



WEB-BASED VILLAGE ADMINISTRATIVE SERVICE INFORMATION SYSTEM IN EPIL BARAT VILLAGE USING THE RAPID APPLICATION DEVELOPMENT (RAD) METHOD

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Abstract :

Administrative services in Epil Barat Village are still carried out conventionally, requiring residents to visit the village office directly to submit administrative letters, obtain public information, and file complaints. This condition results in longer processing times, limited accessibility, difficulty in monitoring administrative processes, and inefficient data management. This study aims to develop a web-based Village Administrative Service Information System that integrates letter services, population data management, information dissemination, and public complaint handling to improve the quality of public service in Epil Barat Village. The system was developed using the Rapid Application Development (RAD) method, comprising Requirements Planning, Design Workshop, and Implementation phases. System modeling employed Business Process Model and Notation (BPMN), Entity Relationship Diagram (ERD), and Unified Modeling Language (UML), including Use Case, Activity, and Class Diagrams. The system supports six user roles: residents, operators, the Welfare Section Head, the Head of General Affairs, the Village Secretary, and the Village Head. Key features include user registration, online letter submission, multi-level verification, village announcements, and public complaint management. Functionality was evaluated using Black Box Testing with the Equivalence Partitioning technique. Results show that the developed system successfully integrates village administrative services into a single platform, accelerates letter submission and verification, improves data management, and enables residents to access services without limitations of distance and time.

Keywords : Information System, Village Administrative Services, Rapid Application Development (RAD), Black Box Testing, Equivalence Partitioning.

INTRODUCTION

The information system for administrative services is an essential part of digital transformation in the public sector, particularly in improving public service delivery. The implementation of information technology in village-level administration enables data management and service delivery to be carried out in a structured, well-documented, and integrated manner (Rusidarma, 2022). Information systems can support administrative processes such as letter submission, population data management, and information dissemination in a faster and more accurate way, thereby improving the quality of service provided



to the community (Rachmat et al., 2024).

Village administrative services play a strategic role in fulfilling the community's continuous administrative needs, including the issuance of certificates, population data management, information dissemination, and public complaint handling. Consequently, village administrative services are required not only to be fast, but also structured, transparent, and accessible to all levels of society (Zania et al., 2024). Previous studies have shown that the implementation of web-based information systems can significantly improve the quality of village administrative services (Basri, 2022). Web-based systems have been proven to minimize recording errors, accelerate data processing, and make it easier for the public to access services without having to visit the village office in person, while also supporting transparency in village administration (Khaerunnisa et al., 2021).

However, in practice, several villages including Epil Barat Village have not yet optimally utilized information technology in administering their services. All processes, such as letter submission, data management, complaint handling, and information dissemination, are still carried out directly at the village office. Residents are required to bring physical documents and go through several stages of manual verification, making the service process difficult to monitor (Prasetya et al., 2026). This manual service condition creates real problems that affect administrative services. Residents who do not bring complete documents must return home to retrieve them, causing service delays. In addition, the considerable distance between hamlets requires residents to spend additional time and money just to process a single document, causing many residents to delay or even neglect their administrative needs. These conditions indicate that administrative services have not been running optimally.

Although various studies have discussed the implementation of village administrative information systems, a research gap remains regarding implementation based on the specific needs of individual villages. Most previous studies focus on general system development without considering geographic conditions, community access constraints, and the real needs of users at the village level in depth. Furthermore, few studies have integrated letter submission, data management, information dissemination, and public complaint handling into a single, unified system tailored to the specific conditions of a village such as Epil Barat.

Therefore, this research is important to address real problems and fill the existing research gap. The development of a web-based administrative service information system is expected to overcome the constraints of distance, time, and cost that have long been faced by the community, while also improving the performance of village officials in managing data and services. This study specifically maps administrative services into a web-based system focusing on six main types of letters: power of attorney, certificates of insufficient means (*surat keterangan tidak mampu*), death certificates, loss certificates, police clearance referral letters (*SKCK*), and marriage certificates, which represent the primary administrative needs of the Epil Barat Village community.

The use of the *Rapid Application Development* (RAD) method in this

research aims to ensure that the developed system aligns with user needs. Through the RAD approach, each design stage directly involves users in providing feedback on the developed prototype. This feedback becomes the basis for refining the design, process flow, and system functions at each iteration, so that the system is developed not based on assumptions, but on the real needs of various actors (Kendall & Kendall, 2011).

The developed system is designed based on an actual workflow involving six main actors in the service process: residents submit applications and complaints online, the operator performs initial verification, the village secretary conducts further validation, and the village head grants final approval through a digital signature. In addition, complaints can be directed to specific actors, and village announcements are managed centrally through an approval process. The resulting system is directed toward producing integrated, structured, and transparent administrative services, providing features for service-type-based letter submission with multi-level verification, real-time status tracking, actor-based complaint management, and village information dissemination accessible to the entire community.

Based on the conditions described above, this research formulates the problem of how to build a village administrative service information system for Epil Barat Village using the Rapid Application Development (RAD) method. Accordingly, this study aims to develop a web-based administrative service information system in Epil Barat Village by applying the Rapid Application Development (RAD) method. It is expected that this system will make it easier for residents to obtain administrative services without visiting the village office directly, simplify administrative management for village staff, and enable the fast and secure input and storage of population data within a MySQL database.

RESEARCH METHOD

This study applies an applied research approach, which focuses on solving real-world problems through the development and implementation of solutions that can be directly used by users. Applied research does not focus on developing new theories, but rather on producing practical, applicable, and contextual solutions to problems faced by an organization or community (Rahmah, 2022). This approach was chosen because it is relevant to the objective of this research, namely producing a practical solution in the form of a web-based Village Administrative Service Information System for Epil Barat Village. The system was designed to assist the letter submission process, population data management, digital document archiving, village information dissemination, and public complaint handling, developed based on the real needs of village officials and the community (Rahmah, 2022).

At the implementation stage, system development was carried out using the Rapid Application Development (RAD) model as the software development approach. The RAD model was selected because it supports the characteristics of applied research, which emphasizes development speed, prototyping, repeated iteration, and active user involvement throughout the development process. This

approach enabled the researcher to obtain direct feedback from users so that the developed system could be adjusted to the actual conditions in the field (Kendall & Kendall, 2011).

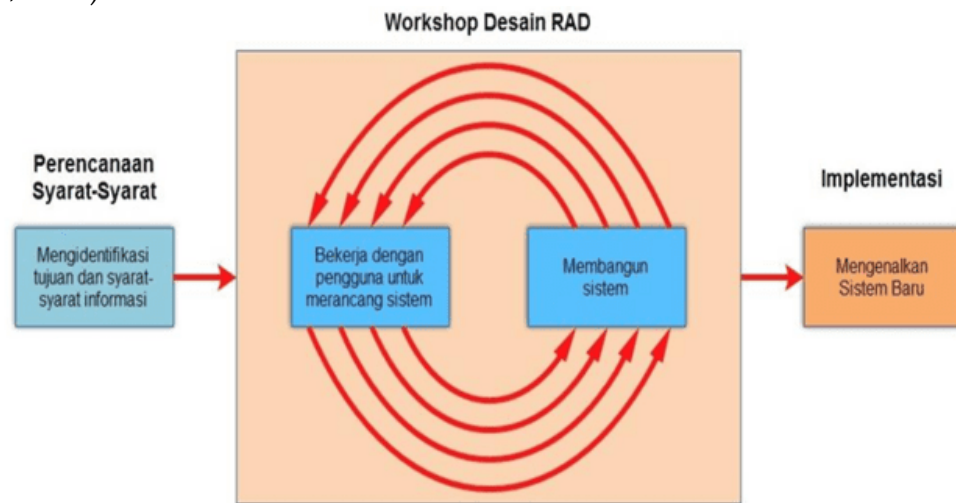


Figure 1. Rapid Application Development (RAD) Method
Source: Kendall & Kendall (2011)

The RAD model consists of three main phases: Requirements Planning, Design Workshop, and Implementation, as illustrated in Figure 1. Each phase involves active collaboration between the researcher and users, allowing the resulting system to be developed based on real user needs rather than assumptions, while also shortening the overall development time compared to conventional system development approaches.

Time and Location

This research was conducted from October 13, 2025, until the research was declared complete. The research location was the Epil Barat Village Office, located in Lais Sub-district, Musi Banyuasin Regency, South Sumatra Province.

Data Collection Method

Data were collected using observation and interview techniques as the main methods for obtaining the information required.

1. *Observation.* Observations conducted at the Epil Barat Village Office revealed that administrative services were still carried out face-to-face, requiring residents to bring documents such as an ID card (KTP) and Family Card (Kartu Keluarga) for verification and data recording by staff. Residents living in hamlets far from the village office reported frequent access difficulties due to long travel times, and when document requirements were incomplete, they had to return the following day, further prolonging the service process. The most frequently processed letters included certificates of insufficient means, SKCK referral letters, marriage referral letters, loss certificates, and relocation letters.
2. *Interview.* Village officials also reported that population data recording was still conducted incrementally, making data retrieval time-consuming, while the continuously growing document archive required a more

organized storage system. Village information dissemination still relied on direct communication, causing residents who live far from the office to sometimes receive important information late. In addition, the community expressed the need for a facility to support the letter submission process without requiring them to visit the village office in person, particularly for urgent matters. Village officials expected a web-based information system capable of providing population data management, online letter submission, easily searchable digital archives, and a platform for disseminating village information accessible at any time.

Analysis of the Current Business Process

The current administrative service process in Epil Barat Village was analyzed and modeled using Business Process Model and Notation (BPMN), as illustrated in Figure 2.

