



Design of a Web-Based Village Population Data Processing Information System: A Case Study of Tanah Merah Village Office, Pasir Penyau District

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ABSTRACT

Population administration at the Tanah Merah Village Office, Pasir Penyau District, previously relied on conventional records that created duplicate data, inconsistent information, slow retrieval, and delayed report preparation. This study designed and implemented a web-based population data processing information system using observation, interviews, literature review, and the waterfall development model. Requirements were translated into use-case, activity, and class diagrams and a MySQL database. The implemented PHP-based system provides administrator authentication, user management, population and destination records, move-out requests, online birth-certificate registration, death-certificate registration, monitoring, document-completeness checks, and service outputs. Black-box testing covered seven navigation and data-management scenarios. All seven scenarios produced the expected results, yielding a 100% pass rate within the documented test scope. The system centralizes village records, reduces dependence on physical archives, and supports faster retrieval and reporting. Further work should evaluate usability, security, data validation, interoperability with higher-level civil-registration services, and operational performance after deployment.

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1. INTRODUCTION

Population data are a basic administrative resource for public services, local planning, resident mobility records, and civil-document processing. When these records remain dispersed across paper forms or independent files, officers face repeated entry, inconsistent values, slow searches, and delays in preparing reports. Web-based information systems can centralize population records and make administrative functions available through a consistent interface [1], [2], [3].

The Tanah Merah Village Office in Pasir Penyau District experienced these limitations in its conventional population-data workflow. Resident and service records were vulnerable to duplication and inconsistency, while retrieval and reporting depended heavily on physical archives. These conditions affected the speed and accuracy of administrative work, particularly for destination and move-out records, birth-certificate registration, death-certificate registration, and supporting documents.

Previous Indonesian studies have developed web-based systems for population management in villages and local administrative units. Related work also shows that integrated demographic applications can reduce manual recording and support more efficient retrieval [4]. These systems demonstrate the practical value of digitization,

but each village has different forms, actor responsibilities, service categories, and reporting needs. Consequently, a local requirements analysis remains necessary before a system can be implemented.

System development also requires an explicit process linking requirements, design, implementation, and verification. The waterfall model organizes these activities sequentially through requirements analysis, system design, coding, testing, and maintenance [5], [6]. Unified Modeling Language (UML) diagrams can document actors, workflows, and structural relationships before programming [7], [8], [9], while a relational database provides controlled storage for the records used by those processes [10].

This study translates the documented administrative workflow into a PHP and MySQL web application. The design covers administrator login and management, population and destination data, move-out applications, birth- and death-certificate services, monitoring, document completeness, and service outputs. The original UML models, database structures, and program screens are retained in this article so that the relationship between analysis and implementation can be inspected directly.

The study aims to design, implement, and functionally verify a web-based village population data processing information system for the Tanah Merah Village Office. Its contribution is a context-specific integration of population and civil-document services within one application. The evidence is limited to seven documented black-box scenarios; therefore, usability, security, interoperability, data quality, and field performance are identified as priorities for subsequent evaluation.

2. RESEARCH METHOD

2.1. Research setting and design

The study was conducted at the Tanah Merah Village Office, Pasir Penyu District, from April to August 2026. It used a system-development design focused on transforming the existing population-administration workflow into a web-based application. Requirements were collected through direct observation, interviews with relevant village personnel, literature review, and examination of the records and forms used in local services. No personally identifiable resident dataset is reproduced in this article.

The requirements were documented with UML use-case, activity, and class diagrams. The application was implemented with PHP, MySQL/XAMPP 3.2.2, and a web interface developed in Adobe Dreamweaver CS6. The database and web-development environment supported the storage and processing of user, population, destination, session, certificate, and administrative records [11], [12].

2.2. Waterfall development procedure

Development followed five waterfall stages. Requirements analysis identified functional and non-functional needs from observation and interviews. System design produced the software architecture, UML models, database tables, and interface layouts. Implementation translated these designs into PHP modules connected to MySQL. Testing examined the externally observable behavior of menus and data operations. Maintenance was positioned as the post-deployment stage for correcting faults and accommodating revised administrative requirements.

