

WEBSITE-BASED POPULATION ADMINISTRATION SERVICE INFORMATION SYSTEM FOR URBAN VILLAGE

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(Naskah diterima: 1 Maret 2026, disetujui: 31 Maret 2026)

Abstract

Population administration services in Pesanggrahan Village are currently still carried out manually, requiring residents to submit physical documents, thus triggering queues and risking document loss. This research aims to design and build a website-based Population Administration Service Information System to digitize the correspondence process, integrate automatic notification features, and publicize regional potential such as MSMEs and tourism. Software development uses the Waterfall method, which includes needs analysis, system design, implementation, testing, and maintenance, built using the Laravel framework and MySQL database. The research results in an integrated platform that facilitates residents to submit letter requests online and upload required digital documents, effectively cutting the physical bureaucratic chain. This system is equipped with Simple Mail Transfer Protocol (SMTP) automation that sends automatic approval notifications via email. Functional testing using Black Box Testing demonstrates that all features function validly and as expected. Conclusively, the implementation of this system successfully optimizes bureaucratic efficiency, secures archival records, and increases the visibility of regional potential.

Keywords: *Information System; Population Administration; Website; Laravel; Waterfall Method.*

Abstrak

Pelayanan administrasi kependudukan di Desa Pesanggrahan saat ini masih dilakukan secara manual yang mengharuskan warga menyerahkan dokumen fisik, sehingga memicu antrean dan berisiko pada kehilangan dokumen. Penelitian ini bertujuan untuk merancang dan membangun Sistem Informasi Pelayanan Administrasi Kependudukan berbasis situs web untuk mendigitalisasi proses persuratan, mengintegrasikan fitur notifikasi otomatis, serta memublikasikan potensi daerah seperti UMKM dan pariwisata. Pengembangan perangkat lunak menggunakan metode Waterfall yang meliputi analisis kebutuhan, desain sistem, implementasi, pengujian, dan pemeliharaan, serta dibangun menggunakan kerangka kerja Laravel dan basis data MySQL. Hasil penelitian berupa platform terintegrasi yang memfasilitasi warga dalam mengajukan permohonan surat secara daring dan mengunggah dokumen digital yang dipersyaratkan, sehingga efektif memangkas rantai birokrasi fisik. Sistem ini dilengkapi otomasi Simple Mail Transfer Protocol (SMTP) yang mengirimkan notifikasi persetujuan otomatis melalui surel. Pengujian fungsional menggunakan Black Box Testing menunjukkan bahwa seluruh fitur berfungsi valid dan As Expected. Kesimpulannya, implementasi sistem ini berhasil mengoptimalkan efisiensi birokrasi, mengamankan rekam jejak arsip, dan meningkatkan visibilitas potensi daerah.

KataKunci: Administrasi Kependudukan; Laravel; Metode Waterfall; Sistem Informasi; Situs Web

I. INTRODUCTION

Public service is a main indicator of good public governance, where national regulations mandate digital transformation at regional-level institutions. Ideally, digitalization targets are focused on accelerating administrative processes and the accuracy of population databases, as well as the mandatory use of electronic systems to ensure the transparency and accountability of village bureaucracy performance. However, there is a gap between digital regulations and the operational reality in Pesanggrahan Village, which is currently still managed manually. The primary problem is evident when residents are required to submit physical requirement documents to the village office counter, which subsequently triggers long queues, decreases apparatus productivity, and raises the risk of document loss and recording errors. This practical gap creates operational inefficiencies that slow down periodic population data reporting to the central government and risk lowering the community satisfaction index. Furthermore, information on the economic potential of Micro, Small, and Medium Enterprises (MSMEs) and local tourism has not been published centrally, making public access difficult.

Various previous studies have attempted to develop village information systems to overcome similar constraints. A digital archive platform was successfully built to manage document management using the Laravel framework (Adensa et al., 2023). In another study, bureaucratic administration services were proven to be technically optimized through the design and development of web-based applications (Fanani et al., 2025). However, the majority of the systems from these previous studies were designed without the integration of automated notification features, and the correspondence and regional publication modules had not been unified within a single platform. The novelty of this research lies in the integration of three operational modules within a single platform that combines digital correspondence services, a Simple Mail Transfer Protocol (SMTP) email automation system for document status updates to residents, and the publication of regional potential. Neglecting these bureaucratic loopholes demands business process automation through the implementation of an integrated information system to minimize data redundancy and cut physical bureaucratic chains. Therefore, this research aims to design a web-based population administration service information system in Pesanggrahan Village, digitize the correspondence request procedure between residents and the village apparatus, and build a centralized information portal to publicize regional economic and tourism potential.