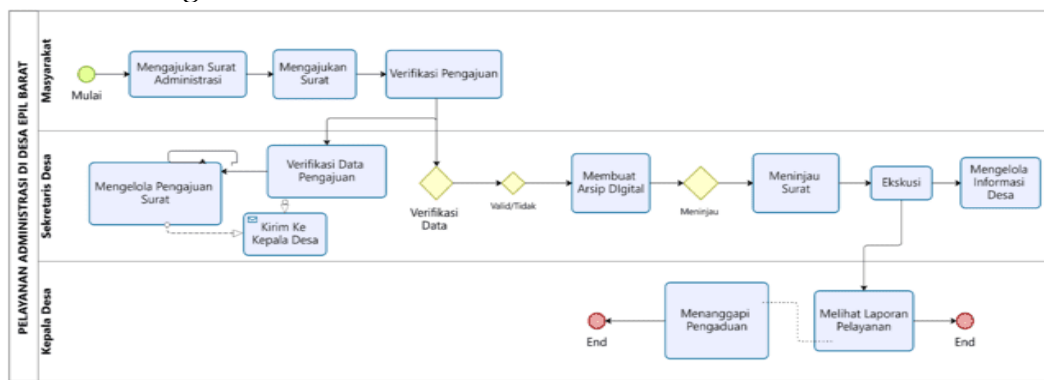


Figure 2. BPMN of the Existing Administrative Service Process

Figure 2 illustrates the BPMN diagram of the current administrative service process in Epil Barat Village. The process begins when a resident submits an administrative letter application and completes the required documents. The application is then subject to initial verification before being forwarded to the Village Secretary for data verification. At this stage, the completeness and accuracy of the data are examined. If the data is found to be invalid, the application is returned for correction and re-verification. Conversely, if the data is declared valid, the Village Secretary creates a digital archive as documentation of the letter. Once the digital archive has been completed, the letter is submitted for review prior to execution. The execution results are then managed as village information. In addition to the letter service process, the Village Head is also responsible for responding to public complaints and reviewing service reports as material for evaluating the implementation of administrative services in the village.

System Development Method

The Rapid Application Development (RAD) method was applied in this research because it allows users to be directly involved in the system development process through feedback provided at each iteration. Input from various stakeholders became the basis for refining the prototype, ensuring that the developed system met user needs and the administrative service process in

Epil Barat Village before implementation. The RAD method was implemented through three main phases, explained as follows.

1. *Requirements Planning Phase.* At this stage, the researcher conducted direct observation and interviews at the Epil Barat Village Office to identify problems in the administrative service process. Data collection results indicated that letter submission, population data recording, archive management, and village information dissemination were still carried out manually, causing information dissemination to be frequently constrained and less able to reach residents living far from the village office. These findings served as the basis for compiling both functional and non-functional system requirements, which were subsequently applied in the development of the web-based village administrative service information system.
2. *Design Workshop Phase.* This phase was a collaborative process between the researcher and village officials in designing the system's interface and workflow. The researcher developed initial prototypes for the letter submission form, population data page, digital archive page, village information page, and public complaint page. In addition to interface design, the researcher also developed UML models, including Use Case Diagrams, Activity Diagrams, and Class Diagrams. The prototypes were tested by village officials and subsequently refined based on their feedback so that the system would be easy to use and consistent with the actual administrative service process. System development was carried out using the Laravel framework with the PHP programming language and MySQL database, using a modular structure to facilitate the development of each feature such as the letter submission module, population data module, digital archive module, village information module, and public complaint module. Testing was conducted periodically throughout the construction process to ensure that each feature functioned according to user requirements and that the system could operate stably.
3. *Implementation Phase.* This phase involved deploying the completed system into the Epil Barat Village environment. Activities included installing the system on a server, migrating initial data (such as population data) into the system, training village officials in system use, and testing functional compliance with users. Once all functions were confirmed to be operating correctly, the system was fully operated as the official medium for village administrative services.

Testing Method

The testing method applied in this research was Black Box Testing, a software testing technique that focuses on system functionality without examining the internal code structure. According to Pressman (2010), Black Box Testing aims to ensure that a system operates in accordance with user requirements by examining the correctness of input, process, and output for each system function. Testing was conducted on all main system features, namely:

1. Letter Submission Testing examining whether residents can complete the letter submission form, whether data is stored correctly, and whether submitted letters can be processed by village officials.
2. Population Data Testing examining the add, edit, delete, and search functions for population data to ensure data integrity and accuracy.
3. Digital Archive Testing examining document upload, archive storage, archive search, and document download functions according to user needs.
4. Village Information Testing examining the ability of village officials to add and update information, and ensuring that residents can access information without obstacles.
5. Public Complaint Testing examining the process of complaint submission by residents and the follow-up process by village officials.
6. User Access Rights Testing examining the login, logout, and authentication mechanisms, as well as role-based access restrictions, to ensure the system remains secure.

Testing results were considered satisfactory when all functions operated according to the expected output without errors and could be used easily by both village officials and the community.

Research Stages

The overall research stages, aligned with the RAD method, are illustrated in Figure 3.

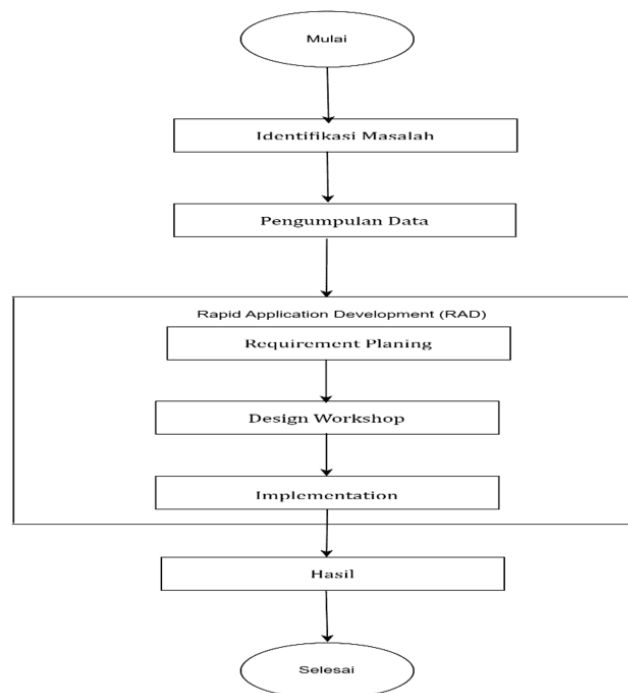


Figure 3. Research Stages

The research stages were arranged based on the applied research type aligned with the RAD method, starting from information gathering through to system implementation, as follows: (1) *Problem Identification* the researcher

conducted observations and interviews with Epil Barat Village officials to identify problems in administrative services and directly understand user needs; (2) *Data Collection* carried out through observation of the administrative service process, interviews with village officials and residents, collection of supporting documents, and a literature review of information system theory and the RAD method; (3) *System Design and Development (RAD Stage)* the researcher performed requirements analysis, designed UML diagrams, built initial interface prototypes, revised the design based on user feedback, and developed the system using PHP and MySQL; and (4) *Results* the system was fully implemented in the Epil Barat Village environment, users were trained, and the researcher compiled a complete report on the development process and final research outcomes.

FINDINGS AND DISCUSSION

Requirements Planning

The Requirements Planning phase was conducted to identify system requirements based on the administrative service problems occurring in Epil Barat Village. At this stage, user requirements were analyzed through observation and interviews, the results of which were mapped into a Fishbone diagram, followed by an analysis of system requirements through iterative interface-design prototyping as the basis for determining the features and design of the village administrative service system.

Problem Identification

A Fishbone diagram was employed as an analytical tool to structurally identify the problems and system requirements based on the observation and interview results regarding the administrative service process currently running in Epil Barat Village. This diagram was used to map the various factors underlying the constraints in village administrative services, so that the existing problems could be comprehensively understood prior to the system design process.

Based on the observation and interviews conducted at the Epil Barat Village Office, several problems were identified in the administrative service process, as illustrated in Figure 4

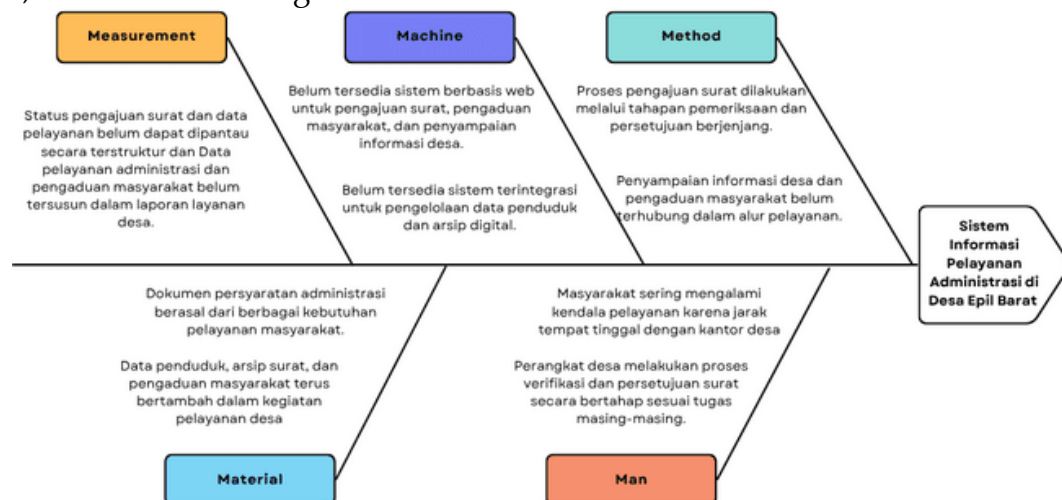


Figure 4. Fishbone Diagram of Administrative Service Problems in Epil Barat Village

On the *Machine* aspect, no web-based system was yet available to integrate letter submission, public complaint handling, village information dissemination, population data management, and digital archiving into a single service platform. On the *Man* aspect, residents frequently experienced service constraints due to the considerable distance between their homes and the village office, while the service process also involved several village officials at different verification and approval stages according to their respective duties. On the *Method* aspect, the letter submission process was carried out through tiered examination and approval stages, while information dissemination and public complaint handling had not yet been integrated into a unified service flow. On the *Material* aspect, administrative documents, population data, letter archives, and public complaint records continued to accumulate in the course of village service activities, requiring a more centralized and structured storage medium. Meanwhile, on the *Measurement* aspect, the status of administrative services and public complaints could not yet be monitored in a structured manner, and service and archival data had not been compiled into an integrated village service report.

These findings indicate that the problems across the *Machine*, *Man*, *Method*, *Material*, and *Measurement* aspects are interrelated and collectively affect the overall administrative service process in Epil Barat Village. A summary of the identified problems is presented in Table 1.

Table 1. Problem Identification Based on Fishbone Analysis

Observed Factor	Identified Problem
Man	Residents frequently experience service constraints due to the distance between their residence and the village office; village officials perform letter verification and approval in stages according to their respective duties.
Method	Letter submission is carried out through tiered examination and approval stages; information dissemination and public complaint handling are not yet integrated into a unified service flow.
Machine	No web-based system is available for letter submission, public complaint handling, and village information dissemination; no integrated system exists for managing population data and digital archives.
Material	Administrative document requirements originate from various community service needs; population data, letter archives, and public complaint records continue to grow in volume.
Measurement	The status of letter submission and service data cannot yet be monitored in a structured manner; administrative service and public complaint data have not been compiled into a village service report.

