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Implementation Of the Saw Method in A Decision Support System for Determining Social Assistance Program Recipients (Case Study: Ciluncat Village)

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ABSTRACT

Poverty is a significant global challenge, particularly in Indonesia, that impedes community welfare and the quality of human resources. The village government has initiated several social aid initiatives to tackle this issue; nevertheless, the distribution is frequently misallocated and imprecise. This study seeks to create a web-based **decision support system** employing **the Simple Additive Weighting (SAW) method to improve the** accuracy, objectivity, and **efficiency of** identifying social assistance beneficiaries in Ciluncat Village. The SAW method evaluates alternatives by aggregating the weighted ratings for given qualities. This research uses descriptive analysis for data gathering and **Object-Oriented Analysis and Design (OOAD)** for **system development**. The findings demonstrate that applying the SAW technique in Ciluncat Village enhances the efficiency of social assistance distribution, minimizes errors, and expedites the delivery time of aid. This system enables village officials to pick assistance recipients objectively and equitably.

Keywords: Attendance, Geolocation, Haversine Formula, Web-Based System, GPS, **Rapid Application Development (RAD), Unified Modeling Language (UML)**

INTRODUCTION

Poverty is a significant challenge encountered by all nations globally, including Indonesia. This persistent issue obstructs a nation's objective of attaining community welfare. Poverty results in diminished human resource quality, as numerous individuals cannot satisfy fundamental requirements such as clothing, food, and shelter.

The government has instituted multiple measures to alleviate poverty, including social assistance to impoverished families. Nonetheless, the allocation of help to these families remains suboptimal, with numerous benefits misallocated, leading to grievances and demonstrations from intended recipients. The current data about receivers of government poverty aid is inaccurate, as local authorities employ a manual selection method based on estimations of various aspects without utilizing specified criteria.

A web-based decision support system can be designed to resolve challenges in the delivery of social assistance and combat fraud by certain entities. (Govindan et al., 2020) A **Decision Support System** (DSS) delivers information, models, and engages with data. Its purpose is to facilitate decision-making in unstructured settings where selecting the appropriate option is challenging. (Sumaizar et al., 2021)

This research will create a **decision support system utilizing the Simple Additive Weighting (SAW) method** in response to these difficulties. SAW will assess the efficacy of each alternative according to designated attributes by aggregating the weights of the performance scores for each attribute. The study will establish the weights for each attribute and rate the possibilities to ascertain the most favorable option.

In light of the aforementioned challenges, the problems identified for this research are as follows:

1. The inadequate allocation of social assistance has resulted in discontent and demonstrations from residents entitled to aid.
2. There is a possibility of fraudulent activities by certain entities in the distribution of social assistance.

3. Erroneous data regarding aid beneficiaries, as the selection procedure continues to rely on estimations of many aspects without definitive criteria.

This research aims to create a decision support system employing the Simple Additive Weighting (SAW) method to improve accuracy, objectivity, and efficiency of identifying beneficiaries of social assistance programs in Ciluncat Village. This project aims to utilize SAW to mitigate errors, discontent, and fraud in the selection of aid recipients while enhancing the quality of data on social assistance beneficiaries to provide more precise and accurate decision-making.

Framework

A system is an entity or structure composed of different ordered and interrelated components that interact systematically, directly, or via subsystems to accomplish objectives through successful collaboration. (Astuti & Rohman, 2024; Sinaga & Riandari, 2020)

Decision Support System

Azmi defines a decision support system as an interactive computer information system that offers multiple alternative solutions for decision-makers. Haryani elucidates that decision support systems are beneficial for resolving issues with particular attributes within organizations. A Decision Support System (DSS) resembles conventional management information systems because both depend on a database for information sourcing. DSS underscores its function in facilitating every phase of the decision-making process, serving as an adjunct to choices made by individuals or collectives. Decision support systems are fundamentally integral to computer technology. DSS enhances efficient decision-making to address diverse situations promptly. (Utami et al., 2022)

Marbun identifies several characteristics of decision support systems, as outlined in (Marbun et al., 2021)

1. DSS is intended to facilitate decision-making, which is sometimes intricate and less structured, especially for senior management.
2. DSS integrates qualitative models with existing data sets.

