growth problems and to support the implementation of appropriate interventions. This is also in line with the Regulation of the Minister of Health of the Republic of Indonesia Number 2 of 2020, which emphasizes the importance of monitoring the growth of young children [2].

The Narwastu Child Development Center (CDC) is an institution that routinely monitors children's growth every month by measuring their body weight and height. These activities are intended to monitor children's growth conditions and detect growth disorders at an early stage that may affect their health and development. The measurement results are then recorded and used as the basis for evaluating children's growth over time. However, the process of recording and evaluating growth data is still carried out manually or semi-digitally, which may lead to recording errors, difficulties in managing and retrieving data, and delays in the evaluation process. Furthermore, since measurements are conducted monthly, the continuously increasing volume of data makes data processing and analysis less effective when performed manually.

Advances in information technology have enabled the implementation of web-based systems to facilitate more structured and integrated management of child growth data. However, in addition to data management, a mechanism is also required to support objective evaluation and decision-making based on the available data. Therefore, a Decision Support System (DSS) is needed to process child growth data and generate information that supports the growth evaluation process.

One of the methods that can be applied in a Decision Support System is the Simple Additive Weighting (SAW) method, as it is capable of evaluating alternatives based on weighted criteria and producing decisions in a simple and objective manner [3]. Based on this background, this study aims to develop a web-based Decision Support System using the SAW method to support the child growth evaluation process at the Narwastu Child Development Center, thereby improving the effectiveness and accuracy of data processing and decision-making.

2. Research Method

2.1. Children's Growth

Child growth and development are continuous processes that occur from the prenatal period through adulthood. Growth refers to measurable physical changes, which can be assessed using anthropometric indicators such as body weight and height, whereas development encompasses improvements in motor, language, cognitive, social, and emotional abilities. Nutritional status is one of the primary factors influencing these processes, as it plays a crucial role in supporting children's physical growth and overall development. Therefore, regular growth monitoring is essential to ensure that children achieve optimal growth and development [4]. In this study, child growth evaluation was conducted based on the indicators of body weight, height, and age, which were processed using the Simple Additive Weighting (SAW) method.

2.2. Decision Support System (DSS)

A Decision Support System (DSS) is a computer-based information system designed to assist the decision-making process by transforming data into relevant information, enabling problems to be solved more efficiently and effectively [5]. In this study, the DSS is employed to support child growth evaluation at the Narwastu Child Development Center by utilizing the Simple Additive Weighting (SAW) method to process body weight and height data, thereby producing an objective assessment of children's growth.
A web-based information system is an information system designed to manage, process, and present data through a web platform, allowing information to be accessed easily, quickly, and accurately [6]. In this study, web technology serves as the implementation platform for the Decision Support System to support centralized management of child growth data, facilitate access to information, and improve the effectiveness of the evaluation and decision-making processes.

2.3. Simple Additive Weighting (SAW)

The Simple Additive Weighting (SAW) method is one of the most widely used multi-criteria decision-making (MCDM) methods. It determines the final score by calculating the weighted sum of each criterion associated with an alternative [3]. In this study, the SAW method is applied to evaluate child growth at the Narwastu Child Development Center based on predetermined growth indicators. Through the processes of normalization, weighting, and preference value calculation, the SAW method provides a more objective assessment, thereby supporting more accurate and systematic decision-making regarding children's growth conditions. The normalization formula used in the SAW method is presented as follows [3].
If *j* is a benefit attribute, then:

$$R_{ij} = \frac{X_{ij}}{Max * X_{ij}}$$

If *j* is a cost attribute, then:

$$R_{ij} = \frac{Min * X_{ij}}{X_{ij}}$$

The preference value for each alternative is then calculated using the following equation:

$$V_i = \sum_{j=1}^{n} W_j R_{ij}$$

Where:

V_i : The preference value of the (i)-th alternative. A higher value indicates that the alternative is more preferable or more suitable for selection..
W_j : The weight assigned to the (j)-th criterion.
R_{ij} : The normalized performance rating of the (i)-th alternative with respect to the (j)-th criterion.

2.4. Black Box Testing

Black Box Testing is a software testing method that focuses on evaluating the functionality of a system based on its inputs and outputs without considering the internal structure or source code of the program. This testing method is performed to ensure that each system function operates according to the specified requirements and is capable of handling various input scenarios, including invalid data [7]. In this study, Black Box Testing was employed to evaluate the system's core functionalities, including child data management, criteria value processing, SAW method calculations, the ranking process, and the presentation of child growth evaluation results, thereby ensuring that the system operates correctly and produces accurate outputs.