Table 1 presents the various problems occurring in the current

administrative service process of Epil Barat Village, providing a more detailed explanation of the problem factors based on the *Machine, Man, Method, Material*, and *Measurement* aspects. These findings subsequently served as the basis for formulating the functional requirements of the proposed web-based village administrative service information system.

Interface Design Iteration

Interface design iteration was carried out to design the system's user interface based on the user requirements and the administrative service business process previously analyzed. At this stage, wireframes and prototypes were developed progressively to produce a system interface that is more structured, easy to use, and aligned with user needs. The iteration process was divided into two stages: Iteration 1, representing the system's initial interface design, and Iteration 2, representing the refinement stage carried out when the design produced in Iteration 1 had not yet been approved or still required improvement, prior to system implementation.

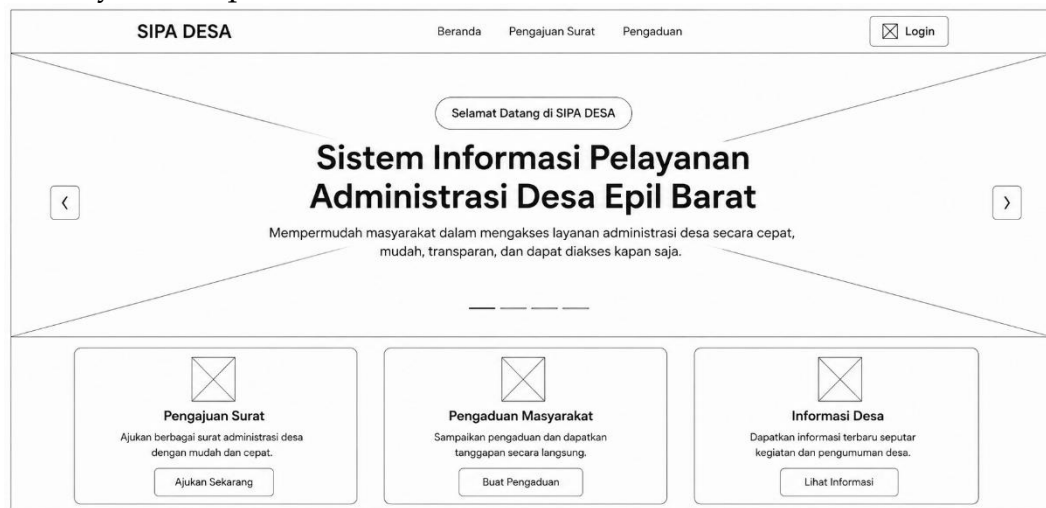


Figure 5. Iteration 1 of the Guest Homepage Interface Design

Figure 5 shows the first iteration of the guest homepage interface as an early wireframe/prototype prior to final design approval. This page can be accessed by users without logging in and consists of a navigation bar containing the system logo, the Home, Letter Submission, and Complaint menus, and a Login button. The main (hero) section displays an information banner containing the title, a brief description of the village administrative service, a navigation slider, and banner indicators, below which are three main feature cards Letter Submission, Public Complaint, and Village Information each equipped with an action button linking to the corresponding page.



Figure 6. Iteration 1 of the Resident's Letter Submission Interface Design

Figure 6 illustrates the letter submission interface used by residents to select the required type of administrative letter and to monitor the status of previously submitted applications. This interface consists of a sidebar navigation menu, letter-type options, a submission history table, application status indicators, letter description information, and a document download feature, representing the initial design of the digital letter-submission workflow for village residents.

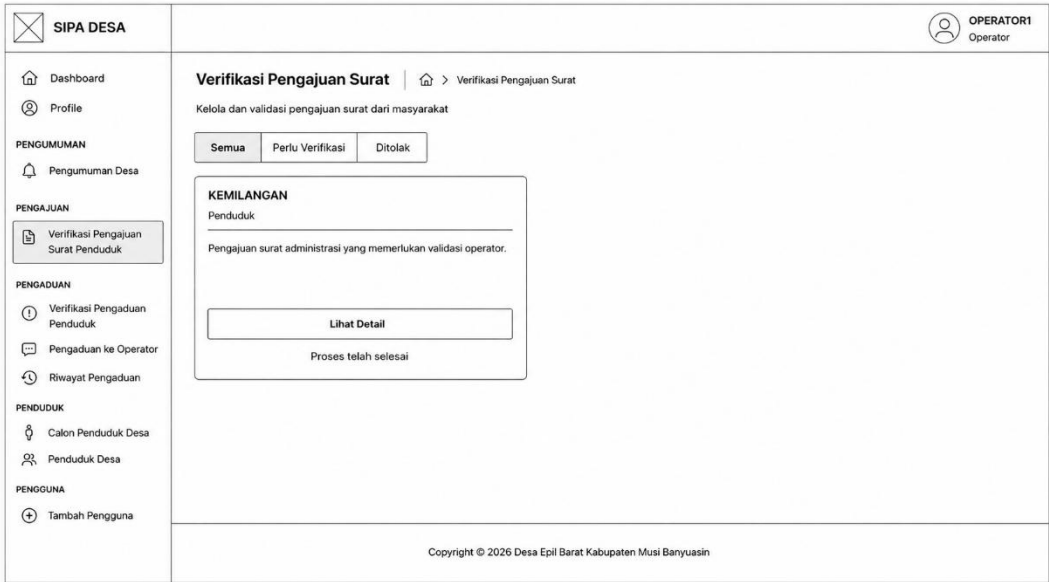


Figure 7. Iteration 1 of the Operator's Letter Verification Interface Design

Figure 7 presents the interface used by the Operator to validate residents' letter submissions based on their application status. This interface includes a sidebar navigation menu, a verification-status filter, application information cards, and an action button to view submission details, representing the initial

design of the administrative verification workflow at the operator level.

Similar iterative design and refinement were carried out for the remaining interfaces required by the other user roles the Village Secretary, Welfare Section Head, Head of General Affairs, and Village Head covering functions such as multi-level verification, digital letter legalization, village announcement management, and public complaint handling. Each interface was revised based on feedback from village officials obtained during the Design Workshop phase until it was considered ready for implementation. The finalized versions of these interfaces are presented in the Implementation subsection.

Design Workshop

The Design Workshop phase was carried out to design the system based on the requirements previously analyzed. At this stage, system modeling was performed using BPMN, ERD, Use Case Diagram, Activity Diagram, and Class Diagram to describe the business processes, data structure, and user interactions of the village administrative service system.

Business Process Modeling Using BPMN

This research proposes a new system design intended to provide a solution to the administrative service problems occurring in Epil Barat Village. The proposed design serves as a guideline for developing a web-based village administrative service information system that supports letter submission, public complaint handling, and village information dissemination in an integrated manner. The implementation of this system is expected to support the administrative service process involving residents, the Operator, the Village Secretary, the Village Head, and the Head of General Affairs within a single, structured service flow.

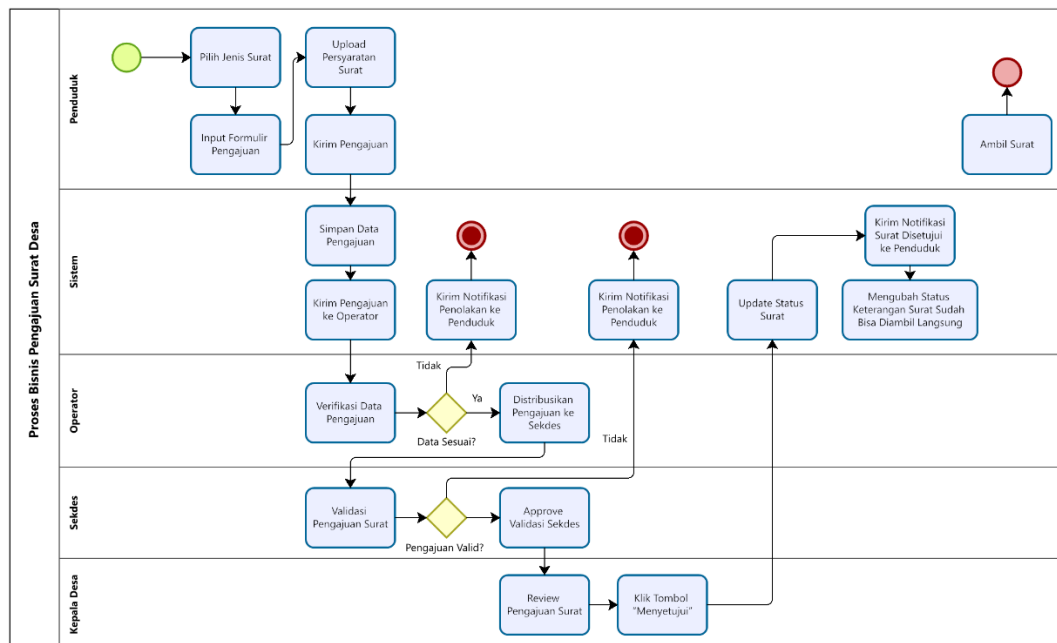


Figure 8. Proposed Business Process of Village Letter Submission

The proposed business process flow for village letter submission is shown

in Figure 8. The process begins when a resident submits a letter application through the system by completing a form and uploading the required documents. The application data is then verified by the Operator and validated by the Village Secretary. If the application is approved, the Village Head sends a notification to the resident indicating that the letter has been fully processed. The letter is subsequently distributed for the resident to collect directly.