Figure 1 reproduces the original use-case diagram from the thesis. It identifies the user as the principal actor and connects that actor to the home page, administrative data, move management, certificate management, and document functions. The figure is used as originally documented rather than being replaced by a newly interpreted diagram.

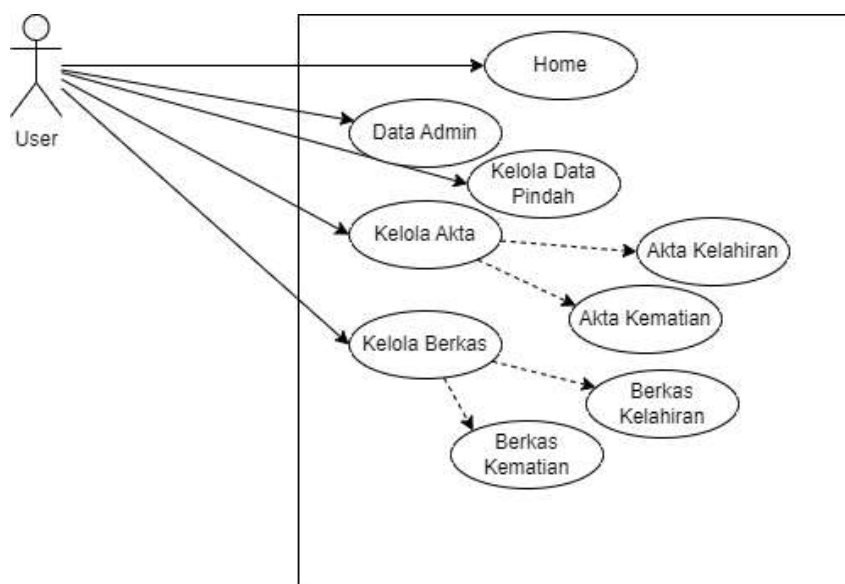


Figure 1. Original use-case diagram of the population information system

Figure 2 presents the original activity diagram. The workflow begins with authentication, separates invalid from valid credentials, and then directs an authenticated user to data entry, processing, storage, and report production. This sequence provides the operational bridge between user actions and database transactions.

