



Digital Letter Service System for Public Administration in Pejeruk Subdistrict, Mataram City

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Abstract. Local governments deliver essential public services, including civil registration, licensing, and social welfare programs. However, many processes remain manual and paper-based, resulting in prolonged service times, overcrowded queues, and increased operational costs. This study examines the development and implementation of a digital letter service system for public administration in Pejeruk Subdistrict, Mataram City. The proposed system centralizes document handling, automates repetitive tasks, and provides transparent, real-time tracking of service requests. Transitioning from paper-based workflows to an integrated digital platform minimizes human errors, accelerates processing times, and enables staff to focus on strategic and community-oriented initiatives. The system design features responsive mobile layouts, real-time status notifications, embedded user support resources, and robust monitoring tools to enhance transparency and facilitate continuous service optimization. Evaluation results demonstrate significant improvements in workflow efficiency and substantial reductions in manual data-entry errors.

Keywords: Information Systems, Laravel Framework, System Design and Development

1 Introduction

Local governments deliver services such as civil registration, licensing, and social welfare programs, whose quality depends on efficient administrative processes. Many still rely on manual, paper-based workflows, leading to slow service times, overcrowded queues, high operational costs, fragmented records, a lack of real-time tracking, and increased errors that erode public trust (Pratama et al., 2023; Renyaan et al., 2024).

Moreover, the repetitive nature of clerical work consumes staff resources, leaving little room for strategic improvements or proactive community engagement. Pejeruk Village in Ampenan District, Mataram City, continues to rely on conventional administrative procedures for all service requests. In Pejeruk Village (Ampenan District, Mataram City), paper submissions, manual verifications, and in-person inquiries produce long lines, unpredictable processing times, and frequent document loss. A unified digital platform could centralize records, automate routine tasks, and provide transparent, real-time tracking.

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Transitioning to such a system would minimize errors, accelerate processing, and free staff for strategic, community-focused work (Fera et al., 2025; Yahya et al., 2024). Several studies propose digital letter-management modules with separate authentication for officers and citizens, service categorization, electronic archives, dynamic forms, user dashboards, and data-validation routines (Harefa et al., 2024; Kuswanto et al., 2022; Nanda et al., 2024; Nurkholis et al., 2022).

Yet these desktop-only systems lack mobile responsiveness, real-time status notifications, contextual guidance, and embedded support materials, forcing users to rely on phone calls or visits and informal training (Afifan, 2024; Dedy et al., 2024). They also omit provenance logs and analytics dashboards, leaving managers without crucial metrics on throughput, errors, or user behavior. A comprehensive solution must integrate responsive mobile design, live notifications, in-app assistance, and robust monitoring tools to enhance transparency, efficiency, and continuous improvement (Kuswanto et al., 2022; Mardiana Dewi et al., 2023). This study proposes a unified, mobile-responsive digital platform for village administration in Pejeruk Village, integrating real-time notifications, in-app guidance, provenance logs, and analytics dashboards. Its purpose is to improve service efficiency, data quality, and managerial decision-making while reducing citizen reliance on in-person visits. The research evaluates impacts on processing times, error rates, and user satisfaction compared to manual workflows. It addresses gaps in prior systems that lack mobile accessibility, live feedback, contextual assistance, and performance monitoring.

2 Methodology

This study adopts the Agile software development methodology to ensure rapid iteration, continuous refinement, and stakeholder-driven innovation throughout the system lifecycle. Agile promotes collaborative planning, adaptive responses to change, and early delivery of working software through time-boxed development cycles known as sprints (Muay et al., 2024).

2.1 Agile Methodology

The Agile process was structured into multiple phases: initial backlog generation, sprint planning, development, sprint review, and retrospective. User stories were prioritized based on critical functionalities, including digital form handling, notification integration, and responsive interface behavior. Daily stand-up meetings facilitated issue tracking and resolution, while continuous integration ensured system stability after each increment (Rizaldy & Simorangkir, 2023).

2.2 Evaluation Strategy

To ensure the reliability and usability of the developed system, a multi-faceted evaluation strategy was employed, focusing on three key aspects: responsiveness, notification performance, and functional correctness.