3. DSS offers interactive features that enable communication between human users and computers.
4. DSS is adaptable and proficient at accommodating changes.

Basic Additive Weighting

The SAW approach, commonly known as the summation method, prioritizes weighting factors. Its core tenet is to compute the weighted aggregate of performance rankings for each choice, predicated on the values of the attribute criteria (Lubis et al., 2022; Ramandeep, 2022).

Simple Additive Weighting (SAW) Method

The SAW method is a multi-criteria decision-making tool that streamlines the evaluation process by enabling decision-makers to assess and rank alternatives according to various criteria. The SAW technique is theoretically grounded in weighted summing, wherein the performance of each alternative is evaluated against multiple criteria to establish a thorough ranking. (Wardani et al., 2020)

Multi-Criteria Decision-Making (MCDM)

Multi-Criteria Decision Making (MCDM) entails assessing various conflicting criteria in the decision-making process. The theoretical foundations of MCDM offer frameworks for analyzing trade-offs and prioritizing alternatives, which are essential for properly identifying recipients of social assistance programs. (Siwa et al., 2020)

Quality and Precision of Information

Theories of information quality underscore the need to possess precise, pertinent, and timely data for decision-making. Ensuring data integrity in selecting social assistance clients is essential for improving the efficacy of welfare programs and minimizing errors in aid distribution.

This research aims to create a decision support system utilizing the Simple Additive Weighting (SAW) method to improve the accuracy, objectivity, and efficiency of identifying beneficiaries of social assistance programs in Ciluncat Village. This research employs SAW

to mitigate errors, discontent, and fraud in selecting aid recipients while enhancing the quality of data regarding social assistance beneficiaries to facilitate more precise and accurate decision-making.

METHOD

This project will employ a quantitative methodology utilizing a descriptive research design to create a decision support system grounded in the Simple Additive Weighting (SAW) technique for identifying beneficiaries of social assistance programs in Ciluncat Village. The data collection process will encompass the acquisition of primary data via surveys and interviews with local government officials, social workers, and prospective receivers, in addition to the analysis of secondary data from existing records and socio-economic information. A stratified random sampling approach will guarantee a representative sample of homes, with factors such as income level, family size, and health conditions established and weighted according to their importance in the selection process.

The SAW approach will be executed by normalizing the data, computing weighted sums, and ranking households to choose the most qualified individuals for assistance. A web-based decision support system will be created, incorporating an intuitive interface for data entry and automatic computations. Validation discussions with stakeholders will confirm the system's alignment with their requirements, while testing with historical data will assess its precision. The study evaluates the efficacy of the SAW technique in facilitating decision-making. It will culminate in recommendations for optimizing the system and refining the selection process for social assistance beneficiaries.

DISCUSSION

BUSINESS PROCESS ANALYSIS

This project will employ a quantitative methodology utilizing a descriptive research design to create a decision support system grounded in the Simple Additive Weighting (SAW) technique for identifying beneficiaries of social assistance programs in Ciluncat Village. The data collection process will encompass the acquisition of primary data via

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Figure 1. Analysis of ongoing business processes

SYSTEM DESIGN

a. Formulating the SAW Method

At this juncture, the Simple Additive Weighting (SAW) method is computed to ascertain whether residents qualify for the Family Hope Program (PKH) social assistance. The dataset utilized for this computation comprises five residents and two social assistance packages.

1. Standards and Proportion

The criteria are the considerations employed in the selection method for social assistance clients, which must coincide with the policies of the village authorities. Each criterion possesses a distinct weight, allocated according to its significance to the system.

