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Design of a Web Based Population Data Information System at Matawai Atu Village Office

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Abstract

The development of information technology has greatly influenced many sectors, including village administration. The Matawai Atu Village Office, located in Umalulu Subdistrict, East Sumba Regency, still uses a manual system to record population data such as births, deaths, new residents, and relocations. Data is recorded in a main register book and then processed using Microsoft Word to create reports. This method causes several problems, including the risk of data loss, data entry errors, slow data searching, and delays in report preparation. To solve these problems, this study aims to design a web-based population data information system that is effective and efficient. The study uses the Waterfall method, which includes the stages of requirements analysis, system design, implementation, testing, and maintenance. The system is developed using PHP and a MySQL database. Data collection is carried out through interviews, direct observation at the research location, and literature study. System testing is conducted using Black Box Testing to ensure that all features work properly, and the System Usability Scale (SUS) to measure how easy the system is for users. The results show that the developed system can manage population data more accurately, quickly, and securely. The system also makes it easier for staff to search data, manage documents, and prepare reports. With this system, it is expected that public services at the Matawai Atu Village Office will improve and better support the work of village staff.

Keywords: *Information Systems, Population Registration, Waterfall, Web, Matawai Atu Village Office*

1. Introduction

The recording of population data at the village level plays a very important role, even though such data is already recorded by the Population and Civil Registration Office (Dukcapil), which handles population data recording at the central or regional government levels. This is because the Population and Civil Registration Office only handles macro-level data and often lacks information on changes in population status at the micro level, such as births, deaths, new arrivals, and residents who have moved. Therefore, it is necessary to collect population data at the village level, as this data will be more up-to-date and accurate, containing information about people who have recently been born, died, moved in, or moved out without having to wait for updates from higher-level agencies.

Matawai Atu Village is a small part of Umalulu Subdistrict and is responsible for conducting population censuses. The current population stands at 1,866 people, comprising 954 men and 912 women. At present, the population data collection process at the Matawai Atu Village Office does not utilize technology; the process does not yet employ computer-based tools. Population data collection is currently done manually, recorded in a book called the Village Master Register; the recorded data is then stored and neatly organized in a special cabinet provided by the Village Office. At the end of each month, the population data is re-entered into Microsoft Word to generate a summary report for the Population and Civil Registration Office. This system creates difficulties for officials, including challenges in retrieving data, particularly when there are urgent requests regarding birth, death, new arrivals, or population movements. Officials must search for data one by one, which inevitably takes hours or even days. Additionally, the accumulation of data poses a significant challenge in document management, as some data may be lost or damaged.

Given these issues, there is a need for a web-based population data collection system capable of improving the effectiveness and efficiency of village officials' work. In this study, the system's effectiveness is measured by its ability to generate accurate data, facilitate the management of population data, and expedite the delivery of information and reports. Meanwhile, the system's efficiency is assessed based on time savings in data search and processing, the reduction of repetitive manual tasks, and the minimization of physical document use. The Waterfall method was employed. The system was developed using PHP and MySQL as the database. It is hoped that this system will assist the Matawai Atu Village Office.

2. Research Methodology

This section presents a flowchart of the research process, followed by an explanation of each stage.

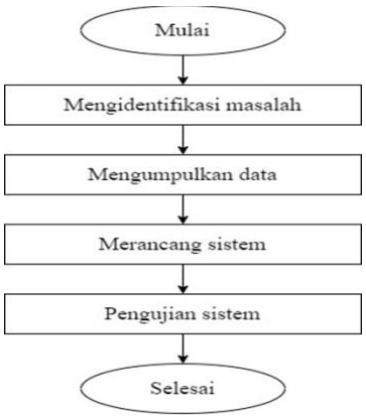

Fig. 1: Stages of Research

The research process outlined in the figure above is as follows:

1. Identifying the Problem is the stage in which we identify an issue or need of the users or the research site and analyze the existing problem (prior to implementing the new information system to be developed)
2. Data Collection. The next step in the research process is to collect data through direct observation, interviews, and documentation at the research site, specifically at the, Matawai Atu Village Office:
   a) Observation, or direct observation, is a data collection method that involves directly observing the population data processing procedures at the Matawai Atu Village Office.
   b) Interviews were conducted in person at the Matawai Atu Village Office regarding population data processing. The results of these interviews can serve as a reference for integrating population data into the website. In this study, the researcher conducted direct interviews with the Village Secretary.
   c) Documentation. In this study, documents were instrumental in providing additional information to supplement the primary data, thereby ensuring the study's comprehensiveness. The relevant documents included reports and records pertaining to population data held by the Matawai Atu Village Office.
3. System design refers to the design of the system to be developed, which includes use case diagrams, activity diagrams, sequence diagrams, and class diagrams that serve as a reference during the system development process, where all the system's requirements are outlined in the diagrams.
4. Testing is the phase in which the developed system is tested using black-box testing techniques.