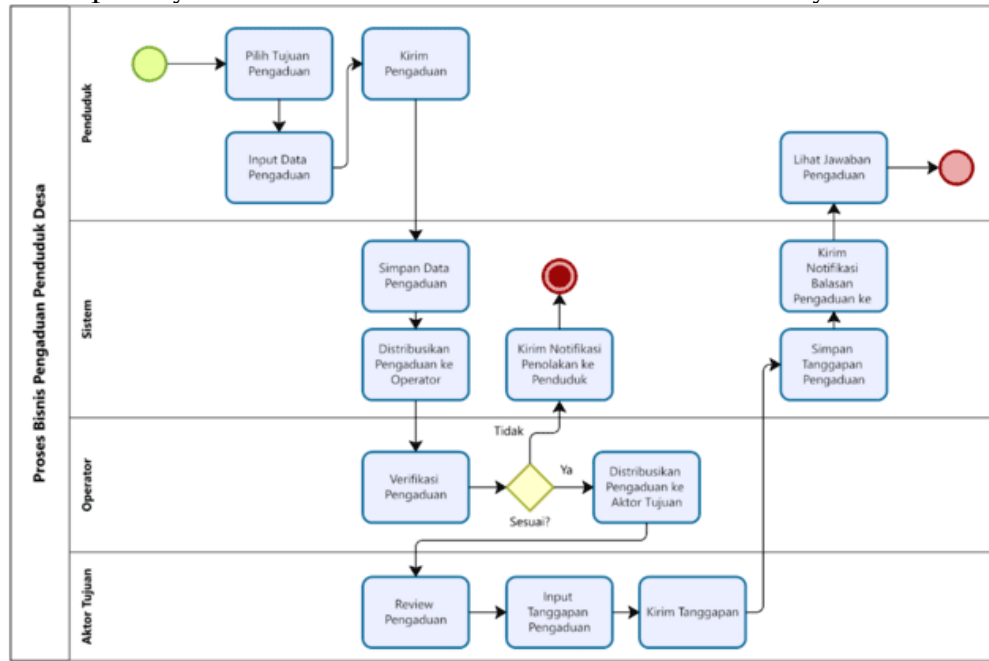


Figure 9. Proposed Business Process of Public Complaint Handling

Figure 9 shows the proposed business process for handling residents' complaints, which begins when a resident selects the intended recipient and enters the complaint data through the system. The submitted complaint is stored by the system and forwarded to the Operator for verification. If the complaint is deemed invalid, the system sends a rejection notification to the resident; if valid, the complaint is distributed to the designated actor according to the resident's selection. The designated actor then reviews the complaint, provides a response, and sends the reply through the system. The system subsequently stores the response and sends a reply notification to the resident, allowing them to view the response to the complaint submitted.

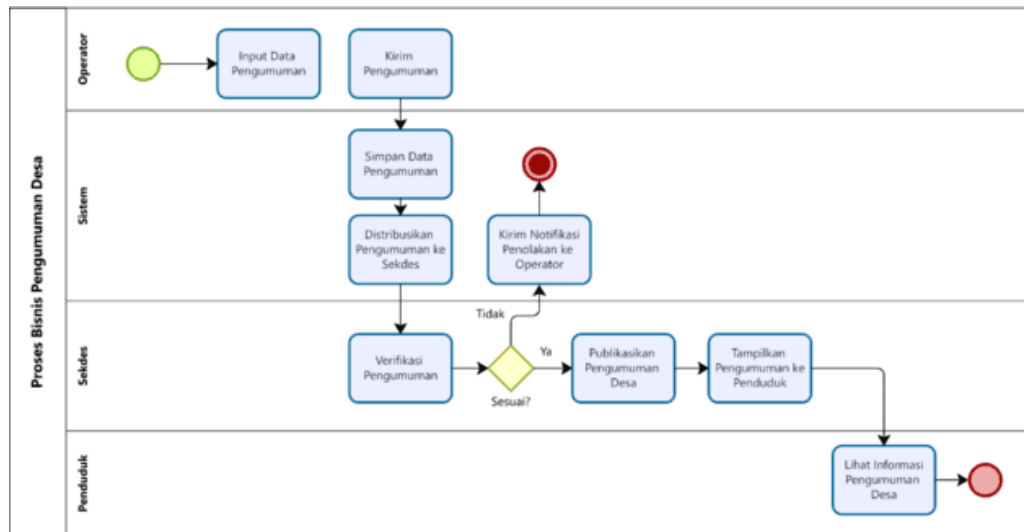


Figure 10. Proposed Business Process of Village Announcement Management

Figure 10 shows the proposed business process for village announcement management, which begins when the Operator enters and submits the announcement data through the system. The system then stores the announcement data and forwards it to the Village Secretary for verification. If the announcement is deemed inappropriate, the system sends a rejection notification to the Operator; if appropriate, the Village Secretary publishes the announcement through the system. Once published, the system displays the announcement information to residents, enabling them to view the published village information.

Data Modeling Using ERD

ERD is a conceptual model used to describe the structure of, and relationships among, data within an information system. It assists in designing and visualizing how each entity interacts through its attributes and relationships, thereby forming a structured, integrated, and consistent database design. In this village administrative and public complaint service information system, the ERD uses Barker notation, representing entities as rectangles and inter-entity relationships as lines with clearly defined cardinality.

The system's ERD comprises several core entities, including Users, DetailUser, Desa, StatusPenduduk, SyaratPendaftaran, PengajuanSurat, LogPengajuan, TTDKades, Pengaduan, PengaduanLog, Pengumuman, PengumumanLog, PengumumanRead, and TemplateSurat. Each entity has attributes and relationships aligned with the administrative service, public complaint management, and village announcement dissemination processes. The Users entity serves as the central node connected to all user data and system activity, while PengajuanSurat, Pengaduan, and Pengumuman form the core of the village's digital services, involving verification, disposition, activity-log recording, and service-status monitoring. Both a logical data model and a physical data model were used to represent the characteristics of, and

relationships among, the data in the system being developed.

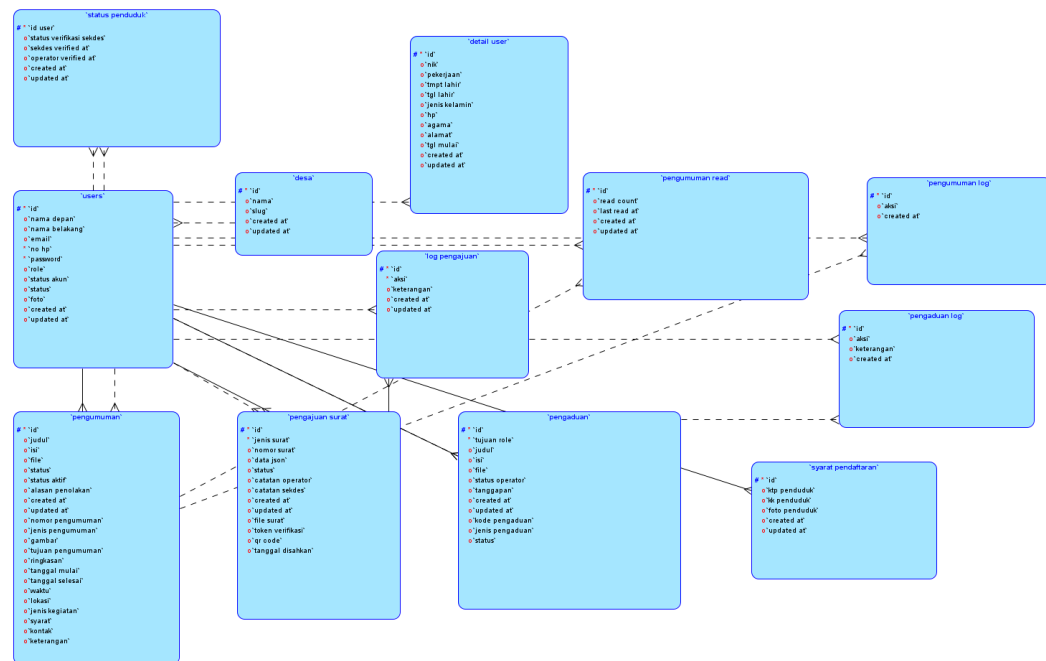


Figure 11. Logical Entity Relationship Diagram

Figure 11 presents the Logical Entity Relationship Diagram (LDM), which shows that the Users entity is the central component of the system, managing all user data based on roles such as Operator, Resident, Village Secretary, Village Head, Head of General Affairs, and Welfare Section Head. The DetailUser, SyaratPendaftaran, and StatusPenduduk entities are directly connected to Users to complete residents' identity data, registration document requirements, and the account-verification process, while the Desa entity groups user data according to each village region.

In the administrative service process, the PengajuanSurat entity forms the core of letter-service management, connected to Users as the letter applicant. The LogPengajuan entity records the entire history of submission activities, from submission and Operator verification to Village Secretary validation, Village Head approval, and completion of the letter. The TTDKades entity stores the Village Head's digital signature data used in validating official village letters.

In the public complaint process, the Pengaduan entity is directly related to Users as the complaint sender and to village officials who provide responses. The PengaduanLog entity records the entire complaint activity, including report submission, Operator verification, complaint forwarding, and the response process by the relevant official. In the village information dissemination process, the Pengumuman entity manages official village announcement data created by the Operator and verified by the Village Secretary before publication, while PengumumanLog stores announcement activity history and PengumumanRead records residents' announcement-reading activity, allowing the system to monitor the frequency and history of information access by the community.

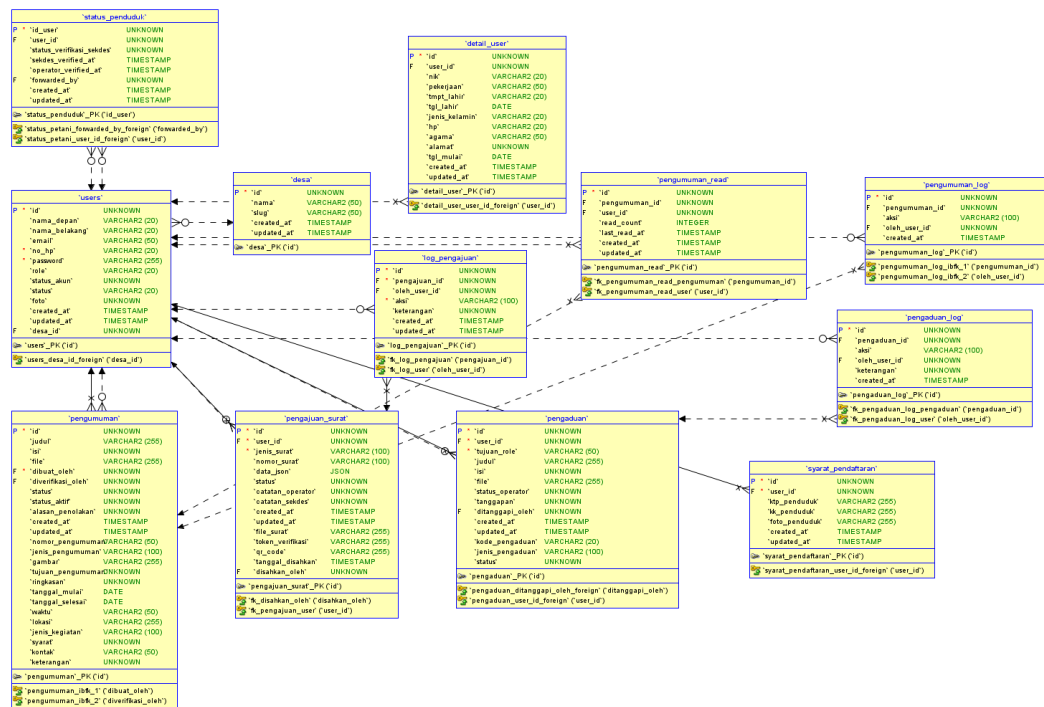


Figure 12. Physical Entity Relationship Diagram

Figure 12 presents the Physical Entity Relationship Diagram (PDM), showing the technical database structure, including tables, columns, data types, and inter-entity relationships through primary and foreign keys. The pengajuan_surat table stores residents' letter-application data along with the processing status, letter number, letter file, and submission data in JSON format, and is related to the log_pengajuan table, which records the complete submission history from letter submission and Operator verification to Village Secretary validation and Village Head approval. The ttd_kades table stores the Village Head's digital-signature file, linked directly to the letter-validation process through the pengajuan_id foreign key.