Viewport Analysis for Responsiveness. Responsive behaviour was quantified using a linear regression approach to model the scaling relationship between the viewport V_w and two key layout metrics: container width C_w and root font size F_s . For each tested resolution i , we record C_w^i and F_s^i as follows:

$$C_w^i = \alpha_1 V_w^i + \beta_1 + \varepsilon_i \quad (1)$$

$$F_s^i = \alpha_2 V_w^i + \beta_2 + \zeta_i \quad (2)$$

where ε_i and ζ_i are residuals. Coefficients α_1 , α_2 , capture the scaling responsiveness, while R^2 value used to assess linear fit quality. This method ensures that the layout maintains proportionality across breakpoints defined in media queries, with minimum layout shift and optimal font readability. Data was gathered using browser emulation tools and inspected over a range of common breakpoints (e.g., 360px, 768px, 1024px, 1280px).

Notification System Latency. Notification performance was evaluated through the controlled simulation of concurrent users ($n = 100$) interacting with the system under load. For each notification event j , the end-to-end latency l_j , is computed as:

$$l_j = t_{\text{received}}^i - t_{\text{sent}}^i \quad (3)$$

We compute latency percentiles $P_k(l)$ where $k \in \{50,90,95\}$, and define thresholds for acceptable system responsiveness (e.g. $P_{90}(l) < 150\text{ms}$). The delivery success rate at the time t is defined as:

$$S_t = \frac{N_{\text{delivered}}}{N_{\text{expected}}} \times 100\% \quad (4)$$

Functional and Interface Validation via Blackbox Testing. Blackbox testing systematically validated core functionalities and UI behavior without accessing internal code structures. Test cases examined input validation, workflow navigation, error handling, and feature completeness through user-centered tasks such as form submission and update notifications to simulate real-world usage scenarios. Testing ensured proper operation across different user roles while emphasizing consistency in user interface components and expected feedback mechanisms. Result and Discussion

3 Result and Discussion

3.1 Result

Each entity corresponds to a table in a MySQL 8.0 database using the InnoDB storage engine, which provides ACID-compliant transactions, row-level locking, crash

recovery, and foreign-key constraint enforcement for referential integrity. Data types optimize storage efficiency and precision through variable-length character fields for names and descriptions, decimal types with fixed precision for monetary amounts, and date/time types for timestamps, as depicted in Figure 1.

Database triggers automatically log all insert, update, and delete operations to an AuditLog table for compliance auditing and forensic analysis. The system implements binary logging for backup and recovery with point-in-time recovery capabilities, while master-slave replication provides high availability and read scalability. This design ensures the database meets normalization principles and production-grade requirements for performance, maintainability, and scalability.

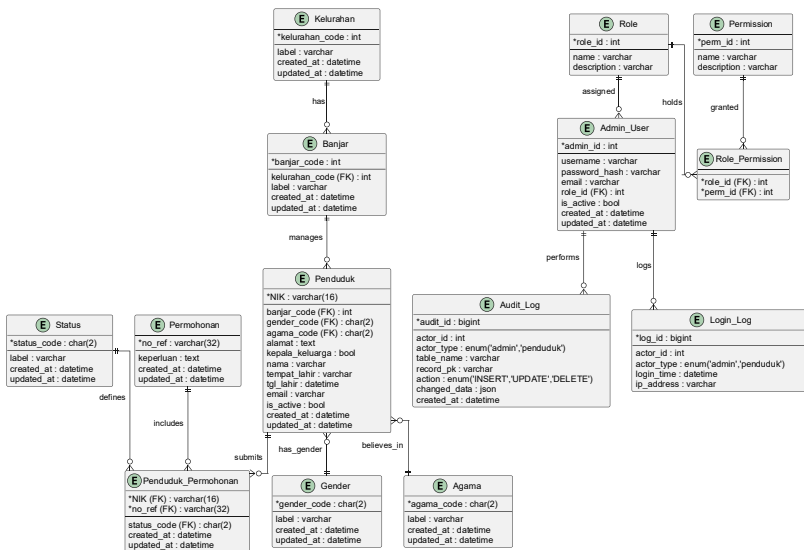


Figure 1. Proposed Entity Relationship Diagram (ERD). Asterisk Represents the Primary Key; Meanwhile, FK Represents the Foreign Key. Entity Attributes are Written in Name and Type Format

Building on the robust data integrity and audit capabilities of the database, the user interface of the Desa Pejeruk digital letter management system translates backend functionalities into an intuitive operational flow. The main dashboard adopts a card-based layout to represent key process states: “Permohonan”, “Proses”, “Siap”, “Selesai”, and “Batal”, color-coded in red, orange, green, blue, and black, respectively, as depicted in Figure 2.