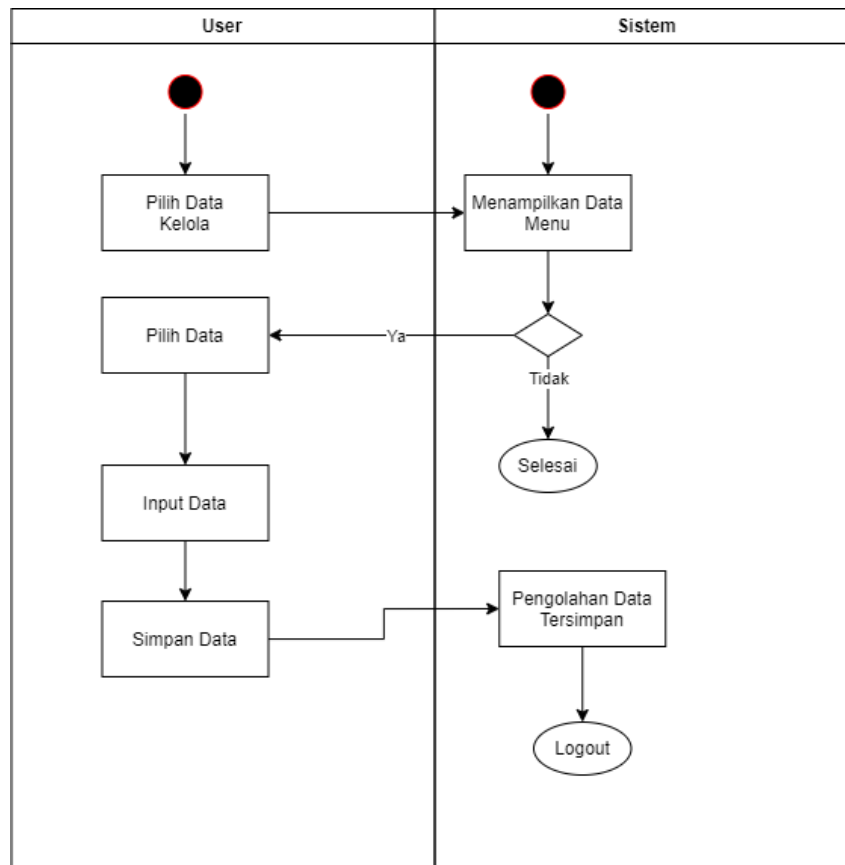


Figure 2. Original activity diagram of the administrative workflow

The original class diagram in Figure 3 describes the structural relationship among user, destination, region, and session-related classes. It complements the activity view by showing the attributes and associations required for persistent data management.

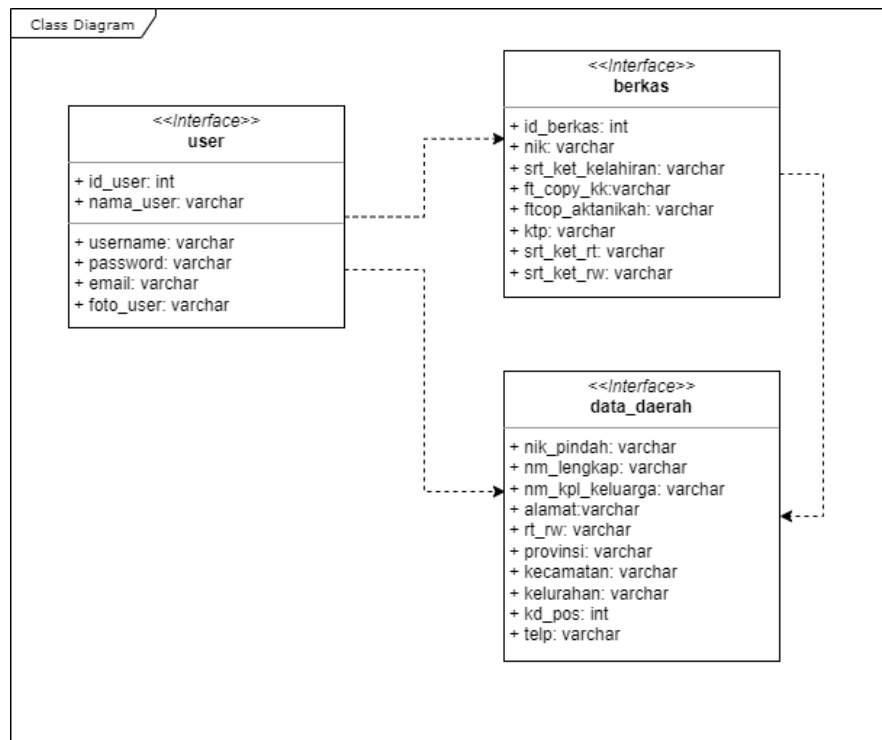


Figure 3. Original class diagram of the population information system

2.3. Functional requirements

The documented workflow centers on an authorized village administrator who maintains population records and processes service requests. Public-facing pages provide information and entry points for certificate and mobility services. Table 1 summarizes the principal functions derived from the thesis.