II. THEORETICAL FRAMEWORK

Population administration encompasses the entire series of procedures for structuring, issuing, and controlling legal documents related to community identity, which includes demographic recording, population mutation, up to the issuance of official population cover letters (Al Hasri & Sudarmilah, 2021). To manage these procedures, a system is required, which is an integrated entity of functional component sets that interact dynamically to achieve institutional targets (Bratha, 2022). This system is tasked with processing raw data into information, a context that has meaning boundaries and utility value for decision-makers (Zulfa & Wanda, 2023). The arrangement that systematically combines hardware, software, network infrastructure, and human work procedures to collect and distribute such data is classified as an information system (Permana & Diana, 2021).

In the practice of distributing public information, the system is built on a website, which is a collection of interactive electronic pages within the global internet network functioning to present various formats of digital content to end users without spatial and temporal limitations (Awaliyah & Krishantoro, 2025). The engineering of this web platform is accelerated using Laravel, an advanced framework based on the Model-View-Controller (MVC) architecture that simplifies program syntax writing for large-scale applications (Adensa et al., 2023). Algorithmic logic processing is regulated by PHP 8.2 as a server-side scripting programming language (Nurhanifah & Martanto, 2023). Meanwhile, relational database management is handled using MySQL to prevent duplication in the recording of population track records (Fanani et al., 2025). The offline development and testing environment is facilitated by XAMPP as a comprehensive local server (Zulfa & Wanda, 2023). On the interface side, the page structure is built using Hypertext Markup Language (HTML) (Pujiantoro et al., 2023), visually styled through Cascading Style Sheet (CSS) (Tanjung et al., 2025), and perfected with Bootstrap to guarantee automatically responsive design (Aulia & Darsiti, 2024). To automate communication lines, this system integrates Simple Mail Transfer Protocol (SMTP), an internet protocol standard exclusively focused on executing the transmission of electronic mail messages from the system to residents' emails (Zikri et al., 2023).

The underlying development methodology is the Waterfall model, a linear sequential engineering methodology that requires computational design through strict and downward sequential operational stages (Harjono & Tute, 2022). The visual modeling of the system architecture is designed using the Unified Modeling Language (UML) to represent an object-oriented paradigm (Permana & Diana, 2021). The database design is conceptually represented

through an Entity Relationship Diagram (ERD) (Ayumida et al., 2022), which is then translated into a detailed physical relational schema through Logical Record Structure (LRS) (Daus & Utami, 2024). The final stage is measured using Black Box Testing to evaluate the software's external specification compliance without having to uncover the internal structure of the program code lines (Fanani et al., 2025).