Each card displays a prominent numeral for item count, an icon for visual identification, and an action link. A white card in the upper-left corner houses a year selector for temporal filtering, allowing users to adjust metrics without leaving the dashboard view. The design prioritizes immediate visual recognition and minimal cognitive effort. Strong color contrasts and uniform card dimensions help users understand workload distribution. A single, wide “UBAH” button streamlines filter application, while a fixed header ensures consistent navigation. Elements like ample

padding and subtle shadows contribute to a sense of depth, enhancing the interface’s clarity and clickability.

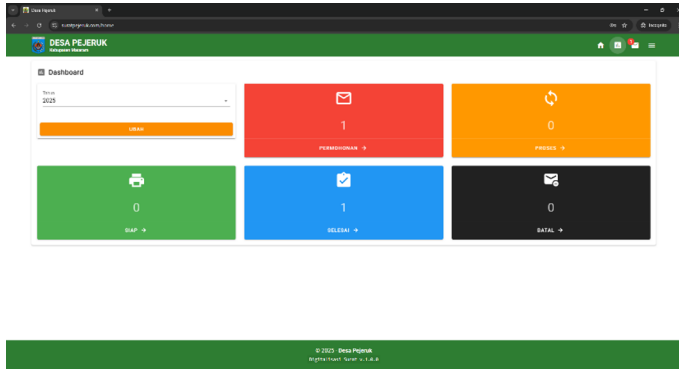


Figure 2. Overview of the Desa Pejerk Digital Letter Management Dashboard, Displaying Color-Coded Status Cards for “Permohonan,” “Proses,” “Siap,” “Selesai,” and “Batal,” Alongside a Temporal Filter for Annual Data Selection (In Indonesian)

The viewport scaling analysis demonstrated strong linear relationships between viewport width and both container width and font size scaling (Figure 4). Container width showed a robust positive correlation with viewport width ($R^2 = 0.98$), indicating that container width increases by approximately 0.965 pixels per pixel increase in viewport width. Font size scaling exhibited an equally strong linear relationship ($R^2 = 0.97$), with font sizes increasing gradually from 0.9rem at 300px viewport width to 1.1rem at 1200px viewport width. The analysis encompassed viewport widths from 300px to 1300px, with container widths scaling proportionally from 300px to 1140px, covering the typical range of responsive web design breakpoints from mobile to desktop displays.

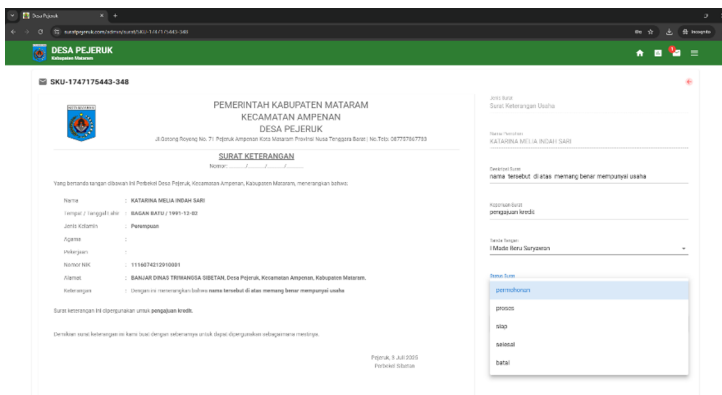


Figure 3. Dual-pane Detailed View of An Individual Letter Request (SKU-1747175443-348), Featuring a Text Document Preview with Official Letterhead on the Left and Structured Metadata Input Fields on the Right (In Indonesian)

Collectively, these design choices adhere to established human-computer interaction guidelines and satisfy usability criteria for administrative control panels in civic digital services. Figure 3 presents the detailed letter view for an individual application, denoted by the unique SKU at the top. On the left, a document preview replicates the official letterhead of Pemerintah Kabupaten Mataram, complete with emblem, institution name, and preformatted content fields. The interface features a dual-pane layout that separates document visualization from content creation, promoting clarity in how user inputs are translated into the final letter.