Tabel 1. Kebutuhan fungsional sistem informasi kependudukan

Peran	Fungsi yang Dibutuhkan	Hasil yang Diharapkan
Administrator	Melakukan autentikasi dan mengelola pengguna	Hanya petugas terdaftar yang dapat mengakses fungsi pengelolaan
Administrator	Mengelola data penduduk dan wilayah	Data penduduk dan daerah tujuan tersimpan secara terpusat
Administrator	Memproses permohonan pindah keluar	Permohonan perpindahan dapat dicatat dan dipantau
Administrator	Memproses pendaftaran kelahiran	Permohonan dan dokumen akta kelahiran dapat dikelola
Administrator	Memproses pendaftaran kematian	Permohonan dan dokumen akta kematian dapat dikelola
Pengguna umum	Melihat layanan dan pemantauan	Informasi layanan dan status permohonan dapat diakses
Sistem	Menyimpan data dan menghasilkan keluaran	Data administrasi dan laporan dapat ditampilkan kembali

2.4. Implementation and functional testing

The development environment used Windows 10 Pro, Adobe Dreamweaver CS6, and MySQL/XAMPP 3.2.2 on an Acer laptop with an AMD E2-9000e processor, 4 GB RAM, and a 120 GB solid-state drive. Functional testing used a black-box strategy, examining visible inputs, navigation actions, and outputs without relying on internal code paths [13], [14], [15]. Seven scenarios covered administrator login, the main menu, move-data entry, birth and death registration, save, and delete operations. A scenario passed when the observed response matched the expected behavior.

3. RESULTS AND DISCUSSION

3.1. Requirement translation and system structure

Requirements analysis confirmed that duplicate recording, inconsistent information, physical-archive dependence, and slow report preparation were the principal administrative constraints. The implemented design centralizes data in the database named kependudukan and connects it to task-specific forms. Its tables cover users, destination regions, resident or regional records, sessions, birth records, death records, mobility data, and supporting documents.

2. Tabel Daerah Tujuan

This table contains destination-region data for residents who move out of the village. The address and domicile attributes are recorded according to the structure presented below.

Tabel 2. Daerah Tujuan

No.	Nama Kolom	Tipe	Ukuran	Keterangan
1	id_tujuan	Int	11	id_tujuan
2	nik_pindah	Varchar	16	nik_pindah
3	almt_tjuan	Varchar	50	almt_tjuan
4	rt_rww	Varchar	10	rt_rww
5	provinsii	Varchar	30	provinsii
6	kabupatenn	Varchar	30	kabupatenn
7	kecamatan	Varchar	30	kecamatan
8	kelurahann	Varchar	30	kelurahann
9	kode_pos	Int	11	kode_pos

3. Tabel Data Daerah

This table stores the regional and resident attributes required for population data processing. The complete field structure is presented below.

Tabel 3. Data Daerah

No.	Nama Kolom	Tipe	Ukuran	Keterangan
1	nik_pindah	Varchar	16	nik_pindah
2	nm_lengkap	Varchar	30	nm_lengkap
3	nm_kpl_keluarga	Varchar	30	nm_kpl_keluarga
4	alamat	Varchar	50	alamat
5	rt_rw	Varchar	10	rt_rw
6	propinsi	Varchar	20	propinsi
7	kabupaten	Varchar	30	kabupaten
8	kecamatan	Varchar	30	kecamatan
9	kelurahan	Varchar	30	kelurahan
10	kd_pos	Int	11	kd_pos
11	telp	Varchar	12	telp

The database structure supports continuity between input and output. An authenticated officer can record a service request, validate and save its attributes, retrieve the record for monitoring, and present it through a service page or report. This connection replaces isolated paper handling with a traceable sequence of form, storage, retrieval, and output.

3.2. Implemented user interfaces

Figure 4 shows the administrator login page used to restrict access to management functions. An officer enters a registered username and password before the system opens the administrative area. This authentication step separates protected data-management activities from publicly accessible service information.



Figure 4. Administrator login page

Figure 5 shows the add-administrator interface. The form records the administrator's name, username, password, email address, and profile image, while the Save action submits the new account. Centralized account management allows authorized personnel to maintain the officers who can operate the system.



Figure 5. Add-administrator data interface

Figure 6 presents the move-out request form. The officer records the applicant's NIK, full name, head of household, address, administrative region, postal code, and telephone number. These fields provide the origin information required to process and monitor a change-of-domicile request.