III. RESEARCH METHOD

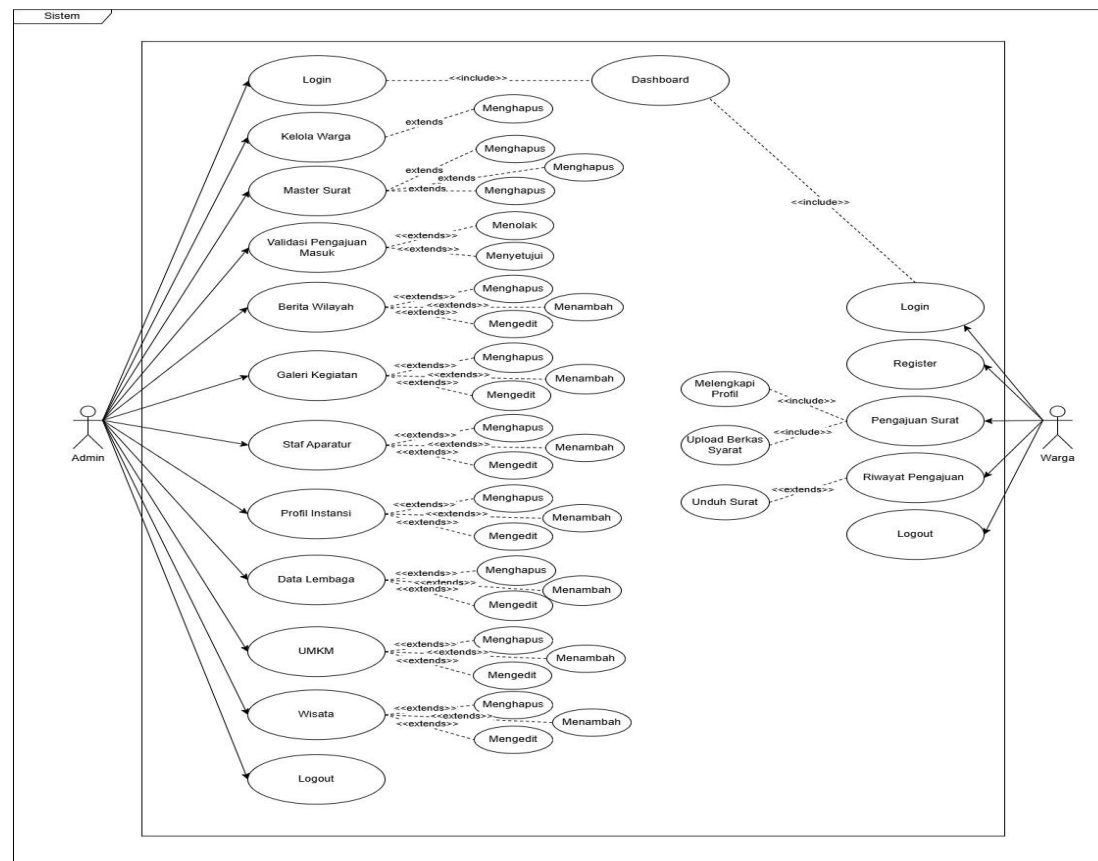
This research is a software development study that specifically utilizes a linear sequential approach, namely the Waterfall method, which consists of the stages of requirement analysis, system design, program code implementation, testing, and maintenance. The data collection and requirement analysis techniques focus on mapping the functional and non-functional specifications of the current operational system to formulate the boundaries of access right authorities, specifically the village apparatus (Admin) and the community (Residents). Based on the results of this analysis, the data is transformed into the system design stage to engineer the logical architecture and relational database using Unified Modeling Language (UML), Entity Relationship Diagram (ERD), and Logical Record Structure (LRS) modeling. Once the design is completed, the research specifications are technically implemented using the PHP programming language on the Laravel framework and the MySQL database management system. The final feasibility evaluation of the system uses the Black Box Testing method, which focuses on providing varied stimuli into the system interface to thoroughly validate external functionality without the need to examine the internal structure of the program code lines.

IV. RESEARCH RESULTS

1. System Requirement Analysis

Based on the analysis of the current system in Pesanggrahan Village, the functional software requirements are defined into two user access authority roles, namely the village apparatus as the Admin and the community as the Resident. The system requirements for the Admin include the capabilities to: a. conduct the security authentication process; b. manage institutional profile data, apparatus structure, and activity galleries; c. manage registration, validate, and delete resident data; d. determine letter categories along with specific document requirements; e. validate incoming request files, change request statuses, upload signed letter

The system architecture design stage is structurally modeled using visual diagram instruments. The functional system requirements are recorded in a Use Case Diagram that describes the structured interactions between the Admin and Resident actors regarding application functionalities.



During the database design phase, the relational schema is constructed through Entity Relationship Diagram (ERD) modeling to prevent memory allocation redundancy. This conceptual model is subsequently translated into a detailed physical table relation schema using Logical Record Structure (LRS), which maps the primary keys and foreign keys across data

files such as the users table, residents profile (wargas), letter transactions (pengajuans), and publication data.