3. Analysis and Design

3.1. System Requirements Analysis

1. User Requirements Analysis

The child growth evaluation process at the Narwastu Child Development Center is still performed manually, requiring considerable time and increasing the likelihood of errors in data processing and growth evaluation. Furthermore, the continuous increase in child growth data collected each month makes the analysis and decision-making processes less efficient. Therefore, this study aims to develop a web-based Decision Support System (DSS) using the Simple Additive Weighting (SAW) method to support child growth evaluation based on the indicators of body weight, height, age, and head circumference.

Based on the requirements analysis, the system was designed to be used by administrators, teachers, and parents. The system provides core functionalities, including child data management, criteria weight management, growth data entry, SAW calculation, and the presentation of child growth evaluation results. In addition, the system was designed to be user-friendly, secure through a user authentication mechanism, accessible via a web browser, and capable of processing and presenting data quickly and accurately.

2. Software Requirements Analysis

The software requirements used in this study are presented in **Table 1**.

Table 1: Software Requirements

No.	Software	Function
1	Windows 10/11 Operating System	Provides the platform for running all software required for system development and deployment.
2	Visual Studio Code	A source code editor used to develop the web-based application
3	XAMPP	Provides the Apache web server, PHP, and MySQL as the application development environment.
4	MySQL	A database management system used to store and manage system data.
5	Google Chrome	A web browser used to run, test, and access the web-based application.
6	Codeigniter 4	A PHP framework used to develop the web-based application by implementing the Model–View–Controller (MVC) architecture, resulting in a more structured and maintainable system development process.
7	Bootstrap	A front-end framework used to create a responsive and user-friendly web interface.

3.2. Framework

1. Data Understanding

The data used in this study consist of child growth data obtained from measurements and records collected by the Narwastu Child Development Center. The data attributes used in this study include the following:

Tabel 2: Data Attributes

No.	Criteria	Description
1	Body Weight (BB)	The child's body weight measured in kilograms (kg).
2	Height (TB)	The child's height measured in centimeters (cm).
3	Age	The child's age used as the reference for growth evaluation.

2. Data Preparation

The Data Preparation stage aims to prepare the data before it is processed using the Simple Additive Weighting (SAW) method. This stage includes data cleaning to ensure that there are no missing values, duplicate records, or input errors; data transformation into the form of alternatives and criteria; and the assignment of weights to each criterion according to its level of importance in child growth evaluation. Subsequently, the prepared data are validated to ensure that all data are accurate and can be processed correctly by the system during the SAW calculation stage.

3. Modelling

The Modelling stage applies the Simple Additive Weighting (SAW) method to determine children's growth status based on body weight, height, and age data. Age is used to determine the reference growth values, while body weight and height serve as the evaluation criteria. The SAW method then processes these criteria to generate a preference value, which is used to determine each child's growth status.

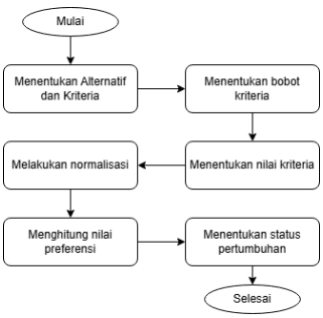

Fig 1: Flowchart of the SAW Method Process

The calculation process begins by assigning scores to each criterion based on its correspondence with the reference data. The data are then normalized and weighted to obtain the SAW preference values. The resulting preference values are subsequently used to determine each child's growth status, namely Undernutrition, At Risk of Stunting, Normal, or Overweight. Model validation is performed by comparing the system-generated results with manual calculations, while the system's functionality is evaluated using the Black Box Testing method to ensure that all features operate according to the specified requirements.

4. Implementation and Testing

4.1. Implementation

The system was developed using the PHP programming language with the CodeIgniter 4 framework and MySQL as the database management system. The system implementation includes user authentication, child and child growth data management, child–parent relationship management, SAW criteria weight configuration, and the presentation of child growth analysis results based on the calculations performed by the system.

4.1.1. User Interface Design

The user Interface of the Decision Support System (DSS) for child growth evaluation consists of the login page, dashboard, user management, child data management, parent data management, child growth data management, SAW criteria weight management, and the analysis page.

a. Login Page Interface

The login page serves as the authentication interface used to verify users' usernames and passwords before granting access to the system. This process ensures that only authorized users are allowed to access and use the application.