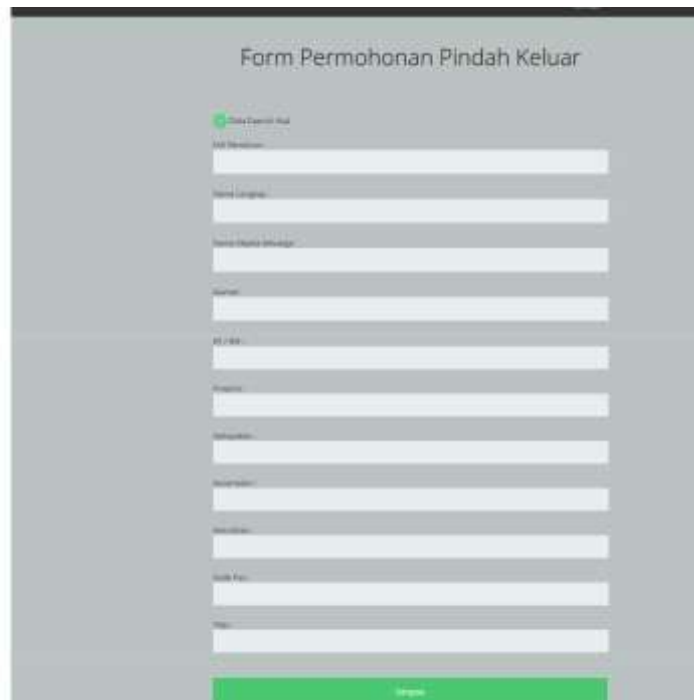


Figure 6. Move-out request form

Figure 7 presents the online birth-registration form. It captures family information, parental identity, infant identity, sex, place of delivery, place of birth, and date of birth before the record is saved. Structuring these attributes in one form supports consistent collection of the data required for a birth-certificate application.

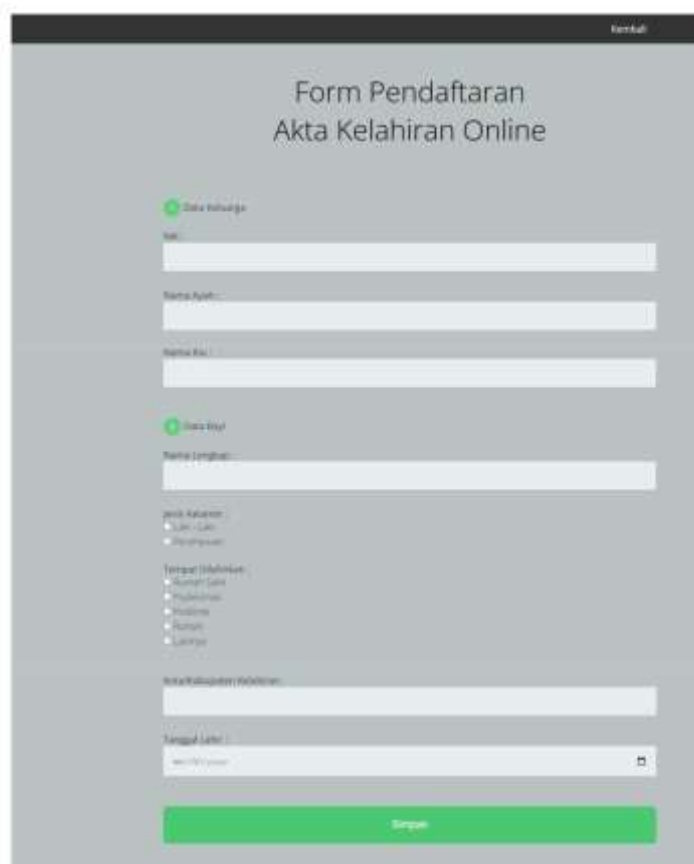


Figure 7. Online birth-registration form

Figure 8 shows the main population-service page. Three visually distinct entry points direct users to birth registration, death registration, and change-of-domicile services. The page provides a concise service overview and reduces the need to search through separate administrative documents.