For the complaint process, the pengaduan table stores complaint data such as the title, report content, supporting files, complaint status, complaint type, and the response from village officials, and is related to the pengaduan_log table, which records every stage of the complaint-handling activity. For the village-information process, the pengumuman table stores official village announcement data including title, content, file, image, activity type, location, activity time, and verification status related to pengumuman_log and pengumuman_read, which respectively record announcement activity history and residents' reading history through the pengumuman_id and user_id foreign keys. Together, these tables represent the technical realization of the data relationships that support the flow of administrative services, public complaint handling, and village information management in a consistent and integrated manner.

Use Case Diagram

The Use Case Diagram was designed to describe the interaction between

user actors and the developed village administrative service system. This diagram illustrates the access rights, system functions, and processes that each actor can perform in managing administrative services, letter submission, public complaints, and village announcements.

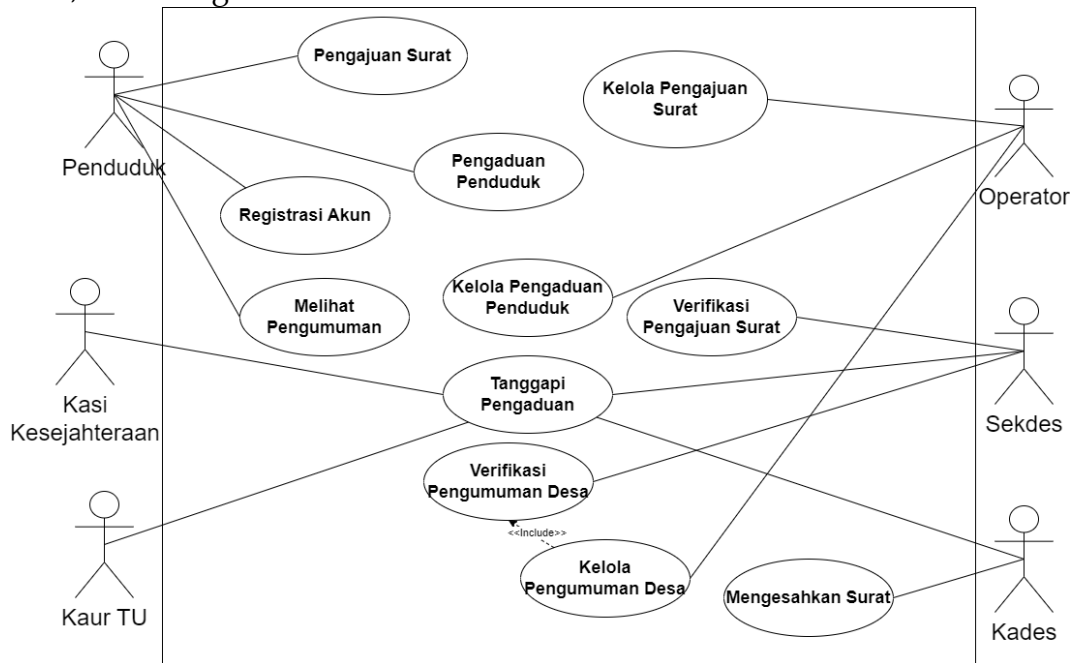


Figure 13. Use Case Diagram of the Village Administrative Service Information System

Figure 13 visually depicts the relationship between the actors and the Epil Barat Village Administrative Service Information System, showing each actor's interactions according to their respective tasks and access rights. Residents act as the primary users, able to register an account, view village announcements, submit letters, and send public complaints. The Operator manages letter submissions, resident complaints, and village announcements. The Welfare Section Head manages public complaints related to welfare matters. The Head of General Affairs manages complaints that have been processed within the system. The Village Secretary verifies letter submissions, manages village announcements, and manages public complaints before forwarding them to the next stage. The Village Head is responsible for managing letter submissions and public complaints as a form of oversight over administrative services. Through this Use Case Diagram, the entire administrative service process can be depicted in an integrated manner between the community and village officials, thereby improving the overall service process.

Table 2. Description of Use Case Actors

Actor	Description
Resident	Acts as the primary system user, able to view village announcements, submit administrative letters, and send public complaints through the web-based administrative service system.
Operator	Manages village announcement data, verifies residents'

	letter submissions, and manages incoming public complaints. Also responsible for managing user and resident data.
Welfare Section Head	Manages public complaints related to welfare matters and provides responses to complaints received through the system.
Head of General Affairs	Manages approved letter submissions, provides responses to letter applications, finalizes the administrative letter process, and manages public complaints.
Village Secretary	Verifies residents' letter submissions, verifies village announcements prior to publication, and manages incoming public complaints within the administrative service system.
Village Head	Provides final approval for residents' letter submissions and manages and responds to public complaints received through the system.

The Use Case Diagram design stage was carried out to identify the actors and the functions each actor can perform within the system. The Epil Barat Village Administrative Service Information System involves six main actors Resident, Operator, Welfare Section Head, Head of General Affairs, Village Secretary, and Village Head each with distinct access rights and duties corresponding to the administrative service process, including letter submission, public complaint management, and village announcement management, as described in Table 2.

Activity Diagram

The Activity Diagram was used to visualize the flow of activities within each process running on the Epil Barat Village Administrative Service Information System, describing the main activities carried out by each actor according to their tasks and access rights. Through the Activity Diagram, the flow of the administrative service process from letter submission and verification to complaint management and village information dissemination can be understood more clearly, supporting system development in accordance with user needs. Design was carried out for eleven core processes; three representative examples are presented below.

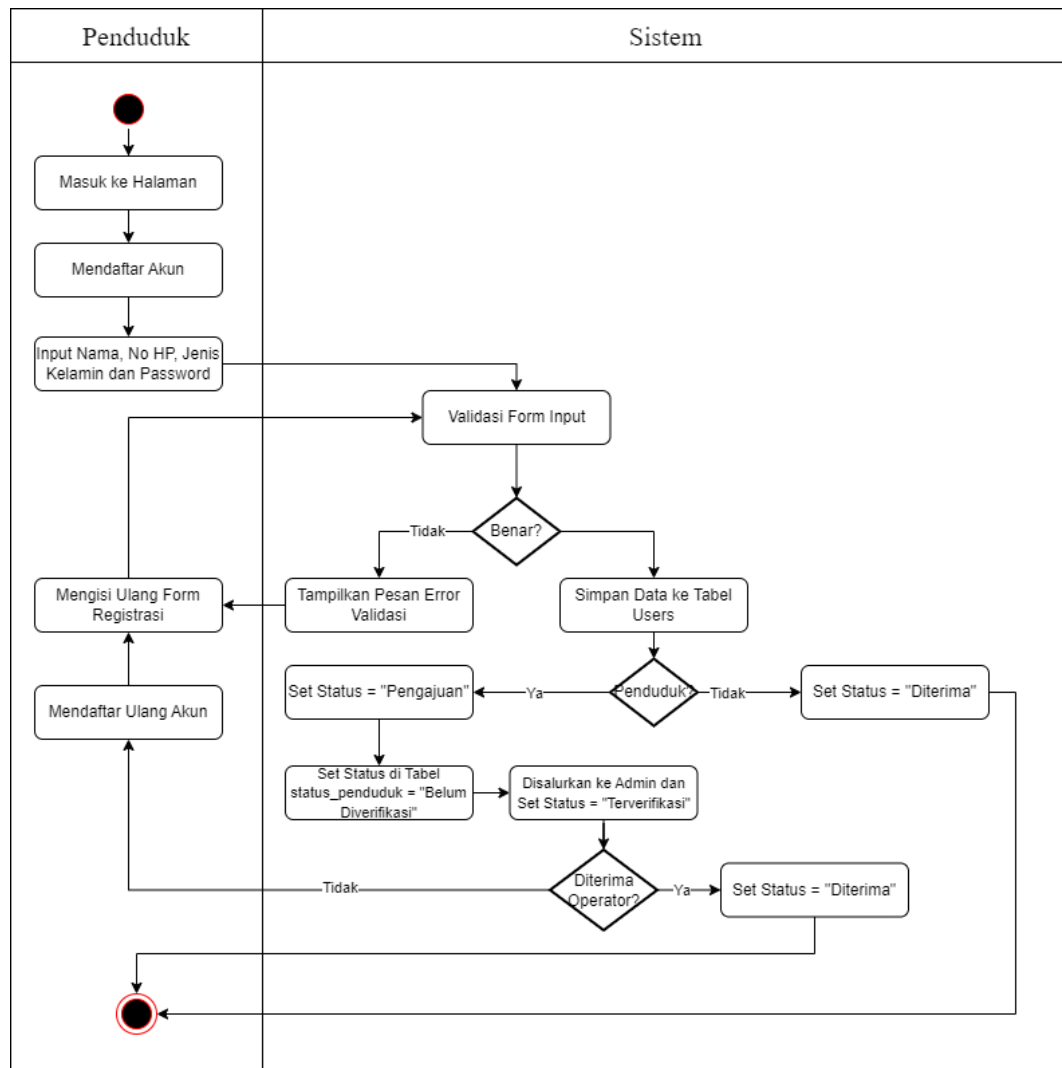


Figure 14. Activity Diagram of Account Registration

Figure 14 shows the account-registration process, which begins when a resident completes the registration form with the required data. The system then validates the entered data; if invalid, an error message is displayed and the user is asked to re-enter the data. If valid, the system stores the account data and determines its status according to the user's role. For the resident role, the account undergoes Operator verification before activation, whereas other roles are activated directly. The registration process is completed once the account has been successfully verified.