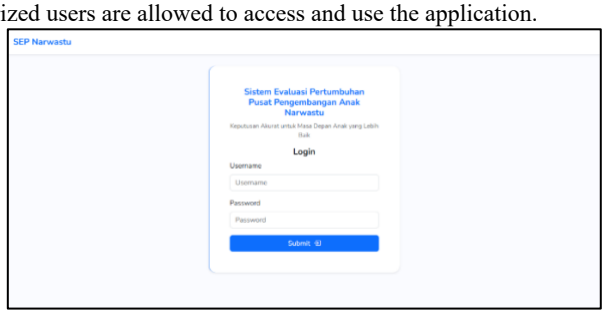

Fig. 2: Login Page Interface

b. Dashboard Interface

The dashboard serves as the main page displayed after a user successfully logs into the system. It functions as the central hub for accessing system features and viewing essential information. The dashboard interface is customized according to the user's role, namely administrator**,** teacher, or parent. For administrators, the dashboard displays a summary of key information, including the total number of child records, registered users, and SAW criteria weights.

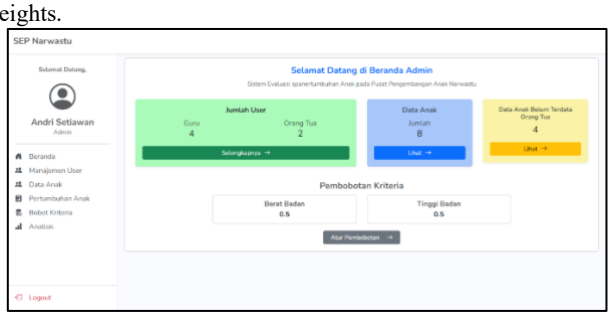

Fig 3: Administrator Dashboard Interface

Fig. 4: Teacher Dashboard Interface

Fig. 5: Parent Dashboard Interface

c. User Management Page Interface

The User Management page enables administrators to manage user accounts registered in the system, including users assigned the roles of teacher and parent, according to their respective access privileges and responsibilities.

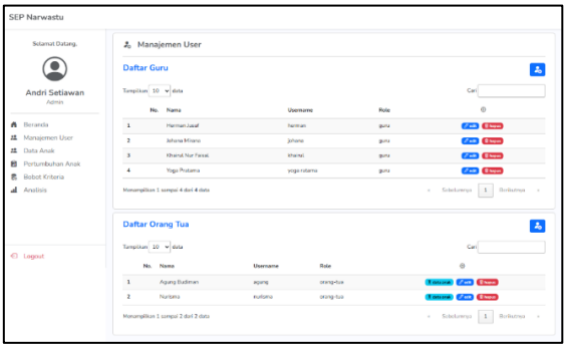

Fig. 6: User Management Page Interface

d. Child Data Page Interface

The Child Data page is used to manage the records of children who are the subjects of the growth evaluation. It includes identification information such as the child's name, gender, and date of birth.

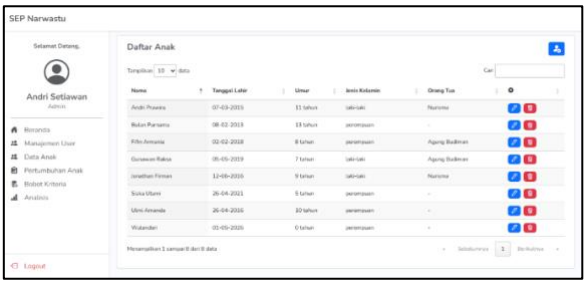

Fig. 7: Child Data Page Interface

e. Parent Data Page Interface

The Parent Data page is used to associate parent records with child records, ensuring that each parent can access only the information and child growth evaluation results associated with their registered account.