Figure 8. Main population-service page

Figure 9 shows the birth-certificate service page. Users can begin a birth registration, monitor the application process, or review document-completeness information from the same page. This grouping connects submission and follow-up activities within one service category.



Figure 9. Birth-certificate service page

Figure 10 shows the death-certificate service page. Its functions allow users to initiate a death registration, check processing status, and inspect the required supporting documents. Consistent navigation between birth and death services reduces interface variation for users who access different civil-document functions.



Figure 10. Death-certificate service page

Figure 11 presents the change-of-domicile service page. The available actions support submission of a move request, printing proof of registration, and obtaining assistance. These functions connect the initial application with the documentary output required for subsequent administrative processing.



Figure 11. Change-of-domicile service page

3.3. Functional test results

Table 4 reports the seven black-box scenarios documented in the thesis. Every scenario produced the expected navigation or data operation. The functional pass rate was therefore $7/7 \times 100\% = 100\%$ within the documented scope.

Table 4. Black-box functional test results

No.	Test Scenario	Expected Result	Observed Result	Status
1	Administrator login	The administrator home page opens	Displayed as expected	Passed
2	Select the main menu	The configured main-menu functions are displayed	Displayed as expected	Passed
3	Open move-data management	The move-out request form is displayed	Displayed as expected	Passed
4	Enter a birth registration	The birth record is added to the system	Added as expected	Passed

No.	Test Scenario	Expected Result	Observed Result	Status
5	Enter a death registration	The death record is added to the system	Added as expected	Passed
6	Select the Save button	The entered data are stored	Stored as expected	Passed
7	Select the Delete button	The selected record is removed	Removed as expected	Passed

3.4. Discussion

The results show that the waterfall stages produced a coherent relationship between administrative requirements, UML models, database structures, and implemented pages. The most important outcome is the connection between population records and civil-document services: data entered for mobility, birth, or death processes can be stored centrally and presented through task-specific outputs. This finding is consistent with earlier village population systems that reported more efficient recording and retrieval after web-based integration.

All seven documented black-box scenarios passed, indicating that the tested navigation paths and data-management operations were connected correctly. Black-box testing is suitable for verifying observable system behavior, but the result must be interpreted narrowly. A 100% pass rate across seven scenarios does not establish complete coverage of invalid NIK values, duplicate residents, database interruptions, session expiration, authorization boundaries, concurrent access, browser variation, or security attacks.

The system's operational value therefore lies in providing a functional centralized alternative to paper-based work, not in proving every quality attribute. A subsequent field evaluation should measure task completion, processing time, data-entry errors, report preparation time, and officer satisfaction. Database constraints and validation rules should also be tested with duplicate, incomplete, and contradictory records to ensure that digitization does not merely transfer existing inconsistencies into a new medium.

Security and interoperability are equally important because population records contain sensitive personal information. Future testing should examine password storage, role-based authorization, session management, audit trails, input validation, backup and recovery, and transport security [16], [17], [18]. Integration with district or regency civil-registration services should use verified identifiers and controlled data-exchange procedures rather than ad hoc exports. Population information also supports local demographic planning [19], while server performance affects the responsiveness of web-based services [20]. Evidence from other web information systems further emphasizes the importance of consistent data structures, clear interfaces, and maintainable implementation [21], [22], [23], [24], [25]. These additions would extend the present functional prototype into a more defensible public-service system.

4. CONCLUSION

A web-based village population data processing information system was designed and implemented for the Tanah Merah Village Office using the waterfall model. The system connects administrator authentication, user and population records, destination and move-out data, birth and death registration, monitoring, document completeness, and service outputs through a centralized MySQL database. All seven documented black-box scenarios passed, demonstrating that the tested navigation and data operations behaved as expected. The system therefore offers a functional alternative to fragmented paper archives and supports faster retrieval and reporting. The available evidence does not yet establish usability, security, interoperability, data quality, or long-term field performance; these aspects should be addressed through representative-user testing, expanded validation, security assessment, and controlled integration with higher-level civil-registration services.

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