The waterfall model is the most widely used software development model. According to Sukamto and Shalahuddin, the waterfall method is a sequential approach to the software development lifecycle, beginning with analysis, design, coding, testing, and support. Development of a decision support system for academic departments. There are five stages in the waterfall model, as shown in the figure below:

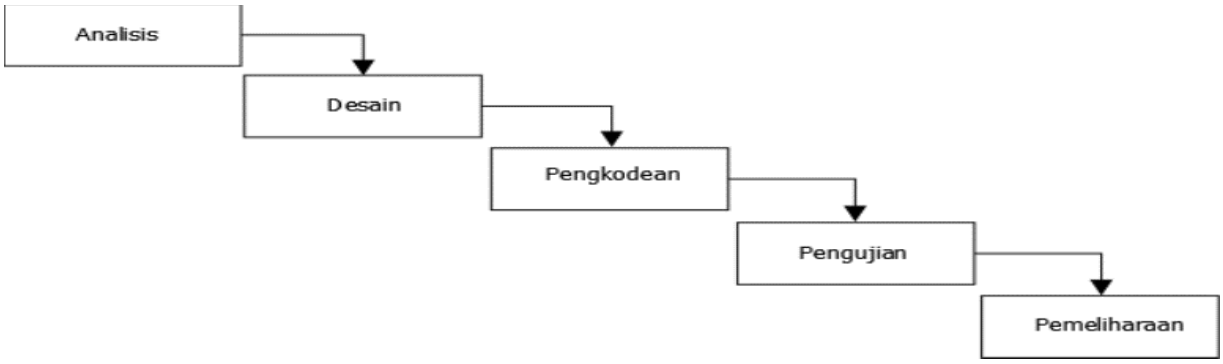

Fig. 2: Waterfall Method

1. The requirements analysis phase aims to identify user and organizational needs and analyze existing conditions (prior to the implementation of the new information system).
2. The design phase aims to determine the detailed specifications of the information system components (people, hardware, software) and information products in accordance with the results of the analysis phase.
3. The coding phase involves the creation and development of hardware and software to produce the application's output.
4. The testing phase involves testing the successfully developed application. Testing is intended to evaluate the application's performance.

5. The maintenance phase is carried out once the information system is operational. During this phase, processes are monitored, evaluated, and modified (improved) as needed.

3. Testing and Analysis

All paragraphs must be justified alignment. With justified alignment, both sides of the paragraph are straight.

3.1. Login Page

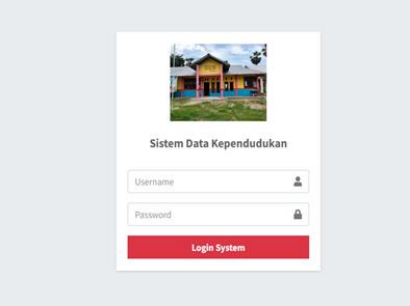

Fig. 3: Login Page Display.

Figure 3 shows the login page of the Population Data Information System. Users are required to enter their username and password to access the system. Upon successful authentication, users are redirected to the main dashboard.

3.2. Dashboard

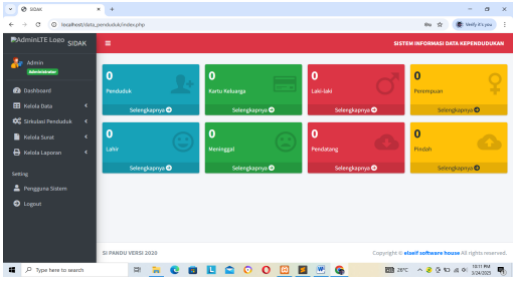

Fig. 4: Dashboard Display

Figure 4 shows the main dashboard of the system, which displays summary information on population data, including the total number of residents, family cards (KK), male and female populations, and population circulation data (births, deaths, newcomers, and relocations). This dashboard enables users to quickly overview the current state of village population data.

Only the first word in a title must be capital and other word should be in small case. Author details must not show any professional title (e.g. Managing Director), any academic title (e.g. Dr.) or any membership of any professional organization (e.g. Senior Member IEEE).