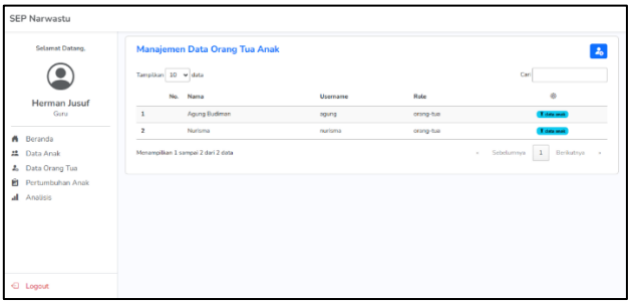

Fig. 8: Parent Data Page Interface

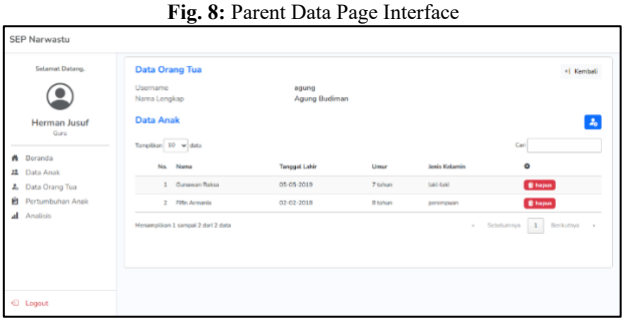

Fig. 9: Parent–Child Relationship Management Page Interface

f. Child Growth Page Interface

The Child Growth page is used to manage children's periodic growth measurement records by displaying a list of registered children from which users can select a child to record growth measurement data.

Fig. 10: Child Growth Page Interface

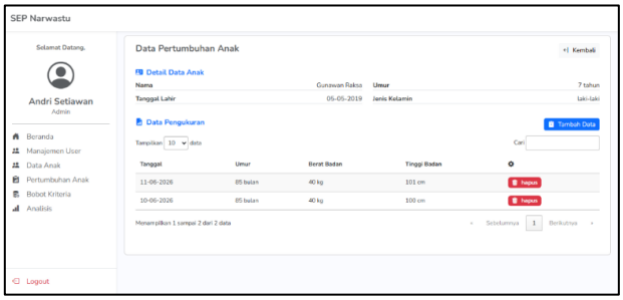

Fig. 11: Child Growth Measurement Page Interface

g. Criteria Weight Page Interface

The Criteria Weight page is used to manage the weights assigned to the body weight and height criteria used in the Simple Additive Weighting (SAW) calculation process.

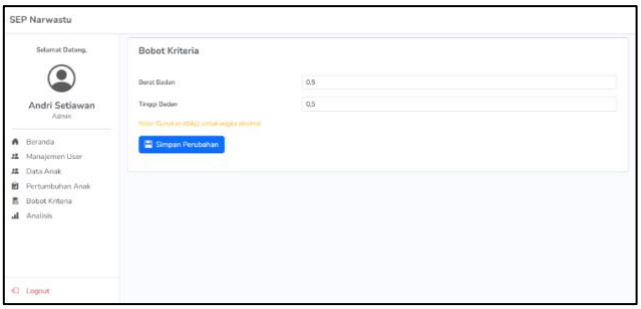

Fig. 12: Criteria Weight Page Interface

h. Analysis Page Interface

The Analysis page is used to present the results of child growth evaluation based on the calculations performed using the Simple Additive Weighting (SAW) method. This page displays the analysis results, growth measurement history, and child growth charts to facilitate monitoring of children's growth and development over time.

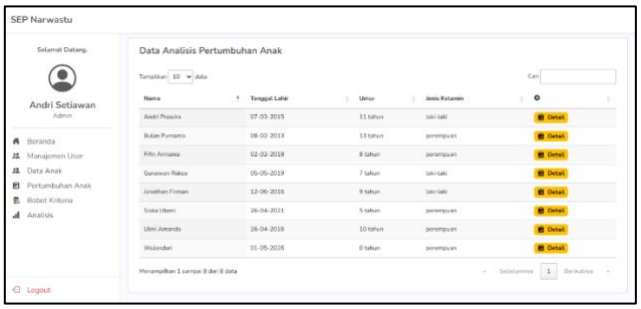

Fig. 13: Analysis Page Interface

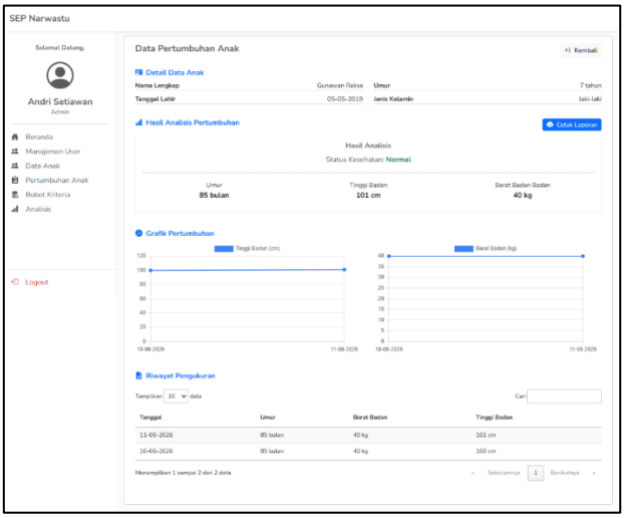

Fig. 14: Analysis Results and Growth Measurement History Page Interface

4.1.2. Code Generation

The Simple Additive Weighting (SAW) method was implemented to evaluate children's growth status based on the criteria of body weight (C1) and height (C2). The calculation process begins by comparing each child's measurement data with the age-specific growth reference data. The resulting values are then processed using the SAW method.