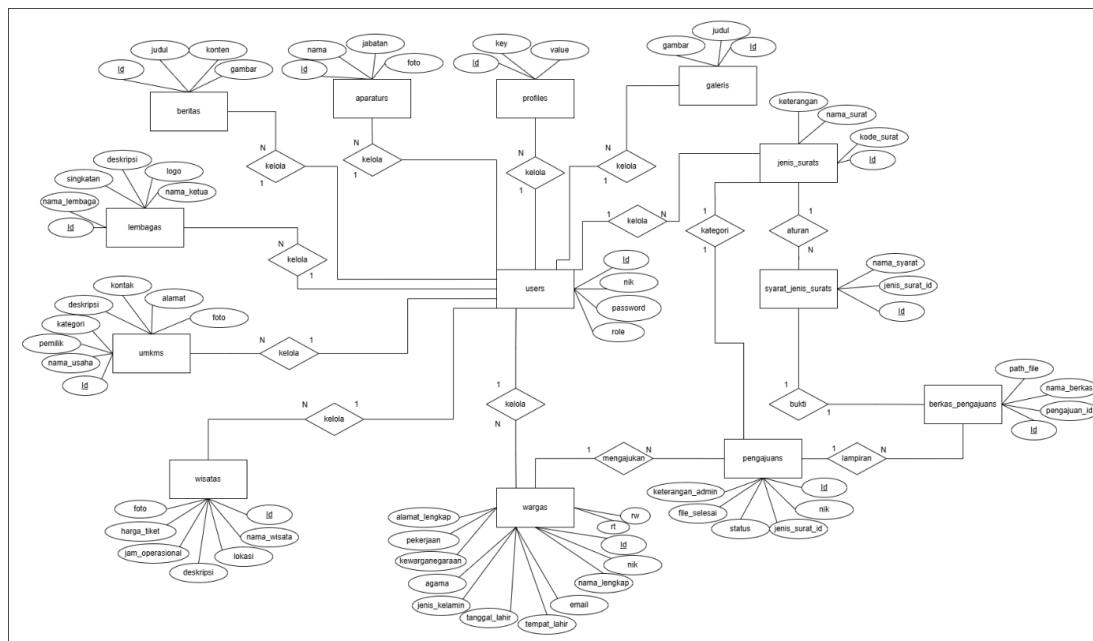


Figure 2 ERD Diagram

3. System and Interface Implementation

The implementation stage is the construction phase where the system architecture design is transformed into program source code lines using the PHP programming language and the Laravel framework. On the community interface side, the system renders an interactive letter request form page that allows residents to select the type of letter service and upload digital physical documents as administrative completeness validation requirements.

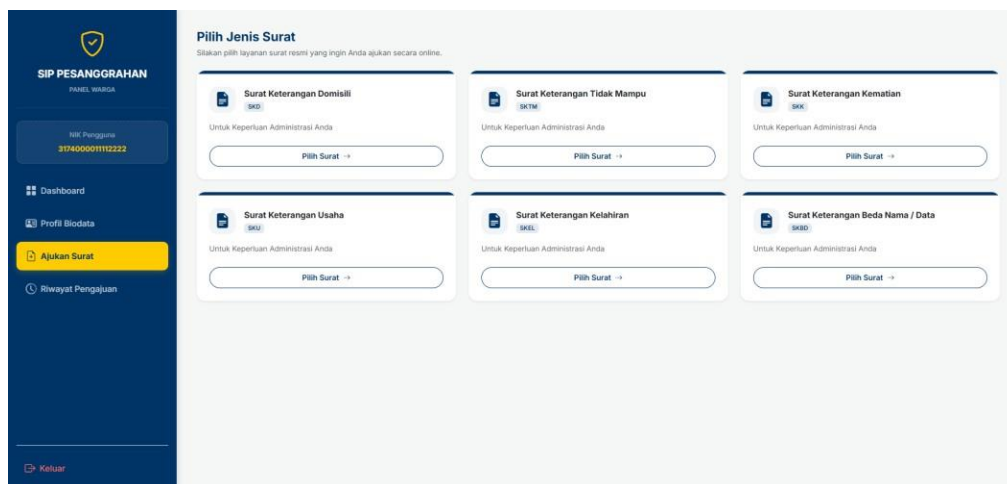


Figure 3 Letter Submission Page

For the village apparatus, implementation focuses on the incoming request management control center. The validation interface is used by the Admin to review request details, verify attachment validity, change the status to completed, and upload the authorized Portable Document Format (PDF) letter document. The status update in this system directly triggers the application controller to execute the mailer class in the background, which automatically sends a Simple Mail Transfer Protocol (SMTP) notification to the resident without interrupting the Admin's activities.