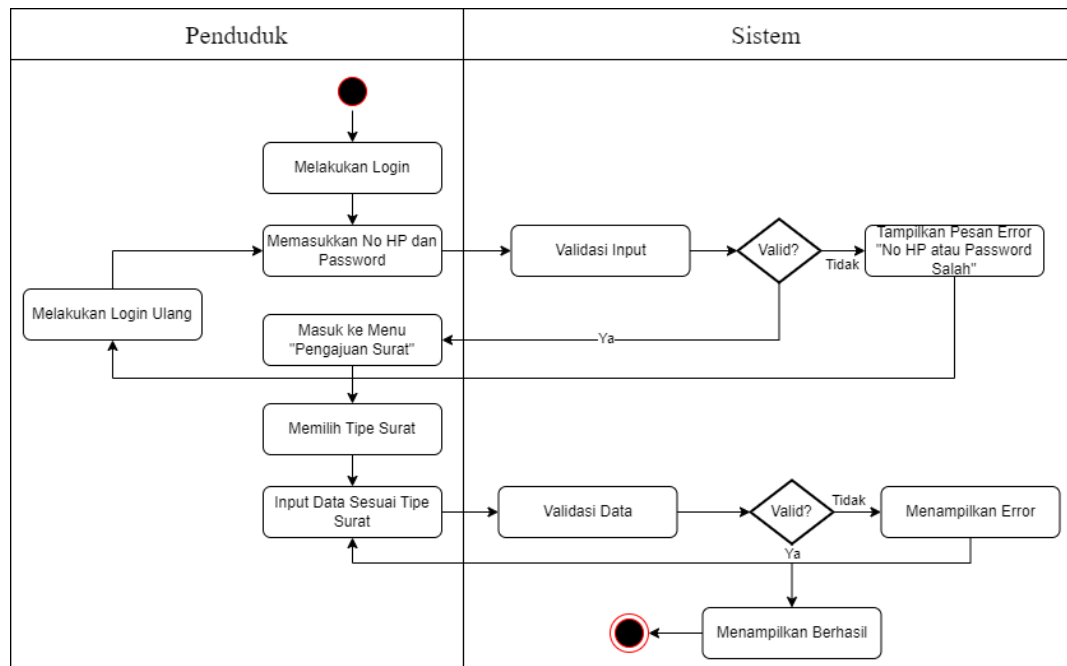


Figure 15. Activity Diagram of Letter Submission

Figure 15 shows the letter-submission process. After logging in, the user selects the desired letter type and completes the submission data accordingly. The system then validates the submission data, displaying a success message if the data is valid or an error message if invalid.

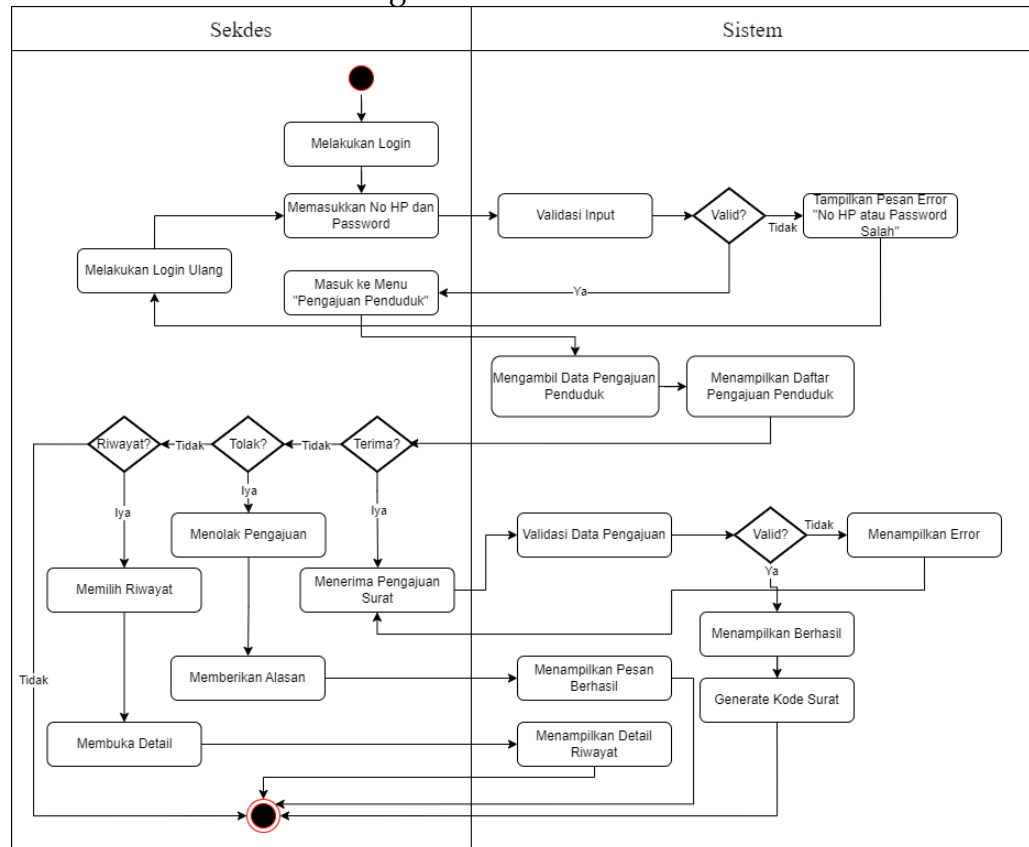


Figure 16. Activity Diagram of Letter Submission Verification

Figure 16 shows the Village Secretary's letter-verification process. After logging in, the Village Secretary opens the list of letter submissions, selects an application, reviews its details, and decides to approve or reject it. If rejected, the Village Secretary provides a reason for rejection; if approved, the system validates the data, displays a success message, and generates a letter code. The Village Secretary can also view submission history along with its details.

Similar activity-flow modeling was carried out for the remaining core processes village announcement management, public-complaint verification and response, viewing announcements, and letter legalization by the Village Head each describing the login validation, main task execution, system data validation, and resulting success or error notification specific to the corresponding actor and function.

Class Diagram

The Class Diagram describes the structure of, and relationships among, the main classes that form the integrated village administrative service system. It consists of several core classes representing the administrative service process, including resident-data management, letter submission, public complaint handling, and village information dissemination. The Users class serves as the central hub for user-data management, connected to the Detail_User, Status_Penduduk, and Syarat_Pendaftaran classes to support the verification and management of resident data. The Pengajuan_Surat, Ttd_Kades, and Log_Pengajuan classes represent the letter-submission process, multi-level verification, Village Head approval via digital signature, and the recording of submission-process history.

In the public-service component, the Pengaduan and Pengaduan_Log classes handle the public-complaint process and the history of follow-up actions taken by village officials. The Pengumuman, Pengumuman_Read, and Pengumuman_Log classes represent the management of village information, the recording of users' announcement-reading activity, and the announcement activity history. The Desa class connects regional data to the users registered within the system. Each class is interconnected through logical, integrated relationships, with Users serving as the primary relational hub linking Pengajuan_Surat, Pengaduan, Pengumuman, and resident data.

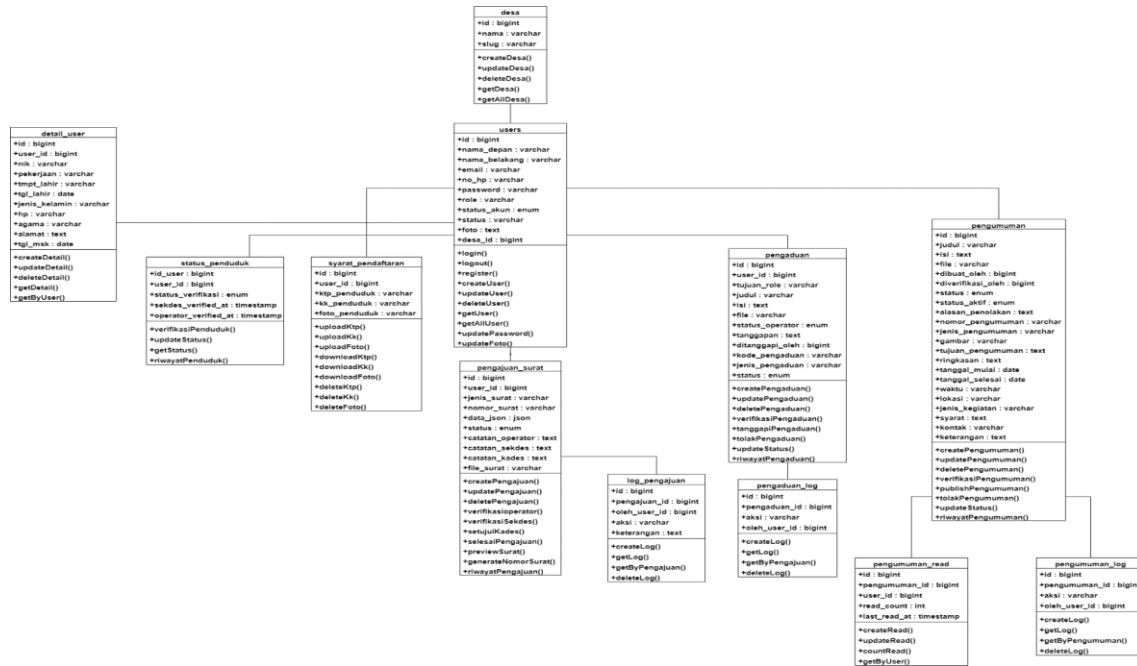


Figure 17. Class Diagram of the Village Administrative Service Information System

Figure 17 illustrates the overall data structure forming the foundation of the Epil Barat Village Administrative Service Information System. The Users class functions as the main hub connected to Detail_User, Status_Penduduk, and Syarat_Pendaftaran to support user-identity management, population data, and administrative verification. The letter-service process is represented by Pengajuan_Surat, Ttd_Kades, and Log_Pengajuan, managing multi-level verification, digital-signature approval, and activity history. Public-complaint services are represented by Pengaduan and Pengaduan_Log, while village-information dissemination is represented by Pengumuman, Pengumuman_Read, and Pengumuman_Log. Together, these interconnected classes enable the system to support a structured, integrated web-based village administrative service process from resident data management and letter submission to public complaint handling and village information dissemination.