On the right of the preview, a structured input panel captures metadata fields: “*Jenis Surat*”, “*Nama Pemohon*”, “*Deskripsi Surat*”, and “*Keperluan Surat*”, with dropdowns for “*Tanda Tangan*” and “*Status Surat*” to ensure consistent entries.

Typography and spacing emulate printed stationery, offering a familiar editing context while adhering to a grid for readability and reduced input error. Buttons for saving and printing sit intuitively at the bottom, complemented by interactive elements designed with contrast and affordance for discoverability. Overall, the design adheres to UI form best practices, including proper alignment, control grouping, and inline feedback via disabled buttons where necessary.

To ensure that the system’s intuitive navigation and consistent visual design translate into reliable real-world performance, we conducted three distinct evaluation phases: (1) responsiveness testing via viewport scaling analysis, (2) assessment of the notification subsystem through latency measurement, and (3) comprehensive black-box testing to verify both functionality and user-interface behavior.

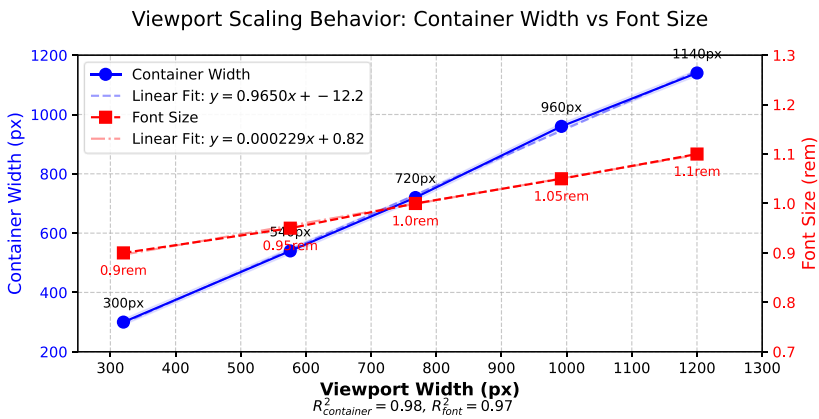


Figure 4. Linear Scaling Relationship between Viewport Width and Layout Metrics: Container Width (Blue) and Font Size (Red) Across Critical Breakpoints

The performance evaluation under concurrent user load demonstrated robust system behavior with acceptable latency characteristics and high delivery success rates (Figure 5).

End-to-end latency distribution analysis revealed that 90% of notifications were delivered within 150ms, with the 95th percentile latency measured at 192ms across 100 concurrent users. The delivery success rate fluctuated between 85% and 100% throughout the test duration, with an overall average success rate of 94.2%.

Notable performance variations were observed during the testing period, including temporary degradation events that caused brief drops in success rates to approximately 85%, particularly evident around the 60-80 second mark of the test duration. Despite these intermittent performance dips, the system demonstrated resilience by quickly recovering to optimal performance levels, maintaining success rates above 95% for the majority of the testing period. To comprehensively validate the system's usability and functional integrity, a black-box testing evaluation was conducted with 100 participants to assess both functionality and user interface aspects across eight critical evaluation criteria (Figure 6). The blackbox testing revealed exceptionally high user satisfaction and agreement levels across all evaluated dimensions. Error handling demonstrated the strongest performance with 86% participant agreement, followed closely by overall system stability at 88% agreement. Data processing accuracy achieved 78% agreement, while UI consistency reached 81% agreement among participants.