3.3. Population Data

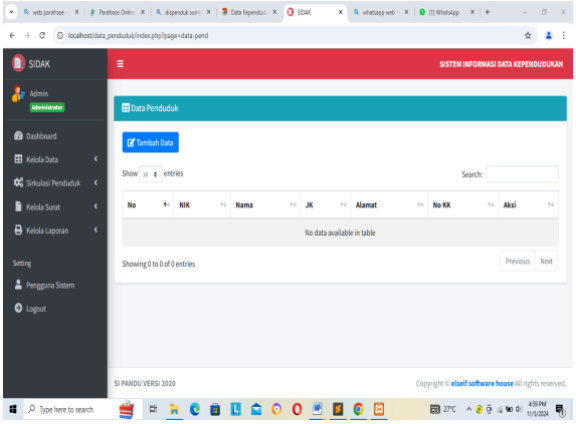

Fig. 5: Population Data Display

Figure 5 shows the population data management interface, which displays residents' NIK (national ID), name, gender, address, and family card number. Admin users can add, edit, and delete population records through this interface.

3.4. Family Card (KK) Data

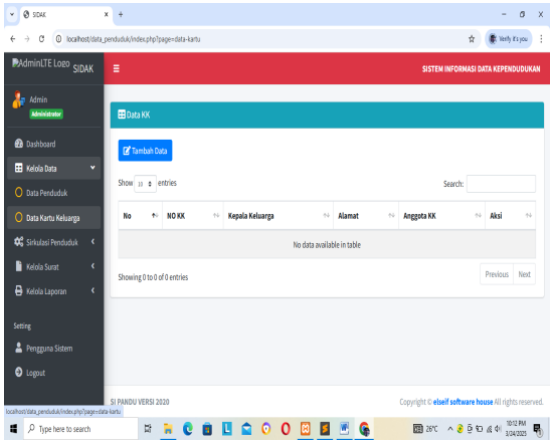

Fig. 6: Family Card Data Display

Figure 6 displays the family card (KK) management page, which contains information on KK number, head of household, address, and family members.

3.5. Death Data

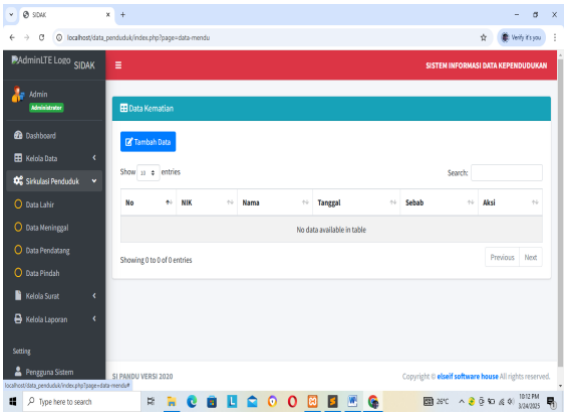

Fig. 7: Death Data Display

Figure 7 shows the death data management page, which records NIK, date of death, and cause of death for each deceased resident.

3.6. Birth Data

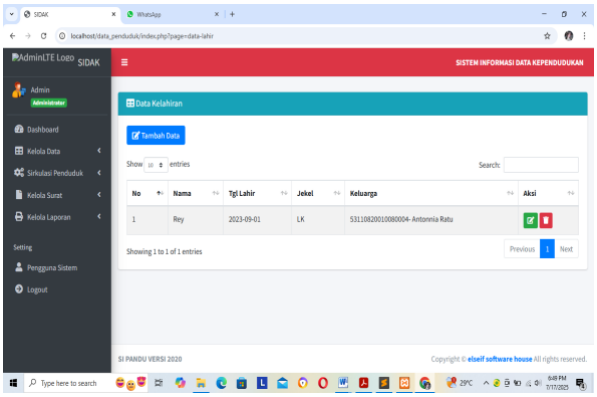

Fig. 8: Birth Data Display

Figure 8 presents the birth data management interface, containing fields for the child's name, gender, and family information.

3.7. New Resident Data

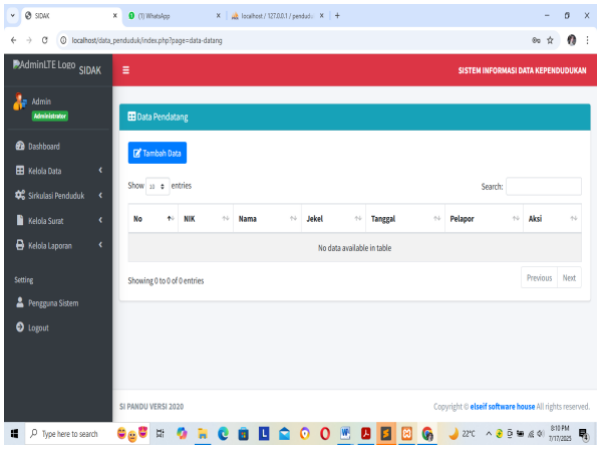

Fig. 9: New Comer Data Display

Figure 9 shows the new resident (pendatang) data management page, which records NIK, name, gender, date of arrival, and the person reporting the arrival.