Implementation

The Implementation phase represents the stage in which the design results produced in the Design Workshop phase were realized into an operational web-based application. This phase consisted of three main activities: database implementation, user-interface implementation, and system testing, carried out to ensure that the Epil Barat Village Administrative Service Information System operated in accordance with the design that had previously been established.

Database Implementation

Database implementation was carried out to translate the Physical Entity Relationship Diagram shown in Figure 12 into an operational MySQL database. Fourteen interrelated tables were built to support user authentication, resident identity data, letter submission, public complaint handling, and village

announcement management, as summarized in Table 3.

Table 3. Database Tables of the Village Administrative Service Information System

No	Table	Function
1	users	Central table for user authentication, identification, and role-based access (Resident, Operator, Village Secretary, Village Head, Head of General Affairs, Welfare Section Head)
2	detail_users	Stores residents' additional identity data (NIK, occupation, place/ date of birth, gender, contact, religion, address)
3	desa	Stores village-region reference data used to group users by village
4	status_penduduk	Records the resident account verification status by the Village Secretary and Operator
5	syarat_pendaftaran	Stores registration document uploads (ID card, family card, resident photo)
6	pengajuan_surat	Stores letter-submission data, processing status, and the generated letter file
7	log_pengajuan	Records the complete history of letter-submission activities
8	pengaduan	Stores public complaint data, status, and officials' responses
9	pengaduan_log	Records the history of complaint-handling activities
10	pengumuman	Stores village announcement data and its verification status
11	pengumuman_log	Records the history of announcement activities
12	pengumuman_read	Records residents' announcement-reading activity
13	ttd_kades	Stores the Village Head's digital-signature file used for letter legalization
14	template_surat	Stores administrative letter templates used to generate output documents

As an illustration of the table-level structure, the *pengajuan_surat* table the most transaction-intensive table in the system, since it stores every stage of the letter-submission process from initial submission to final legalization is presented in detail in Table 4.

Table 4. Structure of the *pengajuan_surat* Table

Column	Data Type	Description	Key
id	bigint unsigned	Unique identifier of the letter submission	PK
user_id	bigint unsigned	Relation to the applicant on the users table	FK
jenis_surat	varchar(100)	Type of letter submitted	
nomor_surat	varchar(100)	Official letter number generated after approval	
data_json	json	Submission detail data stored in JSON format	
status	enum	Submission status (sent, verified/rejected by Operator, verified/rejected by Village Secretary, approved by Village Head, ready for collection, completed)	
catatan_operator / catatan_sekdes / catatan_kaurtu	text	Notes from the Operator, Village Secretary, and Head of General Affairs	
file_surat	varchar(255)	Path of the generated letter file	

created_at / updated_at	timestamp	Record creation and update time	
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The remaining thirteen tables follow the same normalized structure each is directly related to the *users* table through a foreign key and records its own activity log, consistent with the relationships already presented in the Physical Entity Relationship Diagram (Figure 12).

User Interface Implementation

User-interface implementation is the realization stage of the interface design developed during the Design Workshop phase (see the Interface Design Iteration section), refined into the system's final interface based on feedback obtained from village officials. The final interface was implemented for six user roles Resident, Operator, Village Secretary, Village Head, Head of General Affairs, and Welfare Section Head across thirteen main pages; eight representative pages are presented below.



Figure 18. Guest Homepage

Figure 18 shows the guest homepage, accessible to the public without logging in. The page displays a navigation bar (Home, Letter Submission, Complaint, and a Login button), a hero section introducing the Epil Barat Village Administrative Service System, and a background image of the village office that gives the system a distinct visual identity, allowing residents to obtain an initial overview of the service before accessing it further.



Figure 19. Login Page

Figure 19 shows the login page used for user authentication, consisting of an informational panel on the left and a login form on the right containing email and password fields, a login button, and a link to the registration page.

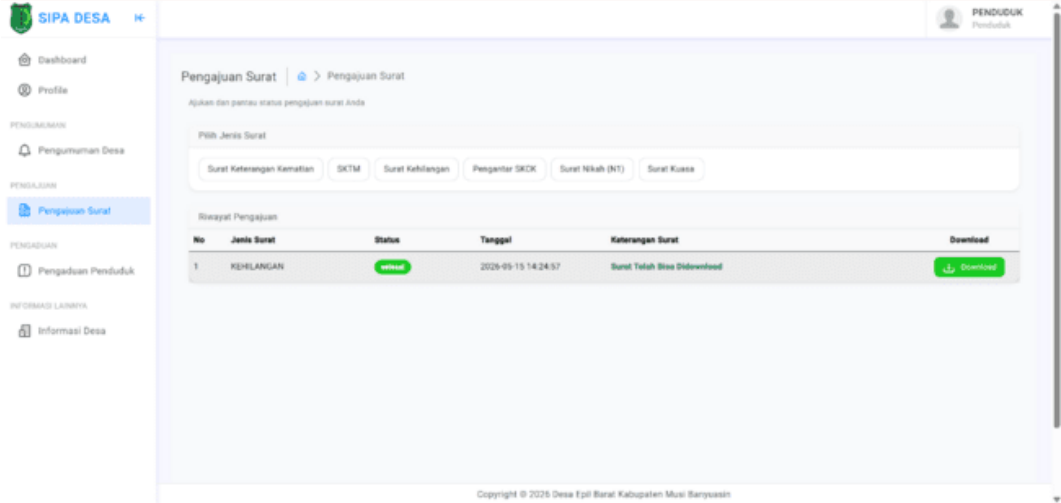


Figure 20. Resident's Letter Submission Page

Figure 20 shows the letter-submission page used by residents to select a letter type, monitor submission status, and download completed letters. The page displays available letter types, submission history, real-time status, and a download feature once a letter has been fully processed.

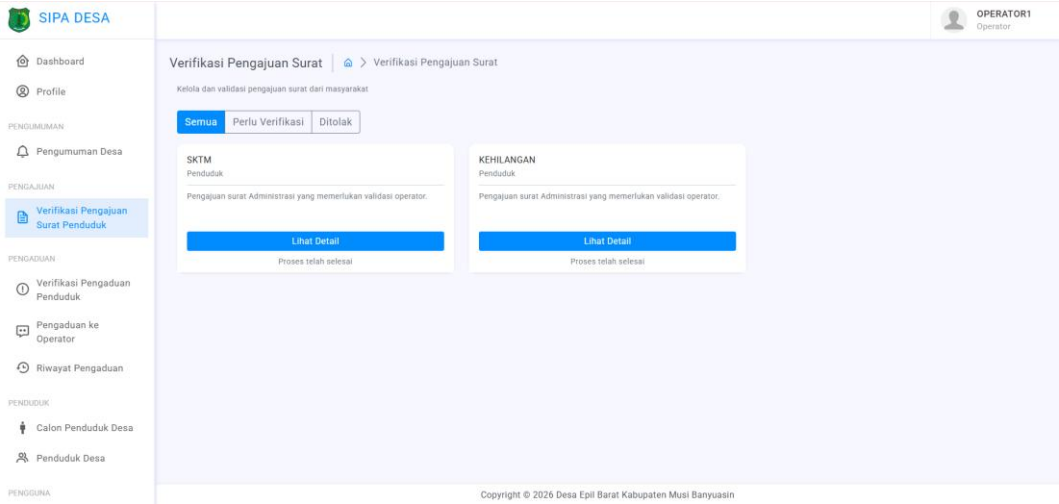


Figure 21. Operator's Letter-Verification Page

Figure 21 shows the interface used by the Operator to perform initial verification of residents' letter submissions, displaying the submission list by status, a status filter, and a detail button for reviewing each application.

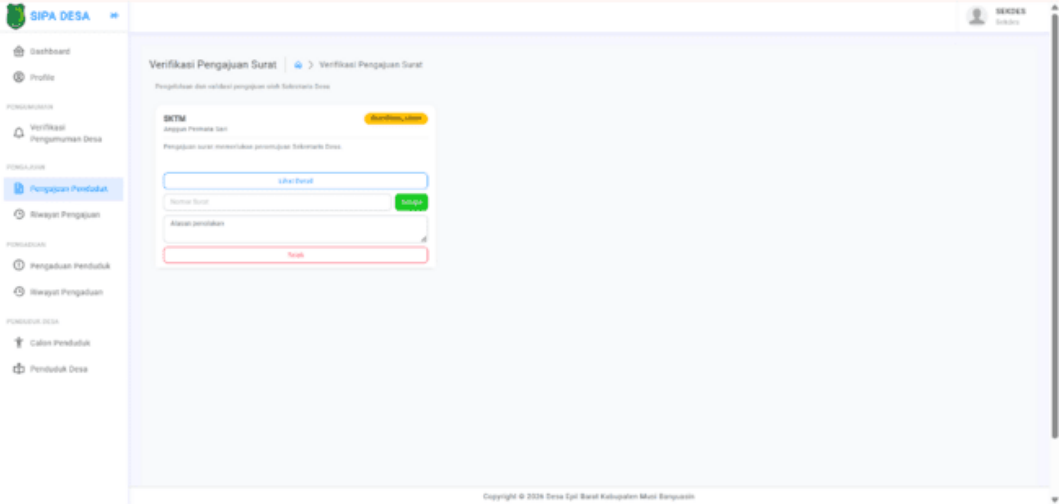


Figure 22. Village Secretary's Letter-Verification Page

Figure 22 shows the interface used by the Village Secretary to conduct further validation, including the Operator's verification status, a letter-number input form, a rejection-reason field, and approval/rejection action buttons.