The criteria and their associated weights are outlined in the subsequent table:

Table 1. Criteria and Weights

No	Criteria name	Attribute	Weight	Level of interest
1	Work	Cost	15	Low
2	Income	Cost	40	Very important
3	Liability	Benefit	25	Important
4	Residence	Cost	20	Quite important

A comprehensive elucidation of the criteria employed in this approach can be furnished based on the following table:

Table 2. Job Criteria

No	Category	Mark
1	Doesn't work	1
2	Laborer	2
3	Retired	3
4	Self-Employed / Entrepreneur	4
5	Private	5

Table 3. Income Criteria

No	Range	Mark
1	< Rp. 1.000.000	1
2	Rp. 1.000.000 - Rp. 2.249.000	2
3	Rp. 2.250.000 - Rp. 3.249.000	3
4	Rp. 3.250.000 – Rp. 3.999.000	4
5	> Rp. 4.000.000	5

Table 4. Dependent Criteria

No	Range	Nilai
1	0	1
2	1	2
3	2 – 3	3
4	4 – 5	4
5	6 – 10	5

Table 5. Residence Criteria

No	Category	Nilai
1	Hitchhiking	1
2	Contract	2
3	My own house	3

Implementation of the SAW Method

The calculation process utilizing the Simple Additive Weighting (SAW) approach is now being performed to determine residents qualified for social assistance. The following table presents the sample data of the inhabitants utilized in this approach.

Table 6. Sample Citizen Data

No	Work	Income	Liability	Residence
1	Self-employed	1.000.000	1	Milik sendiri
2	Self-employed	2.000.000	7	Kontrak
3	Laborer	4.000.000	2	Numpang
4	Doesn't work	1.500.000	4	kontrak
5	Retired	5.000.000	3	kontrak

The subsequent table correlates citizen data categories with previously defined criteria values.

Table 7. Citizen Data Matching

No	Work	Income	Liability	Residence
1	4	1	2	3
2	4	2	5	2
3	2	5	3	1
4	1	2	4	2
5	3	5	3	2

Residents' data is calculated utilizing the Simple Additive Weighting (SAW) method, which is derived from the aforementioned sample data table of inhabitants and the table of weights and attributes.

a) Normalization Matrix (R)

The normalization matrix is calculated to derive the normalized matrix for each criterion. The computation procedure is executed as follows:

R1 1 =

$$\frac{\min(4;4;2;1;3)}{4} = 0,25$$

R1 2 =

$$\frac{\min(4;4;2;1;3)}{4} = 0,25$$

R1 3 =

$$\frac{\min(4;4;2;1;3)}{2} = 0,5$$

R1 4 =

$$\frac{\min(4;4;2;1;3)}{1} = 1$$

R1 5 =

$$\frac{\min(4;4;2;1;3)}{3} = 0,333$$

R2 1 =

$$\frac{\min(1;2;5;2;5)}{1} = 1$$

R2 2 =

$$\frac{\min(1;2;5;2;5)}{2} = 0,5$$

R2 3 =

$$\frac{\min(1;2;5;2;5)}{5} = 0,2$$

R2 4 =

$$\frac{\min(1;2;5;2;5)}{2} = 0,5$$

R2 5 =

$$\frac{\min(1;2;5;2;5)}{5} = 0,2$$

$$\begin{aligned}
 R3\ 1 &= \frac{2}{\max(2,5,3,4,3)} = 0,4 \\
 R3\ 2 &= \frac{5}{\max(2,5,3,4,3)} = 1 \\
 R3\ 3 &= \frac{3}{\max(2,5,3,4,3)} = 0,6 \\
 R3\ 4 &= \frac{4}{\max(2,5,3,4,3)} = 0,8 \\
 R3\ 5 &= \frac{3}{\max(2,5,3,4,3)} = 0,6 \\
 R4\ 1 &= \frac{\min(3;2;1;2;2)}{3} = 0,333 \\
 R4\ 2 &= \frac{\min(3;2;1;2;2)}{2} = 0,5 \\
 R4\ 3 &= \frac{\min(3;2;1;2;2)}{1} = 1 \\
 R4\ 4 &= \frac{\min(3;2;1;2;2)}{2} = 0,5 \\
 R4\ 5 &= \frac{\min(3;2;1;2;2)}{2} = 0,5
 \end{aligned}$$