1. Criteria Value Determination

The following code is used to determine the criterion values by comparing the child's body weight and height data with the age-specific growth reference data. The comparison results are then converted into scores, which are used in the SAW calculation process.

```
$nilai = [
    'C1' => $this->skorBB(
        $bb,
        $referensi['bb_min'],
        $referensi['bb_max']
    ),
    'C2' => $this->skorTB(
        $tb,
        $referensi['tb_min'],
        $referensi['tb_max']
    ),
];
```

For the body weight criterion, the system uses the skorBB() function to determine the corresponding score based on the predefined reference value ranges.

```
private function skorBB($bb, $min, $max)
{
    if ($bb < $min * 0.8) {
        return 1;
    }

    if ($bb < $min) {
        return 2;
    }

    if ($bb <= $max) {
        return 3;
    }

    if ($bb <= $max * 1.1) {
        return 4;
    }

    return 5;
}
```

Similarly, for the height criterion, the score is determined using the skorTB() function based on the same mechanism.

```
private function skorTB($tb, $min, $max)
{
    if ($tb < $min * 0.8) {
```

```
        return 1;
    }

    if ($tb < $min) {
        return 2;
    }

    if ($tb <= $max) {
        return 3;
    }

    if ($tb <= $max * 1.1) {
        return 4;
    }

    return 5;
}
```

Based on these two functions, the system generates a score for each criterion according to the following classification.

Table 3: Criteria Score Description

Score	Description
1	Significantly below the growth standard
2	Below the growth standard
3	Meets the growth standard
4	Above the growth standard
5	Significantly above the growth standard

2. Decision Matrix Normalization

After each criterion has been assigned a score, the normalization process is performed to transform the values into a range between 0 and 1. This ensures that all criteria are represented on the same scale and can be compared objectively.

```
$normalisasi = [];

foreach ($nilai as $kriteria => $v) {

    $normalisasi[$kriteria] = $v / 5;
}
```

3. Preference Value Calculation

The following code is used to calculate the **SAW preference value** by multiplying the normalized value of each criterion by its corresponding weight and then summing the resulting weighted values to obtain the final preference value.

```
$nilaiSaw = 0;

foreach ($normalisasi as $kriteria => $v) {

    $nilaiSaw +=
        $v * $bobot[$kriteria];
}
```

4. Growth Status Determination

The final stage is to classify the SAW preference value into the appropriate growth status category using the getStatus() function.

```
private function getStatus($nilaiSaw)
{
    if ($nilaiSaw < 0.40) {
        return "Kurang Gizi";
    }

    if ($nilaiSaw < 0.60) {
        return "Berisiko Stunting";
    }

    if ($nilaiSaw < 0.80) {
        return "Normal";
    }

    return "Overweight";

}
```

The growth status classification is presented in **Table 4**.

Table 4: Growth Status Classification

Preference Value Range	Growth Status
< 0,40	Undernutrition
0,40 - < 0,60	At Risk of Stunting
0,60 - < 0,80	Normal
>= 0,80	Overweight

4.2. Black Box Testing

System testing was conducted using the Black Box Testing method to ensure that all functions of the Decision Support System (DSS) for child growth evaluation operated according to the specified requirements. The testing process involved providing inputs to each system feature and observing the resulting outputs to verify that the system could correctly accept input, process data, and produce the expected output.