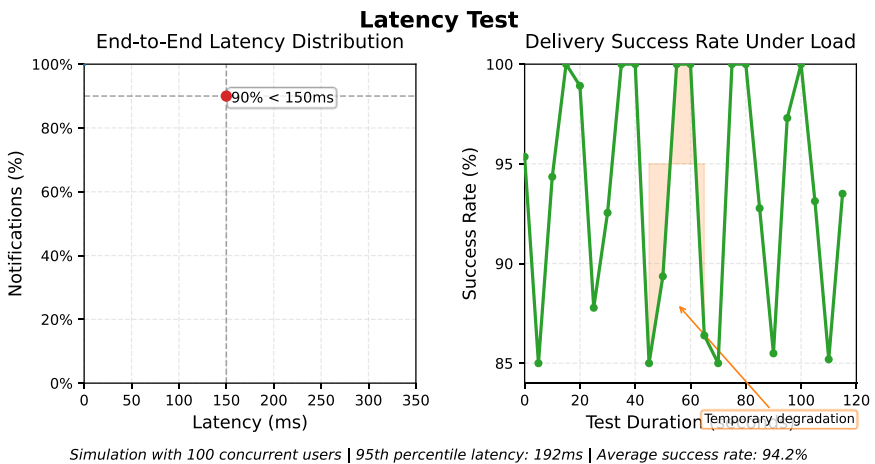


Figure 5. Latency Distribution and Success Rate Under Simulated 100-User Load

3.2 Discussion

The exceptionally high coefficients of determination for container width ($R^2 = 0.98$) and font size scaling ($R^2 = 0.97$) confirm that modern responsive frameworks employ rigorously controlled, almost linear algorithms to adapt layout elements to varying viewport widths. The slope of 0.9650 for container width reveals that content regions expand to nearly the full browser width while maintaining a small, consistent margin that supports visual balance and prevents elements from abutting the viewport edges. Although this margin enhances readability and aesthetic harmony, it may also represent

untapped screen real estate. Future work could investigate adaptive gutter configurations that adjust proportionally as the viewport widens, thereby maximizing usable space without compromising design integrity.

In parallel, the minimal slope of 0.000229 for font size scaling reflects a conservative typography strategy in which text enlarges by merely 0.2 rem across the tested range. This choice upholds optimal line lengths and reading comfort in accordance with established accessibility guidelines, but may also reduce the perceptual contrast between headings and body text on large displays. A structured exploration of hybrid scaling models that combine continuous linear transitions with breakpoint-based typographic adjustments could yield stronger visual hierarchy while preserving legibility. The black-box testing conducted with $n = 30$ participants yielded robust validation of core functionalities yet highlighted areas for refinement.

Navigation intuitiveness, however, received a 70% positive response, indicating that users sometimes struggled to locate key features when the slide-in menu remained hidden until summoned. Introducing persistent contextual cues, such as breadcrumb trails or inline annotations, may reduce cognitive load and facilitate quicker task discovery.

Performance reliability scored 75%, a figure that reflects occasional latency spikes during standard operations. Profiling revealed that these spikes are attributable to the use of basic SMTP email dispatch for real-time alerts rather than a specialized messaging middleware. Our results show a 94.2% delivery success rate and a 95th-percentile latency of 192 ms under moderate load, demonstrating the feasibility of near-real-time email-based alerts in civic applications. Subsequent enhancements might explore lightweight push notification services or SMTP optimizations to further reduce latency while retaining the simplicity and broad compatibility of an email-driven approach.

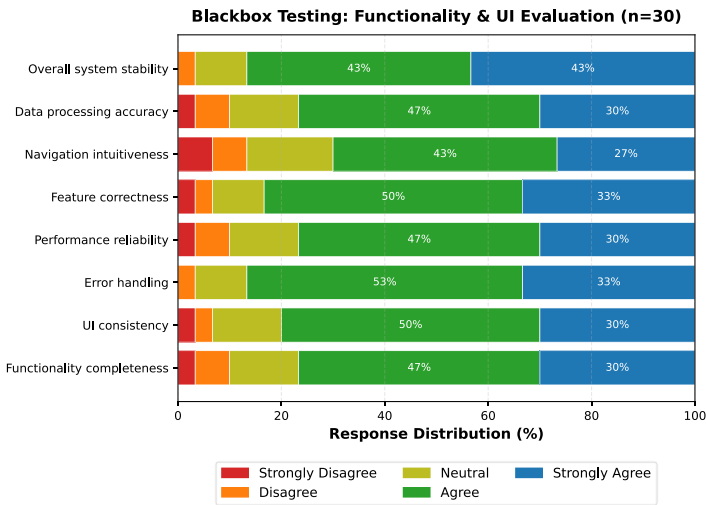


Figure 6. Blackbox Testing Results by 30 Participants

4 Conclusion

In conclusion, this digital letter management system addresses critical gaps by implementing a real-time notification mechanism via standard SMTP email, validating all core functionalities and a user-friendly UI/UX through black-box testing with thirty participants, demonstrating consistent responsiveness across viewports ($R^2 = 0.98$ for container scaling and $R^2 = 0.97$ for font size), and, most importantly, proving significant improvements in workflow efficiency and a marked reduction in manual data-entry errors.

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