$$R = \begin{pmatrix} \underline{0,25} & \underline{1} & \underline{0,4} & \underline{0,333} \\ \underline{0,25} & \underline{0,5} & \underline{1} & \underline{0,5} \\ \underline{0,5} & \underline{0,2} & \underline{0,6} & \underline{1} \\ \underline{1} & \underline{0,5} & \underline{0,8} & \underline{0,5} \\ \underline{0,333} & \underline{0,2} & \underline{0,6} & \underline{0,5} \end{pmatrix}$$

b) Ranking Process (V)

After the matrix normalization stage, the next stage is the V ranking stage as follows:

$$V1 = (0,25).(15) + (1).(40) + (0,4).(25) + (0,333).(20) = 60,41$$

$$V2 = (0,25).(15) + (0,5).(40) + (1).(25) + (0,5).(20) = 58,75$$

$$V3 = (0,5).(15) + (0,2).(40) + (0,6).(25) + (1).(20) = 50,50$$

$$V4 = (1).(15) + (0,5).(40) + (0,8).(25) + (0,5).(20) = 65,00$$

$$V5 = (0,333).(15) + (0,2).(40) + (0,6).(25) + (0,5).(20) = 38,00$$

Use Case Diagram

A Use Case demonstrates user interactions with a system. It delineates the procedures or sequences of actions executed by participants and the system to accomplish a specific task or function. Use Cases are essential in software development as they elucidate user requirements and define the system's objectives. Use Cases guarantees that the built system

meets the users' expectations and requirements.

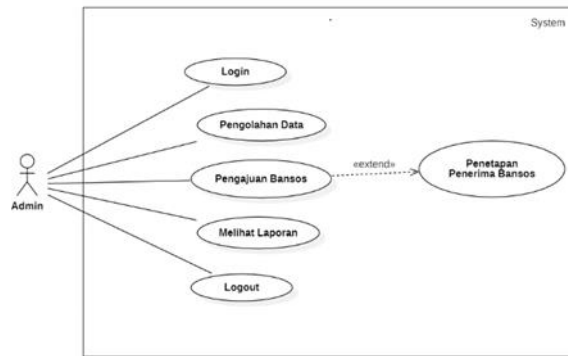


Figure 2. Use Case Diagram

d. Class Diagram

The subsequent depiction represents the class diagram of the decision support system for identifying social assistance recipients.

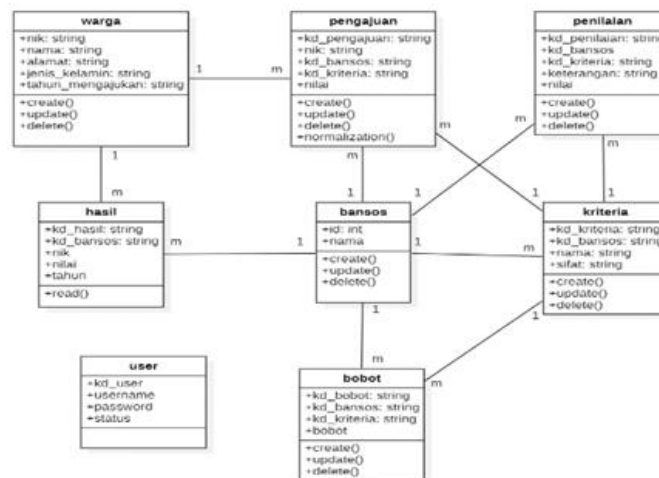


Figure 3. Class Diagram

d. Design of Menu Structure

The design of the menu structure is intended to assist users and serve as a guide for using the Study Program recommendation system application. This is an illustration of the menu structure design.