4.2.1. Login Testing

Table 5: Login Testing

No.	Test Scenario	Expected Result	Test Result	Status
1	Valid username and password	The system displays the dashboard.	As expected	Passed
2	Invalid username and password	The system displays an error message.	As expected	Passed

4.2.2. User Management Testing

Table 6: User Management Testing

No.	Test Scenario	Expected Result	Test Result	Status
1	Add a user account	The user account is successfully saved.	As expected	Passed
2	Update a user account	The user account is successfully updated.	As expected	Passed
3	Delete a user account Delete a user account	The user account is successfully deleted.	As expected	Passed

4.2.3. Child Data Testing

Table 7: Child Data Testing

No.	Test Scenario	Expected Result	Test Result	Status
1	Add child data	The child data are successfully saved.	As expected	Passed
2	Update child data	The child data are successfully updated.	As expected	Passed
3	Delete child data	The child data are successfully updated.	As expected	Passed

4.2.4. Parent Data Testing

Table 8: Parent Data Testing

No.	Test Scenario	Expected Result	Test Result	Status
1	Add a parent–child relationship	The parent–child relationship is successfully established.	As expected	Passed
2	Delete a parent–child relationship	The parent–child relationship is successfully removed.	As expected	Passed

4.2.5. Child Growth Testing

Table 9: Child Growth Testing

No.	Test Scenario	Expected Result	Test Result	Status
1	Add measurement data	The measurement data are successfully saved.	As expected	Passed
2	Delete measurement data	The measurement data are successfully deleted.	As expected	Passed

4.2.6. Criteria Weight Testing

Table 10: Criteria Weight Testing

No.	Test Scenario	Expected Result	Test Result	Status
1	Update body weight criteria weight	The body weight criteria weight is successfully updated.	As expected	Passed
2	Update height criteria weight	The height criteria weight is successfully updated.	As expected	Passed

4.2.7. Analysis Testing

Table 11: Analysis Testing

No.	Test Scenario	Expected Result	Test Result	Status
1	Display child growth status	The system displays the growth status based on SAW analysis results.	As expected	Passed
2	Display growth chart	The system displays the child growth chart.	As expected	Passed
3	Display child growth history	The system displays the child measurement history in a table format.	As expected	Passed

Based on the results of the Black Box Testing, all functions of the Decision Support System (DSS) for child growth evaluation operated in accordance with the specified requirements. Each feature was able to correctly accept input, process data, and produce the expected output.

5. Kesimpulan

Based on the results of this study, a web-based Decision Support System (DSS) for child growth evaluation at the Narwastu Child Development Center was successfully developed and is capable of managing child growth data and presenting evaluation results in an

integrated manner. The Simple Additive Weighting (SAW) method was successfully implemented to evaluate child growth based on the criteria of body weight and height, thereby providing an objective assessment. The testing results demonstrate that all system functions operate according to the specified requirements and effectively support the child growth evaluation process.

Daftar Pustaka

[1] W. Jannah and B. Rusni, "Deteksi Dini Pertumbuhan Anak Usia Dini Berdasarkan Indikator Antropometri di PAUD KB Layumna Cendikia," *Praktisi Nusantara: Jurnal Pengabdian kepada Masyarakat*, vol. 1, no. 3, 2024.

[2] Kementerian Kesehatan Republik Indonesia, "PERATURAN MENTERI KESEHATAN REPUBLIK INDONESIA," 2020.

[3] P. A. Ramadhona, A. Husain, and A. Irawan, "SISTEM PENDUKUNG KEPUTUSAN BALITA TERIDENTIFIKASI STUNTING DI POSYANDU MAWAR PULAU SERIBU MENGGUNAKAN METODE SAW," 2026.

[4] L. A. Laily and S. Indarjo, "Literature Review: Dampak Stunting terhadap Pertumbuhan dan Perkembangan Anak," *HIGEIA (Journal of Public Health Research and Development)*, vol. 7, no. 3, 2023, doi: 10.15294/higeia.v7i3.63544.

[5] F. Sulistiyaningsih, "Sistem Pendukung Keputusan dalam Menentukan Kelayakan Pinjaman Karyawan Menggunakan AHP-TOPSIS pada PT XYZ," *Jurnal Teknologi Dan Sistem Informasi Bisnis*, vol. 7, no. 1, 2025, doi: 10.47233/jteksis.v7i1.1565.

[6] S. F. Arief and Y. Sugiarti, "Literature Review: Analisis Metode Perancangan Sistem Informasi Akademik Berbasis Web," *JURNAL ILMIAH ILMU KOMPUTER*, vol. 8, no. 2, 2022, doi: 10.35329/jiik.v8i2.229.

[7] N. M. D. Febriyanti, A. A. K. Oka Sudana, and I. N. Piarsa, "Implementasi Black Box Testing pada Sistem Informasi Manajemen Dosen," *JITTER : Jurnal Ilmiah Teknologi dan Komputer*, vol. 2, no. 3, 2021, doi: 10.24843/jtrti.2021.v02.i03.p12.