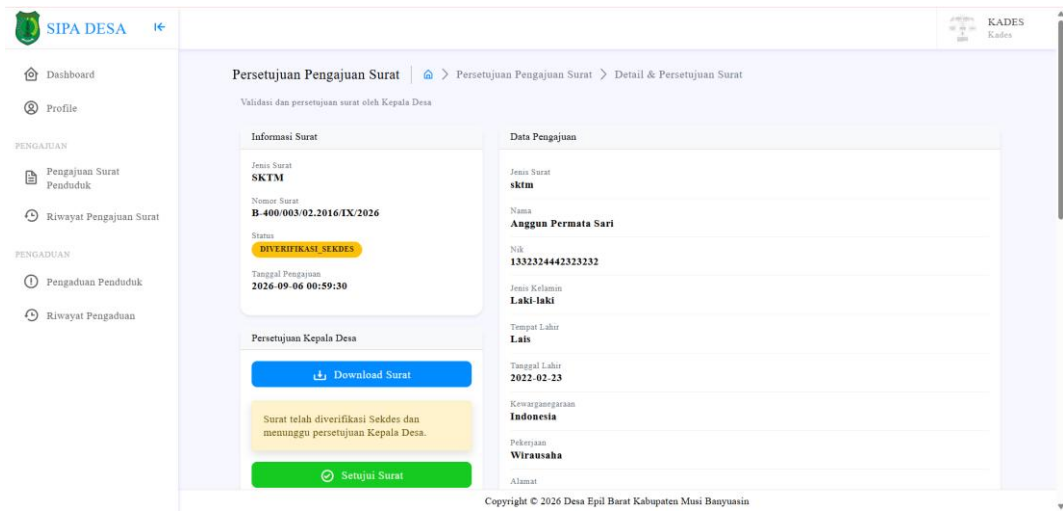


Figure 23. Village Head's Letter-Legalization Page

Figure 23 shows the interface used by the Village Head to grant final approval and legalize the letter digitally, displaying complete applicant data and the Village Secretary's verification status.

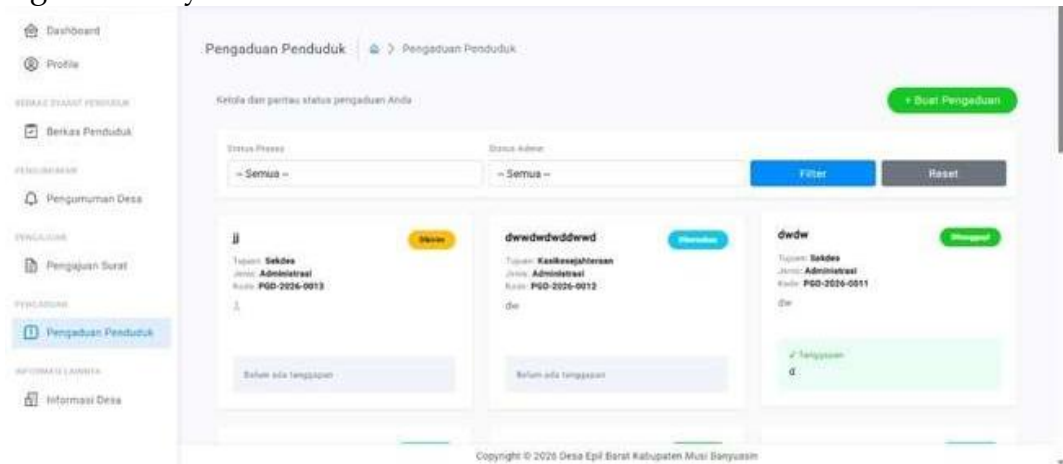


Figure 24. Resident's Public Complaint Page

Figure 24 shows the page used by residents to submit and monitor complaints, presenting each complaint as an information card containing the complaint destination, category, tracking code, status, and the official response received.

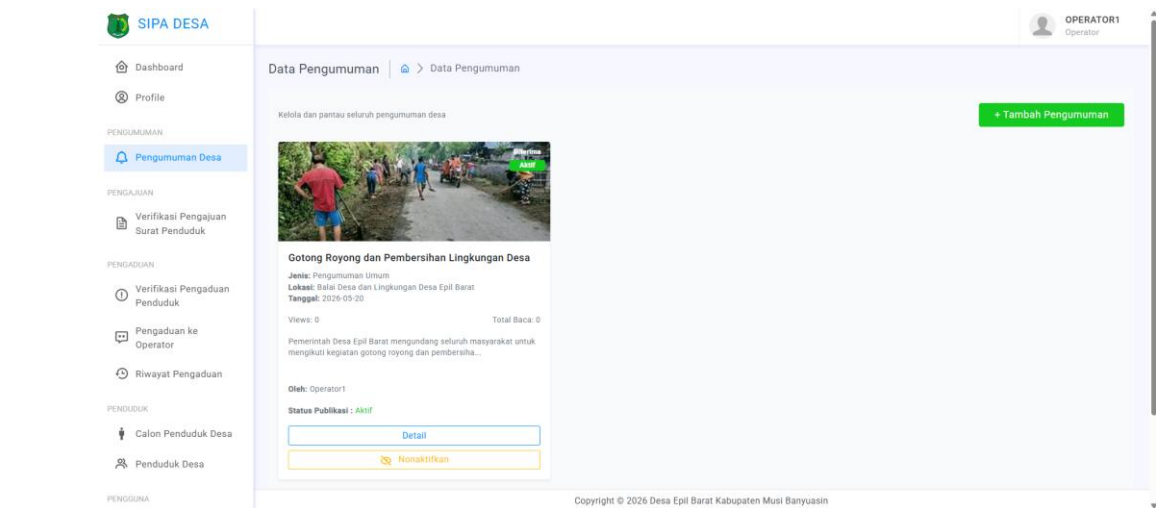


Figure 25. Operator's Village Announcement Management Page

Figure 25 shows the page used by the Operator to manage and publish village announcements, displaying each announcement as an information card with an image, title, category, location, date, and read count, along with add, view-detail, and delete features.

Testing

System testing was carried out using Black Box Testing with the Equivalence Partitioning technique, as described in the Testing Method section, to ensure that every function operated correctly from the perspective of all six system actors: Resident, Operator, Welfare Section Head, Head of General Affairs, Village Secretary, and Village Head. Testing was conducted in two stages for each actor: an initial round (Stage 1) covering all core features accessible to that role, followed by system refinement based on any invalid results, and a second round (Stage 2) repeating the same scenarios to confirm that all functions operated correctly after improvement.

Stage 1 testing, conducted on 1 April 2026, identified several invalid scenarios across the six actors, mainly related to file-type validation on uploads, mandatory-field validation on submission forms, and menu-access restriction based on account-verification status. A representative sample of the invalid findings from the Resident testing is presented in Table 5.

Table 5. Sample of Invalid Findings Resident, Stage 1 Testing (1 April 2026)

No	Feature	Test Scenario	Expected Result	Actual Result
1	Profile Photo Upload	Resident uploads a PDF file as a profile photo	The system rejects the file and shows a "File must be an image" message	The system failed to validate non-image file uploads
2	Certificate of Insufficient	Resident leaves a required field blank	The system rejects the submission and shows a validation message	The system failed to validate empty

	Means Submission			fields, causing a submission error
3	Add Complaint	Resident uploads an .EXE file in the complaint form	The system rejects the file upload	The system failed to validate the uploaded file type
4	Announcement Menu Access	A Resident whose account has not yet been verified opens the Announcement menu	The system denies access to the menu	The system failed to restrict access; the menu remained accessible

Similar invalid findings were also found for the other five actors, generally involving the same categories of issues: file-type validation, mandatory-field validation, and role-based access restriction. Based on these findings, improvements were made to the input-validation logic, file-upload handling, menu-access restriction by account status, and the letter- and complaint-submission forms. Improvement was completed on 2 April 2026, after which Stage 2 testing was carried out using the same scenarios for all six actors. The overall recapitulation of the two testing stages is presented in Table 6.

Table 6. Recapitulation of Black Box Testing Results (Stage 1 vs. Stage 2)

No	Actor	Test Scenarios	Stage 1 (Valid / Invalid)	Stage 2 (Valid / Invalid)
1	Resident	19	15 / 4	19 / 0
2	Operator	25	21 / 4	25 / 0
3	Welfare Section Head	9	1-Aug	Sep-00
4	Head of General Affairs	9	2-Jul	Sep-00
5	Village Secretary	23	19 / 4	23 / 0
6	Village Head	13	2-Nov	13 / 0
	Total	98	81 / 17	98 / 0

Table 6 shows that of the 98 test scenarios executed across the six actors, 17 scenarios were declared invalid in Stage 1 testing, mainly due to insufficient input validation and access-restriction handling. After the improvements were implemented, Stage 2 testing showed that all 98 scenarios (100%) were declared valid, indicating that every function of the Village Administrative Service Information System including letter submission, population data management, digital archiving, village-information dissemination, public-complaint handling, and role-based access control operated in accordance with the intended design

and could be used properly by both village officials and the community.

CONCLUSION

This research successfully developed a web-based Village Administrative Service Information System for Epil Barat Village using the Rapid Application Development (RAD) method. The developed system integrates letter submission, public complaint handling, village announcement management, population data management, and administrative data archiving, and involves six main actors Resident, Operator, Welfare Section Head, Head of General Affairs, Village Secretary, and Village Head each operating according to distinct tasks and access rights. Through this system, residents can access village administrative services online without having to visit the village office in person, thereby overcoming the constraints of distance, time, and cost that previously affected the service process.

The application of the RAD method through the Requirements Planning, Design Workshop, and Implementation phases enabled the system to be developed in accordance with the actual administrative service needs of Epil Barat Village, with direct user involvement at each design iteration ensuring that the resulting interface and workflow reflected real conditions in the field rather than assumptions. The system was modeled using Business Process Model and Notation (BPMN), Entity Relationship Diagram (ERD), and Unified Modeling Language (UML) comprising Use Case, Activity, and Class Diagrams and was implemented using the Laravel framework with a MySQL database consisting of fourteen interrelated tables.

Functionality was evaluated using Black Box Testing with the Equivalence Partitioning technique across all six user roles. The initial testing stage identified 17 invalid scenarios out of 98 test scenarios, primarily related to file-upload validation, mandatory-field validation, and role-based menu-access restriction. Following system improvement, the second testing stage confirmed that all 98 scenarios (100%) operated correctly. These results indicate that the developed system successfully integrates village administrative services into a single, structured platform, accelerates the letter-submission and verification process, improves the accuracy of population and complaint data management, and enables residents to obtain administrative services without limitations of distance and time.

For future development, several aspects may be considered to further enhance the system. These include adding automatic notification features for letter-submission status, complaint responses, and village announcements; extending the system into a mobile application to improve accessibility for residents and village officials; incorporating a digital-signature feature into the letter-approval process to reduce reliance on manual signatures; and conducting additional testing beyond functional aspects, particularly on system security, application performance, and user-interface usability. Further development of document archiving and search features, as well as reporting and recapitulation features for administrative service data, is also recommended to better support

monitoring and decision-making by village officials.

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