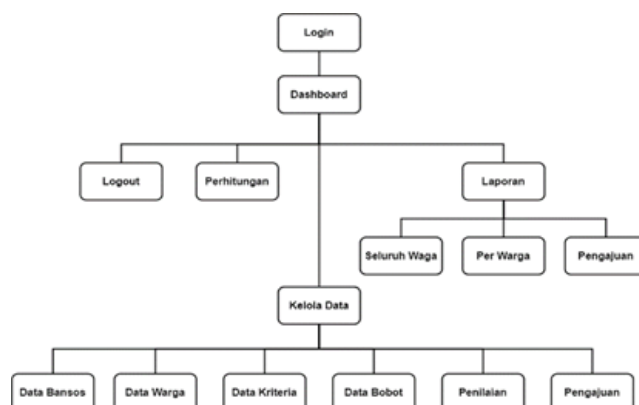


Figure 4. Menu Structure

SYSTEM IMPLEMENTATION



Figure 5. Dashboard View

PERSYARATAN

Beranda **Perhitungan** Kelola Data Laporan Logout Petugas

TAMBAH

Warga

Bansos

Tampilkan

DAFTAR

No	NIK	Nama	Bansos	Kriteria	Nilai	Matrix(R)
1	1	Dede Maryadi	BLT Desa Desa	Lantai	2	Nilai
2	1	Dede Maryadi	BLT Desa Desa	Dinding	2	Nilai
3	1	Dede Maryadi	BLT Desa Desa	Kamar Mandi	2	Nilai
4	1	Dede Maryadi	BLT Desa Desa	Lubrik	1	Nilai
5	1	Dede Maryadi	BLT Desa Desa	Konsumsi Daging	1	Nilai
6	1	Dede Maryadi	BLT Desa Desa	Pendidikan	3	Nilai
7	1	Dede Maryadi	BLT Desa Desa	Penghasilan	3	Nilai
8	1	Dede Maryadi	PKH	Pekerjaan	4	Nilai
9	2	Dadang	PKH	Pekerjaan	4	Nilai
10	3	Otar Sodin	PKH	Pekerjaan	2	Nilai
11	2	Fajar Betawan	PKH	Pekerjaan	1	Nilai
12	5	Deni Agustin	PKH	Pekerjaan	3	Nilai
13	6	Irati Sukasih	PKH	Pekerjaan	5	Nilai
14	1	Dede Maryadi	PKH	Penghasilan	1	Nilai
15	2	Dadang	PKH	Penghasilan	2	Nilai

Figure 6. Submission View

PERHITUNGAN			
PKH			
NIK	Nama	Nilai	Keterangan
7	Fajar Setiawan	65.00000	Layak
1	Dede Maryadi	60.41667	Layak
2	Dadang	58.75000	Tidak Layak
3	Obar Sobirin	60.50000	Tidak Layak
6	Imas Sukasari	42.86667	Tidak Layak
5	Deri Agustian	38.00000	Tidak Layak

Figure 7. Calculation View

CONCLUSION

This study concludes that the introduction of a decision support system utilizing the Simple Additive Weighting (SAW) method in Ciluncat Village markedly enhances the precision of identifying social assistance recipients. The system guarantees that qualifying residents have the necessary support by meticulously evaluating the established criteria and sub-criteria. This method expedites distribution, improves efficiency, minimizes errors, and ensures precise support for those most in need.

Furthermore, the SAW technique streamlines the process for local authorities to identify recipients of social assistance. Minimizing subjectivity in decision-making ensures that choices are grounded in objective standards, resulting in more equitable outcomes. This enhanced objectivity cultivates trust in the system among community members since they can be assured that decisions about social assistance are made clearly and equitably. The use of the SAW technique signifies a substantial improvement in the administration of social assistance programs in the town.

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