3.8. Relocation Data

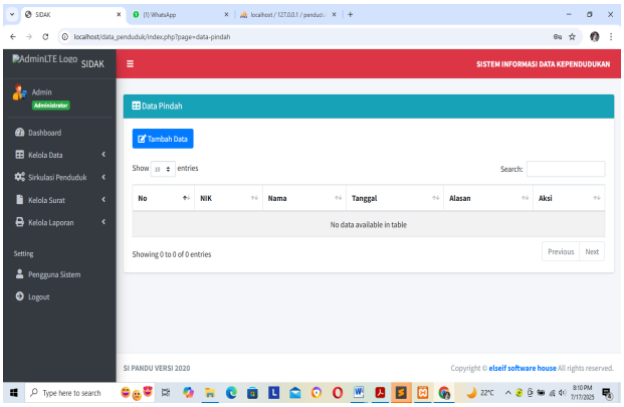

Fig. 10: Relocation Data Display

Figure 10 presents the relocation (pindah) data management interface, recording NIK, name, date of relocation, and the reason for relocation.

3.9. System User Data

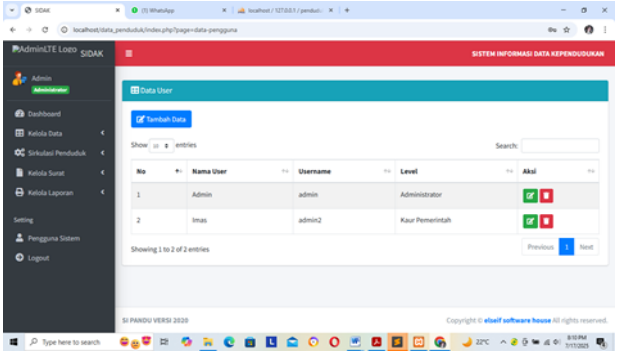

Fig. 11: System User Data Display

Figure 11 shows the user management page, which contains two user roles: Admin and Kaur Pemerintahan (Government Affairs Officer), each with different levels of system access.

3.10. Letter Management

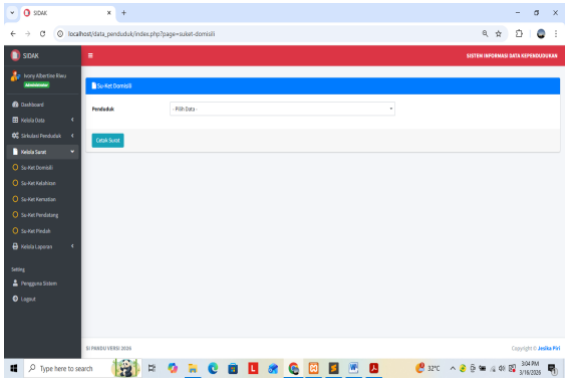

Fig. 12: Letter Mnagement Display

Figure 12 shows the letter management module used to generate and manage various administrative certificates, including domicile certificates, birth certificates, death certificates, newcomer certificates, and relocation letters. This module is linked to population circulation data, enabling automatic generation of letters from existing records, thereby reducing repetitive data entry.

3.11. Blackbox Testing

Functional testing was conducted using Black Box Testing to verify that all system features operate as expected. Tables 1 through 8 present the testing results for all major system modules.

Table 1. Login Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	Enter the wrong username and password	Remain on the login page with an error message	Remain on the login page with an error message	Valid
2	Enter the correct username and password	Redirect to dashboard	Redirect to dashboard	Valid

Table 2. Population Data Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	Add data	Data added successfully	Data added successfully	Valid
2	Edit data	Data updated successfully	Data updated successfully	Valid
3	Delete data	Data deleted successfully	Data deleted successfully	Valid

Table 3. Family Card (KK) Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	Add data	Data added successfully	Data added successfully	Valid
2	Edit data	Data updated successfully	Data updated successfully	Valid
3	Delete data	Data deleted successfully	Data deleted successfully	Valid

Table 4. Birth Data Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	Add data	Data added successfully	Data added successfully	Valid
2	Edit data	Data updated successfully	Data updated successfully	Valid
3	Delete data	Data deleted successfully	Data deleted successfully	Valid