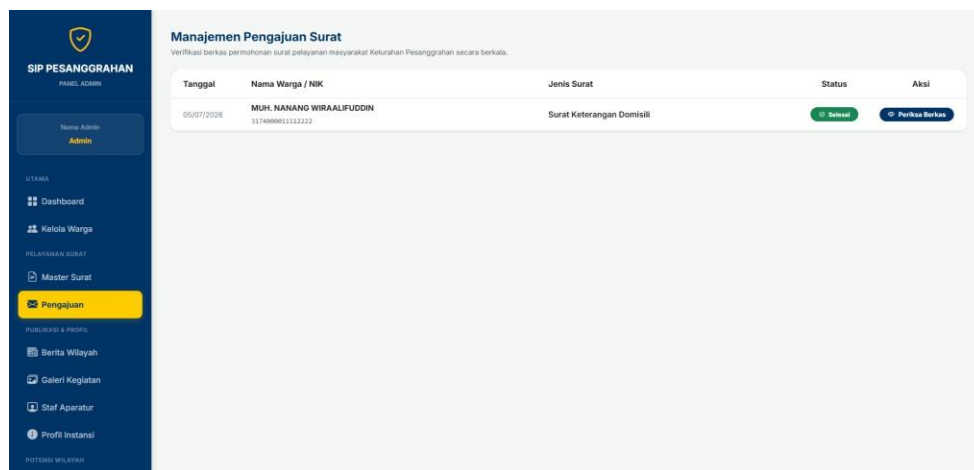


Figure 4 Submission Validation Page (Admin)

4. Software Testing

The final software evaluation was conducted using the Black-Box Testing method, which focuses on testing the external functionality of the system interfaces. Testing procedures were executed against various input stimuli, both from the Resident's side, such as registration testing, profile completion, and digital requirement uploads, as well as from the Admin's side, such as master letter configurations and the execution of automated email notification dispatch. The test results indicated that all operational features responded validly and the system output matched the expected scenarios, proving the application is ready to be officially launched.

No.	Test Item	Test Scenario	Expected results	Test Result	Conclusion
1.	Admin Account Login	Entering an incorrect combination of NIK and password on the admin login page.	The system denies access, displays a login error message, and keeps the user on the authentication page.	As Expected	Valid
2.	Admin Account Login	Enter the correct combination of NIK and password on the admin login page.	The system validates authorization data, grants an Admin access session, and redirects the user to the Admin Dashboard page.	As Expected	Valid
3.	<i>Submission Validation</i>	Reviewing submitted resident applications, selecting the "Rejected" status, and providing a note explaining the reason for rejection.	The system updates the transaction status in the submission table to "Rejected" and displays the reason for rejection on the resident's dashboard.	As Expected	Valid

4.	<i>Submission Validation</i>	Validating incoming resident files, changing the status to "Completed," and uploading the physical result document (PDF).	The system saves the PDF file to the storage server, updates the status column to "Completed," and triggers an email notification.	As Expected	Valid
5.	<i>Email Notification</i>	Execute the email automation function after the admin presses the button to update the submission status to "Completed".	The system executes the delivery of notification emails via an SMTP service, silently and directly to the residents' email inboxes.	As Expected	Valid
6.	<i>Manage Letter Templates</i>	Adding a new service type master record using a letter code that has already been used.	The system detects a duplicate, rejects the save command due to the Unique Key rule, and displays an error message.	As Expected	Valid

7.	<i>Manag e Letter Templ ates</i>	Adding new document requirement criteria to the sub-district letter master management settings menu.	The system successfully recorded the requirement text data, created an ID relationship with the `syarat_jenis_surat` table, and updated the table visualization.	As Expected	Valid
8.	<i>Manag e Regional News</i>	Enter the news headline, write the content, provide regional information, upload a thumbnail image, and click save.	The automated system generates a unique slug from the title, uploads the image to the server, and records the complete data into the `beritas` table.	As Expected	Valid
9.	<i>Manag e MSME s</i>	Add a new local business profile to the menu for managing regional potential publication data (MSMEs).	The system successfully registered residents' business data into the `umkms` table, updated the table list, and displayed it on the public page.	As Expected	Valid
10.	<i>Manag e Reside nt Data</i>	Click the "Delete Resident" button on the urban village population account management panel.	The system processes the deletion in its entirety, permanently removing profile records from the `wargas` and `users` tables.	As Expected	Valid

TABLE I. Black-Box Testing of Admin Access Rights

V. CONCLUSION

The implementation of the web-based Population Administration Service Information System in Pesanggrahan Village has successfully solved the constraints of bureaucratic operational inefficiency that were previously carried out manually. The development of the digital correspondence service module within this system effectively eliminates the obligation of residents' physical presence and the submission of printed document stacks at the village office, thereby unraveling long queues and accelerating the bureaucratic service workflow. Furthermore, the electronic archive validation module integrated with the Simple Mail Transfer Protocol (SMTP) allows the village apparatus to accurately record submission histories and automatically send approval notifications via email to residents, which significantly reduces the risk of physical document loss and minimizes correspondence track record errors. As a complement to public services, this system also successfully embeds a centralized content management architecture on the public portal to digitize and publish village profile information, institutional data, the visibility of Micro, Small, and Medium Enterprises (MSMEs), and regional tourism destinations so they can be accessed independently by the wider community.

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