Table 5. Death Data Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	Add data	Data added successfully	Data added successfully	Valid
2	Edit data	Data updated successfully	Data updated successfully	Valid
3	Delete data	Data deleted successfully	Data deleted successfully	Valid

Table 6. Newcomer Data Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	Add data	Data added successfully	Data added successfully	Valid

No.	Testing	Expected Result	Actual Result	Conclusion
2	Edit data	Data updated successfully	Data updated successfully	Valid
3	Delete data	Data deleted successfully	Data deleted successfully	Valid

Table 7. Relocation Data Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	Add data	Data added successfully	Data added successfully	Valid
2	Edit data	Data updated successfully	Data updated successfully	Valid
3	Delete data	Data deleted successfully	Data deleted successfully	Valid

Table 8. Report Menu Testing Results

No.	Testing	Expected Result	Actual Result	Conclusion
1	View report	Report data displayed	Report data displayed	Valid
2	Print/export data	Data printed/exported	Data printed/exported	Valid

Based on the Black Box Testing results shown in Tables 1–8, all tested features of the system operate as expected. Login validation, CRUD operations for population data, KK, birth, death, newcomer, relocation, and report functions all produced results consistent with the expected outputs. This confirms that the system is functionally reliable and meets the operational requirements of the Matawai Atu Village Office.

3.12. System Usability Scale (SUS) Evaluation

System Usability Scale (SUS) testing was conducted to measure the level of usability and user experience with the developed system. A questionnaire consisting of 10 statements covering aspects of ease of use, satisfaction, and efficiency was administered to 10 respondents. Respondents rated each item on a scale of 1 to 5.

Table 9. SUS Score per Respondent

R	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Score
R1	4	4	4	3	4	3	3	4	4	3	90
R2	3	3	3	4	3	3	4	4	4	3	85
R3	3	4	4	4	4	4	3	3	4	4	92.5
R4	4	3	4	3	3	4	4	3	4	3	87.5
R5	3	4	3	3	4	3	4	4	3	4	87.5
R6	3	4	3	4	3	3	4	4	3	4	87.5
R7	4	4	4	3	4	4	3	3	3	4	90
R8	4	4	4	3	4	3	3	4	4	3	90
R9	3	4	3	4	4	3	4	4	4	4	92.5
R10	4	4	4	4	4	3	3	4	4	3	92.5

The mean SUS score was calculated as: (90+85+92.5+87.5+87.5+87.5+90+90+92.5+92.5) / 10 = 895 / 10 = 89.5. A score of 89.5 falls in the Excellent category (≥ 80.3), indicating that the system is highly usable and well-accepted by users. These results are consistent with findings from comparable studies. Similarly reported successful system implementations that improved data management efficiency at village offices using the Waterfall method. The Waterfall approach proved suitable for this structured, requirement-driven project context.

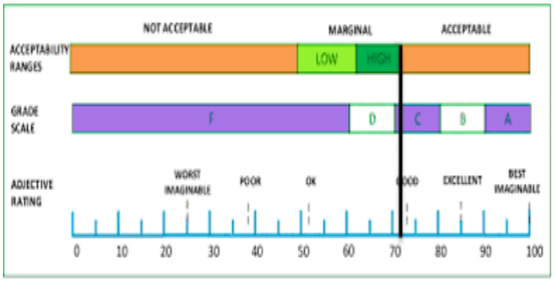

Fig. 13: SUS Score Indicator

As illustrated in Figure 18, the obtained average SUS score of 89.5 falls within the 'Excellent' grade range, confirming that the web-based population data information system is easy to use, meets user expectations, and is ready for practical implementation at the Matawai Atu Village Office.The system developed in this study offers additional advantages through its integrated letter management module, which

automates the generation of administrative certificates from existing population records, eliminating redundant data entry and reducing administrative workload.

4. Conclucsion

This study successfully designed and implemented a web-based population information system for Matawai Atu Village Office. The system addresses key weaknesses of the previous manual recording approach by enabling accurate, fast, and secure management of population data, including births, deaths, newcomers, and relocations. Black Box Testing confirmed that all system features perform as expected. The SUS evaluation yielded a mean score of 89.5, classified as Excellent, demonstrating that the system is easy to use and well-received by village office staff. The system significantly improves data retrieval speed, report generation, and letter management, thereby enhancing overall village administrative service quality.

Future development is recommended to include: multi-factor authentication and automatic backup mechanisms; mobile or Android application versions for greater accessibility; and statistical visualization features such as charts and graphs for more informative population reporting.

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